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Australian Consumers' Likely Response to Cost-Reflective Electricity Pricing

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Executive summary

Background

The Australian electricity industry is moving from a highly centralised system toward an increasingly decentralised, 'distributed' energy future. While this transition appears inevitable, at the same time it is clear that the industry faces a major challenge: cost-effectively managing and minimising extreme spikes in peak demand. Meaningful demand-side participation by many millions of Australian consumers is seen as a key component of these endeavours, and critical to *optimising the nation's future electricity systems* and *stabilising the real costs of electricity* to consumers.

It is toward these dual ends that momentum has been building for transitioning residential consumers away from traditional 'flat rate' tariffs toward more dynamic, flexible methods of electricity pricing. 'Cost-reflective' pricing schemes that more adequately reflect the true costs of supply are considered to be a critical means for promoting efficient demand-side participation in the electricity market, by providing consumers with a 'price signal' that should induce the desired behaviour change, shifting electricity consumption away from peak periods and flattening peak demand. Tariff reform is also seen as a way to mitigate the largely invisible cross-subsidies embodied in flat rate tariffs that may result in social inequity impacting lower income households.

For cost-reflective pricing to successfully achieve these benefits, there are at least two essential and inextricably linked requirements. First, there must be widespread *uptake* among consumers. Second, and very importantly, there must be optimal *usage* (i.e., appropriate behavioural response). While traditional economic models of human decision-making (e.g., rational choice theory) might predict high rates of voluntary uptake and rational behavioural responses, this optimistic prospect overlooks some important insights from psychology and behavioural economics. A more psychologically-informed view – one that takes into account what theory and evidence tell us about the peculiarities of human decision-making – suggests that for the desired efficiencies and shared benefits of cost-reflective pricing to be fully realised, it must be accompanied by a suite of supporting strategies that facilitate both consumer acceptance and 'appropriate' demand response. It is critically important to understand the factors impacting both initial widespread *uptake* and longer-term optimal *usage* of cost-reflective tariffs. While these issues have not received extensive attention to date, we demonstrate here that psychology can suggest some of the answers by shedding light on how consumers are likely to respond to the introduction of cost-reflective pricing.

First, in regard to the initial *uptake* of cost-reflective pricing, we note that there is vast scope for a more evidence-based analysis of what a broad, representative array of Australian householders actually think about different pricing schemes. Considering the significance of the proposed tariff reforms, and the extent to which they depend on voluntary uptake en masse, there is a need to better understand what kinds of tariffs might be preferred and what features of the 'offer' might be more or less appealing to householders. To our knowledge, there has been no large-scale, systematic, scientific research investigating Australian consumers' likelihood of accepting cost-reflective pricing, and the factors influencing their response to these kinds of tariffs.

Second, in regard to ongoing *usage*, we note that the presumed benefits of cost-reflective tariffs rest heavily on one critical assumption at the core of economic modelling: that consumers will respond 'rationally' to price signals, and shift their consumption accordingly. While an empirical analysis of the likely usage of cost-reflective pricing is beyond the scope of our current study, it is worth noting upfront that there has been inadequate investigation of whether consumers in general (vs. enthusiastic trial participants) have the capacity and/or motivation to manually respond to cost-reflective tariffs in this optimal way, particularly over the longer-term, and without intensive support. Extant theory and research already give cause for caution, and should certainly render us less sanguine about the prospects – at least in the absence of supporting strategies (e.g., automated devices) that might assist consumers in their optimal utilisation of cost-reflective tariffs.

Research design

To begin addressing the first issue of initial uptake, we conducted a nationwide randomised experimental survey with a large sample of Australian householders (final n=1181). We gauged their self-reported likelihood of accepting an electricity tariff offer that was described to them with simple text and visuals (a table and a graph), in a manner consistent with retailers' likely approach to consumers. After reviewing this description, participants were asked to indicate on a visual 0-100% scale:

> *"How likely is it that you would choose a pricing plan like this, if it was offered?"*

The particular tariff they considered was (unbeknownst to participants) selected for them *at random* from among six different pricing structures. This included five cost-reflective tariffs (time of use, critical peak pricing, peak time rebate, real-time pricing, capacity pricing) and a flat rate tariff (which effectively served as a control condition against which the relative appeal of more cost-reflective pricing structures could be gauged).

Further, each tariff 'offer' was (also by random assignment) presented in one of three different ways: a *basic* description just of the pricing structure itself, the basic description with the addition of a *money-back guarantee*, and the basic description accompanied by the offer of a *free automation device*. Thus, there were 18 distinct (randomly assigned) conditions in this 6x3 'factorial' experiment, encompassing 6 different tariff types, crossed by 3 different versions of the offer. The latter variations (leaving the tariff to stand on its own merits, or adding a money-back guarantee, or an enabling device) reflect key 'risk relief' factors that are thought generally to enhance consumers' likelihood of abandoning the status quo for a new offering.

We expect that our study's findings regarding *relative* tariff preferences will closely resemble actual consumer response to real tariff offers of this nature. However, we also expect there would be real value in conducting a follow-up randomised experiment where similar offers are presented in much the same way but by an actual electricity retailer (rather than a research agency). By contrast, we do *not* expect that a still more realistic picture could be gleaned from an actual roll-out of cost-reflective pricing in a limited, resource-intensive pilot trial, which invests far more in customer engagement and support (especially around ongoing usage of a tariff) than any mass roll-out would be able to accomplish.

We summarise our main empirical findings from the study as follows.

Acceptance of cost-reflective pricing as a function of tariff type and risk relief

- Consumers find *all forms* of cost-reflective pricing significantly less attractive than traditional flat rate tariffs.
- Consumers are particularly resistant to *real-time* pricing and (especially) *capacity* pricing, presumably on account of their greater novelty and complexity (hence, perceived risk), and pervasive mistrust and rejection of the concept that electricity should cost more depending upon demand.

- Simpler cost-reflective tariffs featuring pre-determined peak and off-peak periods – namely, *critical peak* pricing, *peak time rebate* and *time of use* tariffs – have greater consumer appeal, although still significantly less than flat rate pricing.

- The 'risk relievers' of a money-back guarantee and (to a lesser degree) free automation device generally boost the uptake of any tariff offer, providing consumers roughly the same encouragement to accept an offer irrespective of tariff type (i.e., they seem to increase the appeal of cost-reflective tariffs to the same degree they boost acceptance of any other offer, including flat-rate pricing).

Acceptance of specific cost-reflective pricing offers

- A 'basic' flat rate tariff (without any 'risk relief') is significantly more appealing to consumers than:
    - any form of *capacity* pricing, even with a money-back guarantee or automatic enabling technology; and
    - *real-time* pricing without any such 'risk relievers'.

- *Real-time* pricing must come with a compelling money-back guarantee in order to approach the appeal of a basic flat rate tariff, or have even a chance of being accepted.

- Even with the prospect of a risk-free trial, or an enabling device to help maximise the advantages of the new plan, there is limited consumer interest in shifting to novel, demand-based pricing structures like *capacity* pricing.

- A *flat rate* tariff offer with money-back guarantee achieves an unparalleled level of consumer acceptance, unmatched by any other combination of tariff and risk relief.

- Only a limited set of cost-reflective pricing offers seem to rival consumer acceptance of flat rate tariffs, specifically:
    - *peak time rebates* with the offer of a free automation device (aimed at easing management and maximising consumer benefit from the tariff); and
    - *time of use* tariffs, or *critical peak* pricing, when accompanied by the money-back guarantee (aimed at alleviating consumers' perceived risks in trialling the new offer).

- With the addition of risk relief mechanisms, cost-reflective tariffs can be made more acceptable to consumers, but not more acceptable than *flat rate* tariffs offered on the same terms.

The moderating role of socio-demographic characteristics

Overall, those population segments that appear more amenable to taking up certain forms of cost-reflective pricing include, most significantly, people with higher levels of formal education and renters.

The cost-reflective pricing form that seems to have the greatest (although not great) appeal to *lower income* consumers is critical peak pricing. This is understandable insofar as it holds out the prospect of much cheaper electricity for much of the year, in return for avoiding usage for a few hours a day across just a few weeks.

More specifically, we find that:

INCOME

- Lower income households are relatively indifferent between, and equally favour, flat rate tariffs and *critical peak* pricing over other schemes.
- Flat rate tariffs are increasingly favoured over *critical peak* pricing as household income rises.
- The addition of an automation device to a tariff offer only increases the likelihood of uptake (although still modestly) for higher income households.
- Adding automation technology to the mix may actually discourage lower income households from taking up a tariff offer.

EDUCATION

- *Time of use* tariffs, in particular, are considerably more acceptable than flat rate tariffs to those with higher education.
- Less well-educated consumers have a marked preference for flat rate pricing.

EMPLOYMENT

- Households whose main income earner is only employed part-time are significantly more enthusiastic about *peak time rebates* than are others, and the only ones who generally prefer them to flat rate tariffs.
- Money-back guarantees are generally tempting regardless of employment status, but especially for households headed by a part-time employee.

HOUSEHOLD SIZE & TYPE

- Consumers' relative preference for flat rate tariffs over *real-time* pricing is significantly diminished, though not erased, as household size increases.
- The advantage that flat rate tariffs generally enjoy over *real-time* pricing is greater among childless couples than among other household types.

DWELLING TYPE

- The addition of a free automation device to a tariff offer generally increases uptake only for those living in semi-detached homes rather than other kinds of dwellings.

HOME OWNERSHIP

- Being a renter is associated with greater uptake of *real-time* pricing, *capacity* pricing and *peak time rebates* (the latter favoured by renters over all other tariff types).
- Flat rate pricing remains far more appealing to non-renters than any form of cost-reflective pricing, especially *capacity* pricing.

Conclusions

Meaningful demand-side participation by many millions of Australian consumers will be critical to optimising an increasingly decentralised electricity system and stabilising the real cost of electricity to consumers. However, consistent with well-known biases against complexity, novelty and risk, and the pervasive human preference for simplicity, familiarity and certainty, it appears that Australian consumers generally prefer flat rate tariffs to all forms of cost-reflective pricing. Our empirical results suggest that the various tariff types are ultimately 'ranked' in a fairly predictable fashion: from the simplest, most familiar and seemingly lowest-risk offers (flat rate tariffs) down to the most complex, novel and apparently highest-risk offers (real-time tariffs and, least favoured of all, capacity pricing). Overall, we understand these relative tariff preferences as roughly reflecting public perceptions both of how difficult a proposed pricing structure is to comprehend, and how hard it might be for households to behave in ways that would maximise its benefits.

Of all the cost-reflective options, *peak time rebates*, *time of use* tariffs and *critical peak pricing* seem to be perceived more favourably than *real-time* and *capacity pricing*. This is presumably partly because the former have broader, more predictable and manageable off-peak/lower cost periods, which either recur in a regular way each day, or else only confront the consumer for a few hours on a few days each year. Peak time rebates appear to predominate among the cost-reflective options, perhaps because they feature potential gains rather than losses, and the latter is something to which we know human decision-makers are disproportionately averse. In other words, the consumer stands only to gain (via rebates for reduced peak consumption), and never to lose (via higher charges for peak consumption). They are also offered the perceived certainty that comes with a flat rate tariff.

In the end, however, the greatest barrier to uptake of cost-reflective pricing appears to be consumers' aversion to making *any* kind of choice, i.e., their aversion to giving up the status quo (which we know is only magnified as the decision-making environment grows more complex). Taking into account those who will never even respond to such a tariff offer, our calculations suggest that the initial voluntary uptake of cost-reflective pricing is unlikely to exceed 5-10% of households. On the face of it, this seems to present policymakers, regulators, networks and retailers with two alternative, essentially equivalent (and probably equally unsatisfactory) courses of action:

- Allow the enthusiastic 5-10% to voluntarily 'opt-in' to cost-reflective pricing, and willingly sustain 100% effort to modify their energy usage appropriately, while the remaining 90-95% of households do not participate; or

- Use mandates or 'opt-out' schemes to (essentially) impose cost-reflective pricing on 100% of consumers, while anticipating that only a small proportion will deploy it effectively[1], i.e., by significantly modifying their energy usage in response to changing price signals (especially if no automated enabling technology is provided).

In the absence of automated technology that might help consumers reap the benefits of dynamic pricing, these are our best estimates of the realistic prospects for a broad roll-out of cost-reflective tariffs into the Australian energy market. However, these are *not* the only two options available. Indeed, we show that a more integrated and holistic approach is essential.

We highlight the fact that a major reason we use electricity is to make daily life easier and more comfortable. With this in mind, it is not hard to understand why many people might find it difficult – at least in the absence of automated devices – to significantly modify their energy-related behaviour,

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[1] This prediction is drawn on the basis of key insights from psychology and behavioural economics, alongside some empirical findings from recent randomised controlled trials conducted overseas (see Braithwait, Hansen, & Armstong, 2012; Navigant Consulting, 2011).

especially at times of extreme network peak demand. We therefore have some concerns that intensive consumer education campaigns, if they *do* prove compelling, might potentially result in many households taking up pricing schemes they then struggle to deploy effectively (i.e., in such a way that reduces household bills and/or improves network efficiency) because manually responding to dynamic price signals proves too difficult or discomforting.

Since uptake does not equate to effective usage, the same concerns might arise around those money-back guarantees that, in our analyses, showed potential to boost acceptance of cost-reflective tariffs. Again, there may be hazards involved in inducing consumers – who might otherwise have made a different assessment of risks relative to returns – to take up cost-reflective pricing, without actually equipping them with the necessary means to respond to such pricing and exploit those schemes effectively.

On the other hand, while in our study automation devices proved less important than money-back guarantees in promoting tariff *uptake*, there is reason to believe they might be far more consequential in terms of enhancing effective tariff *usage*, and ultimately, network efficiency. This is because automated devices minimise the need for *manual* response by consumers, with household electricity usage adjusted automatically in response to changes in demand, rather than being heavily reliant on shifting human behaviour. Automated devices thus have great potential to simplify household demand response at peak times, consistently achieve desired reductions in household bills (and rather painlessly too, from the consumer standpoint), reliably mitigate network peak demand spikes, and deliver overall improvements to network efficiencies and utilisation rates.

In the end, then, considering our own findings in conjunction with prior research on usage, and in light of key principles from psychology and behavioural economics, we judge that:

Cost-reflective pricing will be more successful the <u>less</u> it relies on consumers, themselves, responding to changing price signals.

We contend that, ultimately, our collective problem is not how to get consumers to *take up* cost-reflective pricing, not even how to get them to effectively *use* cost-reflective pricing, but rather, *how best to reduce peak demand* – ideally in a manner yielding benefits for consumers and networks alike. Cost-reflective pricing is just one proposed solution to this problem, and clearly one that has garnered considerable support across the industry. But international experience suggests that cost-reflective tariffs are unlikely to yield the desired benefits without an appropriate suite of supportive mechanisms facilitating their optimal usage.

A substantial and enduring mass shift in electricity usage that flattens peak demand would seem to require not isolated tariff reform, but rather tariff reform accompanied by systemic technological changes, especially around automation of usage. As outlined earlier, automated load control devices for high demand household appliances may prove particularly important for optimising household usage of cost-reflective pricing. In this regard, it is worth noting that Australia is a global leader in the development of demand response standards for high demand household appliances. In fact the AS/NZS4755 suite of Australian Standards has already been voluntarily adopted by numerous international manufacturers of the three appliance types that generate around 80% of residential peak demand: air conditioning, swimming pool filtration and electric hot water. The Commonwealth has also advised its intention to mandate compliance with AS/NZS4755 across all such appliances sold, giving Australia an unparalleled opportunity to optimise its future energy systems.

Under this more structural (vs. behavioural) approach – where demand response relies more heavily on the appliances than the people – cost-reflective pricing would *primarily* function as a *quid pro quo* benefit to those households that pre-commit (periodically and infrequently, e.g., upon contract renewal) to demand-side participation in return for favourable tariffs (rather than serving as a shifting signal to which householders must attend and respond).

Other potential additions to a more holistic mix of solutions that seem, on the extant evidence, to have reasonable prospects of reducing peak demand (and better prospects than cost-reflective tariffs *alone)* include:

- Simple, low cognitive-effort, high visual-impact reminder devices for the home, such as 'energy orbs' ('ambient orbs') that glow different colours (e.g., red, yellow, green) depending on current household energy usage (and possibly even network status), inducing consumers to engage in other energy-saving actions that cannot be easily automated; and

- Innovations in building and technology design (e.g., building codes, solar air-conditioning, solar PV, battery storage, electric vehicle integration with home energy systems).

One could always seek to boost consumer uptake of any of these alternative/complementary solutions by taking into account, and actually making use of, those same cognitive biases and psychological influences that can mitigate against uptake of cost-reflective pricing, e.g., pre-commitment, inertial attachment to the status quo/defaults, aversion to complexity and loss, attention to social norms and tendency to conformity. However, we would caution against deploying psychological/behavioural interventions to boost uptake of cost-reflective pricing, itself, without also *ensuring consumers are equipped with the means (be they individual capacities or household devices) to utilise such pricing effectively* – and in a way that actually minimises household costs at the same time it enhances network efficiency. Otherwise, to the extent that intensive campaigns of 'consumer education' and/or 'risk relief' (e.g., money-back guarantees) *did* manage to persuade people to take up cost-reflective pricing, a good proportion of those consumers might still prove unable and/or unwilling to respond to the new tariffs in ways that maximise their benefits, at least if the core insights of behavioural economics are to be believed. One could even imagine that the more persuasive the campaign, the more unsuitable might be the consumers it persuaded to take up tariffs they may be ill-equipped to effectively deploy, either in their own or the public interest. If this were how the roll-out scenario unfolded, the aggregate result may well be insignificant improvements in household electricity bills, peak demand and network efficiency, all 'purchased' at considerable risk and expense.

We conclude that in all policy making around cost-reflective pricing it will be absolutely critical to distinguish what might promote *uptake* as opposed to effective *usage* of cost-reflective pricing, and to recognise that anything that induces the former without also facilitating the latter might entail considerable political, economic and social risks.

1 Introduction

1.1 Background

In Australia, as overseas, recent years have seen momentum build in the energy industry in favour of introducing more cost-reflective electricity tariffs. Energy retailers and distributors, as well as market regulators and policymakers, are increasingly calling for more dynamic pricing, e.g., where the price charged for electricity changes over time in response to varying levels of demand placed on the network. Cost-reflective electricity pricing is considered to be a solution both to the problem of peak demand, as well as to the unfair distribution of network costs across customers (cross-subsidisation).

From a financial standpoint, the cost of generating and supplying electricity to end-users varies greatly depending on both demand and supply-side factors. Ordinarily, the cost is higher during peak periods when network-wide demand for electricity is greatest, but comparatively lower during off-peak periods when there is less strain on the network. Yet in Australia, the default ‘flat rate’ electricity tariffs applied to most residential consumers do not accurately reflect the true costs of supply. This has led to largely invisible cross-subsidisation across consumers, with those who in peak periods have below-average consumption subsidising those with above-average consumption.

Traditionally, residential electricity pricing in Australia has been structured as two-part tariffs that comprise a fixed charge (also known as a service charge/daily supply charge) for supplying electricity to a property, and a ‘flat rate’ charge (or usage/consumption charge) for each kilowatt hour (kWh) of electricity used during a billing period. Traditional flat rate tariffs charge consumers the same amount (cents per kWh) for using electricity *regardless* of when they use it (e.g., time of day/day of the week/season) and the level of network demand (e.g., peak/off-peak period). In this way, flat rate tariffs provide a degree of predictability and stability: customers know upfront what they will be charged for using electricity, and this rate per kWh does not change over time.

In contrast, a cost-reflective tariff – also known as ‘dynamic’ or ‘flexible’ pricing – is inherently dynamic in nature. The price that consumers pay for electricity can depend upon *when* they use the electricity, *how much* they use, and/or the *level of demand* placed on the network at the time. While some of these tariffs (e.g., real-time pricing) are far more genuinely cost-reflective than others, they all share one common feature: consumers are charged a *variable* rate for the electricity they use, which may add an element of unpredictability to electricity pricing.

1.2 Types of electricity pricing

While most residential customers in Australia remain on ‘flat rate’ electricity tariffs, around the globe a number of tariff types incorporating various degrees of cost-reflectivity are gaining traction. These include so called ‘energy-based pricing’ such as time of use (TOU) tariffs, critical peak pricing (CPP), peak time rebates (PTR) and real-time pricing (RPT), as well as ‘demand-based pricing’ such as capacity tariffs (CAP). Their central features are described in Table 1, as follows.

Table 1 Types of electricity tariffs: Traditional vs. cost-reflective

TYPE OF TARIFF	KEY FEATURES
Flat rate tariff (FLAT)	• Customer pays a fixed ('flat') price for each kilowatt hour (kWh) of electricity used. • The cost of electricity (cents per kWh) used during a billing cycle remains the same, regardless of how much electricity a customer uses (e.g., a large or small amount) and when they use it (e.g., what time of day, season, etc.).
Time of use (TOU)	• Customer pays a variable price for each kilowatt hour (kWh) of electricity used, depending on what *time of day* and *day of the week* it is used. • The day is usually divided into three time-periods – peak, shoulder and off-peak – and the customer pays a different price per kWh for each period. Ordinarily: o a higher price is paid for the electricity used between 4pm and 8pm on weekdays ('peak periods') o a lower price is paid for the electricity used overnight between 10pm and 7am ('off peak periods'), and o a moderate price is paid for the electricity used at any other time ('shoulder periods'). • Different utilities may implement different ratios between peak and off-peak pricing, and have peak and non-peak periods of varying timing and duration.
Critical peak pricing (CPP)	• Customer pays a much higher price (per kWh) for the electricity used on ~15 'critical event days' per annum (when system-wide demand for electricity is highest), but a lower price for the electricity used at all other times of the year. • Critical event days are typically times of 'extreme weather' – in warmer climates, the few hottest days of summer when use of air-conditioning spikes, and in cooler climates, the few coldest days of winter when space heating spikes. • Ordinarily, a utility specifies the maximum number of critical events that can be 'called' in one season. A critical event day is 'called' when high system load is predicted (usually based on weather forecasts). • Customer is notified the day before a critical event / 'extreme temperature' day is going to happen (e.g., via text message, email).
Peak time rebate (PTR)	• Customer pays a flat price for each kilowatt hour (kWh) of electricity used, but they also receive a rebate (money back on bill) on each occasion they use less electricity than normal, during critical events – i.e., on about 15 'extreme temperature' days each year. • The price (cents per kWh) paid for using electricity remains the same regardless of when it is used it (e.g., no matter what time of day, day of the week, season), but the customer earns a rebate each time they used less electricity than normal during the very hottest and/or coldest days each year. • The amount of reduction is usually calculated using a household-specific measure of energy consumption during similar conditions on other days with similar weather patterns. • Customer is notified the day before a critical event / 'extreme temperature' day is going to happen (e.g., via text message, email). • If customer does not use less electricity than normal on critical event days – either because they do not want to, or cannot manage it – they simply pay the normal price for the electricity they do use, but do not earn the rebate (money back on bill) on that occasion.

