ACIL ALLEN CONSULTING

REPORT TO
**ESSENTIAL SERVICES COMMISSION**
1 MARCH 2019

# VICTORIAN ENERGY USAGE PROFILES

## PROFILE CALCULATION METHODOLOGY AND RESULTS

ACIL ALLEN CONSULTING PTY LTD
ABN 68 102 652 148

LEVEL NINE
60 COLLINS STREET
MELBOURNE VIC 3000
AUSTRALIA
T+61 3 8650 6000
F+61 3 9654 6363

LEVEL ONE
50 PITT STREET
SYDNEY NSW 2000
AUSTRALIA
T+61 2 8272 5100
F+61 2 9247 2455

LEVEL FIFTEEN
127 CREEK STREET
BRISBANE QLD 4000
AUSTRALIA
T+61 7 3009 8700
F+61 7 3009 8799

LEVEL ONE
15 LONDON CIRCUIT
CANBERRA ACT 2600
AUSTRALIA
T+61 2 6103 8200
F+61 2 6103 8233

LEVEL TWELVE, BGC CENTRE
28 THE ESPLANADE
PERTH WA 6000
AUSTRALIA
T+61 8 9449 9600
F+61 8 9322 3955

167 FLINDERS STREET
ADELAIDE SA 5000
AUSTRALIA
T +61 8 8122 4965

ACILALLEN.COM.AU

SUGGESTED CITATION FOR THIS REPORT

ACIL ALLEN CONSULTING, 2019, VICTORIAN ENERGY USAGE PROFILES

# CONTENTS



## FIGURES

# CONTENTS



## TABLES

# EXECUTIVE SUMMARY

In August 2017, the *Independent Review of the Electricity and Gas Retail Markets*, known as the Thwaites review, made a series of recommendations intended to increase the extent to which Victorian retail energy markets work to the benefit of Victorian consumers.

The Essential Services Commission (the Commission) is in the process of implementing recommendation 3, which relates to giving consumers better information to allow them to compare retail energy plans.

The Commission's draft decision of December 2018 was that it would introduce a new Victorian energy fact sheet to replace existing price and product information statements and offer summaries.

An essential part of the Victorian Energy Fact Sheet will be indicative annuals bill that customers can use to compare energy offers on a like for like basis. The Thwaites review recommended that these be based on '*three or four typical usage profiles'*. The Commission has engaged ACIL Allen to help it in developing those profiles.

The Australian Energy Regulator (AER) recently released *Basic Plan Information Documents* (BPIDs) which are broadly similar to Victorian Energy Fact Sheets. The Commission's approach in its draft decision, and our approach to developing profiles, has been to adopt the AER's approach unless the benefit of changing is significant. An improvement in the profiles would improve either, or both, of:

— *Interpretability* - the ease with which consumers can understand the profiles and the advice they support

— *Accuracy* – whether the profiles lead consumers to make the 'right' choice between competing offers.

## Similarities in approach between AER and Victorian profiles

Key similarities between the AER's approach in preparing BPID profiles and the approach we have taken here are that electricity profiles are defined by:

— household size, using the same three groupings as the AER (1 person, 2-3 people, 4+ people)

— climate zone, with three zones available in Victoria.

The profiles were developed from the same dataset, which is the dataset we collected on the AER's behalf in 2017 to prepare energy consumption benchmarks

Gas profiles are also defined by month and household size (defined as above), similar to the AER's approach.

## Differences in approach between AER and Victorian profiles

Key differences between the AER's approach in preparing BPID profiles and the approach taken in this report and recommended for the Victorian profiles are that:

- Victorian profiles are defined for each half-hour block within a year, capitalising on the availability of smart meter data in Victoria and facilitating use in the Victorian Energy Compare portal.
- general electricity consumption profiles are the same for customers with controlled loads and those without
- a separate controlled load profile is provided which can be used where needed
- the treatment of household characteristics such as swimming pools, gas and solar panels is different:
  - The BPID profiles differ *either for* customers with and without swimming pools (in most cases) or for customers with and without gas connections
  - Our experience in previous projects, including in developing the energy consumption benchmarks, is that people find the use of swimming pools in this context counterintuitive. They typically expect profiles to take account of whether they have solar or gas, but not swimming pools
  - Our analysis here and in previous projects shows that the presence or absence of a swimming pool is important in estimating the amount of electricity a particular household is likely to use, making it a useful variable in developing energy consumption benchmarks
  - However, our analysis also shows that the presence or absence of a swimming pool has little impact on the shape of the household's profile, making it relatively *unimportant* in the current context where the objective is to compare between competing offers rather than to estimate annual usage
  - Therefore, the profiles we have developed are aggregated across customers regardless of whether they have a swimming pool
  - We have also provided profiles which distinguish between customers with and without solar panels in case the Commission prefers to use these for interpretability reasons

# 1 INTRODUCTION

In August 2017, the *Independent Review of the Electricity and Gas Retail Markets*, known as the Thwaites review, made a series of recommendations intended to increase the extent to which Victorian retail energy markets work to the benefit of Victorian consumers.

One of the key problems the Thwaites review identified was that consumers are confused about the products and services available to them. It found that many consumers pay more for their energy than necessary and concluded that this is often because consumers find it impossible to compare offers directly. The Thwaites review was concerned that this has a dampening effect on competition.

Recommendation 3 from the Thwaites review intends to address this problem. It can be summarised saying that there will be new rules to ensure that consumers can compare and assess retail energy plans more confidently.

The Essential Services Commission (Commission) is currently implementing recommendation 3. In December 2018 it published a draft decision in which it announced its intention to introduce a new Victorian energy fact sheet to replace the existing price and product information statements and offer summaries.

Details of the proposed energy fact sheets can be found in the Commission's draft decision, which is available from its website. The fact sheets will be based, in terms of form and content, on the Australian Energy Regulator's (AER) Basic Plan Information Document (BPID).

The fact sheets will include a comparison tool showing the annual cost of the relevant plan, which is to be calculated in a way that allows them to be used to compare between alternative retail offers. This relates to recommendation 3C:

*that the Commission should develop three or four typical customer usage profiles for use in standardised marketing material*

This report relates solely to these profiles. It is written in the context that the profiles are to be used as an input to the energy fact sheets and the comparison tool they will include. The report does not relate to the design of the fact sheets more broadly.

### 1.1.1 Report structure

The report is structured as follows:

- Chapter 2 describes the policy context, including:
  - the AER's BPIDs. These are not applicable in Victoria because Victoria has not adopted the National Energy Customer Framework. However, the Commission has decided that the

methodology used to compute the Victorian profiles should follow that used by the AER where appropriate
  - Victorian Energy Compare, which is a price comparator website operated by the Victorian Government.
- Chapter 3 describes the data upon which the profiles were based, including how they were collected.
- Chapter 4 describes the methodology taken to developing the profiles which, in very broad terms, is to apply the AER's methodology, with some adjustments to better fit the Victorian context. The chapter also deals with several practical issues relating to profile form and presentation.
- Chapter 5 describes the tool that ACIL Allen has developed to assist the Commission to generate energy consumption profiles.

# 2 POLICY CONTEXT

This chapter provides an overview of two contextual factors that have an impact on the design of the energy fact sheets, and therefore the profiles, namely:

- *Basic Plan Information Documents* required by the Australian Energy Regulator's (AER) *Retail Pricing Information Guidelines*
- the Victorian Government's *Victorian Energy Compare* website.

## 2.1 Basic Plan Information Documents

In 2018 the Australian Competition and Consumer Commission (ACCC) published the final report of its Retail Electricity Pricing Inquiry, entitled *Restoring electricity affordability and Australia's competitive advantage* (ACCC report).

The ACCC report included similar policy recommendations to those that have given rise to the Victorian energy fact sheets.

In this respect the ACCC's recommendations were consistent with work that the AER had already commenced to standardise retailer marketing material, which had followed retailer commitments to the Prime Minister's Office in 2017 to improve customers' ability to compare offers.

Therefore, the AER's *Retail Pricing Information Guidelines*, updated in August 2018, created a new document called a Basic Plan Information Document (BPID). Among other things, a BPID must:

- be produced for each tariff a retailer offers
- contain a comparison pricing table that shows a cost estimate of the tariff using three consumption profiles.

The *Retail Pricing Information Guidelines* do not apply in Victoria, because it has not adopted the National Energy Customer framework. However, they are relevant to the Commission's consideration of the best way to introduce energy fact sheets because, as the Commission noted in its draft decision on this matter, "*the design and key product features represented in the [BPIDs] are the product of extensive consumer testing and behavioural insights*" which was designed to identify the best way to "*reduce the complexity of plan information, and simplify energy plan comparisons*".

For this reason, the Commission has decided that:[1]

- the form and content of the Victorian energy fact sheet will be based on the BPID.
- the methodology used to calculate the profiles to which this report relates should align with the methodology the AER used to calculate the profiles it uses for the BPIDs.

[1] Essential Services Commission, "Helping customers engage confidently in the retail energy market Draft decision", 18 December 2018, available from www.esc.vic.gov.au, accessed 19 December 2018

### 2.1.1 Accessing the BPIDs

To obtain a BPID from the AER's Energy Made Easy website consumers must specify:

- whether they wish to compare offers for electricity, gas or both
- the number of people in their household
- their postcode
- whether they have:
  - solar panels
  - a pool
  - a smart meter
  - a gas heater (if they have chosen to compare gas only)
- their current electricity provider (or gas provider if they choose to compare gas only)
- whether they want to enter actual usage data from a recent energy bill.

BPIDs can also be obtained through energy retailer's websites. In these cases the approach to producing them varies from retailer to retailer, though the customer must always enter their postcode.

### 2.1.2 Energy Consumption Profiles

An illustrative BPID (first page only) is shown in Figure 2.1. The estimated price box, which we have circled in the top left hand corner, provides estimates of the annual cost of the plan in question for customers of three household sizes. It shows that these annual costs were estimated on the assumptions that:

- a one person household uses 9.3 kWh of electricity per day
- a 2 to 3 person household uses 14.3 kWh of electricity per day
- a 4 to 5+ person household uses 19.2 kWh of electricity per day.

These consumption levels are based on analysis of the 2017 Energy Consumption Benchmarks, though there are five household sizes in these benchmarks which are aggregated into three categories in the BPID. Those benchmarks, as well as the low, medium, and high consumption profiles for the BPIDs were estimated by ACIL Allen in 2017 based on data we collected in that year.

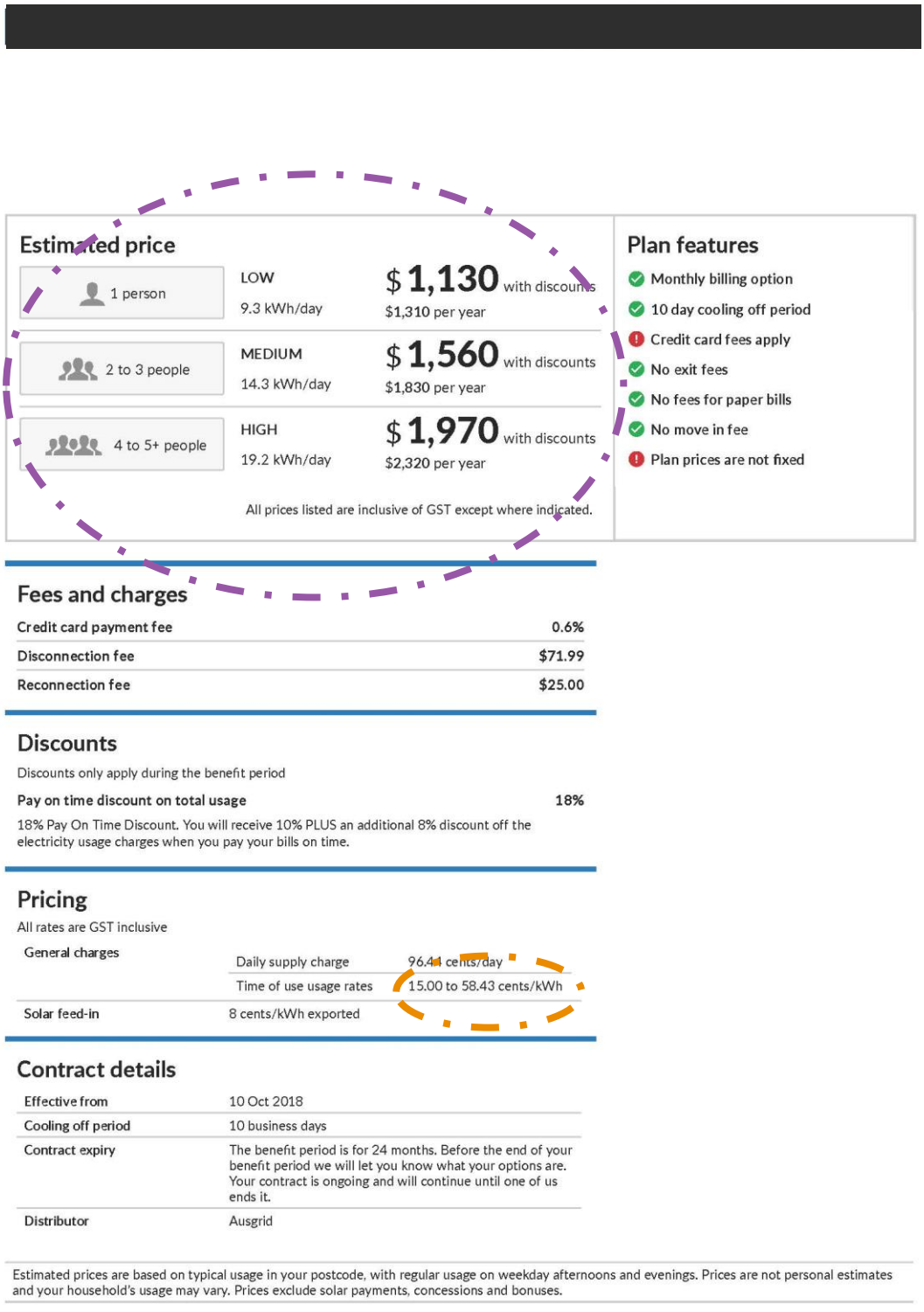
The Energy Consumption Benchmarks, and the consumption levels for households in the BPIDs are differentiated by state and climate zone. In several of these regions different consumption levels are estimated based on whether households have a pool. [2]

This BPID relates to a *time of use* tariff, meaning that customers on this plan pay different prices for electricity used at different times of day. Therefore, to compute the annual cost requires that the total usage assumptions shown above are apportioned between peak, shoulder and off peak times. The proportions used to do this were also estimated by ACIL Allen based on the 2017 Energy Consumption Benchmark data.

