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GROUP OF EIGHT

Addressing Peak Demand

The opportunities and risks for vulnerable households

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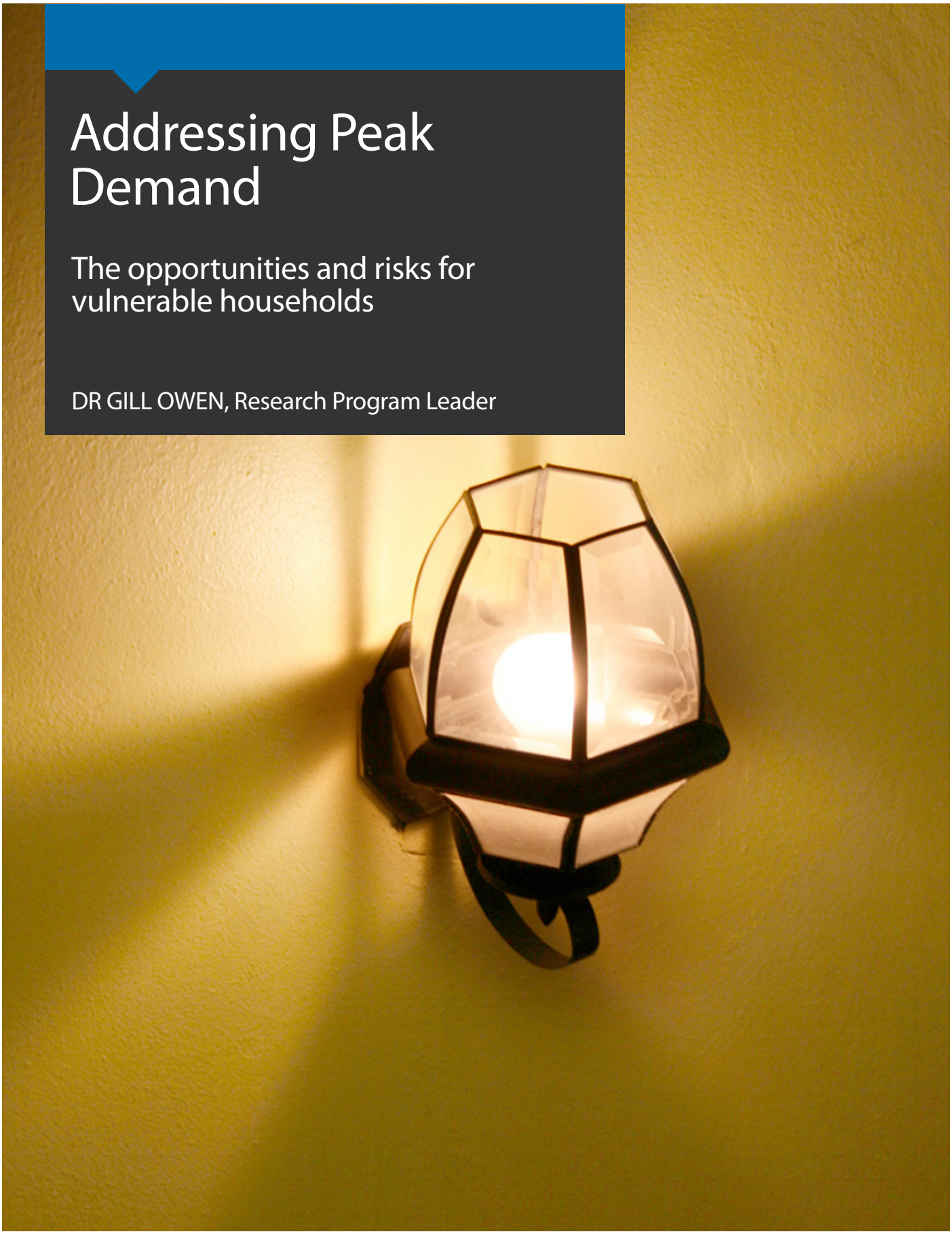

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Executive Summary

Rising peak demand is considered to be one of the key drivers of Australia's rising electricity prices.