TYPE OF TARIFF	KEY FEATURES
Real-time pricing (RTP)	• Customer pays a particular price for each kilowatt hour (kWh) of electricity used, and this price varies hour-by-hour so as to more closely reflect the true costs of supplying electricity at any one time. Ordinarily, the price is: o higher when it costs more to supply the electricity a customer wants to use (e.g., when other customers are wanting to use lots of electricity at that moment, for example during peak periods), and o lower when it costs less to supply the electricity a customer wants to use (e.g., when other customers are not wanting to use lots of electricity at that moment, for example during off-peak periods). • Customer can usually find out the hour-by-hour prices for the next day either by mobile alerts, logging on to a website, or calling a toll-free number. They may also have access to a web portal or enabling technology (e.g., in-home display) that shows the price at a particular time. • In some cases, the customer is notified the day before (e.g., by text message, email) if the prices are going to be especially high.
Capacity pricing (CAP)	• The price of electricity is based on demand in kilowatts (kW) rather than consumption (kWh), such that the customer pays for the maximum amount of electricity used *at any moment in time* (rather than how much they use) over a given time period. • Customer pays one charge for the whole billing period (e.g., the past month), and this charge is determined by what was the most electricity they used at any one moment during that month. That is, the customer pays a one-off monthly charge that covers all the electricity they use for that period. • The charge depends on what 'ceiling' (e.g., 'low', 'medium', or 'high') the customer had managed to keep their electricity usage under at all times that month. The charge is: o lower on a given month if the customer had only ever used a small amount of electricity at any one point in time, but o higher if the customer had ever used a large amount of electricity all at once (which could happen if they had a number of major appliances running all at once). • Customer is always notified (e.g., via text message, email) at the time if their electricity usage at any moment looks like it might 'break through' the next 'ceiling'. • If at any moment that month a customer's electricity usage does break through that next ceiling, they automatically move up to the next 'band' of service (e.g., from 'low' to 'medium', or from 'medium' to 'high') and pay a higher charge for that month.

Note. A fixed component (i.e., a daily 'supply charge' or fixed 'service fee') can also be combined with any of the tariff structures. This fixed service fee is a daily charge for every day that electricity is supplied to a property.

1.3 Why cost-reflective pricing? The rationale of 'rational choice'

From an economic perspective, the main rationale offered for the introduction of cost-reflective tariffs is that they better reflect and 'pass on' the actual costs of generating, supplying and transporting electricity to end users. According to the Australian Energy Market Commission, this means that consumers *'can more accurately value, and thereby efficiently respond to, ways to help minimise these costs over time. This in turn will ensure energy expenditure is as low as efficiently possible for all consumers in the long run'* (AEMC, 2012, p. 155). Cost-reflective tariffs are seen to provide a financial incentive or 'price signal' that might encourage consumers to shift their energy-usage behaviour in ways that improve network efficiency, e.g., by reducing their consumption during times of peak demand (when costs are higher) and/or shifting consumption to off-peak periods (when costs are lower). Industry reviews support more flexible, dynamic pricing as a means of enabling consumers to make optimal energy-usage decisions (AEMC, 2012).

The aforementioned benefits (for both consumers and networks) of cost-reflective tariffs rest heavily on the assumption that people will act as rational utility-maximisers when making decisions about how and when to use electricity. While many would consider this a reasonable assumption, research across the fields of psychology and behavioural economics provides ample evidence that people frequently stray from the 'rational choice' assumed by traditional economic modelling. And certainly this extends to the specific domain of residential electricity consumption (Allcott & Mullainathan, 2010; Frederiks, Stenner, & Hobman, 2015a). Rather than objectively weighing up costs and benefits to maximise their economic gains, people often rely on information processing shortcuts ('heuristics' and rules-of-thumb) that minimise the need for extensive analysis, all while pursuing (with varying levels of consciousness) end goals that need not include (let alone be dominated by) their own material advantage. While this may offer functional benefits – reducing cognitive overload and speeding up information processing – it tends to lead to systematic 'errors' (cognitive and social biases) in decision-making and behaviour. In sum, people often make choices that deviate from the assumption of rationality.

Once we incorporate the insights of *behavioural* economics, it seems unlikely, *first*, that consumers will voluntarily *take up* cost-reflective pricing at the rates predicted were households simply weighing up economic costs and benefits and settling on the tariff offer that maximises their objective material interests[2]. *Second*, among those consumers that *do* take up cost-reflective tariffs, it would seem unlikely – without a whole suite of supporting mechanisms – that many will prove willing and able to shift their electricity *usage* in response to 'price signals', or at least not consistently and reliably enough to benefit their households and networks.

All of this highlights the importance of supplementing traditional economic assumptions about human decision-making with evidence-based behavioural insights, if we are to adequately explain and predict consumer response to cost-reflective pricing. We contend that psychology and behavioural economics have critical perspectives to offer on the issue, and can greatly enhance any understanding derived only from the assumption of rational choice. For cost-reflective pricing to yield the efficiencies and shared benefits that industry and government are striving for, it is vitally important that we identify the psychological factors likely to impact both the *uptake* and *usage* of such tariffs. In the current report, we focus on addressing the first of these issues: factors influencing the *uptake* of cost-reflective electricity pricing by Australian households.

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[2] For instance, commentators with a more 'rational' perspective on the prospects might anticipate a 50% acceptance rate, given that half of consumers are expected to be financially better off under cost-reflective pricing in Faruqui and Palmer's (2011) empirical simulation of a revenue-neutral dynamic tariff.

1.4 Limited empirical evidence

Despite growing calls for the introduction of cost-reflective tariffs, there has been little empirical research in Australia on the likely response of different kinds of consumers, and the psychological factors that may underpin those responses. Given the significance of the proposed tariff changes, there is an urgent need to better understand how consumers are likely to react to their introduction (e.g., what proportion of the population is likely to respond positively, under what conditions, and why), what features might be more or less important to them, and how mutual benefits for both consumers and networks can best be realised. Some international research has found that while recruitment rates for time-based rate programs may vary widely (ranging from 5% to 28% for opt-in studies, and from 78% to 87% for opt-out studies), for a utility's planning purposes, assuming 10% recruitment rate seems most appropriate for voluntary opt-in programs (Todd, Cappers, & Goldman, 2013). Yet very little is known about *who* is likely to subscribe[3], *why* they sign up, and *what* might encourage others to do the same. Overall, despite the strong impetus around the globe for the introduction of cost-reflective pricing, there is limited work in this sphere internationally and, to our knowledge, no systematic, scientific research on a large, representative sample of Australian consumers.

In the current investigation, we address this gap in the literature by conducting a nationwide, randomised experimental survey that systematically analyses the likely uptake of cost-reflective pricing in Australia, and the key factors influencing consumer response. As outlined earlier, even if it is economically rational for consumers to shift to dynamic pricing that might allow them to reduce their electricity costs with some simple behavioural changes, this does not mean they are likely to do so. While there is surprisingly little direct *empirical* evidence on the prospects for, and determinants of, consumer uptake of cost-reflective pricing – a notable deficiency that has motivated our present endeavours – *theoretically* some core principles of psychology and behavioural economics immediately offer some useful insights.

1.5 Psychological and behavioural factors that may impact consumer response

To better understand consumer response to cost-reflective tariffs, we must take into consideration a range of important human elements that are bound to influence both their uptake and usage. These elements are psychological in nature and relate to the peculiarities of human information-processing and decision-making, e.g., how people process complex information, perceive losses and gains, consider risks, weigh up costs and benefits, decide to shift from the status quo, choose between alternative courses of action, and so forth. To take just one pertinent example, we note that a recent AEMC study of NSW consumers bore testament to the inherent human tendency to resist change and retain the 'status quo' (AEMC, 2013; see also Brennan, 2006; Pichert & Katsikopoulos, 2008). The AEMC study found that, faced with a wide range of competitive tariffs and retail offers, many consumers chose to remain on their original tariff and pay more for electricity than they otherwise would have had they switched tariffs or energy retailers.

Such findings are difficult to reconcile relying exclusively on classic economic modelling, but are more easily explained once we take into account some key principles from psychology and behavioural economics. These suggest that a range of other 'predictably irrational' factors shape peoples' decision-making and behavioural choices, even around the seemingly straightforward market decision of buying particular goods or services (Kahneman, 2011; Kahneman, Knetsch, & Thaler, 1991; Kahneman, Slovic, & Tversky, 1982; Thaler & Sunstein, 2008). There are well-known, remarkably persistent cognitive biases and motivational forces that influence human decision-making and behaviour in general, and this applies equally to consumption choices, including around electricity usage.

[3] Other than the basic findings that they tend to be the kinds of consumers with some flexibility to modify electricity demand (Ericson, 2011), and (in the case of time of use pricing) with favourable pre-existing demand profiles (Aigner & Ghali, 1989; Matsukawa, 2001; Patrick, 1990).

‘Departures from rationality’ of special relevance to electricity pricing include phenomena such as loss and risk aversion, status quo bias and reliance on default settings (for a summary, see Frederiks et al., 2015a). There is extensive evidence that people tend to weigh losses more heavily than equal-sized gains, particularly as the stakes rise – a phenomenon known as loss aversion (Kahneman, 2003; Kahneman et al., 1991). They tend to be risk averse, and under-value the chance of large gains (e.g., the potential savings from taking up a new tariff) in favour of smaller gains of which they are more secure; uncertain losses are particularly discouraging (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). The implications of this loss and risk aversion for acceptance of new pricing structures are readily apparent, especially in light of people’s general attachment to the status quo and heavy reliance on ‘default settings’ (Kahneman et al., 1991; Samuelson & Zeckhauser, 1988). Note, too, that all of these decision-making biases demonstrably increase as the environment grows more complex (Kahneman et al., 1991; Samuelson & Zeckhauser, 1988). It may give advocates of three-tiered, time-variant tariffs pause to know that human decision-making markedly deteriorates as the amount or complexity of information increases.

1.6 Research questions and hypotheses

Clearly, as momentum builds across the energy industry to introduce cost-reflective pricing, we urgently require a more realistic, evidence-based understanding of:

- What are the likely rates of uptake of different types of cost-reflective tariffs, relative to one another, and to traditional flat rate tariffs?
- What are the barriers to consumer acceptance of these various forms of cost-reflective pricing?

Drawing on the key principles outlined in the foregoing, we anticipate that many consumers will be reluctant to switch from their current tariff due to concern over the risks or potential losses of doing so, against the considerable inertia provided by their general attachment to the status quo and readiness simply to revert to the default. This should be especially the case to the extent that any other course of action (e.g., adopting a real-time tariff) requires (in its uptake and/or usage) the processing of complex information. Bear in mind that when offered the prospect of switching tariffs, consumers face not only financial risk (the chance of higher bills) but potentially also physical risks (reduced comfort), time, effort and ‘hassle’ risks (from processing complex information and weighing up alternative courses of action), as well as psychological risks (disappointment or regret over selecting the ‘wrong’ tariff). All things considered, consumers could easily consider switching to some new form of cost-reflective pricing an unacceptable ‘gamble’.

Cost-reflective pricing comes in numerous guises, and we anticipate that the appeal of different tariff offers will vary depending on the degree of risk they are perceived to entail. Compared to traditional flat rate tariffs that provide a sense of stability and predictability (and serve here as our baseline for control purposes), *real-time* pricing does offer much higher rewards but also far more risk (Faruqui & Palmer, 2011). We imagine that electricity prices varying by the hour depending on rapidly changing conditions would probably mark out the height of risk for many consumers, although it is certainly possible that *capacity* pricing – where charges are based not even on consumption (kWh) but rather on demand (kW) – might seem equally, if not *more* risky, at least through sheer novelty, if not additional complexity. In terms of consumer ‘hazard perceptions’, other forms of cost-reflective pricing would then be arrayed somewhere in between these complex structures and simple flat rate tariffs. This perceptual array would presumably accord with the apparent stability and predictability of their prices, and the perceived difficulties both of understanding the behaviours necessary to maximise returns, and being able to carry them out. *At least* in consumers’ perceptions, both the immediate actions, and overall behaviour change necessary to maximise benefits from such tariffs may be constrained by employment, dwelling type and ownership, family needs and resources (including education and income) and, importantly, by the time and cognitive effort one is willing/able to invest in understanding and responding ‘appropriately’ to their price signals.

The foregoing suggests two further questions that will also be addressed in this study:

- To what extent does acceptance of cost-reflective tariffs depend upon reducing perceived risks around (for example) choosing the 'right' tariff (e.g., provision of money-back guarantee) and using it effectively (e.g., automation via free enabling device)?
- To what extent does acceptance of cost-reflective tariffs depend upon socio-demographic characteristics of the consumer/household (e.g., income, home ownership)?

In regard to perceived risk, we note that in the retail and marketing domain, considerable attention has been focused on identifying effective risk-reduction strategies – termed 'risk relievers' – that can impact consumer behaviour (Cases, 2002; Derbaix, 1983; Lantos, 2011; Pires, Stanton, & Eckford, 2004; San Martín & Camarero, 2009; Schiffman & Kanuk, 2009; Van den Poel & Leunis, 1999). Money-back guarantees, obligation-free samples, or 'risk free trials' are potentially effective methods of inducing customers to switch to a new product or service (Lantos, 2011). In the specific domain of cost-reflective pricing, bill protection has been suggested as a means of offsetting potential adverse effects (Faruqui, 2010). We anticipate that such strategies, by providing people with a 'safety net' – a sense of certainty and security around the 'unknowns' of shifting from the status quo – might significantly increase acceptance of cost-reflective pricing.

Similarly, perceived risks around one's willingness and ability to take actions that would maximise the benefits of a new pricing plan can presumably be reduced by relieving consumers of some of those burdens of decision-making and behavioural choice. We anticipate that providing consumers with some sort of automation technology/enabling device (e.g., programmable controlled thermostat, direct load control device) might render new tariffs less burdensome and risky, thus more appealing. Automated devices that switch off hot water systems or pool pumps during peak periods, for example, should relieve perceived risk: they capitalise on peoples' preference for defaults and make energy saving less dependent on effort, ability or motivation. Electricity consumers may perceive enabling technology as easing the burden of changing routines and helping to maintain householder comfort (Dutschke & Paetz, 2013; Paetz, Dutschke, & Fichtner, 2012). Ultimately, these devices might enable consumers to more fully leverage the potential benefits associated with cost-reflective pricing (Faruqui, 2010). Research indicates that the demand response associated with cost-reflecting pricing is heightened when coupled with enabling technology (Faruqui & Sergici, 2013).

These then are the four broad research questions we address in the investigation to follow. To our knowledge, no large-scale, representative studies – at least not with realistic scenarios and unobtrusive measurement – have successfully answered these questions for Australian consumers in reference to a comprehensive array of alternative electricity pricing structures. This is certainly true for the Australian population, but indeed, the body of evidence overall proves inadequate for an initiative so strongly advocated and gaining such momentum in energy markets around the globe. This notable deficiency we address directly with the investigation to follow.

2 Method

2.1 Experimental design

To investigate our research questions, a nationwide randomised field experiment was conducted with a large sample of Australian households (final n=1181). Our overriding objective in designing the study was that ultimately it should furnish (at least, to the greatest degree possible) a realistic and accurate, readily generalisable picture of the likely response of consumers – Australian consumers, at the least – to the introduction of cost-reflective pricing, in a range of forms. Since there is a wide variety of cost-reflective tariffs, insufficient evidence of their relative appeal, and uncertainty regarding both the introduction of particular forms of such tariffs and the kinds of offers in which they might be embedded, we settled on an evidence-based, experimental method of gauging consumer reactions to the universe of likely options. While we acknowledge that no scientific study (experimental or otherwise) is without flaws, and that the evidence derived must always be considered in light of a particular methodology's unique strengths and weaknesses, for reasons we elaborate in the following section a randomised experiment was considered to be the ideal method for answering our specific research questions.

As outlined earlier in Table 1, there are five major forms of cost-reflective electricity pricing extant, in addition to the standard flat rate tariff, specifically:

- *Time of use*
- *Critical peak pricing*
- *Peak time rebate*
- *Real-time pricing, and*
- *Capacity pricing.*

Further, as previously suggested, there appear to be two main forms of 'risk relief' that could be added to a tariff offer, with the aim of reducing consumers' perceptions of risk, overcoming their inertial attachment to the status quo and tempting them to try out a new pricing scheme, specifically:

- a *money-back guarantee* of reverting to their old plan without incurring losses if a trial of the new tariff should leave them worse off.
- the offer of a *free automation device* to help them take best advantage of the new tariff.

Putting together all possible variations of these two factors (tariff type x risk scenario) generates 18 different 'pricing plans' (see Table 2) whose consumer appeal we wished systematically to investigate: six distinct types of tariffs (the five cost-reflective tariffs above, vs. a flat rate control condition) with three different risk scenarios (money-back guarantee, or automation device, vs. a basic control description with no risk relief).

Thus we settled on a 6 x 3 'factorial' experiment, manipulating these two different factors (tariff type x risk scenario) to generate 18 distinct tariff 'offers', with each research participant randomly assigned to receive *one* of these offers via a survey (see Appendix B for the exact description of each tariff offer including, where relevant, the risk relievers).

Table 2 Experimental design

TYPE OF TARIFF	TYPE OF DESCRIPTION		
	BASIC DESCRIPTION *(without 'risk relief')*	BASIC + MONEY-BACK GUARANTEE	BASIC + AUTOMATION DEVICE
Flat rate *(control)*	Condition 1	Condition 2	Condition 3
Time of use	Condition 4	Condition 5	Condition 6
Critical peak pricing	Condition 7	Condition 8	Condition 9
Peak time rebate	Condition 10	Condition 11	Condition 12
Real-time pricing	Condition 13	Condition 14	Condition 15
Capacity pricing	Condition 16	Condition 17	Condition 18

2.2 Logic of research design

A nationwide randomised field experiment on a large and broadly representative sample of the population was considered the ideal means of investigating consumer response to these different forms of electricity pricing. Random assignment of participants to one of the different tariff 'offers'' would help ensure that the 18 different experimental groups were approximately 'equal on average' at the outset, i.e., that each experimental group essentially started off with around the same levels of interest in and understanding of electricity usage and pricing, and roughly equivalent distributions of socio-demographic characteristics that could bear upon their decision-making.

That being so (in the logic of random assignment), any differences *subsequently* observed between different experimental groups in their professed likelihood of taking up the 'offer' to which they were (unbeknownst to them) randomly assigned, must be due to what is distinctive about that particular pricing plan (that particular combination of tariff type and risk scenario), since everything else (about the people, their propensities and their decision-making) is said to be 'equal on average' to begin with. All these other possible influences on tariff choice – potential 'confounds' that would otherwise blur the effects of the offer itself – should be equally distributed, thus 'controlled for' and separated out in the analysis. By these means, we would be better able to isolate the impact of the offer itself, and thus the comparative appeal of different pricing structures, both relative to each other, and to flat rate tariffs (our 'business as usual' control condition).

This experimental logic takes for granted, of course, that our different tariff offers are themselves otherwise equivalent, i.e., that apart from describing fundamentally different pricing structures, they each do so in essentially the same way, with the same kind of delivery and presentation, text and visual aids (one table and one graph apiece). It is self-evident that real-time or capacity pricing (for example) cannot be described with the *same simplicity and brevity* as a flat rate tariff (which is, of course, a large part of the real-world challenges we anticipate for these more complex pricing structures). However, the equivalence we strove for was to have described each pricing plan *as simply and briefly as possible*. Readers may judge for themselves (see Appendix B) whether we have indeed conveyed each pricing plan as simply and concisely as a retailer in the future will need to describe – to the general public, in the normal course of business – a new tariff offer of this kind.

The critical outcome variable in this investigation is participants' self-reported likelihood[4] (0-100%) of choosing *"a pricing plan like this, if it was offered"*. The 'offer' was embedded within a brief mail-out survey (see Appendix A), which was entitled *"CSIRO Electricity Pricing Survey: Have your say about how Australians should pay for electricity in the future!"*, and prefaced with the rationale:

> *"First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you".*

Notice that we do not draw participants' attention to their current pricing plan, nor suggest that flat rate pricing is 'traditional' or the 'norm' or that cost-reflective pricing is novel, nor ask them explicitly to choose between a flat rate tariff and a randomly assigned cost-reflective structure. These various alternative research designs were considered and rejected, on the grounds that they might confound participants' attachment to the status quo with tariff preferences. Should participants have proved reluctant to take up the pricing plan 'offered' to them, we might otherwise have had difficulty distinguishing the extent to which this reluctance was due to their inertial preference for the status quo in general, as distinct from preference for a particular kind of tariff[5].

Instead, all pricing offers were considered in isolation, on their own merits[6]. For example, the flat rate tariff was presented to those participants randomly assigned to it on essentially the same terms that the cost-reflective alternatives were presented to participants randomly assigned to *those* conditions, i.e., presented without reminders of, or reflection upon their current pricing, and with the *implication* at least that this was a new offering they might choose to take up. This research design brings us as close as we can come to properly separating out general attachment to the status quo from preference for a particular type of tariff.

Note too that by having participants in each of these experimental groups consider just one tariff offer – rather than comparing and choosing among all alternatives – we have preserved (as far as possible) the realism of this consumer decision and, ultimately, the generalisability of our findings to normal business with the public at large. Note that the alternative of asking a research participant to consider and choose among a variety of pricing forms is *not* necessarily the best means of gauging their relative preferences. Consider the alternative research design of intensive engagement with, and interrogation of a small focus group of research participants who are (typically) especially interested (in the subject and/or the promised payment). Even if we could be assured they were not a highly selective fragment of the population, these focus group participants would likely receive far more information about, and education on pricing structures than would ever be accomplished in the retailer's normal course of business (presumably also,

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[4] This outcome variable is ultimately the best analogue we could construct to a real tariff choice in response to a retailer's mail-out offer. We readily acknowledge that this 'self-reported likelihood' of taking up some hypothetical future tariff offer is only suggestive or indicative of those likely future choices (particularly among different tariff arrays). However, while acknowledging these inevitable limitations in the critical dependent variable, we emphasise that it nevertheless meets our primary goal of providing as realistic as possible a picture of Australian consumers' relative preferences among different tariff options. While we have done our best in this report to estimate future uptake – using both our own data and that from international experience – until we are able to construct a more realistic decision environment for our 'consumers' (ideally, in some future study conducted in collaboration with a retailer on the brink of roll-out), we naturally remain far more confident in our assessment of consumers' *relative tariff preferences* than in their *absolute levels of uptake* of different options in the future.