As the BPID in Figure 2.1 shows, the profile used to compute the annual cost is not a personal estimate, but is "based on typical usage" in the postcode entered to produce it, which was 2203 in this case.

[2] Further information on the Energy Consumption Benchmarks can be found on the AER's website: https://www.aer.gov.au/retail-markets/retail-guidelines-reviews/electricity-and-gas-bill-benchmarks-for-residential-customers-2017.

**FIGURE 2.1** ILLUSTRATIVE BASIC PLAN INFORMATION DOCUMENT



## Estimated price

| | | | |
|---|---|---|---|
| 1 person | LOW | 9.3 kWh/day | $1,130 with discounts<br>$1,310 per year |
| 2 to 3 people | MEDIUM | 14.3 kWh/day | $1,560 with discounts<br>$1,830 per year |
| 4 to 5+ people | HIGH | 19.2 kWh/day | $1,970 with discounts<br>$2,320 per year |

All prices listed are inclusive of GST except where indicated.

## Plan features

- Monthly billing option
- 10 day cooling off period
- Credit card fees apply
- No exit fees
- No fees for paper bills
- No move in fee
- Plan prices are not fixed

## Fees and charges

| | |
|---|---|
| Credit card payment fee | 0.6% |
| Disconnection fee | $71.99 |
| Reconnection fee | $25.00 |

## Discounts

Discounts only apply during the benefit period

**Pay on time discount on total usage** **18%**

18% Pay On Time Discount. You will receive 10% PLUS an additional 8% discount off the electricity usage charges when you pay your bills on time.

## Pricing

All rates are GST inclusive

| | | |
|---|---|---|
| General charges | Daily supply charge | 96.44 cents/day |
| | Time of use usage rates | 15.00 to 58.43 cents/kWh |
| Solar feed-in | 8 cents/kWh exported | |

## Contract details

| | |
|---|---|
| Effective from | 10 Oct 2018 |
| Cooling off period | 10 business days |
| Contract expiry | The benefit period is for 24 months. Before the end of your benefit period we will let you know what your options are. Your contract is ongoing and will continue until one of us ends it. |
| Distributor | Ausgrid |

Estimated prices are based on typical usage in your postcode, with regular usage on weekday afternoons and evenings. Prices are not personal estimates and your household's usage may vary. Prices exclude solar payments, concessions and bonuses.

*SOURCE: CREATED USING HTTPS://WWW.ENERGYMADEEASY.GOV.AU/ ON 23 JANUARY 2019*

### 2.1.3 Gas profiles

Gas profiles are estimated using a similar approach to electricity profiles, with adjustments to reflect the fact that:

- gas consumption is measured primarily using accumulation meters, meaning more sophisticated tariffs are not applicable to these profiles
- penetration of mains gas is more limited than electricity in general, and non-existent in some areas.

For these reasons, gas profiles:

- are apportioned to seasons, but not to intra-day blocks
- differ by State/Territory
- do not differ by:
  - climate zone
  - household characteristics.

### 2.1.4 Implications for the Victorian energy fact sheet profile estimation

In summary, the usage profiles that inform the BPID comparison tool:

- distinguish between 3 household sizes, namely one person, two or three person, and four or more
- reflect daily energy consumption consistent with the 2017 Energy Consumption Benchmarks that is apportioned to consumption blocks using a standard definition of those blocks
  - for example, 'peak', 'shoulder', 'off peak', and 'controlled load' for electricity
  - for gas, consumption is apportioned to seasons
- are 'mapped' to postcodes, but only differ by:
  - State/ Territory
  - climate zone (for electricity profiles)
- vary by reference to whether the customer in question has a swimming pool in some cases.

Given the Commission's decision that the methodology used to produce profiles to be used for Victorian Energy Fact Sheets should align with that used by the AER, our starting point is that the Victorian profiles should have these characteristics. Our approach to determining whether to move away from this starting point is described in chapter 4

## 2.2 Victorian Energy Compare

In October 2015, the Victorian Government introduced Victorian Energy Compare (VEC) as a new tool, replacing the former My Power Planner, to help Victorians save money on their power bills.

VEC's primary function is as a price comparator. It functions similarly to Energy Made Easy in that customers who want to compare energy offers can use VEC to obtain an estimate of the annual cost they would incur for electricity and gas on various energy plans and use that estimate to compare between plans.

However, as the Commission noted in the draft decision on this matter, VEC uses a more detailed approach to producing the underlying profile. Specifically, VEC estimates bills based on a profile at half-hourly resolution. This means that bill estimates are based on the specific parameters of the energy plan in question. For example, the cost of 'peak' energy consumption is based on the half-hour blocks in the profile corresponding to the exact time periods specified in the tariff. This is in contrast to the more generalised estimate of 'peak' consumption in Energy Made Easy, and enabled by the ubiquity of smart meters in Victoria.

### 2.2.1 Generating the energy consumption profiles on VEC

To produce the energy consumption profile on VEC, residential electricity and gas customers have the option of uploading actual historical usage data and, thereby, producing annual cost estimates based on their own past usage profile.

Alternatively, customers can choose to develop a profile within VEC. This is done by answering a series of ten questions which are applied to a pre-defined mathematical model that produces an annual usage profile.

In either case, the customer's usage profile is then applied to available retail offers to provide an estimate of the annual cost of electricity and/ or gas under each of the available offers. This is done seamlessly by the website, so the customer is not required to deal directly with the profile data unless they choose to upload it.

### 2.2.2 Relationship to the Victorian Energy Fact sheets

As the Commission noted in its draft decision, VEC users will receive bill estimates based on a more personalised profile than is possible with a fact sheet. This gives VEC the advantage of being more accurate than a fact sheet approach can hope to be, but this accuracy comes at the price of complexity. The strength of the energy fact sheets is that they can be accessed quickly and simply, without requiring the customer to answer questions or to download and upload usage data.

VEC will interact with the energy fact sheets in two ways. First, it is likely that retailers will use the retailer portal part of VEC to produce the fact sheets, or at least the values to be shown in the price comparison table. This leads to various practical questions concerning the use of VEC, but none that are relevant for the profiles.

Second, some customers can be expected to compare the outputs from VEC with the energy fact sheets.

# 3 THE DATASET

The profiles are based on the Victorian part of a national dataset we collected in 2016 on behalf of the Australian Energy Regulator. We used that dataset to compute the energy consumption benchmarks now available from the *Energy Made Easy* website.

The process by which the dataset was collected is described in detail in a report that is available from the AER's website.[3] This chapter provides a high level summary of the dataset as background to the profiles to be developed here. The summary consists of:

— demographics in section 3.1

— energy consumption in section 3.2.

## 3.1 Basic demographics

The dataset is a 'paired' dataset consisting of responses people provided to a questionnaire and metering data showing the electricity and, where applicable, gas usage of those people. The electricity and gas usage data were collected from the relevant distribution network service providers. The national dataset includes data relating to 8,174 Australian residential electricity customers, 2,518 of whom also have gas. The Victorian part of the dataset consists of 3,079 responses, 1,076 of whom also have gas.

Table 3.1 provides a summary of select demographic characteristics of the sample, based on their responses to the questionnaire.

[3] https://www.aer.gov.au/retail-markets/retail-guidelines-reviews/electricity-and-gas-bill-benchmarks-for-residential-customers-2017

**TABLE 3.1** BASIC DEMOGRAPHICS

| Characteristic | Electricity Sample | Gas Sample | Population |
|---|---|---|---|
| Number of Households | 3,079 | 1,076 | N/A |
| **Gender of survey respondent^** | | | |
| Male | 64% | 53% | N/A |
| Female | 35% | 47% | N/A |
| Other | 1% | 2% | N/A |
| **Age Distribution** | | | |
| **Age of survey respondent^** | | | |
| 18-29 | 8% | 8% | N/A |
| 30-50 | 13% | 11% | N/A |
| 51-65 | 8% | 9% | N/A |
| Over 65 | 15% | 15% | N/A |
| **Age of all household members** | | | |
| 0 to 4 years | 8% | 8% | 7% |
| 5 to 12 years | 13% | 11% | 12% |
| 13 to 17 years | 8% | 9% | 6% |
| 18 to 29 years | 15% | 15% | 14% |
| 30 to 50 years | 22% | 22% | 28% |
| 51+ years | 35% | 35% | 33% |

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

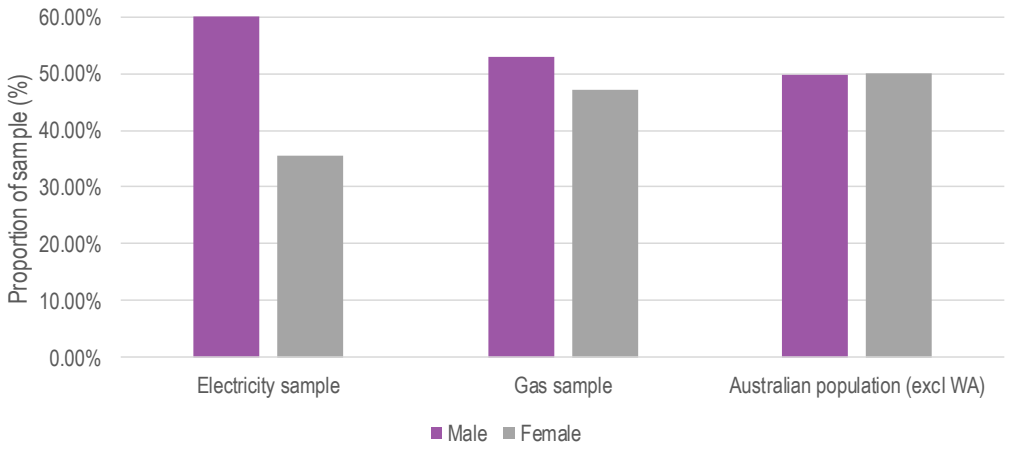
Note: column totals may not add to 100 per cent due to rounding

*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 the sample is 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

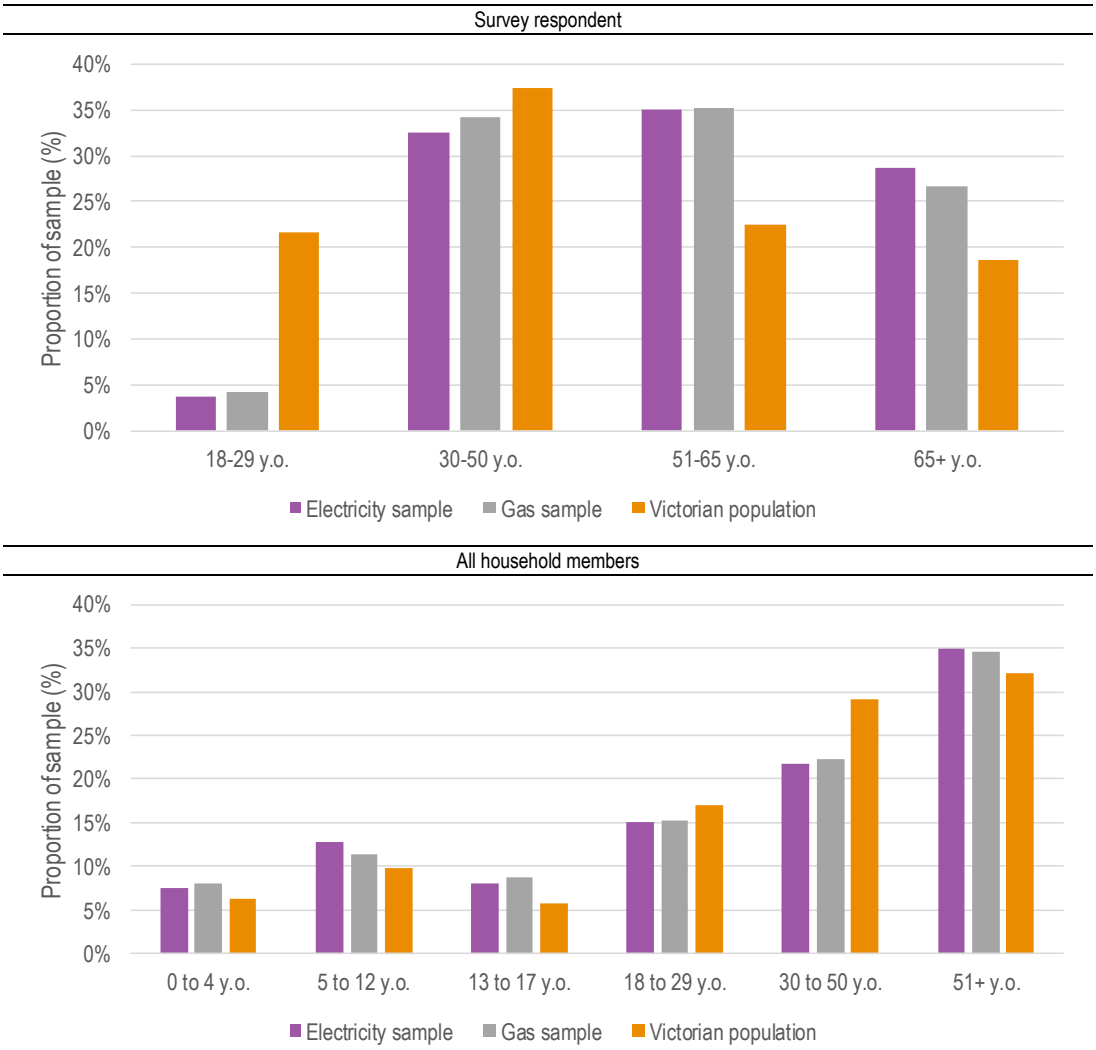
The top pane of Figure 3.2 and the middle pane of Table 3.1 show the age distribution of survey respondents. The lower panes of both go beyond the respondents to include others living in their households (hence showing a number of children aged under 12 years old who were obviously not survey respondents).