[5] Ultimately, this important separation does appear to have been achieved. Our results do indicate both that flat rate tariffs are generally preferred to all forms of cost-reflective pricing and, at the same time, that consumers are generally averse to giving up the status quo (whatever that might be).

[6] Or at worst, were considered in relation to some (probably imperfectly remembered) current tariff to which we did not draw respondents' attention. Note that respondents' current pricing structures were bound – by virtue of random assignment – to be roughly equally distributed across each of our experimental conditions. Thus the current tariff to which the new offer was potentially being mentally compared was 'controlled for' and could not significantly affect *relative preferences* among the new options, which is our primary concern here. In any case, we considered it likely that when advertising a new cost-reflective tariff to existing customers, retailers would probably promote on its own the merits of the new pricing structure, rather than explicitly compare the new offering to some existing tariff it hoped to replace (or to a suite of alternative pricing options).

more excitement and enthusiasm). And they would be explicitly comparing the universe of pricing alternatives when, realistically, it is unlikely such a menu of options would be offered to them. Should cost-reflective pricing be introduced into an energy market, it may not be offered in a wide variety of forms, nor by means much more engaging and informative than a simple mail-out from the retailer.

In non-experimental research designs – such as simple observational[7] surveys and focus group discussions – realism and generalisability may be reduced by the fact that participants are knowingly part of a study of their *relative* preferences. In an effort to minimise this bias, participants in our study were never explicitly asked to consciously state their preferences among alternative pricing structures. Rather, we *inferred* relative preferences in subsequent analysis simply by observing the varying likelihood of acceptance across randomly assigned pricing offers, whose recipients had been 'equal on average' at the outset. By virtue of this initial group equivalence achieved by random assignment, it is *as if* each group had considered each alternative *but* with less of the kind of bias introduced by participants knowing they are part of a study of their relative preferences[8], and perhaps shaping those preferences to accord with (or even foil) what (they imagine) the researcher expects, or hopes to find (so-called 'demand characteristics'; see Brewer, 2000; Nichols & Maner, 2008; Orne, 1962)[9].

2.3 Sample and survey procedures

Equally important to the validity and generalisability of a research study are participants representative of the population to which one wishes to extrapolate the study findings. 'External validity' describes the extent to which the results of a particular study hold across variations in time, samples and settings (Brewer, 2000; Druckman, Green, Kuklinski, & Lupia, 2011; Glasgow et al., 2006; Rothwell, 2005; Steckler & McLeroy, 2008) and was considered very important for our purposes. We sought a broadly representative sample of Australian electricity account-holders nationwide (i.e., a sample diverse in attributes like age, education, income and household type/size, roughly proportionate to the relevant population), and one that drew in the unknowledgeable, disinterested and disapproving as much as the enthusiasts, advocates and experts in electricity pricing. One must keep in mind, however, that the population to which we intend to generalise our results is not the Australian population at large, but rather Australian residential *electricity account holders*, since it is they who are most likely to make decisions about whether to accept a new tariff offer from an electricity retailer.

Our sample also needed to be sizeable. Given our 18-cell research design, the experimental manipulation of two distinct factors, and our intention to examine multiple interactions between the explanatory variables, it was critically important to achieve participant numbers sufficient to power the complex analyses we had in mind: we determined that 50 respondents per cell would be required at a minimum. For an unsolicited mailout survey addressed only to unnamed householders – on a topic met with disinterest, if not disfavour

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[7] The term "observational" identifies forms of research where one simply observes what is happening in some domain (that is, measures variables and determines their existing association, i.e., the extent of their co-variation). This kind of observational research stands in contrast to a stimulus-response study (for example), in which one actually experimentally manipulates (vs. merely observes) one or more variables, and determines the impact of that (manipulated) variation on certain outcomes.

[8] Of which they are imperfectly aware in any case, due to weak or absent introspective access to their cognitive processes (see Greenwald & Banaji, 1995; Nisbett & Wilson, 1977).

[9] While a randomised experimental design was considered the best approach for answering our particular research questions, we acknowledge that alternative research designs may be preferable for investigating *other* types of questions, and certainly have their place in the 'toolbox' of research methodologies. For example, if aiming to describe subjective states (e.g., values and feelings) or explore underlying processes (e.g., mediators and moderators), research designs that afford richer qualitative insights, greater flexibility, and the iterative inclusion of feedback and learning (even the investigator's active involvement in the study, via 'participant observation') may be more appropriate than a highly controlled experiment. When the primary goal is to predict *future behavioural response* (e.g., likely actions), a randomised experiment is arguably the best approach to take. However, if the aim is ultimately to *explain* the processes underlying this future behaviour, then greater value might be gained by integrating data from multiple methods. For example, integrating quantitative evidence from a randomised experiment with qualitative data from interviews or open-ended commentary (as we have done here) can allow a researcher to isolate with greater precision and certainty the impact of a predictor on subsequent behavior, while at the same time also gaining deep insights into the processes underlying those effects.

by Australian consumers – with only the chance to win a modest prize as incentive, we anticipated a response rate in the order of 5% to 10%. Accordingly, we determined that we would begin with a sample of about 18,000 households.

The sample was selected from the comprehensive G-NAF (Geocoded National Address File) database, compiled by PSMA Australia from each of the governments of Australia, the Australian Electoral Commission and Australia Post. From this database – containing over 9 million residential addresses covering all states and territories of Australia – 18,347 cases were selected using SQL Server software. A short self-report survey with reply-paid envelope was posted to each address (December 1, 2014), with each survey also containing a URL and QR code that allowed householders to submit their responses alternately via a matching online questionnaire. (See Appendices A and B for the hard copy survey materials, and the following URLs for fully functional examples of the online versions: http://csiro64.questionpro.com; http://csiro29.questionpro.com; http://csiro46.questionpro.com).

Each survey was addressed *“To the electricity account-holder”*; we had no capacity to personalise with resident names. Any adult living in the household to which the survey was addressed, whose name appeared on the household’s electricity bill, was eligible to participate. As an incentive, participants were given the option of entering a random prize draw to win one of four $500 department store gift cards (for which they would need to provide some contact details, though assured these would be discarded after the draw). The survey began with the randomly assigned tariff offer, along with the key outcome variable previously described: a visual scale (0-100%) gauging respondents’ likelihood of *"choos[ing] a pricing plan like this, if it was offered"*. Then came a single open-ended follow-up question: *"Can you please tell us why?"* Note that some of the open-ended responses to this question will be used in the current report to illustrate key findings from this experimental analysis. However, this vast and rich commentary may also be analysed systematically in its own right, via separate qualitative analysis.

This brief survey then closed with 10 optional socio-demographic questions covering age, sex, postcode, household size and type, dwelling ownership and type, education, employment status and household income. These questions were closely modelled on those routinely utilised by the Australian Bureau of Statistics – including on the Australian Census – although for the income item, we combined categories for the sake of simplicity, and collapsed the upper end of their income scale, in order not to discourage participants of lower socio-economic status. In regard to these socio-demographic questions, participants were assured they could *"skip over any that [they didn't] wish to answer"*. To qualify for the prize draw, they needed only to have answered the first two questions in the survey (their likelihood, and why) and returned it to the CSIRO research team before the specified closing date (midnight of 31 December, 2014). Thus, the survey was neither arduous nor forbidding, and could have been completed in just a few minutes. We considered this a critical part of ensuring a broadly representative sample, and numbers sufficient to power our intended analyses. We later confirmed for our online respondents that the median time taken to complete the questionnaire (automatically measured by our web survey programme) was just 3 minutes and 9 seconds.

2.4 Participants

Of the 18,347 surveys originally posted, 1051 were returned to the CSIRO research team undelivered (i.e., ‘return to sender’), suggesting that around 17,296 surveys reached the intended addresses. At the time of conducting the analysis, 1192 survey responses had been received (996 paper and 196 online). Of these, 11 paper surveys were returned with no usable data and therefore excluded from analysis. This brings the final sample to 1181 responses – 985 paper (83%) and 196 online (17%) – which represents an overall response rate of about 7%, much as expected.

Although we did not expect our sample characteristics to perfectly align with known Census population parameters – since ‘residential electricity account-holders’ do not equate to ‘adults in general’ – there appears to be a satisfactory correspondence. Our final sample seems to diverge from the Australian adult population mainly in being a good deal older[10], somewhat better educated, and more likely to be male, all of which may be consistent with their being bill-paying heads of households. Ultimately, this is the relevant 'population' for this investigation, and our generalisations technically apply only to this subset of persons.

Overall, the socio-demographic profile of the sample was pleasingly diverse (see Appendix C), covering consumers from a range of age groups and geographic locations living in different types of dwellings, with disparate education and income levels, household sizes and types, and varying employment status. The final sample was 57% male, and around 40% were aged 65 or over. The median age was around 59 years. Participants reported a wide range of education levels but, as noted, tended to be better educated, with about 22% possessing some postgraduate education past bachelor's degree. Nearly 80% held some qualification beyond high school, the norm being a certificate (21%) or diploma/advanced diploma (16%).

Almost two-thirds (66%) of the main household income earners were said to be employed, either full-time (40%), part-time (13%) or in some other arrangement (13%). Only 2% were unemployed and looking for work. The heads of almost a third (32%) of these households were not in the labour force. The latter, typically in their late 60s, were presumably retired. There was a decent spread of household income, and good representation of lower income levels, with almost 27% earning less than $31,200 per annum, and 7% reporting less than $15,600[11]. At the upper end of the income distribution, around 26% claimed household incomes of $104,000 or more. The median income level came in around $52,000-$77,999 per year.

Over two-thirds of respondents (68%) had households consisting of just one or two people (the latter being the modal response); indeed, a quarter of the sample lived alone. A small minority – not even 7% – had more than four people in their household; less than 20% had more than three. Unsurprisingly then, the most common household type was a couple (38%), while a quarter constituted couples with kids, and a quarter were singles. Other household forms were far less common: single-parent households made up 5% of the sample, extended families represented 3%, and unrelated share households just 2%.

In regard to dwelling, more than three-quarters of our respondents (76%) lived in detached houses. Residents of flats, units or apartments were the next most common (13%), while small minorities resided in semi- detached (8%) or "other" kinds of dwellings (3%). In terms of their ownership, 84% either owned their home outright (55%) or were paying off a mortgage (29%). Almost 15% were renters, while less than 2% lived "rent free" or had some "other" kind of arrangement.

Finally, and importantly for our analyses to follow, we note that respondents were distributed fairly evenly across the different experimental conditions (see Appendix C, C.1) and no condition was left short of our desired minimum of 50 respondents. A Pearson's chi-squared test provides some assurance there was no experimental condition that attracted a significantly greater/lesser number of respondents ($p = 0.683$).

[10] While our sample being notably older than the Australian population at large is consistent with what one might expect for a collection of bill-paying heads of households, nevertheless we do have some concerns that the bulk of the sample are aged over 50, given that younger people might arguably be less inertial and more willing to contemplate new pricing structures.

[11] These are not all 'working poor', however. For instance, given the age profile of our sample, it is likely that a significant proportion are pensioners with low income but sometimes considerable assets.

3 Results I: Tariff type and risk relief

The first and most fundamental question for our analysis is the consumer appeal of various forms of cost-reflective pricing relative to the more traditional flat rate tariff. Table 3 depicts respondents' self-reported likelihood of *"choos[ing] a pricing plan like this, if it was offered"* for each of the 18 experimental conditions.

Table 3 Mean likelihood of choosing tariff offer, across different experimental conditions

TYPE OF TARIFF	TYPE OF DESCRIPTION			OVERALL *(per tariff)*
	BASIC DESCRIPTION *(without 'risk relief')*	BASIC + MONEY-BACK GUARANTEE	BASIC + AUTOMATION DEVICE	
Flat rate *(control)*	58.47	74.42	65.93	**65.94**
Time of use	53.06	60.62	55.14	**56.53**
Critical peak pricing	54.26	61.67	53.98	**56.65**
Peak time rebate	53.01	54.20	62.35	**56.04**
Real-time pricing	37.20	55.00	47.50	**46.75**
Capacity pricing	36.81	43.30	35.65	**38.11**
OVERALL *(per risk scenario)*	**48.74**	**58.57**	**52.74**	**53.30**

Note. Cell entries indicate respondents' self-reported likelihood (0-100%) of choosing the tariff offer proposed to them, averaged across respondents in different experimental conditions; n=1097. Note that there was no significant correlation (Pearson's r=-.213, p=.416) between tariff 'acceptance rate' and response rate across the 18 experimental conditions.

3.1 Acceptance of cost-reflective pricing as a function of tariff type

While we will subsequently delve into the specifics of the relative consumer appeal of these 18 separate tariff 'offers', analytically we begin at a higher level. We first analyse consumer 'uptake' as a function not of 18 separate experimental conditions, but of two explanatory factors and their interaction (6 tariff types x 3 risk scenarios).

In a formal statistical test, we regressed respondents' self-reported likelihood (0-100%) of accepting their (randomly assigned) tariff offer against a series of 'dummy' variables, reflecting the five different tariff types (relative to the excluded category: flat rate pricing) and the two 'risk relievers' (relative to the excluded category: basic tariff description) (see Table 4). Importantly, the initial model also included all possible interactions between tariff type and risk scenario, each of which was ultimately dropped, once determined to be (statistically) insignificant. All remaining coefficients are significant at least at $p < .05$ (one-tailed test applied where appropriate).

Table 4 Likelihood of offer acceptance as a function of tariff type and risk scenario

EXPLANATORY FACTORS	*B(S.E.)*	*P*
TARIFF TYPE:		
Flat rate	*excl.*	--
Time of use	-9.92(3.56)	.005
Critical peak pricing	-9.57(3.85)	.013
Peak time rebate	-9.78(3.74)	.009
Real-time pricing	-19.48(3.60)	.000
Capacity pricing	-27.61(3.85)	.000
RISK SCENARIO:		
Basic description	*excl.*	
+ Money-back guarantee	9.54(2.67)	.000
+ Automation device	4.49(2.65)	.045#
Constant	61.46(3.06)	.000

Note. Cell entries are unstandardised (metric) partial regression coefficients *(b)*, with standard errors *(s.e.)* in parentheses, along with their associated p-values *(p)*, from OLS multiple regression analysis; n=1097. Dependent variable is consumers' self-reported (0-100%) likelihood of accepting their tariff offer. For each of the two explanatory factors (tariff type and risk scenario), *excl.* indicates the excluded category against which the effects of the remaining categories are assessed. Interactions between tariff type and risk scenario proved insignificant and were dropped from the model. All coefficients reported in the table significant at least at $p < .05$; # = one-tailed test applied as appropriate.

We find that real-time pricing and capacity pricing are significantly less acceptable to consumers than traditional flat rate tariffs (see Table 4, upper panel). Controlling for our 'risk relievers', respondents prove to be about 19 percentage points less likely to take up real-time tariffs (*b*=-19.48[12], *p*=.000[13]), and almost 28 percentage points less inclined to accept capacity pricing (*b*=-27.61, *p*=.000) than to choose a flat rate tariff (review Section 2.1 in regard to the analytic logic of our experimental design). The latter is really not surprising given that it is a fundamentally different mode of electricity pricing – based on demand (kW) rather than consumption (kWh) – and, from the point of view of well-known biases in human cognition, has the dual disadvantage of being both novel and complex.

Other forms of cost-reflective pricing fare somewhat better, although still meet with significant consumer resistance. We see that consumers are significantly less likely to accept time of use tariffs (*b*=-9.92, *p*=.005), critical peak pricing (*b*=-9.57, *p*=.013), and peak time rebates (*b*=-9.78, *p*=.009) than traditional flat rate pricing. Generally speaking then, they prove to be about 10 percentage points less likely to take up even these simpler varieties of cost-reflective tariffs – even with their less changeable, more predictable pricing – than traditional flat rate tariffs that remain invariant across time.

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[12] An unstandardised (metric) partial regression coefficient (*b*) indicates the change expected in the dependent (outcome) variable for a one-unit increase in the independent (explanatory) variable, holding all else constant. That is, it represents the change in the phenomenon of interest (e.g., consumers' 0-100% likelihood of taking up a tariff offer) that is expected to be produced (i) by a one-unit increase across the scale of an interval-level explanatory variable (e.g., an increase of one person in household size, or an extra year of age), or (ii) by the presence (vs. absence) of some 'nominal' group characteristic (e.g., the receipt ('1') or not ('0') of a real-time pricing offer, or the provision ('1') or not ('0') of a money-back guarantee).

[13] While *p* values cannot technically equal 0, this reflects our rounding.

Overall then, we find that:

- **Consumers find all forms of cost-reflective pricing significantly less attractive than traditional *flat rate* tariffs.**

Participants felt that with flat-rate tariffs, it was *"easier to compare retailers. You know what the price is all the time" (#87)* and feared that *"off peak times may not always be implemented" (#87)*. Flat-rate tariffs were generally thought to be *"much simpler and fairer" (#868)*, with participants tending to *"find this plan simple & easy to use" (#398)* and appreciating that flat-rate tariffs *"provide a degree of certainty" (#543)*.

- **Consumers are particularly resistant to *real-time* pricing and (especially) *capacity* pricing, on account of their greater novelty and complexity (hence, perceived risk) and pervasive mistrust and rejection of the concept that electricity should cost more depending upon demand.**

In regard to real-time pricing, participants thought they would not even want *"to have to check the price on a daily basis" (#252)*, and would be *"unlikely to be checking the hourly price for electricity each day" (#99)*. The extra effort and nuisance introduced by the additional pricing complexity seemed to be a particular sticking point with consumers, who *"don't want just another annoying thing to do every day. Life is complicated enough without adding to it by looking at electricity prices every day (#411)*. The latter participant went on to protest that *"I'm enjoying having a life! Should be a fair, competitive price for electricity which is set for a period, not fluctuating constantly"*. Others noted, further, that they simply *"do not trust the electricity suppliers to not price electricity to maximise their profits rather than to accurately reflect the cost of supplying electricity" (#99)* or saw competitive advantages to prices that indicated *"fixed amount per kWh then you can compare power Co's to change" (#171)*.

In regard to capacity pricing, many participants were unaccustomed to, and uncomfortable with having to consider the complexities of *"so many variances like one very hot day and aircon use, a day of heavy oven usage" (#613)*. Their discomfort with this entirely novel and unfamiliar mode of pricing seemed partly a function of its perceived unfairness, with a number saying something like they *"prefer to pay for electricity I actually use" (#613)* or *"only wish to pay for what is used" (#792)*. In one especially pointed remark, the participant declared: *"This is not a fair system. Pay for what you use is much better & fairer. Especially since the brackets would have a fair range. So I use 20% less than my neighbour who pays the same as me? Don't think so" (#108)*.

- **Simpler cost-reflective tariffs featuring pre-determined peak and off-peak periods – namely, *critical peak* pricing, *peak time rebate* and *time of use* tariffs – have greater consumer appeal, although still significantly less than flat rate pricing.**

In regard to time of use tariffs, participants would simply protest that *"my lifestyle requires me to use electricity through daylight hours" (#107)*. A number made dry remarks along the lines that they *"do not…plan to cook dinner before 4pm or after 8pm" (#82)* or, more pointedly: *"most householders use electricity between 4pm-8pm - how many people use electricity between 10pm-7am - NOT MANY! This system stinks & is not fair" (#354)*. One participant went to some lengths to explain: *"4pm -8pm weekdays is the highest time of electricity use due to cultural traditions of school end of day, family dinner time etc. You cannot choose to reduce amount as most families, groups, individuals need to use large amounts of power at this time. Very few people use power from 10pm-7am at lower price" (#131).*

In regard to critical peak pricing, some participants were repelled by perceived complexity, protesting that it was *"too complicated to monitor" (#409)* and *"requires too much interaction"* when they *"simply want to sign a contract & pay" (#309)*. Beyond simply objecting to the burdens of monitoring the price signals the industry seems determined to provide them, others appeared to consider such pricing fundamentally unfair. Some participants *"think it should be the same price no matter what" (#782)* and *"don't like the idea* *of charging a higher price on days when electricity is used the most" (#173)*, protesting that *"the expensive days are the days you most need to use the electricity" (#782)*. There was a perception of injustice, with attendant mistrust. These participants tended to *"feel taken advantage of" and to think that "it's a way for companies to pocket more money because they know all households will use their cooling systems then" (#173), even* suspecting that *"if a pricing scale like this came in the number of expensive days will keep increasing" (#782)*.

Unsurprisingly, similar concerns were expressed about the closely related scheme of peak time rebates, regarding both its perceived complexity – *"This rebate plan is unworkable. Reduce overall pricing and 'kiss' (keep it simple stupid)" (#754)* – and purported unfairness. In regard to the latter, again some participants objected that *"extreme days are when you would be more likely to use more power"* and even declared that they *"would not trust electricity retailers for a fair discount based on whatever system they propose" (#538)*. Note that peak time rebates seek to incentivise peak reductions with rebates for desired behaviour (rather than penalties for undesired behaviour). Yet loss-averse consumers can still manage to re-frame the proposition as a risk of loss, rather than opportunity for gain, as in this pessimistic assessment: *"I do not want to be penalised for using an air conditioner or pool pump on extreme temperature days. This plan is saying 'do not enjoy the comfort of air conditioning or a swimming pool on extreme temperature days'" (#95)*.

3.2 Acceptance of cost-reflective pricing as a function of risk relief

Next, in regard to the effects of 'risk relief' (see Table 4, lower panel) we find that, controlling for tariff type, the provision of a money-back guarantee tends to boost offer acceptance by just under 10 percentage points (b=9.54, p<.001). Similarly, the addition of a free automation device generally increases uptake by around 4 percentage points across the board (b=4.49), although the significance of this latter 'risk reliever' is more marginal (p=.045 on a one-tailed test). We emphasise that neither of these persuasive effects is contingent upon the kind of tariff. As noted earlier, all interactions between tariff type and risk scenario proved statistically insignificant and were dropped from the model. That is to say, money-back guarantees can generally be expected to boost uptake by about 10 percentage points, and automation devices by about 4 percentage points, regardless of the kind of tariff with which this risk relief is paired. It appears that the encouragement they provide consumers is not confined to cost-reflective pricing, nor (somewhat surprisingly) contingent upon the degree of novelty and complexity in the tariff type.[14]

We conclude that:

- **'risk relievers' like money-back guarantees and (to a lesser degree) free automation devices generally boost the uptake of any tariff offer, providing consumers roughly the same encouragement to act irrespective of tariff type (i.e., they seem to increase the appeal of cost-reflective tariffs to the same degree they boost acceptance of any other offer, including flat-rate pricing).**

[14] We saw little evidence in the data of any real contingency between tariff type and risk scenario. The only interaction that approached statistical significance (p=.107 on a two-tailed test; p=.053 on a one-tailed test) was the interaction of peak time rebate with a money-back guarantee, where the addition of the guarantee was *less* helpful to uptake than normal. It *may* be that a money-back guarantee boosts acceptance of peak time rebates less than for other tariff types (which could also be surmised, informally, from a simple review of Table 3). Perhaps a pricing scheme where consumers stand only to be rewarded (with rebates) for the desired behaviour, rather than penalised (by higher tariffs) for undesired behaviour is simply less congruent with the concept of a money-back guarantee. Accordingly, its appeal might not be enhanced by such an addition to the offer to the same degree as for other tariff types.

In regard to the pull of a money-back guarantee, participants appreciated that they could *"get a comparison to be able to make a choice" (#111)*, seeing it as *"a safe way of trialling the method" (#122)*. Interestingly, the theme of fairness rose again, in the sense that *"having a six month bill comparison to compare both billing usage and cost... at no risk to current set up is fair to the consumer" (#434)*. Further, participants may have thought of the money-back guarantee as a chance to actually learn how altering their electricity usage could save them money. As one participant observed: *"currently it is difficult to have any understanding of the usage to cost impact with the tiers & standing charges" (#111)*. Consumers might *"like the idea of a risk-free trial comparing 'old' and 'new' payments" (#166)* and offering thus a concrete opportunity to learn how to shift usage to maximise gains.

Others saw great *"benefit"* in having a *"free electronic device to help control electricity usage" (#425)*. One participant who observed that *"the accounts I receive are a mystery"* thought that the automation device *"would give me choice and some control over usage" (#458)*. Another clearly appreciated that *"with this plan I have been offered some sort of assistance to help manage and perhaps reduce my energy consumption"*, although noting that whether this ultimately *"help(s) reduce my energy bill… depends on how my provider prices energy usage in the future" (#93)*.

3.3 Acceptance of specific cost-reflective pricing offers

Analytically, we now step down a level, and investigate consumer uptake as a function of these 18 separate tariff offers, rather than two explanatory factors (tariff type and risk scenario). We again regressed respondents' self-reported probability of acceptance against a series of dummy variables this time representing the specific pricing plans. Since the resulting table of results is large and cumbersome – and its principle findings can be grasped in any case by comparing average uptake across the different cells of Table 3 – we will simply convey the significance of our main findings in the text. Note that all findings reported below are significant at least at p=.05 (two-tailed tests), unless otherwise described as "marginal".

Overall, we find that:

- **a 'basic' flat rate tariff (without any 'risk relief') is significantly more appealing to consumers than:**
    - **any form of *capacity* pricing, even with a money-back guarantee or automatic enabling technology, and**
    - ***real-time* pricing without any such 'risk relievers'.**

Those confronting an offer of real-time pricing tended to feel that *"a fixed price enables better budgeting" (#381)*, whereas real-time pricing *"would move the risk of extreme price variations from the retailer to the consumer" (#311)*. Some degree of corporate mistrust again seemed to feature in the latter's calculations, magnifying the perception of risk since *"if an unscrupulous supplier were to manipulate the price it would be the consumer with little say in the matter who would pay the price" (#311)*. Yet even without mistrusting retailer motivations, it was still generally thought that real-time pricing *"would simply result in higher power bills"* since *"how could you avoid using electricity at the same time as other consumers?" (#342)*. The latter participant conceded that *"there may be some usage capable of being moved to off-peak (such as clothes washing)"*. But in regard to *"the more hungry uses such as air-conditioning"*, they worried that people generally had *"no choice about their use - these times are most likely to be when most consumers are using lots of electricity and would therefore be more expensive"*. Other participants were likewise concerned that *"the highest pricing occurs… when we require air conditioning in summer… when it is essential for our health" (#381)*. The dilemma for the industry, then, is that the more electricity prices *do* reflect consumer demand and the true costs of supply, the more unfair – even unscrupulous and exploitative – they seem to consumers. And this fairness issue is quite apart from the logistical challenge apprehended by many: that *"the changes to daily routine needed to make any significant saving would be too impractical" (#449)*.

Note, however, that if the real-time pricing plan does include a money-back guarantee, then self-reported likelihood of uptake is not significantly different than for a basic flat rate offer without any form of risk relief (*p*=.593), with likely acceptance coming in just a few percentage points lower (55% vs. 58%). A money-back guarantee of this kind improves the prospects for real-time pricing far more than does the addition of an enabling device, with the latter offer still substantially less attractive (47% vs. 58%) than the basic flat rate plan (although small cell numbers leave this difference only marginally significant, at *p*=.094). Without any form of risk relief, however, real-time pricing is significantly less appealing (37% vs. 58%) than the basic flat rate tariff (*p*=.001). We might reasonably conclude that:

- ***real-time* pricing must come with a compelling money-back guarantee in order to approach the appeal of a basic flat rate tariff, or have even a chance of being accepted.**

For example, one participant only felt confident they *"would consider this pricing plan if during the 6 month trial I found it to be a way I could reduce my electricity bills" (#185)*. In this way, a money-back guarantee tangibly reduced some of the dangers, and increased the perceived likelihood of gains, from the high-risk/high-reward real-time pricing offer. It allowed the focus of loss-averse consumers to shift more toward the potential benefits of the scheme, with some of them thus persuaded *"it would be good to have this comparison and a 6 month money-back guarantee… to have the choice that would suit in these hard times" (#246)*. Once risks were controlled and benefits came more into view, a number of participants could appreciate that *"we would have the choice to be able to vary our electricity use and control our bill!" (#169)*. Note that some appreciated the money-back guarantee both as a risk-free trial, *and* as an opportunity to actually learn how to alter their patterns of electricity usage to generate bill savings from the real-time pricing offer. As one participant observed: *"I would like to trial the system over 2 x 3 month periods to see if (1) I would save money on my present usage pattern and (2) to see what changes I could make to increase the saving" (#71)*. Another similarly remarked that the *"ability to compare with the old plan"* might ultimately enable better *"control over usage due to constant usage information being provided" (#153)*.

As for capacity pricing, we can confirm that it certainly has the least consumer appeal of all our pricing structures. Even adding in the benefits of automation, the likelihood of uptake is significantly less than for traditional pricing (*p*=.001), with consumer acceptance sinking about 22 percentage points below that of the basic flat rate tariff (36% vs. 58%). The offer of a money-back guarantee only boosts the appeal of capacity pricing by about 7 percentage points, while still leaving it significantly depressed (43% vs. 58%) relative to traditional pricing (*p*=.05). We conclude that:

- **even with the prospect of a risk-free trial, or an enabling device to help maximise the advantages of the new plan, there is limited consumer interest in shifting to novel, demand-based pricing structures like *capacity* pricing.**

A money-back guarantee might initially induce a trial of capacity pricing but would be unlikely ultimately to retain a household whose patterns of usage proved ill-matched to the scheme. As one participant remarked: *"As a family of 5, I believe that our electricity usage would always be in the high band and therefore of no benefit to us. I would trial it so long as you can change back under the risk free trial offer but don't believe it would work out cheaper for us" (#893)*. Overall, the offer of a risk-free trial rarely rendered capacity pricing significantly more palatable to our participants. Indeed, they often seemed to doubt they had *"read this correctly"*, apparently incredulous that *"your bill would be based on the highest spike in the month, not the average use in the month" (#396)*. Themes of unfairness were again prevalent in the commentary, specifically, the perceived injustice of *"allow(ing) Co's to charge on say a one off spike"* whereas *"at present the bill is based on consumption, if you use more, you pay more" (#396)*. As one participant objected: *"why should I be punished for the rest of the month on a higher rate because of that one week, if it gets up to the higher bracket in that 1 week?" (#567)*. Another protested that since they *"live(d) alone, don't use lights at night, only switch on hot water system every 3-4 days"* it seemed wrong that *"if you just crept over the band, you're paying for the full block whether it's fully used or not" (#283)*. The same participant remarked upon the perverse incentives created by such a scheme, where *"there* *would be no incentive to save electricity except if you were just under the top of low band or medium band"*, since *"once you're in the high band…there would be nothing stopping any further use"*. There was also the logistical challenge for consumers who *"don't have a mobile or the internet"* that *"they wouldn't notify me" (#567)* to warn if the household was approaching a demand 'ceiling'.

As noted, neither did the addition of a free automation device make capacity pricing significantly more appealing, many still sharing some version of the opinion: *"What a rip-off system this is!" (#652)*. Irrespective of any practical assistance the device might render in managing such a pricing scheme, philosophically many still objected to a system where *"moving up into the next band solely relies on your high usage at any ONE moment"* and felt that *"a fairer scale would be on total usage for that billing period" (#508)*. One participant who did generally *"think energy monitors are helpful"* still worried that *"businesses like Origin Energy in Vic utilised them to optimise their business, it was not to help the end user" (#172)*. Even with the aid of an automation device, consumers apparently do not savour the prospect of *"ducking & weaving a once-a-month ceiling" (#652)* and generally *"do not want to be worried about whether the billing cycle exceeds the limit" (#146)*. They tended to prefer *"unit pricing"* that just *"needs to be set & transparently communicated" (#172)*, and seemed to think that *"people running households are already overwhelmed & burdened by plans like this that suck up precious time" (#652)*. The same participant – again in regard to the potential for perverse incentives – worried about the risks to *"climate change"* from a *"new pricing plan"* that *"may well lower usage for people to stay under the 'ceiling', but… increase usage once a ceiling has been broken (to get your money's worth)"*, thinking that *"it's better to be educated to use less coal-powered electricity generally, as a lifestyle practice"*.

The consumer appeal of *any* version of the remaining three cost-reflective pricing structures – time of use, critical peak, and peak time rebate – is not significantly different from that of *basic* flat rate pricing, *but* cannot match the temptation of a flat rate offer that includes risk relief. The simple addition of a money-back guarantee to the flat rate offer significantly increases consumer acceptance by a hefty 16 percentage points, boosting uptake from 58% to 74% just by offering a risk-free trial (p=.012). In short:

- **a *flat rate* tariff offer with money-back guarantee achieves an unparalleled level of consumer acceptance, unmatched by any other combination of tariff and risk relief.**

If we now collapse the three base experimental conditions – using as our baseline for comparison not the *basic* flat rate tariff (top left cell, Table 3), but rather flat rate pricing *in general* (top right cell, Table 3), we find that self-reported likelihood of acceptance of flat rate pricing averages about 66%. The fact that our respondents' 'acceptance' of flat-rate tariffs, while apparently higher than that for cost-reflective pricing, is still surprisingly low, hints that many people may be unaware of what their current pricing plan actually entails, and that preference for the status quo *might* perhaps have a stronger hold on consumers – might be a greater source of inertia – than preference for flat-rate pricing *per se*.[15]

Still, almost all other tariff offers have significantly lower rates of consumer acceptance ($p < .05$) – indeed, 10 to 30 percentage points lower – with just a few notable exceptions: peak time rebates combined with automation technology, and critical-peak/time of use pricing with a money-back guarantee (predicted uptake hovering around 62% for all). Overall, we conclude that:

- **only a limited set of cost-reflective pricing offers can really rival consumer acceptance of flat rate tariffs, specifically:**
  - ***peak time rebates* with the offer of a free automation device (aimed at easing management and maximising consumer benefit from the tariff); and**
  - ***time of use* tariffs, or *critical peak* pricing, when accompanied by the money-back guarantee (aimed at alleviating consumers' perceived risks in trialling the new offer).**

[15] Advocates for cost-reflective pricing might well see some potential for optimism in that finding.

It did seem that many consumers *"particularly like the trial exposure option offered" (#718)* and could be tempted to switch to time of use pricing if provided this kind of 'safety net'. At the least, they *"would certainly give it the trial period" (#428)*. If subsequent electricity bills exceeded those under their former pricing plan, consumers could revert to the old scheme with any losses reimbursed, protecting them at least from financial risk. Thus a good number of those considering time of use tariffs with a money-back guarantee were *"interested in… having a comparison made with [their] regular bills and then a choice as to which service [they] continue with" (#474)*, given that *"with the 6 month money-back guarantee if [they] did not have a lower bill, [they] could return to [their] previous pricing plan" (#751)*. Their risk aversion thus somewhat allayed[16], potential gains might then loom larger than losses, with some participants seeing that they *"can arrange to use power at the lower rate" (#751)* and appreciating *"the option to reschedule [their] use to maximise benefits" (#718)*. Any such shift in consumer focus from losses to gains might be facilitated by recognising that gains would be immediate and not dependent on costly upfront investment in appliances or infrastructure. As one participant remarked, *"anything that will reduce my power bill without any upfront costs involved has to be good"*, comparing time of use pricing favourably to *"solar power installation"* which they judged *"too expensive, with low feed in tariffs you don't get your money back for years" (#428)*. Similar sentiments were voiced overall for critical peak pricing with the same money-back guarantee, where some participants likewise thought they *"would be interested if we would save money on our electricity/gas, as long as it wasn't a locked in contract, & [with] trial as mentioned above" (#788)*.

On the other hand, for peak time rebates, as noted it was the addition of a free automation device that ultimately rendered this particular form of cost-reflective pricing competitive with flat rate tariffs. Interestingly, note that some participants thought that peak time rebate schemes were not just similarly appealing, but actually closely akin to flat rate tariffs and that this system of *"paying a flat rate would be more fairer* (sic)*" (#915)*. They understood they would enjoy the same flat rate at all times of the day and year, but beyond that would simply have the opportunity to earn rebates for limiting consumption on extreme temperature days. The automation device would then help them manage the latter task – for maximum household benefit – and *"become more aware of trying to reduce usage on 'extreme' usage times" (#464)*, although some still wanted to be assured that *"the usage controller could be overridden" (#646)*. All in all, a good number grasped the potential for actual gains, and thought that *"the plan sounds good, it would give [them] more incentive to reduce [their] usage" (#915), "an incentive to save power" (#471)*. Some did however caution that a degree of 'troubling' effort and nuisance might be involved, and that ultimately *"it would depend whether the rebate was worth the trouble" (#646)*.

3.4 Risk relief only adds to the appeal

The foregoing, then, appear to be the most promising prospects for any broad roll-out of cost-reflective pricing into the Australian electricity market. We want to emphasise, however, that the 'risk relief' mechanisms are likely to be critical to public acceptance, *especially* when it is a real tariff offer on the table.

In regard to these risk relievers, we stress that as far as we can tell from our experimental data, their impact on customer uptake is *additive* rather than *interactive* (see Table 4). That is, their influence does not depend (significantly) upon tariff type. Rather, they tend to enhance consumer uptake across the board, independent of the pricing scheme with which they are paired. In this respect, our risk relievers perform much the same function as they do in many purchase decisions. Their impact is neither specific to cost-reflective pricing, nor dependent upon any particular form of it. They are about as helpful in encouraging uptake of flat rate tariffs as boosting acceptance of cost-reflective pricing.

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[16] Note that a money-back guarantee only mitigates financial risk, but not necessarily physical risks (discomfort), time, effort and 'hassle' risks (from weighing up alternatives), and psychological risks (disappointment or regret).

Constraints on sample size meant we did not have the capacity (in this experimental design) to examine any *interactive* effects between the two risk relievers themselves, e.g., asking whether the money-back guarantee is more compelling when combined with enabling technology. But they certainly have significant *additive* effects (multiple regression analysis separates out the independent effects of each variable, while holding all else constant). This means that public acceptance of any tariff offer might generally be boosted by around 14 percentage points (10+4) with the addition of *both* a money-back guarantee and some automation device (see Table 4). Ultimately, however, we find that:

- **with the addition of risk relief mechanisms, cost-reflective tariffs can be made more acceptable to consumers, but not more acceptable than *flat rate* tariffs offered on the same terms.**

In other words, this 'bump up' from piling on risk relievers might give certain cost-reflective pricing schemes a better chance of being *acceptable* to consumers, without actually being *preferred*. As noted, the addition of risk relievers aids acceptance of flat rate tariffs as much as cost-reflective ones. Thus, other things being equal, flat rate pricing would still be favoured by consumers, at least on the evidence presented here.

4 Results II: Socio-demographic characteristics

4.1 The moderating role of socio-demographic characteristics

Of course, all of this might depend upon various characteristics of the home, household and bill-payer, and that is what we examine here in this final section of the investigation. At the most mundane level, socio-demographic characteristics may potentially affect both consumer perceptions and realities regarding the relative costs and benefits of different pricing. As earlier noted, we had taken care to include in the survey a range of socio-demographic questions for this purpose. Although they were optional, the vast majority of participants responded to most of these questions, with around 97% responding to each, and 83% responding to all. The latter completion rate was brought down almost entirely by predictable avoidance of the income question, to which only 89% chose to respond.

Our objective here is to determine whether any of these socio-demographic attributes moderate the appeal of cost-reflective pricing relative to flat rate tariffs (i.e., whether they increase/decrease the effects of tariff type) and/or change the impact of our risk relievers. In formal terms, this amounts to us testing the significance – for customers' self-reported likelihood of acceptance – of potential interactions between tariff type, risk relievers, and socio-demographic characteristics. Given the size of our sample relative to the number of potential explanatory factors (once tariff offers are broken down by various characteristics of the recipient), we chose to conduct a series of multiple regression analyses focused on just one socio-demographic attribute at a time. For example, customer uptake might be analysed as a function of tariff type, risk scenario, education level, and their interaction. A statistically significant interaction term would indicate that the relative appeal of the tariff in question (and/or the impact of that particular form of risk relief) partly depends on a certain socio-demographic characteristic (e.g., respondent's education level).

We now consider findings for each of these characteristics in turn. For the sake of brevity, simplicity and clarity, we do not tabulate here the multitude of regression analyses we conducted[17]. Rather, we report all significant findings in the text itself[18], accompanied by a simple cross-tabulation between the two variables in question, which should give a more concrete character to the findings and assist in comprehending their import[19]. Note that all findings described in the text to follow are significant at least at p=.05, unless otherwise described as "marginal".

[17] Full details are available from the authors upon request.

[18] Note that we might have expected to see some state differences in acceptance of cost-reflective pricing, if only because the states differ in what has been privatised and what tariff structures are already available. However, in that respect there was only one marginal finding, related to somewhat greater acceptance in Western Australia of *critical peak pricing*, perhaps partly due to their familiarity with extremes of temperature and very 'peaky' demand.

[19] We reiterate that these two-way cross-tabulations (often featuring simple median splits of the variables involved) do not reflect the regression analyses that actually generated the findings described in the text (which may have involved interactions with continuous variables, for example). Rather, they are intended only to convey a simpler, more concrete depiction of the main strands of the relationships (already detected by the regression analyses) than can be quickly grasped from a table of multiple regression coefficients.

4.1.1 INCOME

Prior research gives us no clear expectations regarding the impact of household income on both usage, and uptake of various cost-reflective tariffs. In regard to uptake[20] of cost-reflective pricing (the outcome of central concern in *this* investigation), we note that while some voluntary trials have reported greater participation by higher income customers (Faruqui & George, 2005; Williamson & Shishido, 2012), other trials see customers with limited incomes volunteering at higher rates (eMeter Strategic Consulting, 2010). Our own evidence tends to accord with the latter (see Table 5). We find that higher income tends to be associated with lower uptake of critical peak pricing (and marginally, capacity pricing[21]), of which higher income households are somewhat less accepting than lower income households. Higher income households tend to be *more* enthusiastic about flat rate tariffs than those with lesser income. Overall, we conclude that:

- **lower income households are relatively indifferent between, and equally favour flat rate tariffs and *critical peak* pricing over other schemes; and**
- **flat rate tariffs are increasingly favoured over *critical peak* pricing as household income rises.**

Table 5 Mean likelihood of choosing tariff offer, by tariff type, and income

	FLAT RATE	TIME OF USE	CRITICAL PEAK PRICING	PEAK TIME REBATE	REAL-TIME PRICING	CAPACITY PRICING	*COST-REFLECTIVE PRICING (IN GENERAL)*
Higher income *(median split)*	70.97	61.97	56.40	56.05	53.00	37.59	*53.35*
Lower income	58.33	51.61	60.22	56.18	43.33	40.71	*49.67*

Our wealthier participants' comparatively greater attraction to flat rate pricing could be due to the typical electricity consumption patterns of their households. Higher income households tend to have more and larger appliances (e.g., several refrigerators, air-conditioners, pool pumps), larger homes requiring more heating and cooling, 'peakier' demand, and lifestyles perhaps less amenable to time-varying tariffs. As one higher-income participant 'offered' capacity pricing protested: *"It would be very hard to 'stop using electricity' to keep it under as we have a pool pump and air conditioning and these need to be used depending on weather etc. Also, there are too many variables in this and I don't think it's fair to the people who have high usage that they get penalized (#36)*. It could be said that wealthier households actually benefit from tariffs that are *less* reflective of the true costs of supplying their considerable electricity needs, and that flat rate tariffs essentially force lower-income households to subsidise their excess consumption.

Our lower income households might be more willing and able to shift their electricity consumption out of those critical peaks – just a few hours on a few days each year, after all – and more in need of the relief provided by the much lower rates they would enjoy in recompense for the remainder of the year. In the end, this might be enough for them to actually favour critical peak pricing over all other tariff types.

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[20] Similarly in regard to usage of/responsiveness to cost-reflective tariffs, while in some trials higher income households seemed better able to alter their electricity consumption in response to cost-reflective pricing (Faruqui & George, 2005), in other cases they reduced their consumption *less* than did lower income participants (Ida, Ito, & Tanaka, 2013). Faruqui and Palmer (2011) report that in 7 out of 10 trials of cost-reflective pricing they reviewed, lower income participants were less price responsive.

[21] This interaction falls short of statistical significance (p=.068 on a two-tailed test).

However, it seems that when automation technology is in the mix, limited income tends to discourage uptake of a tariff offer (see Table 6). We find that:

- **the addition of an automation device to a tariff offer only increases the likelihood of uptake (although still modestly) for higher income households; and**
- **adding automation technology to the mix may discourage lower income households from taking up a tariff offer.**

Table 6 Mean likelihood of choosing tariff offer with/without automation device, by income

	OFFER EXCLUDES AUTOMATION DEVICE	OFFER INCLUDES AUTOMATION DEVICE
Higher income *(median split)*	55.42	58.11
Lower income	52.98	46.49

It may be that lower income households have fewer of the kinds of appliances (e.g., air-conditioners, pool pumps, solar installations) whose effective regulation and management might benefit from automation technology, and perhaps foresee in these 'free' devices mostly extra expense, complexity and inconvenience that are less likely to be outweighed by tangible benefits. As one lower-income participant unimpressed by the offer of a free automation device put it: *"I already turn off all appliances and I don't have a computer or know how to use the stupid, money making gadgets you are putting out. What we need is lower prices" (#222)*. Another in similar straits reported that the *"question has been discussed with many colleagues, friends & family"* and that *"all have an issue with… having another electronic device to worry about (maintenance/accuracy/availability for service etc. etc.)" (#827)*.