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

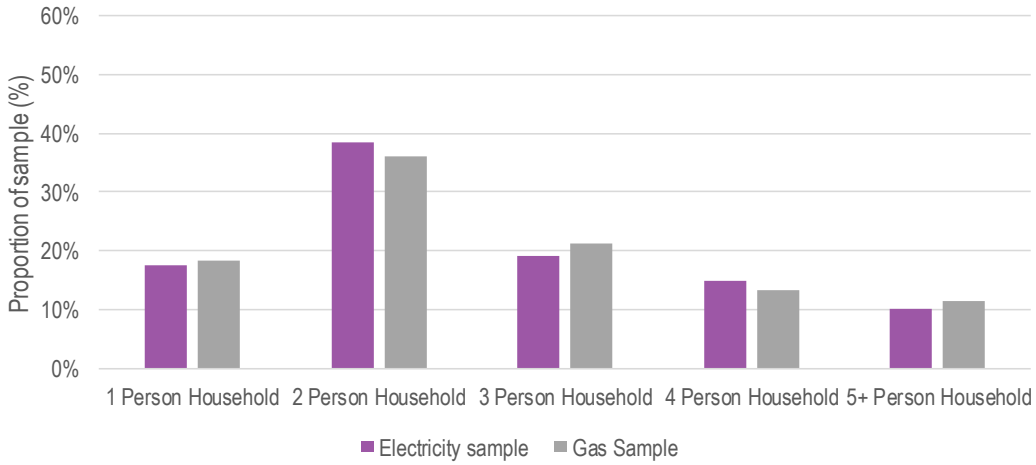



*SOURCE: ACIL ALLEN CONSULTING*

### 3.1.2 Household size

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*

### 3.1.3 Location within Victoria

The profiles upon which BPIDs are based take account of whereabouts a customer lives. To do this, different profiles are available for each State and for each climate zone.[4]

There are eight climate zones in total, though only zones four, six and seven exist to a significant extent in Victoria. There are some households in climate zone eight, but these are considered for the purposes of the profiles to be similar to those in climate zone seven.

Figure 3.4 shows the distribution of the two samples between climate zones broken down by household size. 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 3.2.

The lower panes of Figure 3.4 and Table 3.2 show the same information as the panes above them, but they relate to the gas sample. The broad pattern is similar.

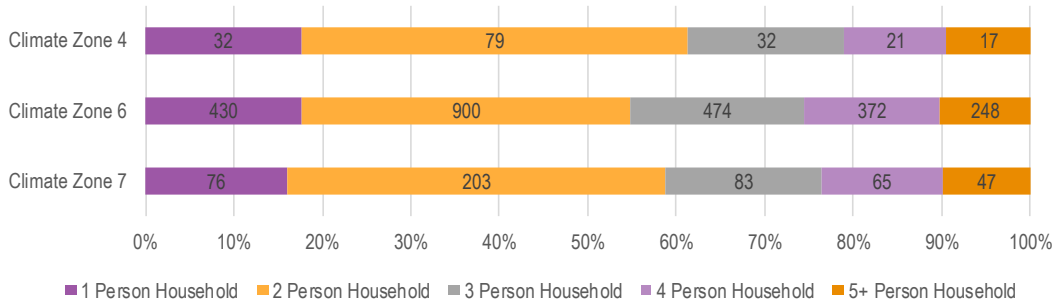
The climate zones are defined by reference to Local Government Areas (LGA). However, in the survey we asked respondents to provide their postcode rather than their LGA to avoid mismatch errors between the formal names of LGAs and the common names of suburbs in which people live. In other words, the risk 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. The process for addressing this is discussed in the energy consumption benchmarks report available from the AER. Another important point 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.

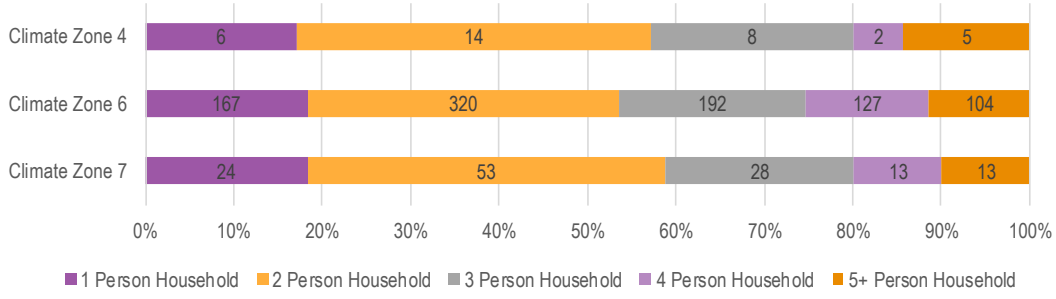
[4] Australia's climate zones were chosen by the Australian Building Codes Board to underpin various aspects of the National Construction Code, particularly those relating to energy efficiency. This was done by analysing climatic data collected by the Bureau of Meteorology. The data analysis supported 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.

**FIGURE 3.4** BREAKDOWN OF SAMPLE BY CLIMATE ZONE AND HOUSEHOLD SIZE

Electricity sample




Gas sample




*SOURCE: ACIL ALLEN CONSULTING*

**TABLE 3.2** BREAKDOWN OF SAMPLE BY CLIMATE ZONE AND HOUSEHOLD SIZE

| Household size | Climate zone four | Climate zone six | Climate zone seven and eight | Total |
|---|---|---|---|---|
| **Electricity sample** | | | | |
| **Number of respondents** | | | | |
| **1 Person Household** | 32 | 430 | 76 | 538 |
| **2 Person Household** | 79 | 900 | 203 | 1182 |
| **3 Person Household** | 32 | 474 | 83 | 589 |
| **4 Person Household** | 21 | 372 | 65 | 458 |
| **5+ Person Household** | 17 | 248 | 47 | 312 |
| **Total** | **181** | **2424** | **474** | **3079** |
| **Gas sample** | | | | |
| **Number of respondents** | | | | |
| **1 Person Household** | 6 | 167 | 24 | 197 |
| **2 Person Household** | 14 | 320 | 53 | 387 |
| **3 Person Household** | 8 | 192 | 28 | 228 |
| **4 Person Household** | 2 | 127 | 13 | 142 |
| **5+ Person Household** | 5 | 104 | 13 | 122 |
| **Total** | **35** | **910** | **131** | **1076** |

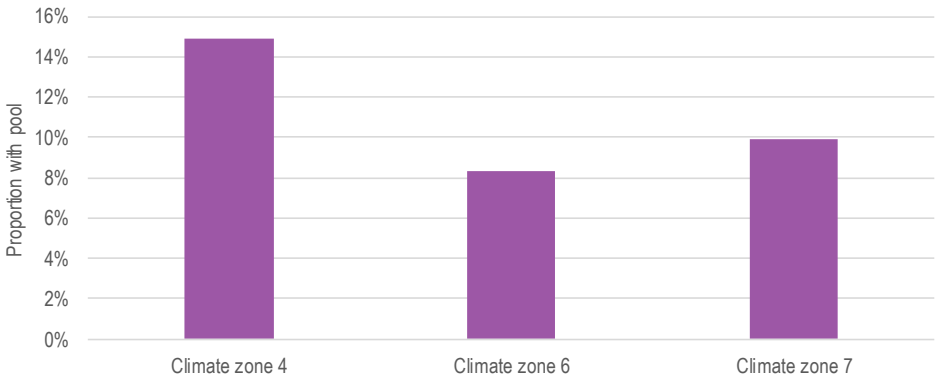
*SOURCE: ACIL ALLEN CONSULTING*

### 3.1.4 Swimming pools

In the analysis underpinning the energy consumption benchmarks we found the presence of a swimming pool to be a relevant factor in determining the quantity of electricity used in a household.[5] The difference in the amount of electricity used by households with swimming pools, compared with those who do not, is so large that it is important that it be taken into account in developing the profiles.

Figure 3.5 shows how pool ownership varies by climate zone within Victoria. Overall, around nine per cent of the Victorian dataset have swimming pools. However, pool ownership in climate zone four is almost twice the level of climate zone six.

**FIGURE 3.5** BREAKDOWN OF SAMPLE BY SWIMMING POOL OWNERSHIP



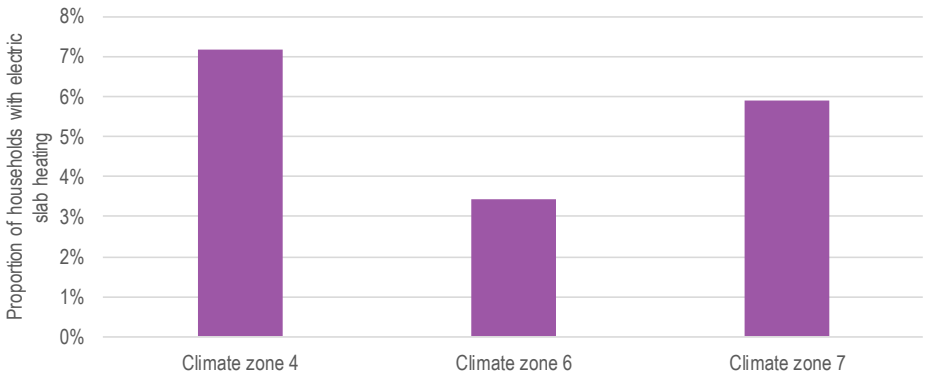

*SOURCE: ACIL ALLEN CONSULTING*

[5] See chapter 4 of the energy consumption benchmarks report for a description of how this was determined.

### 3.1.5 Electric underfloor heating

Similarly to swimming pools, the analysis underpinning the energy consumption benchmarks showed that the presence of electric underfloor (slab) heating is an important variable in explaining variability in electricity consumption in some zones. Figure 3.6 shows the breakdown of the sample by reference to whether respondents have slab heating in their homes.

**FIGURE 3.6** BREAKDOWN OF SAMPLE BY PRESENCE OF SLAB HEATING




*SOURCE: ACIL ALLEN CONSULTING*

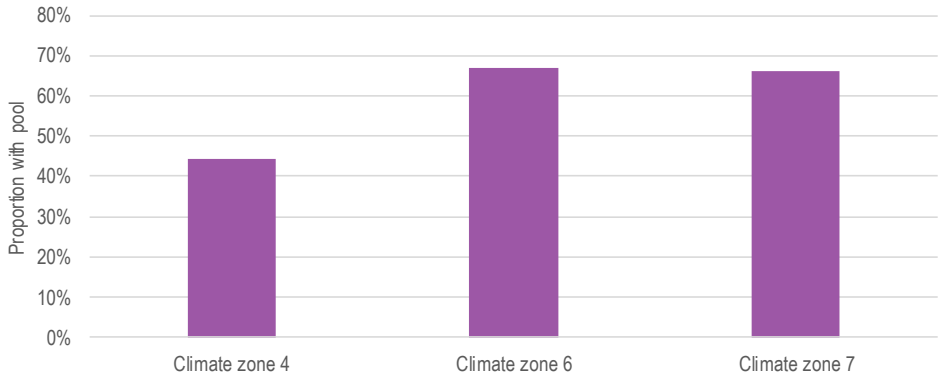
### Gas heating

The presence of gas heating is a relevant factor in determining gas benchmarks and it follows logically that it would also be relevant in determining the amount of electricity a particular household uses. All else being equal a household with access to gas can be expected to use less electricity than a household without access to gas.

As shown in Figure 3.7, 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 76 per cent of the gas sample had some type of gas heater in their home.[6] 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.

[6] 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 3.7** BREAKDOWN OF SAMPLE BY GAS HEATER OWNERSHIP




*SOURCE: ACIL ALLEN CONSULTING*

## 3.2 Energy consumption

This section describes the distribution of energy consumption values across the people to whom the profiles will apply:

- section 3.2.1 summarises the sample size by season and annually for electricity and gas consumption in each of the relevant samples
- section 3.2.2 provides a summary of the electricity consumption of the sample
- section 3.2.3 provides a corresponding summary of gas consumption of the sample.

### 3.2.1 Energy consumption sample size by season

In the energy consumption benchmarks report, 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 is provided Table 3.3. 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 for spring, then an annual consumption figure was not created for that respondent.

**TABLE 3.3** SAMPLE SIZES OF ENERGY CONSUMPTION BY SEASON AND ANNUALLY

| | Autumn | Spring | Summer | Winter | Annual |
|---|---|---|---|---|---|
| **Electricity consumption** | | | | | |
| Electricity sample | 3002 | 2999 | 3002 | 2928 | 2926 |
| Gas sample | 1000 | 999 | 999 | 934 | 933 |
| **Gas consumption** | | | | | |
| Gas sample | 1075 | 1075 | 1076 | 1075 | 1075 |

*SOURCE: ACIL ALLEN CONSULTING*

### 3.2.2 Summary of electricity consumption data

Table 3.4 shows the average electricity consumption in the sample by distribution network service provider (DNSP). Table 3.5 breaks the data down to various subsets distinguished by the presence of controlled load, solar panels and gas.