4.1.2 EDUCATION

In regard to the potential influence of consumer education levels, it may be that those with higher education have greater capacity than the less well educated to understand more complicated cost-reflective tariffs, as well as the various opportunities available to them to change their electricity consumption behaviour. They might also more confidently anticipate success in actually making the required behavioural changes, and thereby gaining maximum benefit from the new pricing plan. The better educated may also have a stronger understanding of the social and environmental impacts of peak consumption, and the shared consequences of failing to address it. Certainly there is evidence that better educated consumers do tend to reduce critical-peak period electricity consumption more than their less well educated counterparts (Faruqui & George, 2005).

We too uncover a significant interaction of this nature between education and tariff preferences[22], with postgraduate education (beyond bachelor's degree and graduate diploma) apparently the critical 'turning point' for favouring cost-reflective pricing. Generally speaking, higher education is associated with lesser interest in flat rate tariffs and greater acceptance of cost-reflective pricing (see Table 7). This is especially the case for time of use tariffs and also real-time pricing, where the preferences of the better and less well educated diverge considerably[23]. Overall, we find that:

[22] Controlling for income, family size, age and other variables with which education may be confounded.

[23] Note, however, that they remain equally averse to capacity pricing.

- ***time of use* tariffs, in particular, are considerably more acceptable than flat rate tariffs to those with higher education, and**
- **less well-educated consumers have a marked preference for flat rate pricing.**

Table 7 Mean likelihood of choosing tariff offer, by tariff type, and education

	FLAT RATE	TIME OF USE	CRITICAL PEAK PRICING	PEAK TIME REBATE	REAL-TIME PRICING	CAPACITY PRICING	*COST-REFLECTIVE PRICING (IN GENERAL)*
Post-graduate education	54.58	72.00	60.89	63.93[#]	60.83	39.26	58.75
Less than post-graduate education	68.41	54.58	55.22	55.35	45.38	38.73	50.15

[#] We note that there are less than 20 cases (n=14) in this particular cell, and advise caution in interpretation in this instance.

One less educated participant contemplating flat-rate pricing remarked that it was: *"Easier to compare retailers. You know what the price is all the time. Off peak times may not always be implemented. The system we have now is too confusing" (#87)*. Another agreed that such a *"pricing system would be vastly easier to understand" (#328)*. In sharp contrast, highly educated participants receiving a flat-rate offer tended to see only missed opportunities, preferring to *"deliberately choose when to use electricity to save money, i.e., off-peak" (#618)*. As one highly educated participant with a flat-rate offer described their disappointment: *"off and on peak pricing allows me greater flexibility to reduce my electricity usage and cost than if there was a fixed price/flat rate (#491)*.

Certainly the less educated were far less comfortable with real-time pricing than the highly educated (who tended to tolerate, if not actually favour it). As one less educated participant noted: *"It seems in this scheme I would really have no idea what the cost of my electricity was. I don't trust electricity retailers enough to agree to this, I want to know & have a guarantee of what the Kwh cost is" (#608)*. Another ticked off their objections thus: *"I am old - nearly blind - don't like change - afraid there may be complications that I am unable to handle" (#706)*.

As noted above, while the highly educated generally favour most forms of cost-reflective pricing over flat rate tariffs, it is time of use pricing that they ultimately prefer. A good number of educated participants claimed that they *"currently… already try to limit use during the peak hours" (#888)*, and *"can time [their] major electricity usage actions outside the 4pm to 8pm time slot" (#299)*. Overall, they tended to think that time of use pricing *"seems reasonable to try & manage our peak demand" (#895)*.

Time of use tariffs arguably require more comprehension and daily management of the necessary behavioural changes than do alternate schemes focused on just a few critical peaks each year (peak time rebates, critical peak pricing), but not so much as would be required to really benefit (or avoid losses) from higher risk/higher reward real-time pricing schemes. It may be, then, that time of use pricing really marks out the limits of cost-reflectiveness that could be made acceptable to Australian electricity consumers, or at least the better-educated among them. The less educated tend either not to grasp, or not to accept the very logic of cost-reflective pricing, for example rejecting time of use tariffs precisely *"because the higher price is charged at the time of our peak usage" (#527)*.

4.1.3 EMPLOYMENT

While there is little consistent evidence on the effects of employment, there is clearly potential for employment status to influence tariff uptake, presumably by virtue of varied life conditions and resources. Varying employment status offers different opportunities and constraints around electricity consumption. For example, full-time employment (by taking one away from the home for an extended period each day) may affect one's capacity to shift household electricity consumption to lower cost periods. Many full-time employees have little choice but to cook, wash, bathe and recreate in the early evening peak. On the other hand, not being in the labour force at all might limit one's ability to access conditions and resources at work (e.g., air-conditioning, computing, meals) that could reduce electricity consumption in the home.

We compared the tariff preferences of all kinds of employees as well as those not in the workforce (see Table 8), and came out with only one particular finding, that:

- **households whose main income earner is only employed part-time are significantly more enthusiastic about *peak time rebates* than are others, and the only ones who generally prefer them to flat rate tariffs.**

Table 8 Mean likelihood of choosing peak time rebates, relative to flat rate tariff, by employment status

	FLAT RATE	PEAK TIME REBATE
Household head is full-time employee	69.43	53.47
Head is part-time employee	63.91	73.33
Head in other type of employment	58.00#	55.80
Head not in workforce	66.06	49.22

We note that there are less than 20 cases (n=15) in this particular cell, and advise caution in interpretation in this instance.

Although we do not pretend to have anticipated this finding *a priori*, it is possible that *part-time* employment might actually unite some of the advantages noted above for employees, while making possible some additional flexibility around peak periods by virtue of less mainstream and/or less regular hours. We note, too, that the particular form of cost-reflective pricing that households headed by part-timers appear to favour – peak time rebate – emphasises the ability to make financial gains (via rebates) rather than avoid financial losses (from higher peak charges). Again, this may have greater appeal to households whose main income earner is only employed part-time, rather than in secure full-time employment or retired (as per the vast majority of those "not in the workforce"). Compare the enthusiasm of this part-timer – *"Simple, encourages conservation, and I would ALWAYS get the rebate. Electricity use is VERY low" (#86)* – with the reaction of a retiree mostly ensconced in their home, rather than heading out each day to work: *"As a pensioner I am more likely to be at home using my a/c on the hottest days, so 'shedding' would impact me considerably… I do not believe that the change would lower my bill" (#557)*.

More tenuous or insufficient income may be one reason why households headed by part-timers seem significantly more likely than others to take up an offer that comes with a risk-free trial (see Table 9). We find that:

- **money-back guarantees are generally tempting regardless of employment status, but especially for households headed by a part-time employee.**

As one part-timer noted: *"Given a 6 month money-back guarantee it is a safe way of trialling the method. I am interested in any way that reduces my power bills and this may do so" (#122)*.

Similarly for another: *"Gives you the 'option' of managing power usage and receiving the rebate. 6 month trial allows for an informed decision on ongoing participation (#344)*.

Table 9 Mean likelihood of choosing tariff offer with/without money-back guarantee, by employment status

	BASIC DESCRIPTION *(without 'risk relief')*	BASIC + MONEY-BACK GUARANTEE
Household head is full-time employee	53.05	57.20
Head is part-time employee	53.12	67.02
Head in other type of employment	46.70	53.90
Head not in workforce	49.04	58.47

4.1.4 HOUSEHOLD SIZE & TYPE

Larger households, unsurprisingly, tend to consume more electricity overall (Frederiks, Stenner, & Hobman, 2015b; Thorsnes, Williams, & Lawson, 2012). This may be relevant to tariff choice because in several previous trials of cost-reflective pricing, higher consumption households have demonstrated greater reductions in peak period usage. This suggests that higher use customers might have more flexibility in when and how they use electricity (Di Cosmo, Lyons, & Nolan, 2012; Faruqui & George, 2005; Ida et al., 2013), which could render them more amenable to trying out cost-reflective pricing and/or more capable (at least in perceptions, if not reality) of making it work to their advantage.

Consistent with these expectations, we do find that increasing household size tends to be associated with greater acceptance of the high-risk/high-reward 'gamble' that is real-time pricing (see Table 10). As the bill-payer of one large household explained it: *"I am always looking at ways at reducing our electricity bill. This suggested pricing plan actually gives me a choice of how much I pay or how little I pay. It certainly seems to be a way of moving forward in how and when we use our electricity" (#329)*.

Note, however, that our finding still leaves real-time tariffs far less acceptable to consumers than flat rate pricing in any case. All we know is that:

- **consumers' relative preference for flat rate tariffs over *real-time* pricing is significantly diminished, though not erased, as household size increases.**

Table 10 Mean likelihood of choosing real-time pricing, relative to flat rate tariff, by household size

	FLAT RATE	REAL-TIME PRICING
Smaller household *(1 or 2 residents)*	66.55	42.36
Larger household *(more than 2 residents)*	66.19	54.17

Similarly in regard to the *type* of household, we found that being a childless couple is associated with significantly lower acceptance of real-time pricing (see Table 11). Overall:

- **the advantage that flat rate tariffs generally enjoy over *real-time* pricing is greater among childless couples than among other household types.**

Table 11 Mean likelihood of choosing real-time pricing, relative to flat rate tariff, by household type

	FLAT RATE	REAL-TIME PRICING
Childless couple	66.75	37.93
Single	70.30	50.65
Household with children	65.73	54.62

We can only speculate about some of the household dynamics that may be underwriting these striking findings. As noted, larger households with children appear to be the most willing to trial real-time pricing, although (along with everyone else) still finding it far less palatable than simple flat rate tariffs. We have argued that their greater willingness to give this form of cost-reflective pricing a try rests on their (potentially) having more to gain, on account of their greater, and more flexible electricity consumption. We might add the fact that some, if not most of their residents are children, whose behaviour is presumably more amenable to adult direction and control. Singles obviously have even more control over the behaviour (their own) that will ultimately determine their ability to properly exploit such a plan. But at the same time, singles' consumption is likely to be lower and less flexible to begin with, ultimately limiting the benefits to be gained from cost-reflective pricing. And childless couples might simply mark out the other extreme of this dynamic: the behaviour of half the household is outside their control, and the consumption of two adults living alone is generally moderate and relatively inflexible. This might naturally render the risk/reward profile of real-time pricing less attractive. One childless couple considering our real-time pricing offer thought it was *"too restricting in when I want to do things" (#516).* Another similarly situated explained their disinterest thus: *"Our lifestyle will not change so it does not matter what the Kwh cost is or when" (#513)*. Their attitude was more often something along the lines of: *"I want electricity when I switch on a power point. Who cares how much it costs" (#689)*.

4.1.5 DWELLING TYPE

In regard to the influence of dwelling type, we find that living in a semi-detached home (rather than some other type of housing) is associated with greater uptake of a tariff offer if free automation technology forms part of the pricing plan (see Table 12). Overall:

- **the addition of a free automation device to a tariff offer generally increases uptake only for those living in semi-detached homes rather than other kinds of dwellings.**

Table 12 Mean likelihood of choosing tariff offer with/without automation device, by dwelling type

	OFFER EXCLUDES AUTOMATION DEVICE	OFFER INCLUDES AUTOMATION DEVICE
Semi-detached home	45.17	63.79
Other kind of dwelling	54.29	51.96

In the absence of any prior research or reasoning, we can only speculate that this finding relates to the fact that those residing in *certain kinds* of semi-detached dwelling (we can only imagine separate flats in a share house) might find that their electricity consumption and billing are likewise difficult to 'detach' from that of their neighbours. They may well imagine that the automation device on offer could provide some much-needed capacity to separately track and manage their own electricity consumption.

4.1.6 HOME OWNERSHIP

Finally, we come to homeownership which, relative to its potential to impact on tariff preferences, is decidedly under-studied as an explanatory factor. Being a renter rather than a homeowner (whether that means owning outright, or paying off a mortgage) seems to be a key characteristic that might influence tariff choice. To date, the only reliable finding around homeownership of which we are aware was based on a real-time pricing trial, where renters (reportedly) undertook more high intensity electricity uses than others during peak hours (eMeter Strategic Consulting, 2010). The implication is that renters might be better able to foresee ways in which their peak time consumption could be shifted to benefit from uptake of cost-reflective pricing.

Some of the reasons why we might expect renters to be more accepting than others of cost-reflective tariffs relate to the association between being a renter and possessing certain *other* influential socio-demographic characteristics. For example, compared to homeowners, renters are probably more likely to have limited income, and be in part-time employment (more often in irregular jobs in hospitality, and in more flexible situations like shift work/night work). They might also be more inclined than homeowners to live in larger household groups, in share households, and in semi-detached dwellings.

Yet apart from these other characteristics whose influence on tariff choice we have already canvassed, we might also consider that renters move around far more than homeowners, and often change energy retailers when they do. The concept of switching electricity providers may already be more familiar to them (at least in certain states), and it may be less of a stretch to try out a new cost-reflective tariff at the same time. Certainly, we know that people tend to be more open to change and willing to shift from the status quo during significant life events and periods of transition, like marriage, the birth of a child, and moving homes.

Another consideration is that renters may be more likely than homeowners to split the electricity bill between multiple occupants – consider especially those living in group share houses. It may well be that trialling a new tariff offer can *seem* less risky under these conditions, when both decision-making and losses will be shared.

It is also the case that homeowners are more likely to invest in once-off energy efficiency measures and expensive home improvements to save energy, e.g., insulation, automation devices and, especially, solar installations. A persistent theme among homeowners contemplating cost-reflective pricing was some version of: *"Does it affect… solar F.I.T?" (#700)*. As one homeowner remarked: *"We have solar panels and receive a F.I.T. rebate. If any retailer were to offer a plan as described above, they would need to apply the rebate prior to the F.I.T." (#668)*. Some of these homeowners were planning to take their properties completely 'off-grid', in which case the issue of electricity pricing – cost-reflective or otherwise – was moot. They were happy just to *"keep the current way as we are going solar soon and hopefully get off the grid altogether" (#386)*.

Homeowners who have already invested in such installations may well think of themselves as already 'doing their bit' to save energy, and be less inclined to think cost-reflective pricing offers them any additional benefits. Conversely, for obvious reasons, renters tend not to make improvements to other people's property, or to buy major appliances for themselves, leading to less financial investment in energy-efficient technology and fixed installations. They might consequently be inclined to view cost-reflective pricing as a useful means – perhaps their only means – of gaining some control over, and savings on their electricity usage, without having to outlay money to do so. As one renter explained it: *"At present we do not have any control or means to lower our electricity bill, as there is only one tariff rate applicable to this account" (#756)*. The general sentiment for renters seemed to be: *"cheaper electricity bills, or the chance of, would always be welcome" (#645)*. As one renter remarked, in regard to peak time rebates: *"If I knew I was going to get a rebate, for using less electricity, I would do my best" (#370)*. *"Anything to get our electricity bill lower" (#446)* seemed to be the typical renters' reaction.

Whatever the reasons, our analysis certainly finds that being a renter (rather than a homeowner or 'other') is associated with greater uptake of cost-reflective pricing in general, and certain forms in particular, specifically: real-time pricing, peak time rebates and capacity pricing (see Table 13). As suggested in their own words, renters do appear more willing than homeowners and others to opt for a higher-risk/higher-reward 'gamble', apparently because it seems to them the only way they might 'get a win'[24]. The extent to which being a renter enhances the appeal of capacity pricing, in particular, is quite remarkable, lifting predicted uptake by more than 28 percentage points, from about 33% (among non-renters) to nearly 62% (among renters). Note that this is *not* to say that renters ultimately prefer capacity pricing, but only that they favour it much more than do non-renters.

Overall, we find that:

- **being a renter is associated with greater uptake of *real-time* pricing, *capacity* pricing and *peak time rebates* (the latter favoured by renters over all other tariff types); and**

- **flat rate pricing remains far more appealing to non-renters than any form of cost-reflective pricing, especially *capacity* pricing.**

Table 13 Mean likelihood of choosing tariff offer, by tariff type, and rental status

	FLAT RATE	TIME OF USE	CRITICAL PEAK PRICING	PEAK TIME REBATE	REAL-TIME PRICING	CAPACITY PRICING	*COST-REFLECTIVE PRICING (IN GENERAL)*
Renter	61.38	58.65	55.23	69.55	63.70	61.79	*61.69*
Not a renter	67.28	56.46	56.60	54.43	45.71	33.24	*49.74*

In the end (at least as far as home ownership status goes), it is only among renters that the uptake of cost-reflective pricing ever exceeds that of flat rate tariffs. For them, peak time rebates are clearly preferred above all else. But for non-renters, flat rate pricing really has no rival: cost-reflective pricing in all its forms simply proves much less attractive.

[24] Although the prospects for a 'loss' also seem considerable, at least for those in shared accommodation with non-compliant members and little capacity to monitor and enforce the necessary energy-saving behaviours.

5 Discussion and conclusions

We close this report by contemplating the central strands of the evidence derived from our empirical study – set alongside other theory and research – and the larger picture these insights collectively paint regarding the realistic prospects for a broad roll-out of cost-reflective electricity pricing to Australian consumers. It is important first to note that since our study only assessed consumers' likely *uptake* (not *usage*) of cost-reflective pricing, evidence-based conclusions can only be drawn in regard to potential uptake. Statements regarding consumers' likely usage (vs. uptake) of such tariffs are generally inferred from evidence provided by other scholars' prior research, considered in light of key principles from psychology and behavioural economics. Accordingly, while we may draw on this literature to offer potential explanations as to why certain tariffs were more or less appealing to consumers, and to predict how households might subsequently respond to them, it must be kept in mind that many of these hypotheses are yet to be directly empirically tested. Thus, we draw out the implications of our study with appropriate caution, and suggest several avenues for future research.

5.1 Summary of key findings

To recap, the main empirical findings from our study are as follows. First, in terms of the likely acceptance of different forms of pricing as a function of tariff type, our analysis revealed that Australian residential consumers find all forms of cost-reflective pricing significantly less attractive than traditional flat rate tariffs. Consumers seem to be particularly resistant to real-time pricing and (especially) capacity pricing, presumably due to their greater novelty and complexity (hence, perceived risk). Indeed, we found that simpler cost-reflective tariffs featuring pre-determined peak and off-peak periods – namely, critical peak pricing, peak time rebate and time of use tariffs – had greater consumer appeal, although still significantly less than flat rate pricing. Second, our results also indicated that so-called 'risk relievers' in the form of money-back guarantees and (to a lesser degree) free automation devices generally boost the likely uptake of any tariff offer, providing consumers with roughly the same encouragement to accept an offer irrespective of tariff type (i.e., these risk-relievers seem to increase the appeal of cost-reflective tariffs to the same degree they boost acceptance of any other offer, including flat-rate pricing). While the addition of risk-relief may therefore make cost-reflective tariffs more acceptable to consumers, our respondents still preferred flat rate tariffs offered on the same terms.

We consider that the combined results of our study constitute the best available evidence for predicting likely voluntary uptake of cost-reflective tariffs among Australian households. Our findings are largely consistent with those well-known cognitive biases against complexity, novelty and risk, and the pervasive human preference for simplicity, familiarity and certainty. While we cannot know for sure which decision-making processes were at play as our participants responded to the survey, the results do show that many consumers consider a flat rate tariff, with its invariant pricing, a more acceptable way of charging for electricity – presumably because it is more predictable and thus manageable in everyday life. Our empirical results strongly reinforce – with systematic, comparative evidence from a highly controlled setting – more anecdotal and impressionistic findings from prior qualitative research: that many people find simpler, static pricing structures more appealing than highly complex, variable pricing schemes (Dutschke & Paetz, 2013; Paetz et al., 2012).

5.1.1 ONLY A LIMITED SET MIGHT WORK, FOR A LIMITED AUDIENCE

Our empirical results suggest that the various tariff types – assigned entirely at random – were ultimately 'ranked' in a fairly predictable fashion: from the simplest, most familiar, and seemingly lowest-risk offers (flat rate tariffs) down to the most complex, novel, and apparently highest-risk offers (real-time tariffs and, least favoured of all, capacity pricing). Of the five cost-reflective tariffs we tested, peak time rebates, time of use tariffs and critical peak pricing seem to be perceived more favourably than real-time and capacity pricing. While we did not examine the underlying psychological processes here, it seems likely that many consumers view capacity pricing with particular disfavour partly due to its highly novel, demand-based pricing structure, which stands in sharp contrast to the more familiar consumption-based mode of pricing electricity. As for real-time pricing, to many consumers it might seem to pose additional burdens, risk and potential for loss. They may well foresee they would find it complex, cumbersome and tiresome to track and respond to.

Overall we understand these relative tariff preferences as reflecting public perceptions, first, of how difficult a proposed tariff offer is to comprehend, and second, of how hard it might be for households to behave in ways that would maximise its benefits. While further research is needed to fully understand the factors at work here, we predict that these perceptions are underlaid (at least in part) by a kind of intuitive risk assessment incorporating both the challenges of understanding what behaviour might be required (and when) in order to reap benefits, and the probability of household members being willing and able to carry out such behaviour.

Based on the evidence presented here, we conclude that only a limited set of cost-reflective pricing offers have a prospect of rivalling consumer acceptance of flat rate tariffs, namely:

- *peak time rebates* combined with the offer of a free automation device (aimed at easing management and maximising consumer benefit from the tariff); and
- *time of use* tariffs, or *critical peak* pricing, when accompanied by a money-back guarantee (aimed at alleviating consumers' perceived risks in trialling the new offer).

Compared to highly dynamic schemes like real-time pricing, these particular forms of cost-reflective pricing are presumably felt to have broader, more predictable and manageable off-peak/lower cost periods, which either recur in a regular way each day, or else only confront the consumer for a few hours on a few days each year. Moreover, although our study did not specifically test *why* different tariffs were more or less appealing to consumers, it is possible that offering a free automation device or money-back guarantee can make a pricing scheme seem less risky and more manageable. The notion of manageability seems particularly relevant when we consider that prior qualitative evidence (although based on interviews with just 10 families) suggests that households on demand-based tariffs tend not to fully familiarise themselves with the precise implications of the tariff, but rather, only note that they are economically better off using electricity in off-peak periods (Bartusch, Wallin, Odlare, Vassileva, & Wester, 2011). In the end, this may be the extent of what most people are willing and able to 'invest' in understanding and responding to their electricity pricing plans.

It is interesting to note that peak time rebates appeared to predominate among the cost-reflective options[25], perhaps because they feature potential gains rather than losses, and the latter is something to which we know human decision-makers are disproportionately averse. Under this type of pricing, the consumer stands only to gain (in the form of rebates for reduced consumption), and never to lose (via higher charges for peak consumption). For most of the year, they are also offered the perceived certainty that comes with a flat rate tariff. The seemingly welcome addition of the automation device to this favoured tariff offer is presumably perceived to aid one's management of the ambiguous and somewhat mysterious process of 'using less than normal' in order to earn the promised rebate. For time of use tariffs

[25] The relative attractiveness of peak time rebates was also observed in pilot trials by Baltimore Gas & Electric, where customers were more satisfied with a specially-designed peak time rebate scheme than with critical peak pricing (see Lich, Mercer, & Tinjum, 2014). The rebate scheme – BGE's 'Smart Energy Rewards' program – in this case also incorporated behavioural solutions, in the form of personalised energy saving tips and timely feedback, delivered by OPower's Behavioural Demand Response. BGE has now rolled out the peak time rebate program alone, and expects all 1.1 million of its residential customers to be enrolled by 2015.

and critical peak pricing to win consumer favour, on the other hand, it might take the assurance of a money-back guarantee to mitigate the risk that shifting consumption to these (albeit broad and predictable) off-peak periods might not be quite as easy as anticipated.

Overall, then, the evidence has clearly converged on a 'middling' set of cost-reflective tariffs and packages where novelty and complexity do not entirely overwhelm, and where the risks, cognitive burdens and requisite behavioural changes are better understood and seen (at least by some segments, in light of their particular circumstances) as manageable and proportionate to the anticipated gains.

Clearly, it is important to consider the potential moderating role of socio-demographic characteristics, as incorporated in our study. Based on our analysis, it seems that those population segments that are more amenable to taking up certain types of cost-reflective pricing include, most significantly, the better educated and renters. In terms of income, the type of cost-reflective pricing that seems to have the greatest (although not great) appeal to *lower income* householders is critical peak pricing. This is understandable insofar as it holds out the prospect of much cheaper electricity for much of the year (presumably especially attractive for those on lower incomes), in return for consumers avoiding usage for a few hours a day across just a few weeks. Importantly, these 'critical peak' periods are pre-determined by others and conveyed ahead of time to the consumer. Compared to some other kinds of cost-reflective tariffs, under critical peak pricing there may be fewer demands on decision-making, the cognitive burden might be more modest in relative terms, and with some attention to the requisite shifts in their behaviour, it should (in principle or perception) be harder for the consumer to 'get it wrong' (i.e., to incur higher electricity bills by not responding to price signals 'appropriately').

In the end, however, the greatest barrier to uptake of cost-reflective pricing appears to be consumers' aversion to making *any* kind of choice, i.e., their aversion to giving up the status quo (which we know is only magnified as the decision-making environment grows more complex).

5.1.2 A KEY BARRIER TO UPTAKE: INERTIA AND THE STATUS QUO BIAS

While our results indicate that consumers have a relative preference for flat rate tariffs, the fact that self-reported uptake rates were far from impressive across the board, coupled with the survey's low overall response rate, seems to suggest that people are very 'inertial' and have a strong attachment to the status quo (*whatever* that might be), hence a general reluctance to respond to *any* new 'offer', whether that pertains to cost-reflective tariffs, electricity pricing more generally, or otherwise. Even if we take Table 3 at face value, we can see that the three most favoured cost-reflective pricing offers hover around just 62% 'acceptance', and only a couple of flat rate pricing offers have rates of 'uptake' exceeding 65%. From the perspective of behavioural economics, there are many reasons why someone might be reluctant to switch tariffs (from a flat-rate to a cost-reflective tariff, *or* vice versa), and instead stick to the status quo. Well-known cognitive biases and psychological influences that may be at work here include loss and risk aversion, temporal discounting, neglect of opportunity costs, cognitive and choice overload, procrastination and avoidance of inconvenience (around time, effort and 'hassle'). Due to any one or more of these factors, consumers might be inclined to stick with the default option, even given the prospect of considerable gains. It is notable that even flat rate pricing with a money-back guarantee (and remember, we did *not* draw participants' attention to their existing pricing plan, nor suggest that flat rate pricing generally prevails) was accepted by less than three-quarters of those who actually responded to the 'offer', who were themselves only a small fraction of the consumers to whom it was originally 'offered'.

Since survey non-response occurred at equivalent rates across the various experimental conditions[26], this does not hinder our understanding of consumers' *relative* preferences among different pricing options. But it does mean that the *absolute* scores for tariff 'acceptance' that we report herein, in all probability vastly

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[26] See Appendix C, C.1, including table notes.

over-estimate their likely uptake across the customer base. The reader will note, accordingly, that we have been unwilling to make much of, or draw elaborate inferences from these absolute rates of tariff 'uptake'. Instead, we have kept attention almost exclusively on the *relative* rates of acceptance of different pricing structures, and their implications.

Realistically, we must take into consideration in our calculations the 93% of study 'participants' who altogether failed to respond to our survey. We might reasonably assume our non-respondents have a 0% likelihood of accepting the kind of 'offer' they received (although of course this remains highly speculative). We consider these survey non-respondents as being (roughly) analogous to customers who fail to respond to some new pricing offer mailed out by an electricity retailer. While an invitation to take part in a survey of future electricity pricing options is obviously not the same as an actual tariff offer from a retailer, their fundamental processes and decision-making environments still bear close resemblance. In each case, the consumer receives in the mail an unsolicited 'offer' on a matter about which they tend to care very little. For responding favourably to the offer, there are intangible, perhaps very modest, and certainly unpredictable rewards in the future. But there are tangible costs and burdens to responding, incurred immediately, along with (perceived) risk of further burdens and losses in the future. The offer is part of a vast 'wall of noise' that they negotiate – with limited time, interest and cognitive capacity – each day of their busy lives, while hardly bothering to struggle against the inertia provided by attachment to the status quo and predictable reversion to defaults or non-decision. And let us not imagine that consumers would prove much more willing to jump at the prospect of abandoning the status quo for an unknown quantity when there is a *real* tariff offer on the table. All things considered, we feel comfortable predicting that the actual rates of uptake of these different pricing offers would be much *closer* to 7% of the rates reported in Table 3, than to those rates as such.

5.1.3 WHAT WE MIGHT EXPECT IN THE AGGREGATE

Instead of tariff uptake ranging from about 36% to 74%, then, we imagine that for new pricing offers the actual rate of voluntary uptake – roughly approximated as the response rate (7%) multiplied by the tariff 'acceptance' rate – might be something more in the order of 2.5% to 5%. Even if (say) we were to double our rate of response, the predicted uptake would still only range from about 5% to 10%, on these estimates. Interestingly, this prediction is roughly the same rate cited by some international scholars for the voluntary uptake of cost-reflective tariffs under 'opt-in' schemes. For example, recent research by Todd et al. (2013) found that although recruitment into time-based electricity rate programs can vary widely (ranging from 5% to 28% for opt-in studies, and from 78% to 87% for opt-out studies), for a utility's planning purposes, assuming a 10% recruitment rate seems most appropriate for voluntary opt-in programs. Equally interesting are some recent findings from two randomised controlled trials conducted overseas, which found that if cost-reflective pricing is introduced in a mandatory form (see Braithwait et al., 2012), or as an 'opt-out' scheme (i.e., the tariff is applied universally unless the customer explicitly opts out; see Navigant Consulting, 2011), only a small proportion of customers (~10%) prove to be 'responders' (those who respond to critical peak events). Summarising broadly then, these findings seem to present policymakers, regulators, networks and retailers with two alternative, essentially equivalent (and probably equally unsatisfactory) courses of action:

- Allow the enthusiastic 5-10% to voluntarily 'opt-in' to cost-reflective pricing, and willingly sustain 100% effort to modify their energy usage appropriately, while the remaining 90-95% of households do not participate; or
- Use mandates or 'opt-out' schemes to (essentially) impose cost-reflective pricing on 100% of consumers, while anticipating that only a small proportion will deploy it effectively, i.e., by significantly modifying their energy usage in response to changing price signals (especially if no automated enabling technology is provided).

Ultimately however, these are *not* the only two options available. Rather, a more integrated and holistic approach is possible, as we will explain below. In our view, this will be the essential way forward if we are to fully realise the desired efficiencies and shared benefits of cost-reflective pricing.

5.2 Practical implications

5.2.1 EDUCATION IS CRITICAL, BUT NOT A SOLUTION

In the absence of automated technology that might help consumers reap the benefits of cost-reflective tariffs, what we have outlined above would be our best estimates of the realistic prospects for a broad roll-out of such pricing into the Australian energy market. Some analysts might claim that these prospects can be improved by a comprehensive consumer campaign of information and 'engagement'. For example, they might assume that because higher education is positively associated with acceptance of cost-reflective pricing (see Table 7), acceptance of cost-reflective pricing can be increased by consumer education. But it does not necessarily follow. The 'education' variable in our analyses indicates not merely exposure to a great deal of information. Importantly, it reflects critical characteristics of the individual that bear upon their cognitive capacity and potential for understanding, preference for complexity and abstraction, habits of thinking, and particular styles of interacting with the world and processing incoming information.

Even if industry stakeholders committed themselves to a very extensive program of consumer education around cost-reflective pricing – one a great deal more resource-intensive and information-dense than the typical mail-out we trialled here – we are not confident that this, in itself, would significantly boost the uptake and effective usage of these new pricing schemes. As we have noted, a consistent finding in psychology and behavioural economics is that decision-making tends to deteriorate as the amount of information, number of choices, and level of complexity increases. As counter-intuitive as it may seem, people typically make better decisions – and indeed, are more likely just to make a decision – with fewer choices, less information, and simpler information. As the amount and complexity of incoming information increases, people tend to make inferior decisions, or avoid making any decision at all, i.e., they stick to the status quo (Kahneman et al., 1991; Samuelson & Zeckhauser, 1988). Complex information and/or choice overload may therefore lead consumers to stick with/take up pricing schemes that are ill-suited to their circumstances or capacities, such that they might then struggle to deploy them effectively in ways that could reduce household bills and/or improve network efficiency.

5.2.2 'RISK RELIEF' SHOULD AID USAGE, NOT JUST UPTAKE

Since uptake does not equate to effective usage, similar conclusions can be drawn regarding those money-back guarantees that, in our analyses (see Table 4), showed potential to boost acceptance of cost-reflective pricing. Again, there may be hazards in inducing consumers – who might otherwise have made a different assessment of risks relative to returns – to take up cost-reflective pricing, without actually equipping them with the necessary means to respond appropriately to such pricing and exploit those schemes effectively.

On the other hand, while automation devices proved less important here than money-back guarantees in promoting tariff *uptake*, there is reason to believe they might be far more consequential in terms of enhancing effective tariff *usage*, and ultimately, network efficiency. This is because automated devices minimise the need for *manual* response by consumers, with household electricity usage adjusted automatically in response to changes in demand, rather than being heavily reliant on shifting human behaviour. Automated devices thus have great potential to simplify household demand response at peak times, to consistently achieve desired reductions in household bills (and rather painlessly too, from the consumer standpoint), to reliably mitigate network peak demand spikes, and to deliver overall improvements in network efficiency and utilisation rates.

5.3 What problem are we actually trying to solve?

At this point, we should notice that our own findings on likely tariff uptake, considered in conjunction with prior research on subsequent usage, and key principles from psychology and behavioural economics, are together tending to converge on one striking proposition: that *cost-reflective pricing will be more successful the less it relies on consumers, themselves, responding to changing price signals*.

Certainly this should encourage us to contemplate whether we are actually asking the right question, or more accurately, trying to solve the right problem. It seems to us that our collective problem is not how to get consumers to *take up* cost-reflective pricing, not even how to get them to effectively *use* cost-reflective pricing, but rather, *how best to reduce peak demand* – ideally in a manner yielding benefits for consumers and networks alike. Cost-reflective pricing is just one proposed solution to this problem, and clearly one that has garnered considerable support across the industry. But international experience suggests that cost-reflective tariffs are unlikely to yield the desired benefits without an appropriate suite of supportive mechanisms facilitating their optimal usage.

A substantial and enduring mass shift in electricity usage that flattens peak demand would seem to require not isolated tariff reform, but rather tariff reform accompanied by systemic technological changes, especially around automation of usage. As outlined earlier, automated load control devices for high demand household appliances may prove particularly important for optimising household usage of cost-reflective pricing. In this regard, it is worth noting that Australia is a global leader in the development of demand response standards for high demand household appliances. In fact the AS/NZS4755 suite of Australian Standards has already been voluntarily adopted by numerous international manufacturers of the three appliance types that generate around 80% of residential peak demand: air conditioning, swimming pool filtration and electric hot water. The Commonwealth has also advised its intention to mandate compliance with AS/NZS4755 across all such appliances sold, giving Australia an unparalleled opportunity to optimise its future energy systems.

Under this more structural (vs. behavioural) approach – where demand response relies more heavily on the appliances than the people – cost-reflective pricing would *primarily* function as a *quid pro quo* benefit to those households that pre-commit (periodically and infrequently, e.g., upon contract renewal) to demand-side participation in return for favourable tariffs (rather than serving as a shifting signal to which householders must attend and respond).

Other potential additions to a more holistic mix of solutions that seem, on the extant evidence, to have reasonable prospects of reducing peak demand (and better prospects than cost-reflective tariffs *alone*) include:

- Simple, low cognitive-effort, high visual-impact reminder devices for the home, such as ‘energy orbs’ (‘ambient orbs’) that glow different colours (e.g., red, yellow, green) depending on current household energy usage (and possibly even network status), inducing consumers to engage in other energy-saving actions that cannot be easily automated; and

- Innovations in building and technology design, e.g., building codes, solar air-conditioning, solar PV, battery storage, electrical vehicle integration with home energy systems.

5.4 The critical importance of ensuring optimal usage following uptake

One could always seek to boost consumer uptake of any of these alternative/complementary solutions by taking into account, and actually making use of, those same cognitive biases and psychological influences that can mitigate against uptake of cost-reflective pricing, e.g., pre-commitment, inertial attachment to the status quo/defaults, aversion to complexity and loss, attention to social norms and tendency to conformity. However, we would caution against deploying psychological/behavioural interventions to boost uptake of cost-reflective pricing, itself, without also *ensuring consumers are equipped with the means (be they* *individual capacities or household devices) to utilise such pricing effectively* – and in a way that actually minimises household costs at the same time it enhances network efficiency. Otherwise, to the extent that intensive campaigns of 'consumer education' and/or 'risk relief' (e.g., money-back guarantees) *did* manage to persuade people to take up cost-reflective pricing, a good proportion of those consumers might still prove unable and/or unwilling to respond to the new tariffs in ways that maximise their benefits, at least if the core insights of behavioural economics are to be believed. One could even imagine that the more persuasive the campaign, the more unsuitable might be the consumers it persuaded to take up tariffs they may be ill-equipped to effectively deploy, either in their own or the public interest. If this were how the roll-out scenario unfolded, the aggregate result may well be insignificant improvements in household electricity bills, peak demand and network efficiency, all 'purchased' at considerable risk and expense. All efforts to increase uptake of cost-reflective pricing should *also* focus on ensuring optimal usage – for instance, by deploying a suite of supportive mechanisms to ensure consumers can respond appropriately.

5.5 Limitations and future research directions

Finally, we want to acknowledge the limitations imposed by the fact that our study involved a *survey* of consumer responses to *hypothetical* future electricity tariffs, rather than a test of consumer uptake of some real-world offer from an electricity retailer. Certainly we believe our experiment has been designed in such a way as to generate a decision-making environment that closely resembles the latter, and accordingly, that our findings regarding *relative* tariff preferences should closely resemble consumer response to real tariff offers of this nature. But of course, there would be value in conducting future research – including a follow-up trial where similar offers were presented in much the same way but by an electricity retailer, rather than a research agency. While consumers would still be responding to hypothetical tariff offers, the realism of the choice context could be enhanced by including specific prices (which themselves could be randomly varied, within a feasible/probable range).

Different modes of delivering the 'offer' (e.g., by mail, email, telephone, social media) could also be tested in future research, to gain valuable insights into how cost-reflective pricing might best be promoted when eventually rolled out, or how it could best be targeted to niche market segments or particular customer profiles (e.g., minority or 'vulnerable' groups such as those with low income or education, the elderly, the unemployed, pensioners, those with a disability, etc.). With a much larger sample of respondents – drawn from a customer base with whom the retailer has some existing relationship, and to whom they are expected to make unsolicited 'offers' from time to time – it would also be possible to test the impact of a number of additional factors (e.g., perhaps including testimonials from existing tariff users and/or empirical evidence of average customer gains under such pricing), as well as how all these factors interact (in a complete factorial design). For example, future research could extend our study by examining the combined impact of offering customers *both* a money-back guarantee *and* an automated device. Another potentially fruitful avenue for future research would be to experimentally test whether capacity pricing – although clearly disfavoured in our study – might attract greater consumer interest by deploying different message framing and/or the use of metaphors borrowed from the mobile/broadband context.

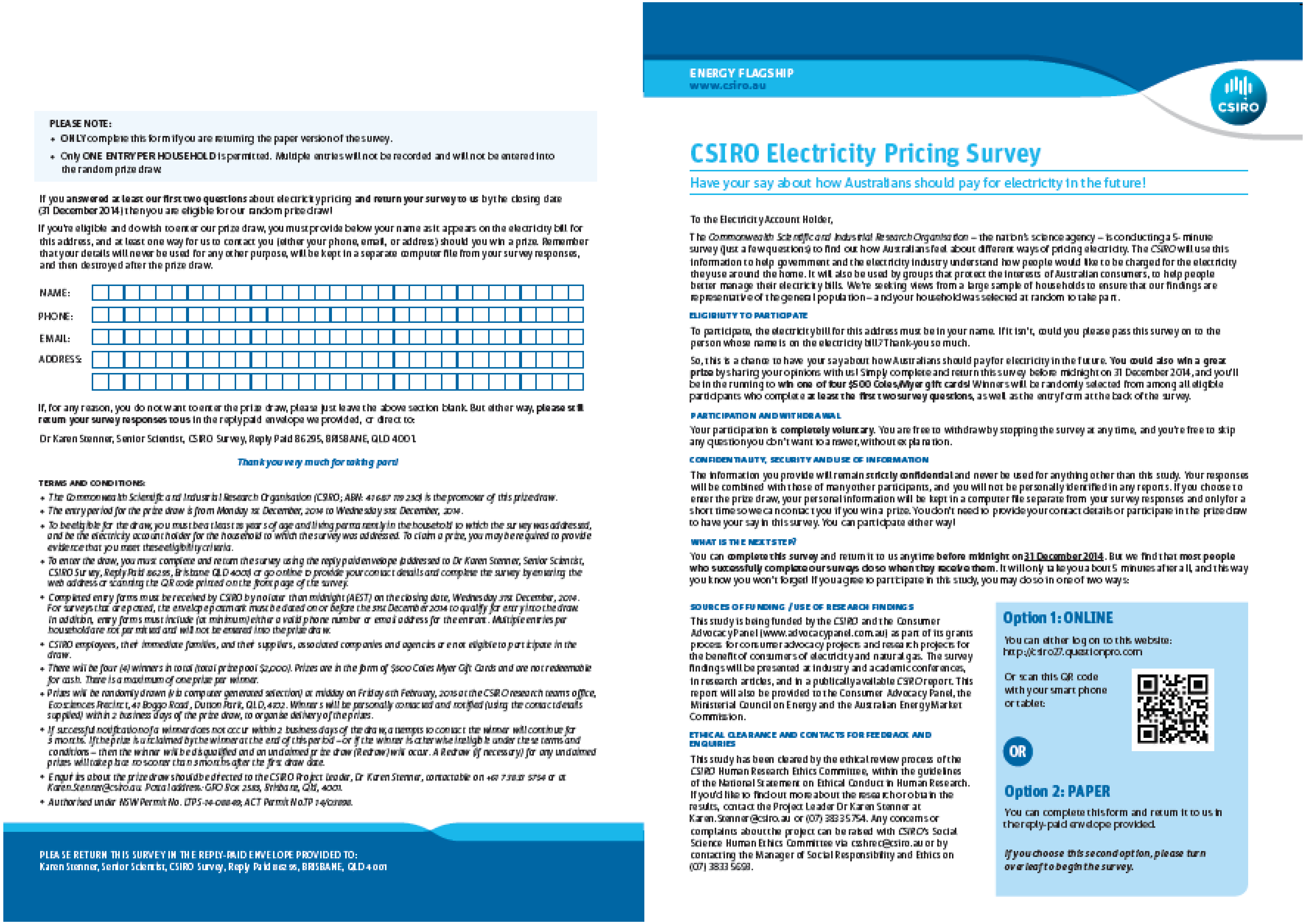
Clearly then, while our study takes an important step toward understanding consumers' likely response to cost-reflective electricity pricing, there is still vast scope for future research in this domain. Identifying the full range of behavioural and psychosocial considerations – all the underlying causal processes and contingencies that shape consumer choices and actions (around both uptake and usage) – would certainly make a significant and timely contribution to the literature. In designing future research, we do caution that limited and resource-intensive pilot trials that invest far more resources (e.g., time, effort, money) in customer engagement and support – especially around ongoing usage of a tariff – than any mass roll-out would be able to accomplish may not yield externally valid and generalisable results. It is vital, then, that future trials accurately replicate – to the greatest degree possible – what a real-world mass roll-out could feasibly achieve. Ensuring high levels of external validity will improve the generalisability of results, thereby yielding more valuable insights about real-world prospects for the universe of cost-reflective tariff offers.

5.6 Conclusion

It is clear that meaningful demand-side participation by many millions of Australians is critical to optimising the nation's future electricity systems and stabilising the real costs of electricity to consumers. Cost-reflective electricity pricing is considered by many stakeholders to be essential to achieving this goal. Against this backdrop, we have conducted here a randomised experimental survey with a large sample of Australian householders, empirically testing consumers' likely response to various forms of cost-reflective pricing.

Our findings should be carefully considered in conjunction with other relevant theories and evidence, and in light of key principles from psychology and behavioural economics. Together, the insights generated suggest that in order to achieve the desired efficiencies and shared benefits of cost-reflective tariffs, new pricing schemes should be accompanied by a suite of supporting strategies and mechanisms that facilitate both consumer acceptance and 'appropriate' demand response. The latter is imperative. A substantial and enduring mass shift in electricity usage that flattens peak demand seems to require not just isolated tariff reform, but rather tariff reform accompanied by systemic technological changes, especially around automation of usage. We conclude that in all policy making around cost-reflective pricing it will be absolutely critical to distinguish what might promote uptake as opposed to effective usage of cost-reflective pricing, and to recognise that anything that induces the former without also facilitating the latter might entail considerable political, economic and social risks.