**TABLE 3.4** AVERAGE ANNUAL ELECTRICITY CONSUMPTION BY DNSP

| DNSP | Annual electricity consumption (kWh) |
|---|---|
| Jemena | 4,055 |
| CitiPower | 4,413 |
| Powercor | 5,413 |
| AusNet | 4,968 |
| United Energy | 4,275 |

*SOURCE: ACIL ALLEN CONSULTING*

**TABLE 3.5** AVERAGE ANNUAL ELECTRICITY CONSUMPTION– VARIOUS SUBSETS OF SAMPLE

| Subset | Annual electricity consumption (kWh) |
|---|---|
| Total | 4,984 |
| No controlled load | 4,618 |
| Controlled load | 6,537 |
| No mains gas | 6,871 |
| Mains gas | 4,432 |
| No solar | 5,241 |
| Solar | 4,671 |
| CL and no mains gas | 7,411 |
| CL and mains gas | 5,542 |
| No CL no mains gas | 6,431 |
| No CL and mains gas | 4,288 |
| CL and no solar | 7,411 |
| CL and solar | 5,542 |
| No mains gas and no solar | 7,145 |
| No mains gas and solar | 6,600 |

*SOURCE: ACIL ALLEN CONSULTING*

Figure 3.8 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 50$^{th}$ percentile electricity consumption is 959 kWh for the season.

The lower pane of Figure 3.8 shows the same curves, but 'zooms in' on the portion between the 20$^{th}$ and 80$^{th}$ percentiles (note the different scale on the vertical axis).

Key features of the sample include:

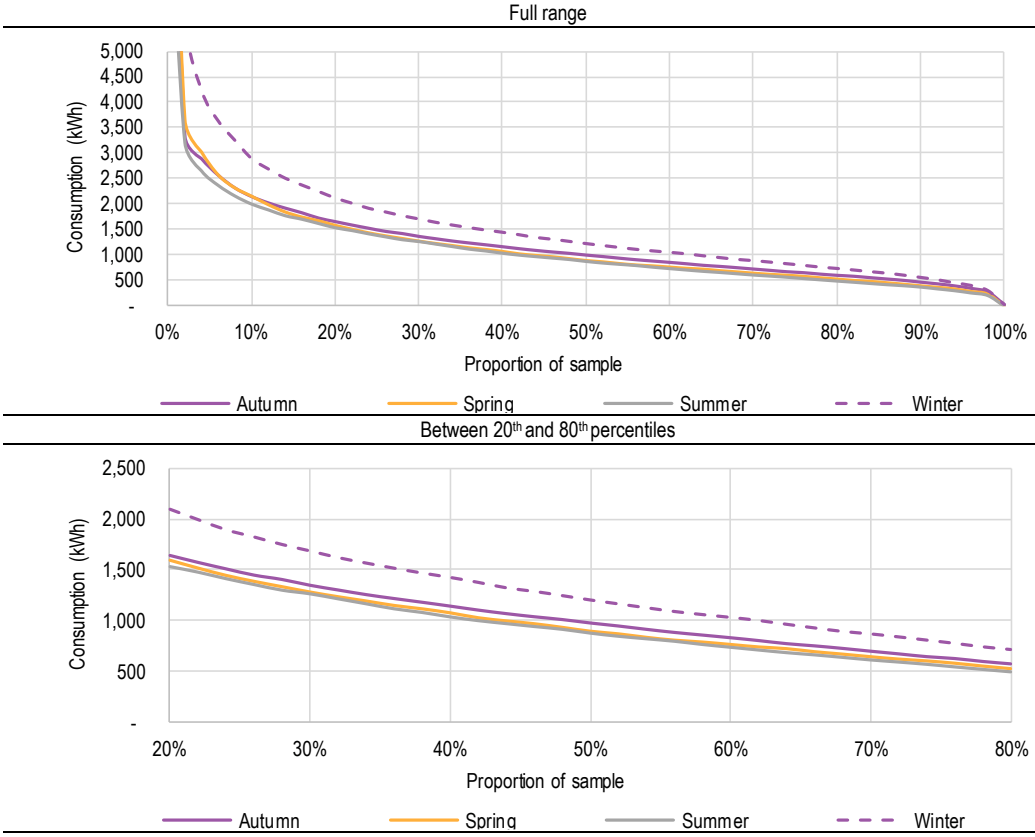
— at any given percentile level, consumption is highest in winter

— consumption levels in all seasons other than winter are quite similar

— at the high levels, consumption grows reasonably steadily to around the 10$^{th}$ 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 more significant decreases.

**FIGURE 3.8** ELECTRICITY SAMPLE – SUMMARY OF ELECTRICITY CONSUMPTION




*SOURCE: ACIL ALLEN CONSULTING*

### 3.2.3 Gas consumption patterns

Table 3.6 shows average annual gas consumption by DNSP.

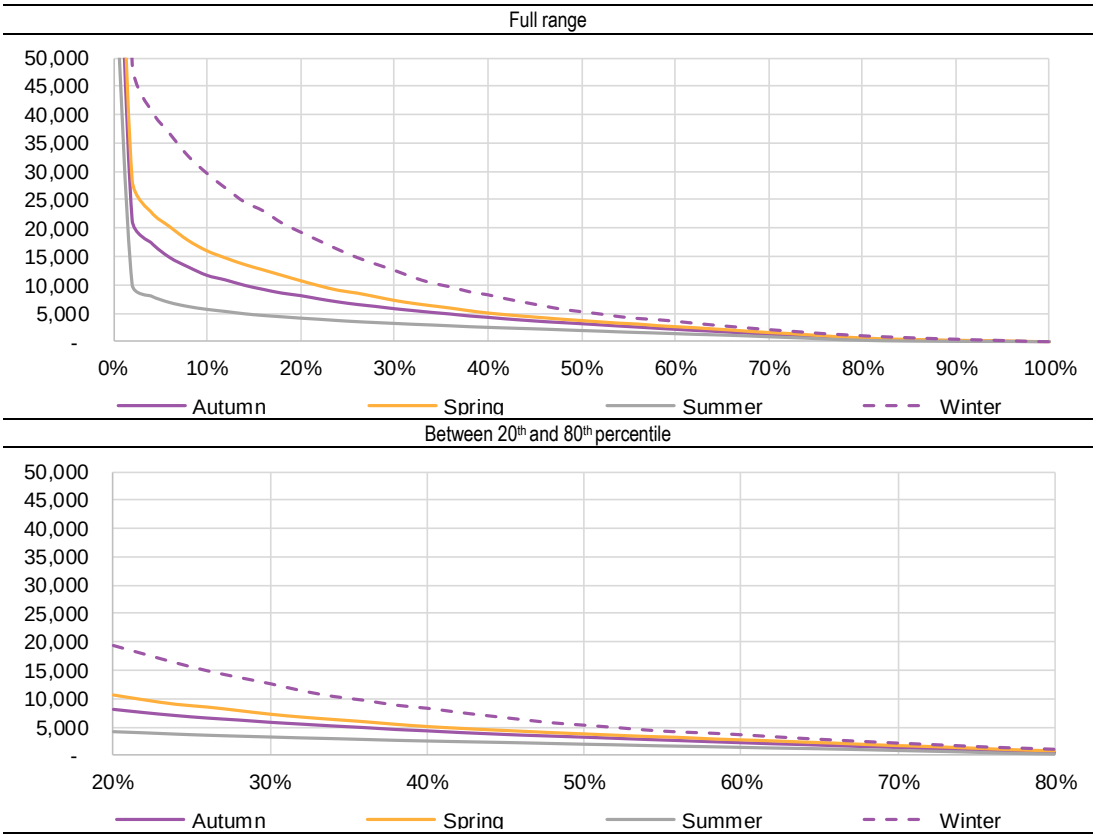
**TABLE 3.6** AVERAGE ANNUAL GAS CONSUMPTION BY DNSP

| DNSP | Average consumption (MJ/annum) |
|---|---|
| Australian Gas Networks | 47,847 |
| AusNet | 72,125 |
| Multinet | 51,222 |

*SOURCE: ACIL ALLEN CONSULTING*

Figure 3.9 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 3.9** GAS SAMPLE – SUMMARY OF GAS CONSUMPTION




*SOURCE: ACIL ALLEN CONSULTING*

# 4 METHODOLOGY AND RESULTS

This chapter outlines the methodology used for choosing the profile definitions. The profiles themselves are described in chapter 5 and are provided in an accompanying spreadsheet tool.

## 4.1 High level approach

As discussed in chapter 2, design of the BPID profiles includes the following considerations:

- **Household size:** 3 household sizes, namely one person, two or three person, and 'larger'
- **Consumption level:** daily energy consumption consistent with the 2017 Energy Consumption Benchmarks
- **Profile shape:** Energy is apportioned to consumption blocks using a standard definition of
  - 'peak', 'shoulder', 'off peak', and 'controlled load' for electricity
  - seasons for gas[7]
- **Geography:** BPID profiles are 'mapped' to postcodes, but only differ by:
  - State/Territory
  - climate zone (for electricity profiles)
- **Household characteristics:** vary by reference to whether the customer in question has a swimming pool in some cases.

The starting point for the methodology is that it should be aligned with the AER's methodology for developing profiles for BPIDs.

However, there are differences between the energy sector in Victoria and other jurisdictions, in particular:

- the widespread use of smart meters
- the availability of a wider range of energy tariffs
- different climate and household characteristics.

These differences might motivate some differences in the approach to be applied

The following sections address each of the design considerations described above in turn and identify where adjustments should be applied due to:

- interpretability – whether it is likely that consumers will understand the reason for using a particular characteristic to distinguish between profiles or whether it is prone to be confusing
- accuracy – whether *not* distinguishing between profiles based on a given characteristic is likely to render the profiles inaccurate.

[7] In some applications the start and end date of seasons, particularly summer, is redefined. This has not been done here so we follow the conventional meaning of each season.

The analysis in this this project focussed on the *accuracy* criterion, where this clearly does not impede on the interpretability criterion. Insofar as interpretability is concerned we were guided by the fact that the AER has done extensive user experience testing which is not repeated here.

We note that the primary role of the profiles discussed in this report is to provide a valid basis for comparing between competing tariff offers. Therefore, a profile would be considered *accurate* if it provides a correct answer to the question:

*Which of these two tariffs would be cheaper for my household?*

This question is different to asking whether an estimated profile is very similar to the customer's actual profile or whether the figure shown in the comparison tool is an accurate estimate of the likely cost of energy for a given customer. These are more demanding tasks that would require the customer to provide more detailed information, such as is done by VEC. The profiles discussed here will not necessarily be suitable for that purpose.

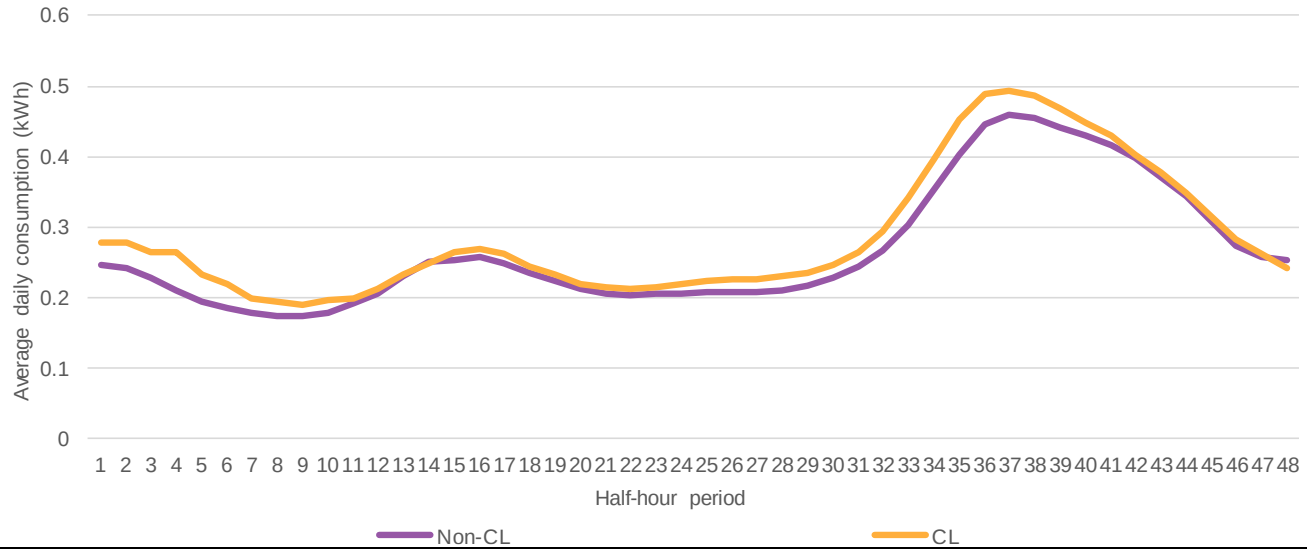
The following sections describe data preparation, followed by the method applied, and results from each of the key areas discussed above.

## 4.2 Data preparation

The analysis is based on data used to estimate the 2017 Energy Consumption Benchmarks, but has been prepared slightly differently to that project. The key differences and decision points in data preparation are discussed below:

- The energy data have been kept in individual half-hour blocks, rather than aggregated to the quarterly or annual level. This allows estimates of the profile shape, which is more acutely relevant to the range of tariffs available in Victoria than it is in other jurisdictions.
- For each household, energy data relate to the period from the beginning of 2016 to mid-2017 (the latest available). Half-hourly blocks are averaged for each household by month, and weekend/weekday.
  - Time-based weights have also been calculated to enable profile aggregation where required (i.e. monthly profiles, quarterly profiles, or annual profiles).
- Population weights have been calculated to ensure that profiles are representative of the population.
  - These are added to time-based weights to calculate the 'total weights' attributable to each response.
- Controlled load is excluded from the profiles. Energy consumption data from Citipower and Powercor include both general light and power and controlled load, so households from these distribution regions with controlled load are excluded from analysis.
  - As shown in Figure 4.1, the general light and power consumption profiles for controlled load customers are similar to those without controlled load, so (while not ideal) this is not anticipated to unreasonably bias the results.