Appendix A Experimental survey



ENERGY FLAGSHIP
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CSIRO

CSIRO Electricity Pricing Survey

Have your say about how Australians should pay for electricity in the future!

To the Electricity Account Holder,

The *Commonwealth Scientific and Industrial Research Organisation* – the nation's science agency – is conducting a 5-minute survey (just a few questions) to find out how Australians feel about different ways of pricing electricity. The *CSIRO* will use this information to help government and the electricity industry understand how people would like to be charged for the electricity they use around the home. It will also be used by groups that protect the interests of Australian consumers, to help people better manage their electricity bills. We're seeking views from a large sample of households to ensure that our findings are representative of the general population – and your household was selected at random to take part.

ELIGIBILITY TO PARTICIPATE

To participate, the electricity bill for this address must be in your name. If it isn't, could you please pass this survey on to the person whose name is on the electricity bill? Thank-you so much.

So, this is a chance to have your say about how Australians should pay for electricity in the future. **You could also win a great prize** by sharing your opinions with us! Simply complete and return this survey before midnight on 31 December 2014, and you'll be in the running to **win one of four $500 Coles/Myer gift cards!** Winners will be randomly selected from among all eligible participants who complete **at least the first two survey questions**, as well as the entry form at the back of the survey.

PARTICIPATION AND WITHDRAWAL

Your participation is **completely voluntary**. You are free to withdraw by stopping the survey at any time, and you're free to skip any question you don't want to answer, without explanation.

CONFIDENTIALITY, SECURITY AND USE OF INFORMATION

The information you provide will remain **strictly confidential** and never be used for anything other than this study. Your responses will be combined with those of many other participants, and you will not be personally identified in any reports. If you choose to enter the prize draw, your personal information will be kept in a computer file separate from your survey responses and only for a short time so we can contact you if you win a prize. You don't need to provide your contact details or participate in the prize draw to have your say in this survey. You can participate either way!

WHAT IS THE NEXT STEP?

You can **complete this survey** and return it to us anytime **before midnight on 31 December 2014**. But we find that **most people who successfully complete our surveys do so when they receive them.** It will only take you about 5 minutes after all, and this way you know you won't forget! If you agree to participate in this study, you may do so in one of two ways:

SOURCES OF FUNDING / USE OF RESEARCH FINDINGS

This study is being funded by the *CSIRO* and the Consumer Advocacy Panel (www.advocacypanel.com.au) as part of its grants process for consumer advocacy projects and research projects for the benefit of consumers of electricity and natural gas. The survey findings will be presented at industry and academic conferences, in research articles, and in a publically available *CSIRO* report. This report will also be provided to the Consumer Advocacy Panel, the Ministerial Council on Energy and the Australian Energy Market Commission.

ETHICAL CLEARANCE AND CONTACTS FOR FEEDBACK AND ENQUIRIES

This study has been cleared by the ethical review process of the *CSIRO* Human Research Ethics Committee, within the guidelines of the National Statement on Ethical Conduct in Human Research. If you'd like to find out more about the research or obtain the results, contact the Project Leader Dr Karen Stenner at Karen.Stenner@csiro.au or (07) 3833 5754. Any concerns or complaints about the project can be raised with *CSIRO's* Social Science Human Ethics Committee via csshrec@csiro.au or by contacting the Manager of Social Responsibility and Ethics on (07) 3833 5693.

Option 1: ONLINE

You can either log on to this website: http://csiro27.questionpro.com

Or scan this QR code with your smart phone or tablet:

OR

Option 2: PAPER

You can complete this form and return it to us in the reply-paid envelope provided.

If you choose this second option, please turn overleaf to begin the survey.

PLEASE NOTE:

- **ONLY** complete this form if you are returning the paper version of the survey.
- Only **ONE ENTRY PER HOUSEHOLD** is permitted. Multiple entries will not be recorded and will not be entered into the random prize draw.

If you **answered at least our first two questions** about electricity pricing **and return your survey to us** by the closing date (31 December 2014) then you are eligible for our random prize draw!

If you're eligible and do wish to enter our prize draw, you must provide below your name as it appears on the electricity bill for this address, and at least one way for us to contact you (either your phone, email, or address) should you win a prize. Remember that your details will never be used for any other purpose, will be kept in a separate computer file from your survey responses, and then destroyed after the prize draw.

NAME:

PHONE:

EMAIL:

ADDRESS:

If, for any reason, you do not want to enter the prize draw, please just leave the above section blank. But either way, **please still return your survey responses to us** in the reply paid envelope we provided, or direct to:

Dr Karen Stenner, Senior Scientist, CSIRO Survey, Reply Paid 86295, BRISBANE, QLD 4001.

Thank you very much for taking part!

TERMS AND CONDITIONS:

- *The Commonwealth Scientific and Industrial Research Organisation (CSIRO; ABN: 41 687 119 230) is the promoter of this prize draw.*
- *The entry period for the prize draw is from Monday 1st December, 2014 to Wednesday 31st December, 2014.*
- *To be eligible for the draw, you must be at least 18 years of age and living permanently in the household to which the survey was addressed, and be the electricity account holder for the household to which the survey was addressed. To claim a prize, you may be required to provide evidence that you meet these eligibility criteria.*
- *To enter the draw, you must complete and return the survey using the reply paid envelope (addressed to Dr Karen Stenner, Senior Scientist, CSIRO Survey, Reply Paid 86295, Brisbane QLD 4001) or go online to provide your contact details and complete the survey by entering the web address or scanning the QR code printed on the front page of the survey.*
- *Completed entry forms must be received by CSIRO by no later than midnight (AEST) on the closing date, Wednesday 31st December, 2014. For surveys that are posted, the envelope postmark must be dated on or before the 31st December 2014 to qualify for entry into the draw. In addition, entry forms must include (at minimum) either a valid phone number or email address for the entrant. Multiple entries per household are not permitted and will not be entered into the prize draw.*
- *CSIRO employees, their immediate families, and their suppliers, associated companies and agencies are not eligible to participate in the draw.*
- *There will be four (4) winners in total (total prize pool $2,000). Prizes are in the form of $500 Coles Myer Gift Cards and are not redeemable for cash. There is a maximum of one prize per winner.*
- *Prizes will be randomly drawn (via computer generated selection) at midday on Friday 6th February, 2015 at the CSIRO research teams office, Ecosciences Precinct, 41 Boggo Road, Dutton Park, QLD, 4102. Winners will be personally contacted and notified (using the contact details supplied) within 2 business days of the prize draw, to organise delivery of the prizes.*
- *If successful notification of a winner does not occur within 2 business days of the draw, attempts to contact the winner will continue for 3 months. If the prize is unclaimed by the winner at the end of this period – or if the winner is otherwise ineligible under these terms and conditions – then the winner will be disqualified and an unclaimed prize draw (Redraw) will occur. A Redraw (if necessary) for any unclaimed prizes will take place no sooner than 3 months after the first draw date.*
- *Enquiries about the prize draw should be directed to the CSIRO Project Leader, Dr Karen Stenner, contactable on +61 7 3833 5754 or at Karen.Stenner@csiro.au. Postal address: GPO Box 2583, Brisbane, Qld, 4001.*
- *Authorised under NSW Permit No. LTPS-14-01849; ACT Permit No TP 14/02090.*

PLEASE RETURN THIS SURVEY IN THE REPLY-PAID ENVELOPE PROVIDED TO:
Karen Stenner, Senior Scientist, CSIRO Survey, Reply Paid 86295, BRISBANE, QLD 4001

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you.

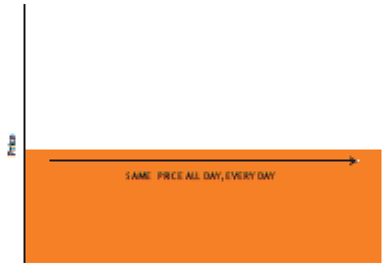
Here's how it might work...

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season).

Under this plan, you could deliberately reduce the amount of electricity you use at any time, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
Any time of day, week, season, etc.	Same price

So then, on the scale below, ranging all the way from 0% (*no chance*) up to 100% (*definitely*), please tell us:

1. How likely is it that you would choose a pricing plan like this, if it was offered?

(Please circle one number)

0%	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100%

2. Can you please tell us why?

____

____

____

____

____

____

These last few questions are about you and your household; you can skip over any that you don't wish to answer.

Your responses will help us describe the types of people and households that completed the survey, but they will never be used to identify you as an individual. They will also help us understand what different types of consumers think about different ways of pricing electricity.

INSTRUCTIONS:

- Please answer the question by placing a cross clearly inside the box, like this ☒.
- If you make a mistake or change your mind, fill in the box like this ■ and then put a cross in the correct box, like this ☒.

3. Which age group do you belong to?

☐ 18-19 ☐ 40-44 ☐ 65-69
☐ 20-24 ☐ 45-49 ☐ 70-74
☐ 25-29 ☐ 50-54 ☐ 75-79
☐ 30-34 ☐ 55-59 ☐ 80-84
☐ 35-39 ☐ 60-64 ☐ 85+

4. Are you ... ?

☐ Male ☐ Female

5. What is your postcode? ____________

6. How many people (including yourself) live in your household? ____________

7. Which of the following best describes your household?

☐ Single person household
☐ One family household – couple family with no children
☐ One family household – couple family with children
☐ One family household – one parent family
☐ Group household – multiple families (e.g., extended family grouping)
☐ Group household – group of unrelated persons (e.g., share-house)
☐ Other type of household

8. Is your dwelling ... ?

☐ Owned outright
☐ Owned with a mortgage
☐ Being purchased under a rent/buy scheme
☐ Being rented
☐ Being occupied rent free
☐ Being occupied under a life tenure scheme
☐ Other

9. Which of the following best describes where you live?

☐ Detached house
☐ Semi-detached, row or terrace house, townhouse etc.
☐ Flat, unit or apartment
☐ Other dwelling

10. What is the highest level of education you have completed?

☐ School Education
☐ Certificate
☐ Advanced Diploma/Diploma
☐ Bachelor Degree
☐ Graduate Diploma/Graduate Certificate
☐ Postgraduate Degree

11. What is the current employment status of the main income earner in your household?

☐ Employed, working full-time
☐ Employed, working part-time
☐ Employed, away from work (e.g., on holidays, paid leave, temporarily stood down, etc.)
☐ Unemployed, looking for full-time work
☐ Unemployed, looking for part-time work
☐ Not in the labour force
☐ Other

12. Thinking of your annual household income all together, what is the total of all wages/salaries, government benefits, pensions, allowances and other income your household usually receives?
(Do not deduct tax).

☐ less than $15,600 per year
☐ $15,600-$31,199 per year
☐ $31,200-$51,999 per year
☐ $52,000-$77,999 per year
☐ $78,000-$103,999 per year
☐ $104,000 or more per year

Appendix B Tariff descriptions

B.1 Flat rate tariff (condition 1)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you.

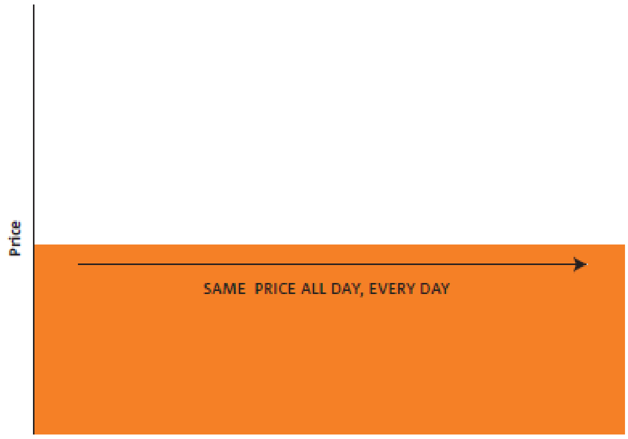
Here's how it might work…

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season).

Under this plan, you could deliberately reduce the amount of electricity you use at any time, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
Any time of day, week, season, etc.	Same price

B.2 Flat rate tariff + money-back guarantee (condition 2)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you.

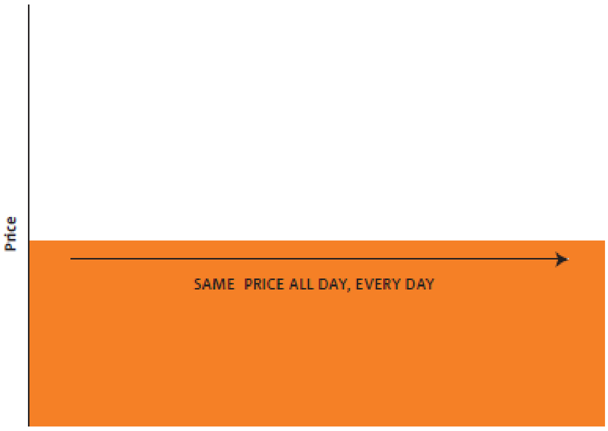
Here's how it might work…

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season).

Under this plan, you could deliberately reduce the amount of electricity you use at any time, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
Any time of day, week, season, etc.	Same price

UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for two billing quarters. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.3 Flat rate tariff + automation device (condition 3)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you.

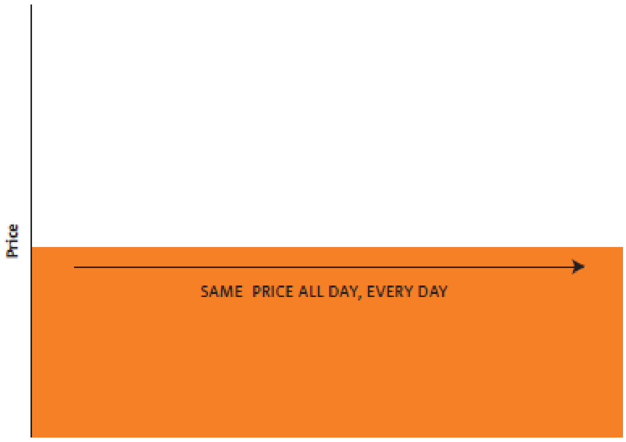
Here's how it might work...

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season).

Under this plan, you could deliberately reduce the amount of electricity you use at any time, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
Any time of day, week, season, etc.	Same price

UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

B.4 Time of use tariff (condition 4)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a higher price for the electricity you use between 4pm and 8pm on weekdays
  - a lower price for the electricity you use overnight between 10pm and 7am, and
  - a moderate price for the electricity you use at any other time

This means that the price (cents per kWh) you pay for using electricity would vary depending on *what time of day* and *day of the week* you were using it.

Under this plan, you could deliberately reduce the amount of electricity you use during more expensive times of the day and/or week, in order to save money on your bill.

TIME PERIOD	PRICING OF ELECTRICITY
4pm to 8pm weekdays	Higher price
7am–4pm and 8pm–10pm weekdays, and 7am–10pm weekends	Moderate price
10pm–7am every day	Lower price

B.5 Time of use tariff + money-back guarantee (condition 5)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a higher price for the electricity you use between 4pm and 8pm on weekdays
  - a lower price for the electricity you use overnight between 10pm and 7am, and
  - a moderate price for the electricity you use at any other time

This means that the price (cents per kWh) you pay for using electricity would vary depending on *what time of day* and *day of the week* you were using it.

Under this plan, you could deliberately reduce the amount of electricity you use during more expensive times of the day and/or week, in order to save money on your bill.

TIME PERIOD	PRICING OF ELECTRICITY
4pm to 8pm weekdays	Higher price
7am–4pm and 8pm–10pm weekdays, and 7am–10pm weekends	Moderate price
10pm–7am every day	Lower price

UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for two billing quarters. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.6 Time of use tariff + automation device (condition 6)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a higher price for the electricity you use between 4pm and 8pm on weekdays
  - a lower price for the electricity you use overnight between 10pm and 7am, and
  - a moderate price for the electricity you use at any other time

This means that the price (cents per kWh) you pay for using electricity would vary depending on *what time of day* and *day of the week* you were using it.

Under this plan, you could deliberately reduce the amount of electricity you use during more expensive times of the day and/or week, in order to save money on your bill.

TIME PERIOD	PRICING OF ELECTRICITY
4pm to 8pm weekdays	Higher price
7am–4pm and 8pm–10pm weekdays, and 7am–10pm weekends	Moderate price
10pm–7am every day	Lower price

UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

B.7 Critical peak pricing (condition 7)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work…

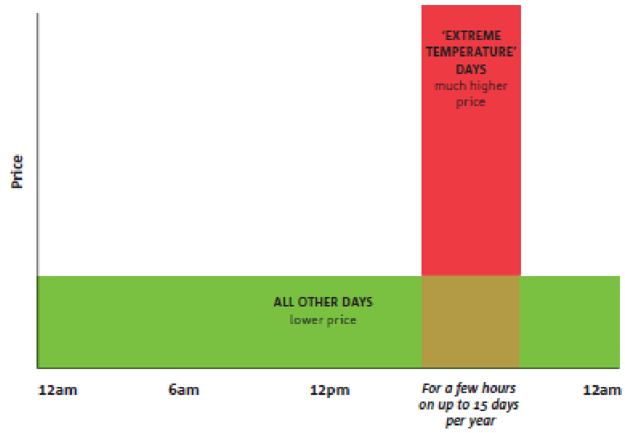
Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a much higher price for the electricity you use during a few hours on up to 15 'extreme temperature' days each year
  - a lower price for the electricity you use at all other times of the year

This means that the price (cents per kWh) you pay for using electricity would be much higher for a few hours on up to 15 days per year – typically the 15 hottest and/or coldest days each year – and lower at all other times.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/or email.

Under this plan, you could deliberately reduce the amount of electricity you use on 'extreme temperature' days, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
For a few hours on 'extreme temperature' days (up to 15 days per year)	Much higher price
All other times	Lower price

B.8 Critical peak pricing + money-back guarantee (condition 8)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work…

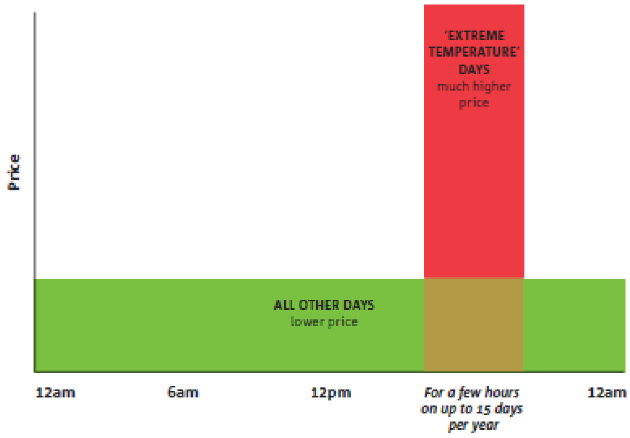
Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a much higher price for the electricity you use during a few hours on up to 15 'extreme temperature' days each year
  - a lower price for the electricity you use at all other times of the year

This means that the price (cents per kWh) you pay for using electricity would be much higher for a few hours on up to 15 days per year – typically the 15 hottest and/or coldest days each year – and lower at all other times.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/or email.

Under this plan, you could deliberately reduce the amount of electricity you use on 'extreme temperature' days, in order to save money on your bill.



TIME PERIOD	PRICING OF ELECTRICITY
For a few hours on 'extreme temperature' days (up to 15 days per year)	Much higher price
All other times	Lower price

UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for two billing quarters. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.9 Critical peak pricing + automation device (condition 9)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work…

Under this pricing plan, you'd pay:

- a particular price for each kilowatt hour (kWh) of electricity you use. This price would depend on when you were using the electricity. You'd pay:
  - a much higher price for the electricity you use during a few hours on up to 15 'extreme temperature' days each year
  - a lower price for the electricity you use at all other times of the year

This means that the price (cents per kWh) you pay for using electricity would be much higher for a few hours on up to 15 days per year – typically the 15 hottest and/or coldest days each year – and lower at all other times.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/or email.

Under this plan, you could deliberately reduce the amount of electricity you use on 'extreme temperature' days, in order to save money on your bill.

TIME PERIOD	PRICING OF ELECTRICITY
For a few hours on 'extreme temperature' days (up to 15 days per year)	Much higher price
All other times	Lower price

UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

B.10 Peak time rebate (condition 10)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary over time.

And you'd receive:

- a rebate (money back on your bill) on each occasion that you use less electricity than normal, during about 15 'extreme temperature' days each year.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season). But you would earn a rebate each time you used less electricity than normal during the very hottest and/or coldest days each year.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/ or email.

If you didn't use less electricity than normal – either because you didn't want to, or couldn't manage it – you'd simply pay the normal price for the electricity you did use, but wouldn't earn the rebate (money back on your bill) on that occasion.

Under this plan, you could deliberately reduce the amount of electricity you were using during one or more of these 'extreme temperature' days, in order to earn a rebate each time you managed to do so.

	PRICING OF ELECTRICITY	
TIME PERIOD	IF YOU DON'T USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION	IF YOU DO USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION
For a few hours on 'extreme temperature' days (up to 15 days per year)	Normal price	Normal price plus receive a rebate
All other times	Normal price	Normal price

B.11 Peak time rebate + money-back guarantee (condition 11)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work…

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary over time.

And you'd receive:

- a rebate (money back on your bill) on each occasion that you use less electricity than normal, during about 15 'extreme temperature' days each year.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season). But you would earn a rebate each time you used less electricity than normal during the very hottest and/or coldest days each year.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/or email.

If you didn't use less electricity than normal – either because you didn't want to, or couldn't manage it – you'd simply pay the normal price for the electricity you did use, but wouldn't earn the rebate (money back on your bill) on that occasion.

Under this plan, you could deliberately reduce the amount of electricity you were using during one or more of these 'extreme temperature' days, in order to earn a rebate each time you managed to do so.

TIME PERIOD	PRICING OF ELECTRICITY	
	IF YOU DON'T USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION	IF YOU DO USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION
For a few hours on 'extreme temperature' days (up to 15 days per year)	Normal price	Normal price plus receive a rebate
All other times	Normal price	Normal price

UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for two billing quarters. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.12 Peak time rebate + automation device (condition 12)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work…

Under this pricing plan, you'd pay:

- a flat price for each kilowatt hour (kWh) of electricity you use. This price would not vary over time.

And you'd receive:

- a rebate (money back on your bill) on each occasion that you use less electricity than normal, during about 15 'extreme temperature' days each year.

This means that the price (cents per kWh) you pay for using electricity would remain the same regardless of when you use it (e.g., no matter what time of day, day of the week, season). But you would earn a rebate each time you used less electricity than normal during the very hottest and/or coldest days each year.

You'd always be alerted the day before an 'extreme temperature' day was to happen, either by text message and/or email.

If you didn't use less electricity than normal – either because you didn't want to, or couldn't manage it – you'd simply pay the normal price for the electricity you did use, but wouldn't earn the rebate (money back on your bill) on that occasion.