**FIGURE 4.1** AVERAGE DAILY CONSUMPTION PROFILES FOR CUSTOMERS WITH OR WITHOUT CONTROLLED LOAD




Note: Analysis based on energy data from general import meters for customers with and without controlled load in Jemena, Ausnet, and United Energy distribution regions.

*SOURCE: ACIL ALLEN CONSULTING*

In each of the following sections we analyse an average annual profile for ease of interpretation, although seasonal variation has been explored in more detail to confirm the high-level findings.

## 4.3 Household size

### Approach

As shown in Figure 2.1, the estimated annual costs in BPIDs are based on household size. For these purposes, household size is presented in three 'categories', either:

- one person households
- two or three person households
- four person or larger households.

These are grouped from the original energy consumption benchmarks, which contain five household size groups. VEC is also based on five household sizes, so, for example, a two person household is assigned a different profile than a three person household.

Recommendation 3C calls for a simple set of 'three or four' typical usage profiles.

Insofar as the *interpretability* criterion is concerned, there is merit in following the AER's decision that profiles should be distinguished by household size. In our experience household size is an important predictor of energy consumption levels. We also note that recommendation 3C called for three or four household size groups.

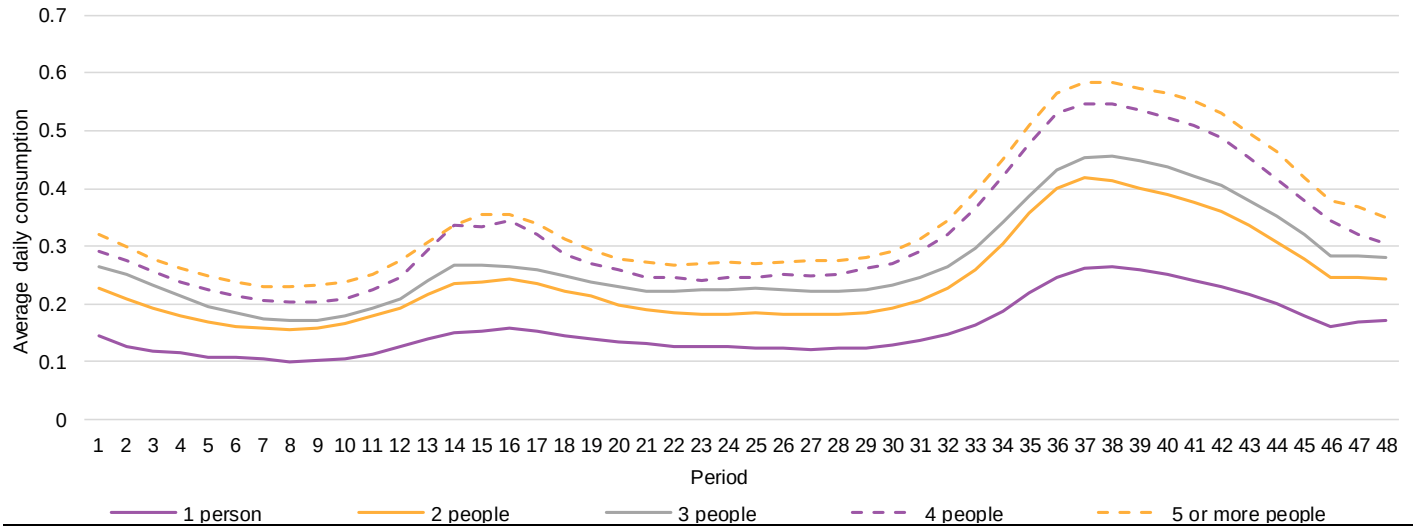
Therefore, it remained only to consider the *accuracy* implications of changing the groupings away from those used by the AER and/or of using four groupings instead of three to provide four profiles.

### Results

It was sufficient for this purpose to conduct a visual analysis of the data, which is summarised in Figure 4.2. The figure shows that average annual electricity consumption profiles by household size. It also shows that the curves representing four and five person households are close to one another. Similarly, the curves representing two and three person households are close to one another, but quite separate from other curves.

In our view this indicates that the AER's approach of grouping household sizes into the single person, 2-3 person, and 4+ person categories is appropriate from an accuracy perspective.

**FIGURE 4.2** AVERAGE ENERGY CONSUMPTION BY HOUSEHOLD SIZE




*SOURCE: ACIL ALLEN CONSULTING*

There is limited perceived benefit of splitting out the categories further. While the profiles for two person and three person households are slightly different (1.6 kWh consumption per day) the aggregate shape is quite similar. We do not believe there is sufficient evidence that adding more profiles would improve accuracy enough to offset the reduced interpretability.

For consistency we have applied the same household size groupings to gas profiles.

## 4.4 Profile shape

The profiles used by the AER to prepare BPIDs were created by apportioning consumption level time blocks using standard definitions of peak, shoulder and off peak. For electricity, this approach is adequate in most jurisdictions in Australia given that there is not currently widespread penetration of electricity smart meters.

However, with the ubiquity of these meters in Victoria there is a real prospect that future retail tariffs will vary in ways that could not be accommodated by profiles consisting of aggregated blocks.

For example, using fixed time definition and these highly aggregated time blocks makes it impossible for BPIDs to accommodate variations in the 'cutover' times between one time block and the next. Similarly, it limits the number of time blocks that can be accommodated.

### Approach

As interval data are available for Victoria our approach to profile shape differs from the BPID approach. We have defined each profile at half-hourly resolution. Many of these blocks follow a repeated pattern (for example, a daily consumption pattern for each month), but the profiles consist of a consumption value for each half-hour of the year.

It should be noted that retailers will not experience differences either way due to the resolution of the profiles. Whether they are aggregated or not is a matter that will only affect the 'back end' of the VEC website. This provides a further argument in favour of half hourly resolution, namely that VEC already operates on this basis.

In contrast to electricity meters, gas meters in Victoria are not 'smart'. Gas usage data is typically collected every two months and is aggregated over that time. We disaggregated the metering data to monthly resolution to compute gas consumption profiles, which were then disaggregated to half hourly resolution to allow them to be applied within VEC.

### 4.4.2 Controlled load

Some households have 'controlled loads' or 'dedicated circuits' for their electricity. These are separate physical electrical circuits in the home to which only certain appliances may be connected, typically either water heaters or concrete slab heaters.

#### Approach

Controlled load can be considered to be an additional 'block' of consumption. Our understanding is that BPIDs for controlled load and non-controlled load tariffs are based on the same overall consumption level as non-controlled load tariffs, but apportion out controlled load from total consumption.

In practice, households with controlled load might be expected to consume more energy overall than households without controlled load, although as shown in Figure 4.1 the general light and power consumption profiles for each of these types of households is quite similar.

Only a relatively small proportion of customers are affected, as only a relatively small proportion have the physical circuit in their homes. However, for these customers it appears desirable that their controlled load usage is estimated and incorporated into the annual cost estimate.

#### Results

As shown in Figure 4.1, the analysis has found that there are only minor differences in the general consumption profile of controlled load and non-controlled load customers. We therefore recommend that no distinction be made between controlled load and non-controlled load customers' consumption profiles.

As discussed above, separate controlled load data for Citipower and Powercor customers are not available, so these customers have been removed from the analysis.

Despite our understanding that controlled load consumption is excluded from the bill estimates in BPIDs, we have produced controlled load profiles by half-hourly resolution, similar to the general light and power profiles. We expect that the Commission will make a separate decision later as to whether it is better from an interpretability perspective to include the cost of controlled load electricity in the annual cost estimate, or perhaps to include it as a separate line item further down the information sheet.

## 4.5 Geography

#### Approach

The AER's Energy Consumption Benchmarks, and therefore the BPID profiles are estimated by State/Territory (for gas) and by State/Territory and (usually) climate zone for electricity.

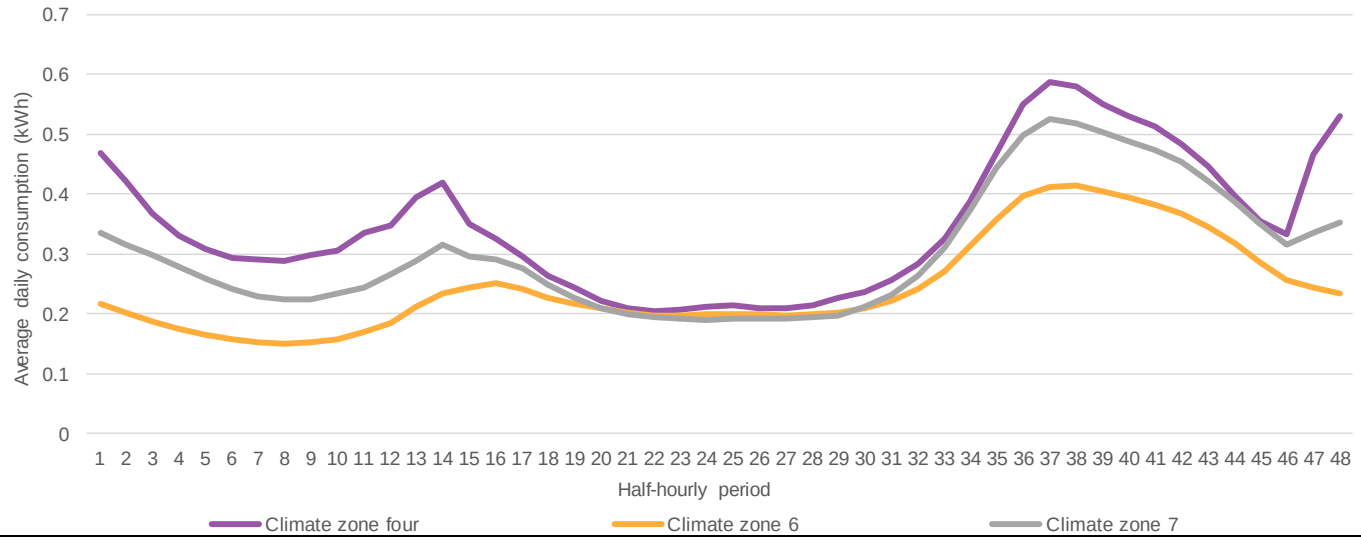
The use of climate zones to define profiles is based on an assumption that people in different climate zones use different amounts of electricity, even if they are in the same State or Territory.

There are three climate zones in Victoria. Most of the population is in climate zones six and seven. North-west Victoria is in climate zone four.

#### Results

Figure 4.3 shows the average daily profile across each of the three climate zones in Victoria. Although consumption is similar during the middle of the day there are some distinct differences at off-peak times. In particular, climate zone four, which is the rural area in the North west of Victoria, has the highest off-peak consumption. This likely reflects differences in housing stock, and use of electric heating where controlled load is not as widely used.

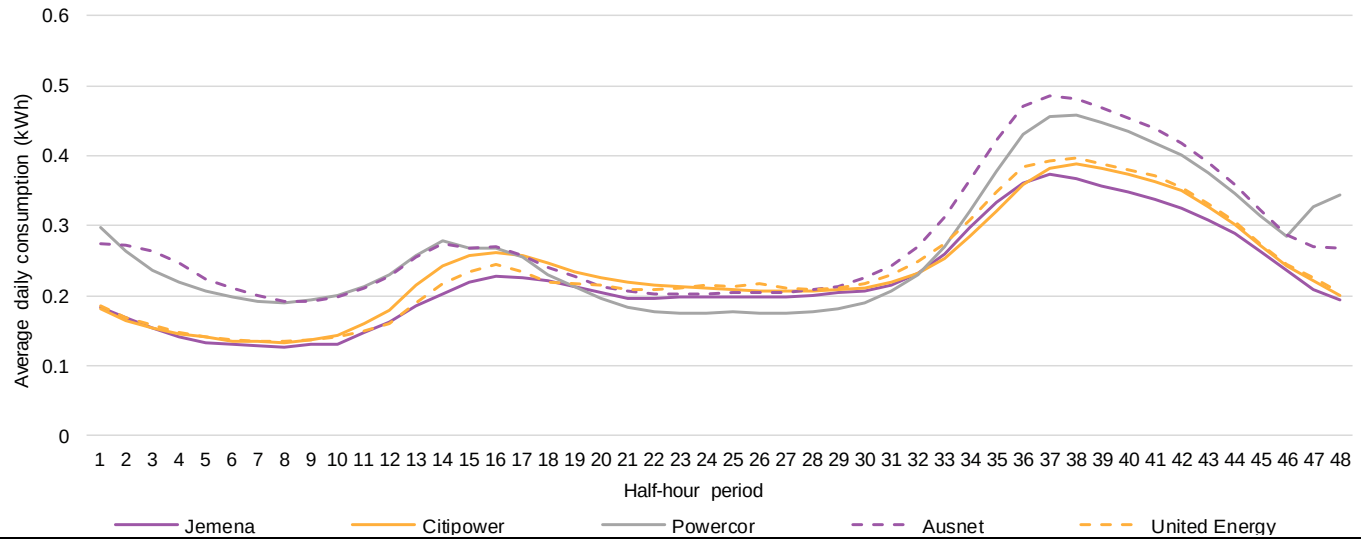
**FIGURE 4.3** CONSUMPTION PROFILES BY CLIMATE ZONE




*SOURCE: ACIL ALLEN CONSULTING*

Figure 4.4 shows profiles by DNSP. There is overlap between the coverage of each DNSP, with Powercor and AusNet being more predominantly in zones four and seven than the other DNSPs. This is reflected in the profiles.

**FIGURE 4.4** CONSUMPTION PROFILES BY DNSP




*SOURCE ACIL ALLEN CONSULTING:*

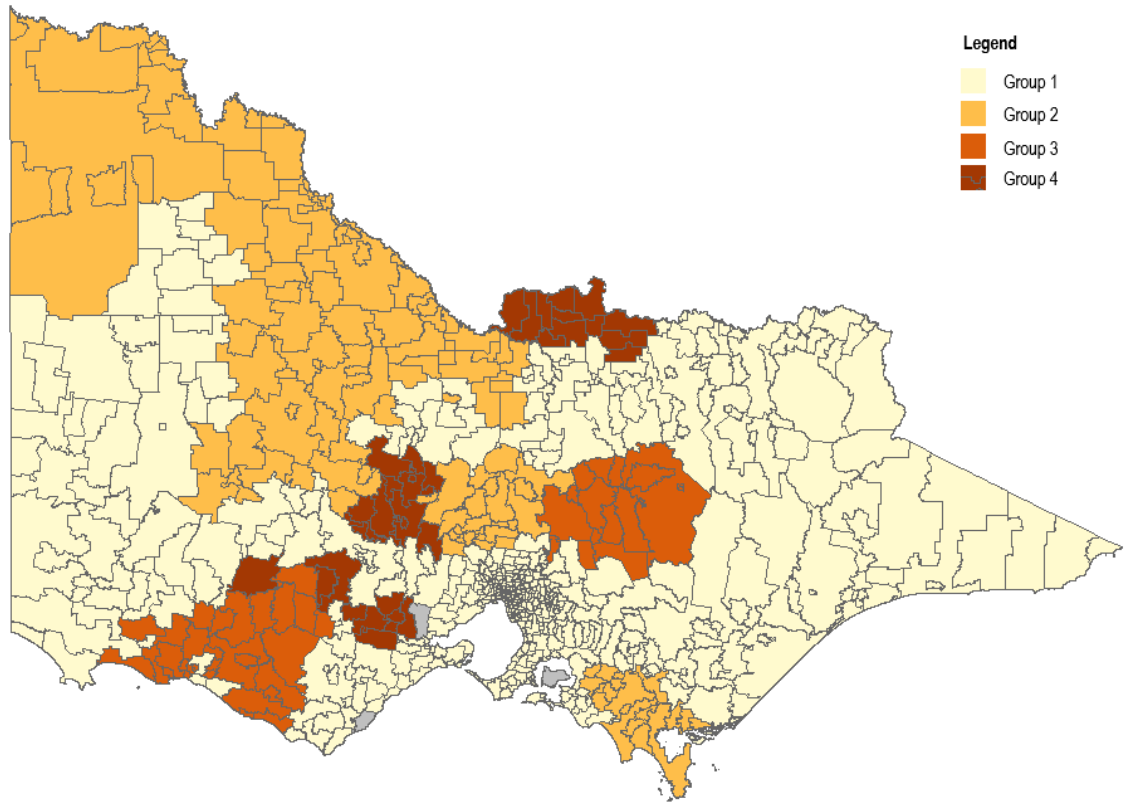
The differences between climate zones appear to be more significant than those by distribution region, suggesting that climate zone is a more appropriate method of geographic segmentation than distributor.

### 4.5.2 Geographic clustering

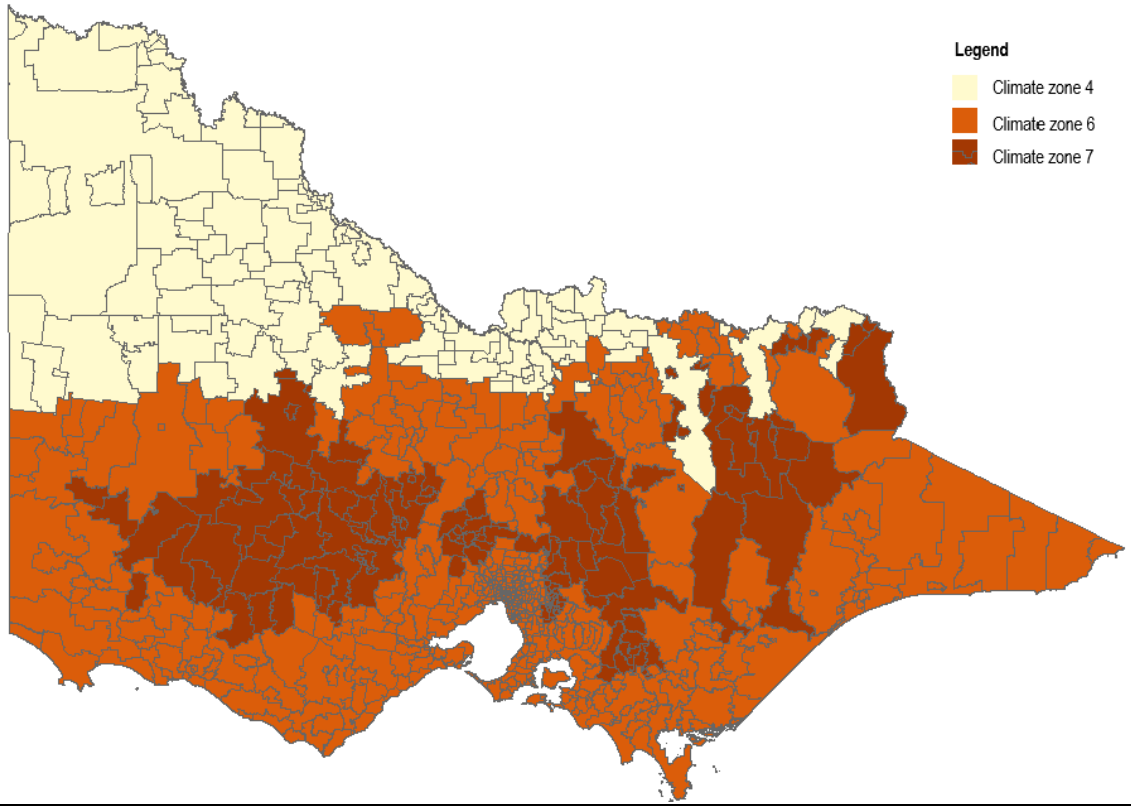
To test whether the above geographic identifiers could be improved we also searched for data-driven geographic groupings. Figure 4.5 compares the regional groupings identified through that analysis, shown in the upper pane, with the climate zones, shown in the lower pane.

**FIGURE 4.5** GEOGRAPHIC CONSUMPTION CLUSTERS IDENTIFIED THROUGH ANALYSIS, AND CLIMATE ZONES

**Geographic clusters**




**Climate zones**




*SOURCE: ACIL ALLEN CONSULTING*

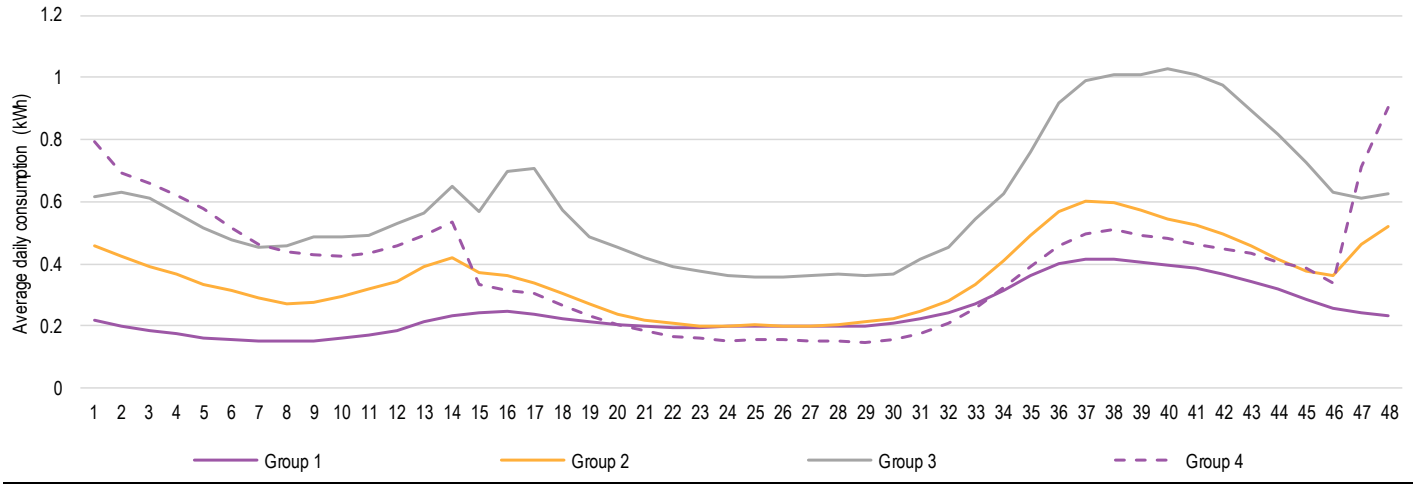
We note that in several parts of the state there were few survey responses, meaning that it is unclear which of the 'clusters' identified through the analysis would be most appropriate. We sought to moderate the impact of this by aggregating responses from local government areas together, but it remains that there are some gaps with respect to which cluster specific regions of Victoria would be assigned.

Of the areas identified there is some evidence for overlap with climate zones. The North-West of Victoria is in one group, and is similar to climate zone four (although it appears to branch further into central Victoria than that climate zone). Group three also overlaps strongly with some areas of climate zone seven.

Figure 4.6 shows the average energy consumption profiles of customers within each of the regions outlined above. As with the climate zone analysis (Figure 4.3) Groups one, two, and four appear to roughly reflect different levels of overnight heating.

Consumption among group three is higher throughout the day than for other groups, which reflects these customers living in cooler areas (perhaps without access to gas heating). It should be noted that this group consists of only 60 households in the dataset. This is fewer data than inform the other profiles, and also reflects that very few people in the state are likely to have this profile.

**FIGURE 4.6** AVERAGE CONSUMPTION PROFILE BY GEOGRAPHIC CLUSTER




*SOURCE: ACIL ALLEN CONSULTING*

### Result

Based on the above analysis our recommendation is that the profiles be distinguished by climate zone. While there may be other geographic groupings that provide more specific profiles for some areas in Victoria, the general trends uncovered through those profiles align with those identified in the climate zone analysis. Further, retailers are familiar with climate zones, due to their usage in the consumption benchmarks and BPIDs, meaning there is less potential for confusion by taking this approach.

### Approach and results for gas profiles

As per the approach to Energy Consumption Benchmarks, the AER calculated one BPID profile per State/Territory. This was partly because mains gas penetration is limited in many parts of Australia. This prohibited the AER from producing profiles for smaller geographic areas.

However, gas penetration in Victoria is high compared to other parts of Australia. This means that the dataset available for preparing gas profiles in Victoria is large enough to enable gas profiles to be computed for the different climate zones independently.

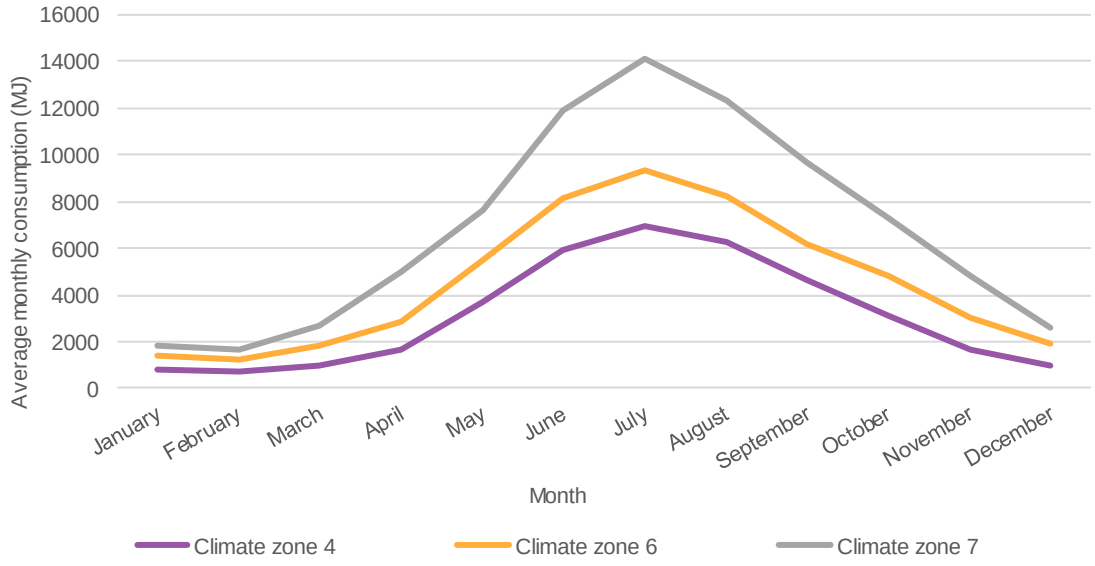
Figure 4.8 shows the average monthly gas consumption across each climate zone in Victoria.

The figure shows that households in climate zone seven use significantly more gas than households in other regions. In Winter their average consumption is around 50 per cent higher than others. In summer it is around 30 per cent higher.

The figure also shows that the 'shape' of gas consumption across the year is similar in the three climate zones. It is therefore unlikely that the *accuracy* of profiles would be hindered by using a single Victorian profile rather than three climate zone profiles. However, the difference in average *level* of consumption is notable, so the climate zone profiles are likely to provide a more accurate estimate of the annual bill customers can expect.

Overall, we have provided a single, Victoria-wide gas profile and separate profiles for the three climate zones which the Commission might prefer to use.

**FIGURE 4.7** AVERAGE MONTHLY GAS CONSUMPTION BY CLIMATE ZONE




*SOURCE: ACIL ALLEN CONSULTING*

## 4.6 Household characteristics

### Approach

The consumption profiles used in electricity BPIDs and the energy consumption benchmarks are different depending on whether the household in question has a swimming pool.