Under this plan, you could deliberately reduce the amount of electricity you were using during one or more of these 'extreme temperature' days, in order to earn a rebate each time you managed to do so.

	PRICING OF ELECTRICITY	
TIME PERIOD	IF YOU <u>DON'T</u> USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION	IF YOU <u>DO</u> USE LESS ELECTRICITY THAN NORMAL ON THAT OCCASION
For a few hours on 'extreme temperature' days (up to 15 days per year)	Normal price	Normal price <u>plus</u> receive a rebate
All other times	Normal price	Normal price

UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

B.13 Real-time pricing (condition 13)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

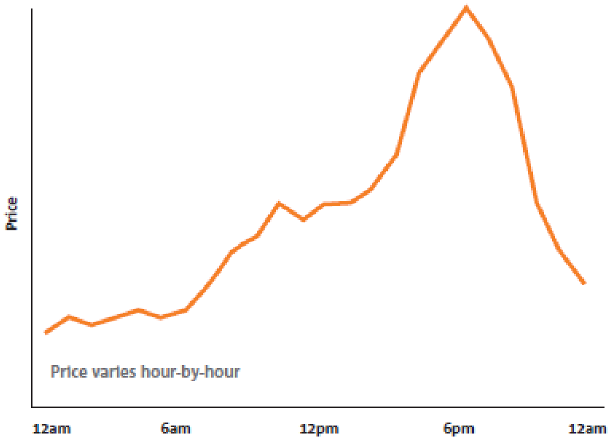
- a particular price for each kilowatt hour (kWh) of electricity you use. This price would vary hour-by-hour. It would be:
  - higher when it costs more to supply the electricity you want to use (e.g., when other customers are wanting to use lots of electricity at that moment).
  - lower when it costs less to supply the electricity you want to use (e.g., when other customers are not wanting to use lots of electricity at that moment).

This means that the price (cents per kWh) you pay for using electricity would change by the hour.

You could find out the hour-by-hour prices for the next day either by mobile alerts, logging on to a website, or calling a toll-free number. And you'd always be alerted the day before, either by text message and/or email, if the prices were going to be especially high.

Under this plan, you could deliberately reduce the amount of electricity you were using at those times when the price was especially high, in order to save money on your bill.

COST OF SUPPLYING THE ELECTRICITY YOU WANT TO USE AT THAT TIME	HOW MUCH YOU PAY FOR USING ELECTRICITY AT THAT TIME
More	Higher price
Less	Lower price



B.14 Real-time pricing + money-back guarantee (condition 14)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

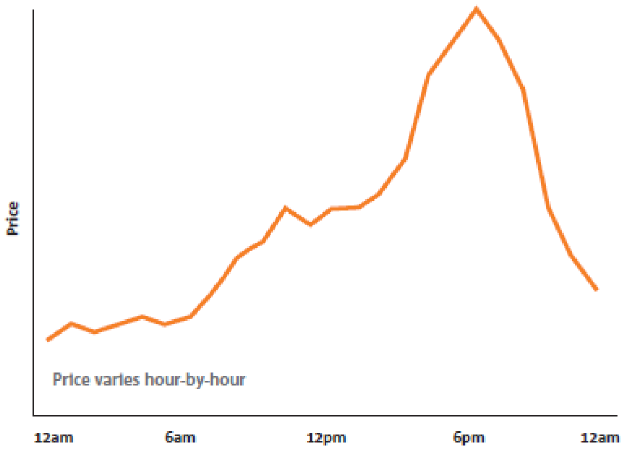
- a particular price for each kilowatt hour (kWh) of electricity you use. This price would vary hour-by-hour. It would be:
  - higher when it costs more to supply the electricity you want to use (e.g., when other customers are wanting to use lots of electricity at that moment).
  - lower when it costs less to supply the electricity you want to use (e.g., when other customers are not wanting to use lots of electricity at that moment).

This means that the price (cents per kWh) you pay for using electricity would change by the hour.

You could find out the hour-by-hour prices for the next day either by mobile alerts, logging on to a website, or calling a toll-free number. And you'd always be alerted the day before, either by text message and/or email, if the prices were going to be especially high.

Under this plan, you could deliberately reduce the amount of electricity you were using at those times when the price was especially high, in order to save money on your bill.

COST OF SUPPLYING THE ELECTRICITY YOU WANT TO USE AT THAT TIME	HOW MUCH YOU PAY FOR USING ELECTRICITY AT THAT TIME
More	Higher price
Less	Lower price



UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for two billing quarters. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.15 Real-time pricing + automation device (condition 15)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

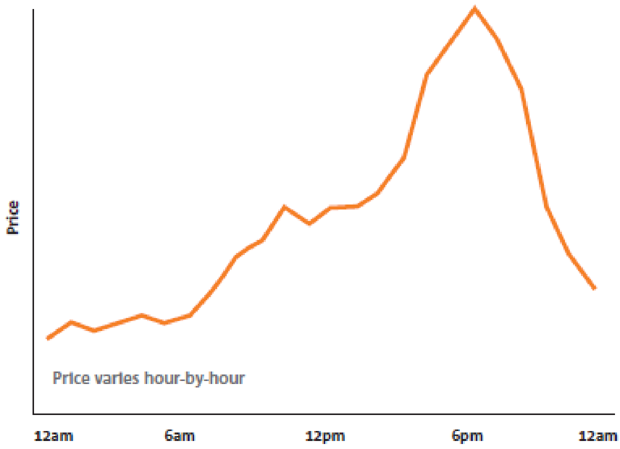
- a particular price for each kilowatt hour (kWh) of electricity you use. This price would vary hour-by-hour. It would be:
  - higher when it costs more to supply the electricity you want to use (e.g., when other customers are wanting to use lots of electricity at that moment).
  - lower when it costs less to supply the electricity you want to use (e.g., when other customers are not wanting to use lots of electricity at that moment).

This means that the price (cents per kWh) you pay for using electricity would change by the hour.

You could find out the hour-by-hour prices for the next day either by mobile alerts, logging on to a website, or calling a toll-free number. And you'd always be alerted the day before, either by text message and/or email, if the prices were going to be especially high.

Under this plan, you could deliberately reduce the amount of electricity you were using at those times when the price was especially high, in order to save money on your bill.

COST OF SUPPLYING THE ELECTRICITY YOU WANT TO USE AT THAT TIME	HOW MUCH YOU PAY FOR USING ELECTRICITY AT THAT TIME
More	Higher price
Less	Lower price



UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

B.16 Capacity pricing (condition 16)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

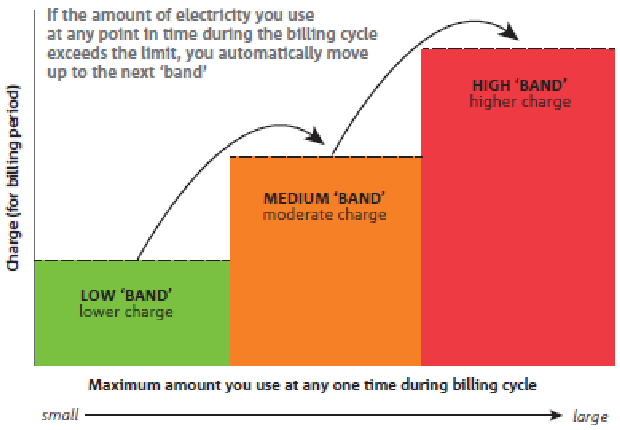
- one charge for the whole billing period (e.g., the past month) that would be determined by what was the most electricity you used at any one moment during that month.

This means you'd pay a one-off monthly charge that would cover all the electricity you used for that period. That charge would depend on what 'ceiling' (e.g., 'low', 'medium', or 'high') you had managed to keep your electricity usage under at all times that month.

This charge would be lower on a given month if you had only ever used a small amount of electricity at any one point in time, but higher if you had ever used a large amount of electricity all at once (which could happen if you had a number of major appliances running all at once).

You'd always be alerted at the time if your electricity usage at any moment looked like it might 'break through' the next 'ceiling'. This alert could come either by text message and/or email. If at any moment that month your electricity usage did break through that next ceiling, you'd automatically move up to the next 'band' of service (e.g., from 'low' to 'medium', or from 'medium' to 'high') and you would pay a higher charge for that month.

Under this plan, you could deliberately avoid ever using lots of electricity all at once, and at every moment keep your electricity usage under the lowest 'ceiling' you could manage at the time, in order to save money on that month's bill.



CEILING/BAND	THE MOST ELECTRICITY YOU USED AT ANY ONE MOMENT IN THAT BILLING PERIOD	ONE-OFF CHARGE FOR ELECTRICITY (PER BILLING PERIOD)
High	Large amount	Higher charge
Medium	Moderate amount	Moderate charge
Low	Small amount	Lower charge

B.17 Capacity pricing + money-back guarantee (condition 17)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- one charge for the whole billing period (e.g., the past month) that would be determined by what was the most electricity you used at any one moment during that month.

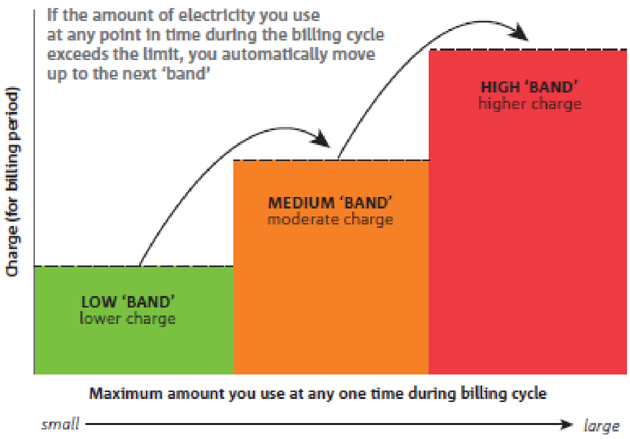
This means you'd pay a one-off monthly charge that would cover all the electricity you used for that period. That charge would depend on what 'ceiling' (e.g., 'low', 'medium', or 'high') you had managed to keep your electricity usage under at all times that month.

This charge would be lower on a given month if you had only ever used a small amount of electricity at any one point in time, but higher if you had ever used a large amount of electricity all at once (which could happen if you had a number of major appliances running all at once).

You'd always be alerted at the time if your electricity usage at any moment looked like it might 'break through' the next 'ceiling'. This alert could come either by text message and/or email. If at any moment that month your electricity usage did break through that next ceiling, you'd automatically move up to the next 'band' of service (e.g., from 'low' to 'medium', or from 'medium' to 'high') and you would pay a higher charge for that month.

Under this plan, you could deliberately avoid ever using lots of electricity all at once, and at every moment keep your electricity usage under the lowest 'ceiling' you could manage at the time, in order to save money on that month's bill.

CEILING/BAND	THE MOST ELECTRICITY YOU USED AT ANY ONE MOMENT IN THAT BILLING PERIOD	ONE-OFF CHARGE FOR ELECTRICITY (PER BILLING PERIOD)
High	Large amount	Higher charge
Medium	Moderate amount	Moderate charge
Low	Small amount	Lower charge



UNDER THIS PRICING PLAN, you'd also have a 6 month money-back guarantee, to give you the time and security necessary to figure out whether or not this pricing plan suits your household. This means you'd have a 'risk-free trial' of the new plan for six months of billing. On your bills, you'd see two different dollar amounts: what you're being charged for your electricity usage under this new plan, and what you would have been charged for this same usage under your old plan. If you then decide you don't want the new pricing plan, you would simply pay the 'old' price and switch back to that plan at no extra cost to you, at any time during the risk-free trial.

B.18 Capacity pricing + automation device (condition 18)

First, we'd like to hear your opinions on how electricity is priced in Australia. Some electricity retailers are considering whether to stick with current ways of pricing, or to do things differently. One type of pricing is described below. We're interested in hearing what you think about this sort of pricing plan, and whether it's something you'd choose if an electricity retailer offered it to you. Here's how it might work...

Under this pricing plan, you'd pay:

- one charge for the whole billing period (e.g., the past month) that would be determined by what was the most electricity you used at any one moment during that month.

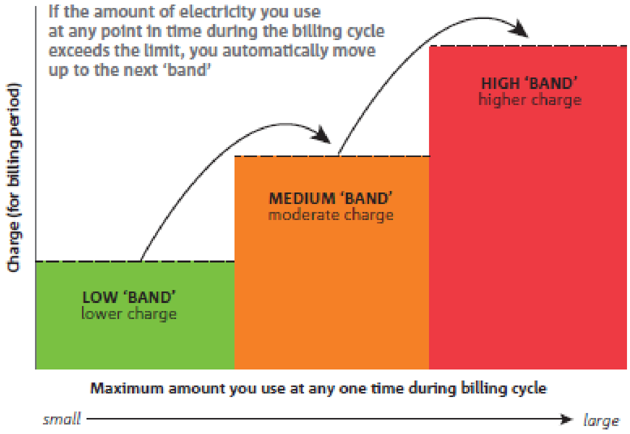
This means you'd pay a one-off monthly charge that would cover all the electricity you used for that period. That charge would depend on what 'ceiling' (e.g., 'low', 'medium', or 'high') you had managed to keep your electricity usage under at all times that month.

This charge would be lower on a given month if you had only ever used a small amount of electricity at any one point in time, but higher if you had ever used a large amount of electricity all at once (which could happen if you had a number of major appliances running all at once).

You'd always be alerted at the time if your electricity usage at any moment looked like it might 'break through' the next 'ceiling'. This alert could come either by text message and/or email. If at any moment that month your electricity usage did break through that next ceiling, you'd automatically move up to the next 'band' of service (e.g., from 'low' to 'medium', or from 'medium' to 'high') and you would pay a higher charge for that month.

Under this plan, you could deliberately avoid ever using lots of electricity all at once, and at every moment keep your electricity usage under the lowest 'ceiling' you could manage at the time, in order to save money on that month's bill.

CEILING/BAND	THE MOST ELECTRICITY YOU USED AT ANY ONE MOMENT IN THAT BILLING PERIOD	ONE-OFF CHARGE FOR ELECTRICITY (PER BILLING PERIOD)
High	Large amount	Higher charge
Medium	Moderate amount	Moderate charge
Low	Small amount	Lower charge



UNDER THIS PRICING PLAN, you'd also receive a free electronic device to help you control your electricity usage, so you can make the most of your new plan. This device would, from time to time, automatically reduce the amount of electricity used by selected energy-intensive household appliances (e.g., air-conditioners, pool pump, hot water system), for just a short period. This device would not damage your appliances. It would be delivered directly to your home, and installed and maintained by a licensed electrical contractor, at no cost to you.

Appendix C Sample

C.1 Respondents by experimental condition

Table 14 Distribution of respondents across experimental conditions (tariff offers)

TYPE OF TARIFF	TYPE OF DESCRIPTION			TOTAL
	BASIC DESCRIPTION *(without 'risk relief')*	BASIC + MONEY-BACK GUARANTEE	BASIC + AUTOMATION DEVICE	
Flat rate	64	56	54	**174**
Time of use	72	83	72	**227**
Critical peak pricing	60	64	61	**185**
Peak time rebate	75	60	55	**190**
Real-time pricing	70	76	74	**220**
Capacity pricing	68	51	65	**184**
Total	**409**	**390**	**381**	**1180**

Note. Cell entries indicate the number of respondents in each experimental condition (tariff offer), i.e., the number of people in each condition who returned at least a partially completed survey. (Note that one of the paper survey returns still had to be excluded from the analysis because information necessary to identify their experimental condition had been removed from the survey). Pearson's chi-squared test indicates there was no condition that attracted a significantly greater/lesser number of respondents; $\chi^2(10) = 7.439$, $p = 0.683$. Across the 18 experimental conditions there was no significant correlation (Pearson's r=-.213, p=.416) between the response rate, and acceptance rate (per Table 3).

C.2 Age

Table 15 Age profile of final sample

AGE (YEARS)	FREQUENCY	PERCENT	CUMULATIVE PERCENT
18-19	1	0.09	0.09
20-24	11	0.94	1.03
25-29	29	2.48	3.51
30-34	51	4.36	7.87
35-39	56	4.79	12.66
40-44	76	6.5	19.16
45-49	67	5.73	24.89
50-54	111	9.5	34.39
55-59	134	11.46	45.85
60-64	164	14.03	59.88
65-69	172	14.71	74.59
70-74	99	8.47	83.06
75-79	86	7.36	90.42
80-84	66	5.65	96.07
85+	46	3.93	100.00
Total	1,169	100.00	

Participants' age (in years) was measured using the following categorical item: "What age group do you belong to?" Participants were asked to select one of 15 response options, which aligned with the five-year age groups from the ABS 2011 Census dictionary.

C.3 Gender

Table 16 Gender profile of final sample

GENDER	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Male	657	56.88	56.88
Female	498	43.12	100.00
Total	1,155	100.00	

Participants' gender was measured using a single item with two categorical response options ('male' or 'female'). This item aligns with the "Sex" measure from the ABS 2011 Census dictionary.

C.4 Education level

Table 17 Education level profile of final sample

EDUCATION LEVEL	FREQUENCY	PERCENT	CUMULATIVE PERCENT
School Education	239	20.86	20.86
Certificate	246	21.47	42.32
Diploma/ Advanced Diploma	184	16.06	58.38
Bachelors Degree	221	19.28	77.66
Graduate Certificate/ Graduate Diploma	106	9.25	86.91
Postgraduate Degree	150	13.09	100.00
Total	1,146	100.00	

Participants' highest level of education was measured using the following item: "What is the highest level of education you have completed?" Participants were asked to select one of five response options, which aligned with the "Level of Highest Educational Attainment" measure from the ABS 2011 Census dictionary.

C.5 Annual household income

Table 18 Annual household income profile of final sample

TOTAL HOUSEHOLD INCOME (PER ANNUM)	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Less than $15,600	71	6.7	6.7
$15,600 – $31,199	209	19.72	26.42
$31,200 – $51,999	176	16.6	43.02
$52,000 – $77,999	173	16.32	59.34
$78,000 – 103,999	157	14.81	74.15
$104,000 or more	274	25.85	100.00
Total	1,060	100.00	

Participants' annual household income was measured using the following item: "Thinking of your annual household income all together, what is the total of all wages/salaries, government benefits, pensions, allowances and other income your household usually receives? (Do not deduct tax)". Participants were asked to select one of six categorical responses, which were adapted from the "Total Family Income" measure from the ABS' 2011 Census dictionary. The ABS Census dictionary categorises family income into 15 income ranges (plus 'negative income' and 'nil income' categories), with income presented in terms of both weekly and annual amounts. For simplicity and brevity, we reduced our number of response options to six by combining categories together, and only presented annual income amounts. Because our study is particularly interested in examining vulnerable groups such as those of limited income, we purposefully created our categories so as to retain greater discrimination among income brackets at lower levels, and sought to de-emphasise higher income in order to encourage the response of lower income households.

C.6 Employment status

Table 19 Employment status profile of final sample

EMPLOYMENT STATUS	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Employed, working full-time	459	39.71	39.71
Employed, working part-time	152	13.15	52.85
Employed, away from work (e.g., on holidays, paid leave, temporarily stood down, etc.)	12	1.04	53.89
Unemployed, looking for full-time work	9	0.78	54.67
Unemployed, looking for part-time work	13	1.12	55.80
Not in the labour force	370	32.01	87.80
Other	141	12.20	100.00
Total	1,156	100.00	

The employment status of participants' head of household was measured using the following item: "What is the current employment status of the main income earner in your household?" Participants were asked to select one of seven response options, which aligned with the "Labour Force Status" measure from the ABS 2011 Census Dictionary.

C.7 Household type

Table 20 Household type profile of final sample

HOUSEHOLD TYPE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Single person household	286	24.7	24.7
One family household – couple family with no children	438	37.82	62.52
One family household – couple family with children	289	24.96	87.48
One family household – one parent family	62	5.35	92.83
Group household – multiple families (e.g., extended family grouping)	32	2.76	95.6
Group household – group of unrelated people (e.g., share-house)	22	1.9	97.5
Other	29	2.5	100.00
Total	1,158	100.00	

The type of household in which participants resided was measured using the following item: "Which of the following best describes your household?" Participants were asked to select one of seven response options, which were based loosely on a combination of categories from the "Family Household Composition (Dwelling)" and "*Household Composition" measures* from the 2011 ABS Census dictionary.

C.8 Household size

Table 21 Household size profile of final sample

HOUSEHOLD SIZE (NO. OF PERSONS)	FREQUENCY	PERCENT	CUMULATIVE PERCENT
1	286	25.09	25.09
2	489	42.89	67.98
3	148	12.98	80.96
4	139	12.19	93.16
5	61	5.35	98.51
6	14	1.23	99.74
7+	3	2.7	100.00
Total	1,140	100.00	

The size of the household in which participants resided was measured using the following open-ended item: "How many people (including yourself) live in your household?" This item aligns with the "Number of Persons Usually Resident in Dwelling" measure from the ABS 2011 Census dictionary.

C.9 Dwelling ownership status

Table 22 Dwelling ownership profile of final sample

DWELLING OWNERSHIP STATUS	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Owned outright	640	55.22	55.22
Owned with a mortgage	333	28.73	83.95
Being purchased under a rent/buy scheme	0	0	83.95
Being rented	165	14.24	98.19
Being occupied rent free	3	0.26	98.45
Being occupied under a life tenure scheme	11	0.95	99.4
Other	7	0.6	100.00
Total	1,159	100.00	

Participants' home ownership status was measured using a categorical item based on the "Tenure Type" measure from the ABS 2011 Census dictionary. Participants responded by selecting one of seven categories that reflected varying types of dwelling ownership, or lack thereof.

C.10 Dwelling type

Table 23 Dwelling type profile of final sample

DWELLING TYPE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
Detached house	884	76.34	76.34
Semi-detached, row or terrace house, townhouse, etc.	94	8.12	84.46
Flat, unit or apartment	149	12.87	97.32
Other dwelling	31	2.68	100.00
Total	1,158	100.00	

The type of dwelling in which participants resided was measured using a categorical item based on the "Dwelling Structure" measure from the ABS 2011 Census dictionary. Participants responded by selecting one of four categories that reflected varying types of dwelling (e.g., detached house, semi-detached, flat/unit/apartment, other dwelling, etc.).

C.11 State of residence

Table 24 State of residence of final sample

STATE OF RESIDENCE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NSW	319	27.36	27.36
ACT	31	2.66	30.02
VIC	295	25.30	55.32
QLD	215	18.44	73.76
SA	128	10.98	84.74
WA	124	10.63	95.37
TAS	47	4.03	99.40
NT	7	0.60	100.00
Total	1,166	100.00	

Constructed from self-reported address and/or postcode.

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