The choice of swimming pool for use in the energy consumption benchmarks was based on an analysis of a range of possible variables. That analysis, which is summarised in our earlier report to the AER was based on what we describe in this report as the accuracy criterion. That is, we concluded that the difference in electricity usage between households with, and without, swimming pools is so substantial that benchmarks that were based on data for all customers would be substantially inaccurate. In doing that we were aware that this created difficulties in terms of what we describe in this report as the *interpretability* criterion. In particular there was a concern that people with solar panels would not understand why the benchmarks did not take account of those solar panels. The answer was that even if solar panels influence the amount of electricity used in a given households, a swimming pool makes substantially more difference to the *total amount of electricity used*.

However, the objective of the current project is not to prepare benchmarks. As discussed in section 4.1 above, the purpose of the profiles is to help consumers choose between retail plans.

Broadly, the differences between one retail plan and another are the 'price' of electricity and whether that price varies depending on the time of day that the electricity is used. The possibility that price might differ during the day means that this analysis must focus on the *shape* of a consumers energy usage to a greater extent than is necessary in preparing energy consumption benchmarks. In turn this introduces the possibility that swimming pools might not be the 'right' characteristic to use in the current context notwithstanding the fact that they are used for the energy consumption benchmarks.

Therefore, we considered the following two questions:

1. whether the profiles should be conditional on a household characteristic
2. if so, which household characteristic should be used.

The BPID experience suggests that one household characteristic can be included without significant impacts on interpretability. Therefore, the answer to the first question is that we recommend the inclusion of a household characteristic as long as doing so explains enough variation and does not impede interpretability. We would not recommend including more than one household characteristic, as this would significantly increase the number of fact sheets required and may confuse customers.

To address the second question, and as discussed in section 3.1.4, our analysis of the dataset and our previous experience suggests that, all else being equal, households:

— *with* swimming pools
— *without* gas heating

tend to use substantially more electricity than other households.

Further, our analysis indicates that the size of this effect outweighs the effect of more intuitively appealing variables, particularly the presence of solar panels. This means that if only one additional variable can be used to 'explain' annual electricity usage by a household of a given size the 'best' choice is likely to be whether the customer in question has a swimming pool or, in some parts of Victoria, whether they have gas heating.

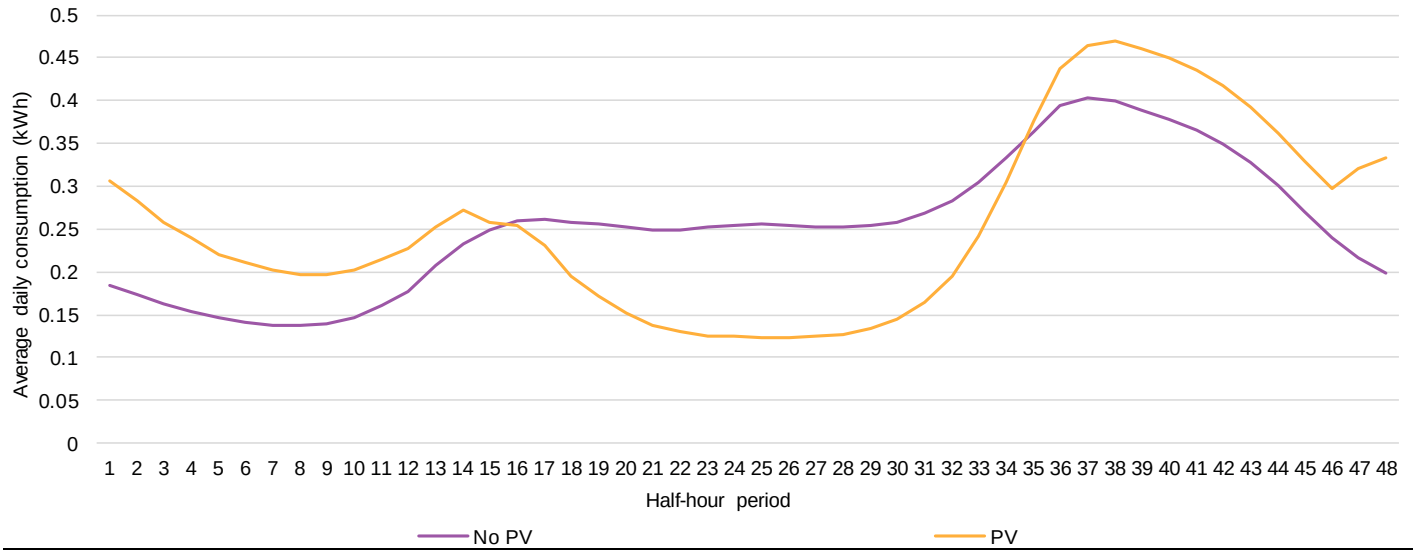
The difference in this context is that, as profiles will differ across time periods, the most predictive characteristic may indeed be solar panels (or another factor).

Therefore, setting aside the level of usage, we examined differences in *profiles* of customers with, and without:

— solar panels
— mains gas
— swimming pools.

Figure 4.8 shows profiles for households with and without solar panels. There are clear differences between profiles across the day, with less consumption in periods that are likely to be billed at peak or shoulder rates, and more consumption at late-peak and off-peak times.

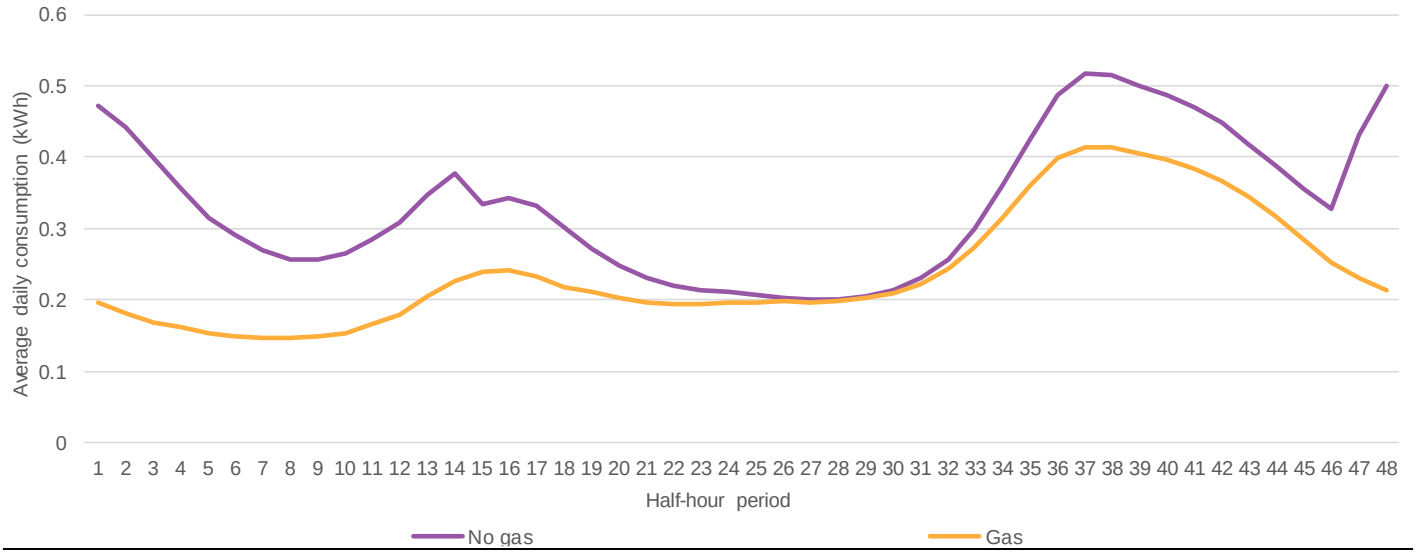
**FIGURE 4.8** PROFILES FOR HOUSEHOLDS WITH OR WITHOUT ROOFTOP PV




*SOURCE: ACIL ALLEN CONSULTING*

Figure 4.9 shows profiles for households with and without mains gas.[8] While consumption is similar in the middle of the day, households without gas consume significantly more energy at peak and off-peak times. However, as discussed in section 4.5 there is likely to be a strong relationship between geography and gas penetration (and therefore the relevant off-peak consumption), so this variability is partly addressed by using different profiles in different climate zones.

**FIGURE 4.9** PROFILES FOR HOUSEHOLDS WITH OR WITHOUT MAINS GAS



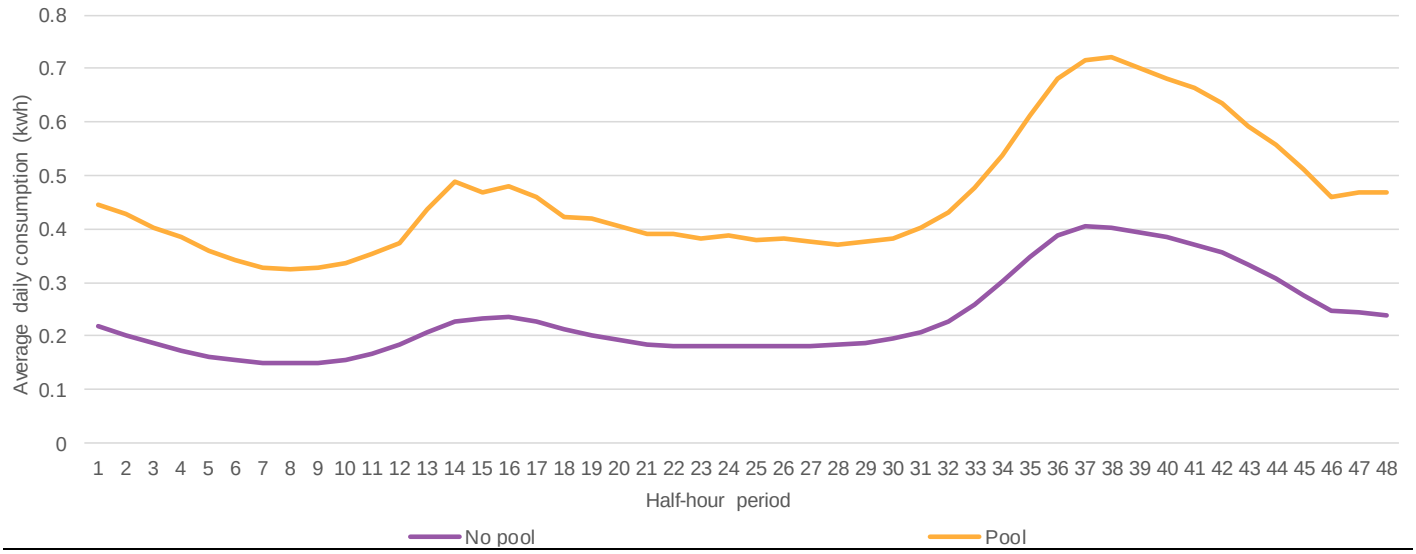

*SOURCE: ACIL ALLEN CONSULTING*

Figure 4.10 shows profiles for households with and without swimming pools. As identified in the 2017 Energy Consumption Benchmarks, the difference in the level of these profiles is more significant than any other corresponding difference in the dataset.

However, notwithstanding the different level of consumption, the consumption *profile*s are quite similar.

[8] Households with bulk bottled gas are in the 'not mains gas' group.

**FIGURE 4.10** PROFILES FOR HOUSEHOLDS WITH OR WITHOUT A POOL




*SOURCE: ACIL ALLEN CONSULTING*

### 4.6.2 Bill recommendation analysis

The visual analysis of different profiles does not give strong support for using either using swimming pools or mains gas as a household characteristic to take into account in selecting profiles. In contrast, it provides some support for using solar panels.

To examine the impact of each variable further, we estimated bills for each household based on two simple tariffs. We looked at bills associated with two tariffs:

- A 'flat' tariff (single rate)
- A 'flexible' tariff (peak, shoulder, and off-peak blocks).

We examined charges under a several tariffs, including energy offers for Lumo, Origin, and a distributor (NUOS) component of a bill. Given that many flexible tariffs are more expensive overall than equivalent flat tariffs, we also compared synthetic offers in which the daily charge was adjusted so that half of households were better off under each tariff.

This analysis yielded the following findings, which were robust for each tariff considered:

- The choice between (synthetic) TOU and flat tariffs is close for all household groups. The starkest differences are for households without Gas, who use a significantly greater amount of off-peak energy and thus benefit from flexible tariffs.
- In many cases a single tariff would be cheaper regardless of whether the household in question has, or does not have, the characteristic being considered. For example, in the example shown in Table 4.1 below all households will prefer a time of use tariff whether they have a swimming pool or not.
- The presence of absence of either a swimming pool or mains gas is most helpful for comparing the level of the bill, which is because these variables have a substantial impact on total electricity consumption.
- In contrast, the data shows that there little difference in total consumption of households with solar panels and those without.[9]

Table 4.1 shows the average bills for each household group under an example flat and example TOU tariff.

[9] We note that this is counter-intuitive. The expectation would be that, by generating electricity, solar panels reduce the amount of electricity import to the household from the grid. This result does not contradict this, but it shows that this effect is offset by households with solar panels also using more electricity in other ways.

**TABLE 4.1** EXAMPLE OF BILL COMPARISON ANALYSIS USING SYNTHETIC TARIFF

| Household characteristic | Flat tariff (b) | TOU tariff (b) | Difference ((b) – (a)) |
|---|---|---|---|
| No characteristic | $1,296 | $1,292 | -$4 |
| With PV | $1,293 | $1,285 | -$8 |
| Without PV | $1,299 | $1,298 | $0 |
| With Gas | $1,227 | $1,229 | $3 |
| Without Gas | $1,622 | $1,584 | -$37 |
| With pool | $2,007 | $1,986 | -$21 |
| Without pool | $1,225 | $1,222 | -$3 |

*SOURCE: ACIL ALLEN CONSULTING*

### Results

The bill analysis indicates that while the presence of gas or a pool helps to estimate the level of the bill, no single characteristic makes the profiles substantially more accurate. That is, no single characteristic is able to improve the profiles ability to guide consumers in their choice between tariffs significantly.

Of the three, the presence or absence of mains gas shows the strongest impact in terms of distinguishing between tariffs. However, this impact is likely to be accounted for through differential profiles by climate zone.

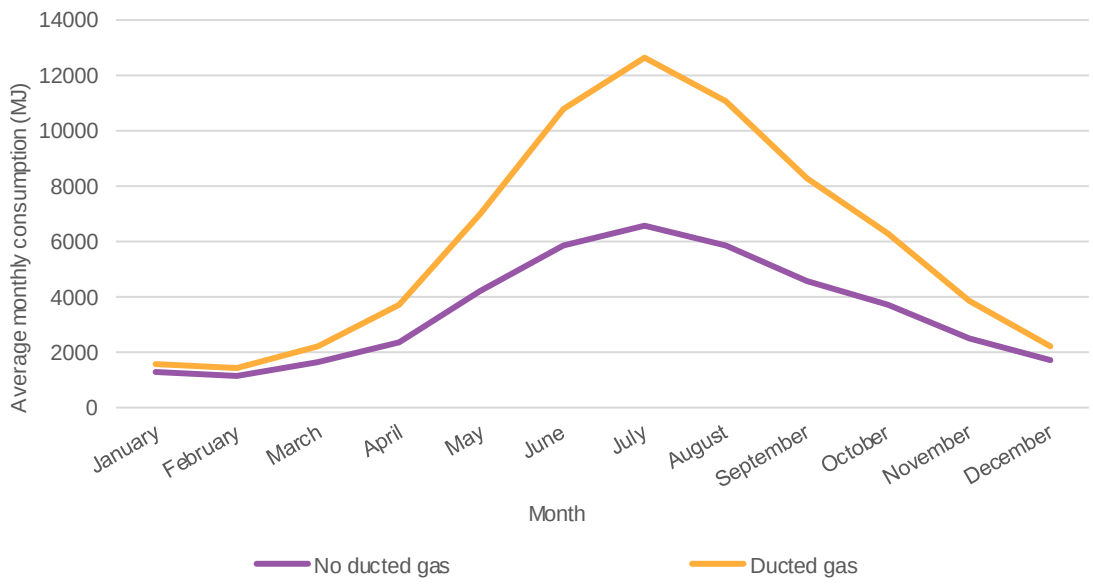
Our recommendation is that the choice be based on the interpretability criterion. The Commission might consider that the simplicity of not using a household characteristic is desirable. Alternatively, it might consider that providing different profiles for customers with and without solar panels is preferable. We have generated separate profiles for customers with and without PV (along with a general profile cutting across both groups) so that the Commission can use this distinction in the future if the need or preference arises.

### Approach and results for gas profiles

In line with the AER's approach, we have not calculated separate gas consumption profiles based on household characteristics. However, we note that in previous work we have found the presence of ducted gas heating to be a key variable in determining the level of gas consumption. Figure 4.11 shows the average monthly profile for households with and without ducted gas heating.

We expect that much of this variation will be captured through the use of profiles defined by climate zone – for example, the proportion of households that have ducted gas heating is significantly higher in climate zone 7 (67 per cent) than in climate zones four (41 per cent) and six (53 per cent).

**FIGURE 4.11** GAS CONSUMPTION BY DUCTED GAS HEATING




*SOURCE: ACIL ALLEN CONSULTING*

## 4.7 Consumption level

Consumption levels in the BPIDs are based on the Energy Consumption Benchmarks (aggregated by household size). These provide a total amount of energy in each profile, which is expressed as a daily energy consumption figure.

### Approach

The overall consumption level (daily consumption) was estimated for the Victorian energy fact sheet profiles based on the same data set as the BPIDs, but

- may be based on different household characteristics than used in the BPIDs and Benchmarks
- may produce separate profiles for controlled load than for non-controlled load, as these correspond to different types of tariffs.

Consequently, the consumption levels in the fact sheets may not necessarily mirror the consumption levels in AER Energy Consumption Benchmarks.

### Results

The overall consumption levels for electricity estimated through our analysis, by climate zone and household size, are as follows.

**TABLE 4.2** SUMMARY OF AVERAGE DAILY ELECTRICITY CONSUMPTION (KWH)

| Household size | Climate zone 4 | Climate zone 6 | Climate zone 7 | Victoria total |
|---|---|---|---|---|
| One person | 13.2 | 7.2 | 8.7 | 7.5 |
| 2-3 people | 16.0 | 11.8 | 13.8 | 12.1 |
| 4+ people | 23.0 | 15.5 | 19.4 | 16.1 |

*SOURCE: ACIL ALLEN CONSULTING*

These daily consumption figures are not directly comparable to the Energy Consumption Benchmarks, as they are conditioned on different household characteristics, use a slightly different sample of households, and apply different weightings than used in the estimation of energy consumption benchmarks.

Table 4.3 shows the equivalent average consumption levels for gas.

**TABLE 4.3** SUMMARY OF AVERAGE DAILY ELECTRICITY CONSUMPTION (MJ)

| Household size | Climate zone 4 | Climate zone 6 | Climate zone 7 | Victoria total |
|---|---|---|---|---|
| One person | 76 | 89 | 119 | 92 |
| 2-3 people | 106 | 149 | 236 | 159 |
| 4+ people | 122 | 193 | 284 | 201 |

*SOURCE: ACIL ALLEN CONSULTING*

## 4.8 Refreshing the analysis

As mentioned previously, the analysis described in this report was based on data collected in 2017 for the AER's Energy Consumption Bill Benchmarks project. By its nature that was a historical dataset when it was collected, with the energy consumption data mostly relating to 2016. If consumption patterns have changed, or change in the future, there is a risk that the profiles will fall out of date.

It would be prudent, therefore, for the Commission to update the profiles from time to time. In one sense the optimal timing for these updates will depend on the speed of change in Victorians' electricity consumption patterns, which cannot be predicted.

In the absence of a valid means of determining when the profiles themselves become inaccurate, our recommendation is that the Commission seek opportunities to collaborate with others who use similar datasets.

In particular, we note that the dataset used for the profiles was the same dataset that we collected for the AER used to produce energy consumption benchmarks. It is similar to that which we collected for the Victorian Government to produce the algorithm in the 'back end' of VEC.

Pursuant to the National Energy Retail Rules (NERR), the energy consumption benchmarks must be updated every three years. If they continue to be produced using the methodology we have applied for the last three iterations this process will generate a dataset that could also be used to update the profiles. Therefore, the Commission might choose to update the profiles on a three yearly basis.

There are some risks in this approach. For example, the NERR do not require the AER to produce gas benchmarks, so it is possible that it will choose not to collect the data necessary for preparing gas profiles in future. There is also the risk that the AER Is no longer able to provide the relevant dataset to the Commission.

In practice, though, these risks appear small, particularly given the Commission's decision to adopt the AER's BPID approach to Victorian Energy Fact Sheets where appropriate.

If the Commission was not inclined to take this approach, we would recommend updating the profiles on approximately a three year cycle anyway. This would limit the risk of underlying usage patterns moving too far beyond the profiles. In this respect the Commission should note that there is a lag inherent in this type of data collection - when one year's usage data are collected the earliest of them are already a year old. It would be possible to streamline the process by some extent by limiting the updating process to simply updating the profiles rather than revisiting the question of household characteristics and geography every time. However, we would recommend that these issues be revisited at least every second cycle (i.e. every six years).

# 5 PROFILE OUTPUTS

This chapter describes the analysis outputs, including the tool used to generate profiles.

## 5.1 Profile generation tool

To calculate the profiles, we have developed a profile generation tool. This will permit the Commission to explore different profiles, and generate new profiles as required.

### 5.1.1 Input selection

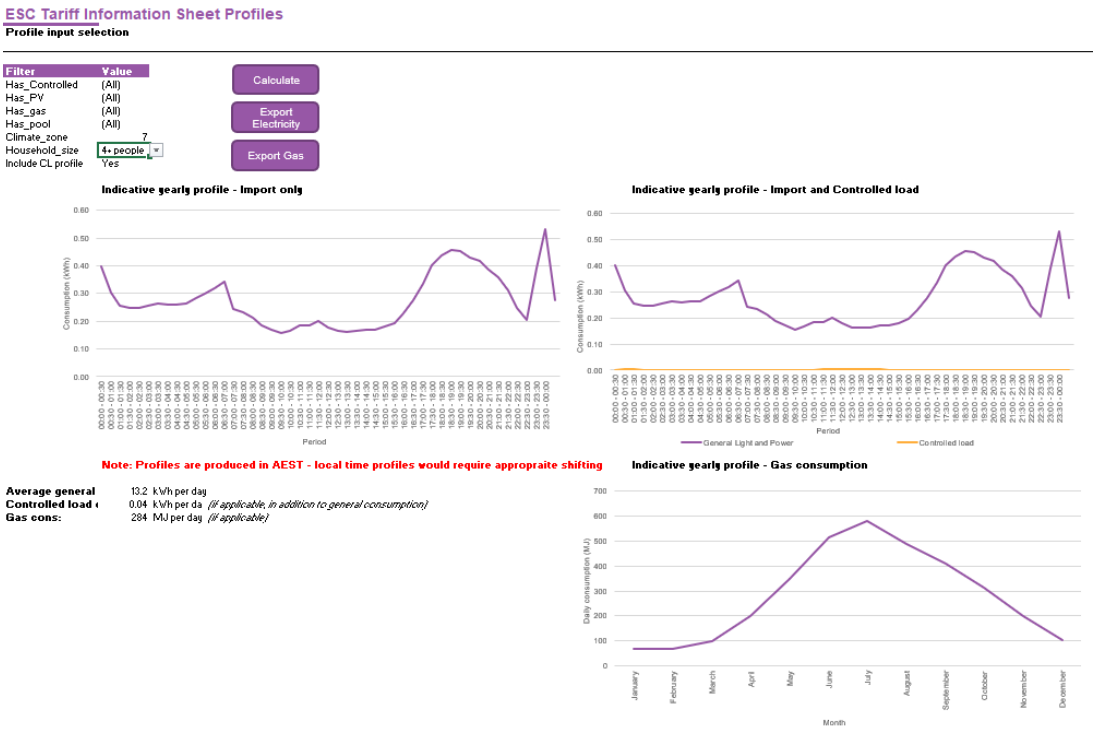
The input selection sheet contains controls to define the electricity profiles to extract from the data. The controls include a series of 'drop-down' boxes which filter the consumption data to produce the profiles. These include:

- Has_controlled: choose households that have or do not have a controlled load circuit
- Has_PV: choose households that have or do not have rooftop PV
- Has_gas: choose households that have or do not have a mains gas connection
- Has_pool: choose households that have or do not have a pool
- Climate_zone: choose the relevant climate zones for analysis
- Household_size: choose the size of the household

Once each of these settings has been selected, press the 'Calculate' button to calculate the profiles. As this is done an indicative average profile will be shown in the charts below, as well as the average daily consumption.

The 'Export Electricity' button runs a macro to produce a VEC-consistent profile output. Further detail is provided in section 5.1.2 below.

**FIGURE 5.1** INPUT SELECTION SHEET




*SOURCE: ACIL ALLEN CONSULTING*

### 5.1.2 Exporting profiles

As noted above, the 'Export Electricity' button produces an output file that is consistent with VEC requirements.

These profiles are:

- yearly profiles at half-hourly resolution
- generated by repeating daily profiles calculated by month and weekend
- specific to the filters selected in the inputs sheet.

Two types of output sheets can be generated:

- A profile that includes a controlled load circuit
- A profile without controlled load (general light and power only).

Controlled load profiles are only based on household size and climate zone.

The profiles are saved as a CSV file with the following naming convention:

- All files start with 'ESCprofile_'
- If any filters are applied to the profile, suffixes are added to the file name to signal the filter and the value of the filter used. For example, '_pv1' means the profile is for households that have rooftop PV. 'pv0' would be for households without rooftop PV.
- If no filters are included, the suffix 'No_conditions' is added.
- If the profile includes a controlled load trace, the suffix 'CLincluded' is added.

Profile files are saved to the same directory as the location of the profile tool.

### 5.1.3 Gas profiles

To produce a gas profile, click on the 'Export Gas' button on the profile inputs sheet. This will generate a yearly gas profile at half-hourly resolution, similar to that generated for electricity profiles.

The average daily gas consumption per household is shown in Table 4.3.

Gas profiles are able to be extracted by climate zone and household size. We note that the AER's approach does not distinguish between climate zones for gas consumption. We have therefore provided an aggregated gas consumption profile, as well as the ability for the Commission to generate profiles by climate zone so the Commission may choose the preferred profiles at a later stage.

Gas profiles generated by the profile calculator have a similar naming convention to electricity profiles, but start with 'ESCprofile_GAS'.

ACIL ALLEN CONSULTING PTY LTD
ABN 68 102 652 148

ACILALLEN.COM.AU

**ABOUT ACIL ALLEN CONSULTING**

ACIL ALLEN CONSULTING IS THE LARGEST INDEPENDENT, AUSTRALIAN OWNED ECONOMIC AND PUBLIC POLICY CONSULTANCY.

WE SPECIALISE IN THE USE OF APPLIED ECONOMICS AND ECONOMETRICS WITH EMPHASIS ON THE ANALYSIS, DEVELOPMENT AND EVALUATION OF POLICY, STRATEGY AND PROGRAMS.

OUR REPUTATION FOR QUALITY RESEARCH, CREDIBLE ANALYSIS AND INNOVATIVE ADVICE HAS BEEN DEVELOPED OVER A PERIOD OF MORE THAN THIRTY YEARS.