The peak demand problem

Recent data may suggest that peak demand may not be growing so fast , but it would be premature to conclude that peak demand is stabilising or falling.

There is growing consensus on the need to tackle peak demand. This paper seeks to inform the debate by identifying potential impacts of solutions to the peak demand problem on vulnerable households and making some recommendations. A more detailed programme of work will be undertaken during 2013-14, particularly on automation of demand response, controlled load electricity and low users.

What can customers do about peak demand?

There are three main ways that customers could change their electricity demand to save themselves money and potentially reduce costs in the electricity system:

- Customers can reduce some uses of electricity.
- Customers can shift electricity consumption to an off-peak time period.
- Customers can self-generate electricity (e.g. solar PV).

Techniques for achieving demand response include:

- Time of use tariffs - different prices applied to fixed periods during the day
- Critical peak tariffs- a high price on maybe just a few hours on a few days a year.
- Automation/ direct load control – using technology to reduce consumption during peak hours, such as turning down the thermostat on air conditioning.

Automation delivers the greatest and most sustained shifts in demand (compared to price incentives alone), particularly where consumers have air conditioners or electric heating. A review of trials found peak reductions of 31% with automation (16% without) for critical peak price tariffs and 16% (5% without) for ToU tariffs.

The timing of the peak and the differential between peak, shoulder and off-peak rates is clearly crucial in terms of the impacts on vulnerable households. Narrow peak periods (e.g. 4-7pm) or infrequent CPP peaks will have a different impact than longer peak periods (e.g. 1-8 pm). The impacts on vulnerable households will also vary depending upon what appliances they have and at what times of day they use them.

Energy vulnerability

Rising energy costs affect all households and businesses, but some are more vulnerable to the impacts. Low incomes can make it difficult to pay bills; and some have health vulnerabilities due to age or disabilities. State based electricity concessions are designed to assist low income households to pay their energy bills. However, these vary considerably from state to state and there is evidence to suggest that there is some under-claiming amongst households who may need them.

Large households and families with children tend to face more difficulties paying electricity bills than smaller and older households. However, some low users may ration their usage to avoid the risk of bill shocks. Vulnerabilty may therefore be visible (e.g. debt and difficulty paying bills) or hidden (e.g. households who over-economise – and potentially risk their health).

Data from NSW and Victoria suggest that most vulnerable and low income households tend to be low or medium users of electricity. Fewer low income consumers tend to be large users, although those who are may be particularly financially stressed (e.g. large low income households).

Key findings

There is a difference between peaks that ocur day in day out and peaks that occur for only a few occasions each year. If the main issue is critical peaks (e.g. 4-5 pm on a few very hot days each summer) then a year round time of use tariff may be less useful than critical peak pricing/ rebates and/or automation of response from appliances such as air-conditioners. Such an approach may produce better outcomes for vulnerable households than time of use tariffs and to provide more certainty of response and thus fewer risks for retailers and networks.

1. We need to be clear about the peak demand problems that need to be addressed – day in day out or a more limited number of critical peaks. This will enable us to better to tailor appropriate solutions, whether that is year round time of use tariffs, critical peak pricing or direct load control.
2. Time of use pricing and other DSR methods may offer benefits to many customers. However, time of use pricing and other DSR methods may add complexity and risk into what is for many consumers an already complex electricity retail market. Many vulnerable households are stuggling to pay bills at present. Risks that might be acceptable for better off households may be much more problematic for low income households. For some vulnerable households there are also potential health risks – e,g, if new pricing encourages them to over-ration usage of heating and/or air conditioning.
3. Impacts on vulnerable households will vary according to factors including size of household, appliance ownership and usage, energy efficiency and tariff design. Any tariff design creates winners and losers – vulnerable households will be in both groups whatever the tariff design.

Main recommendations

Governments

- Energy saving schemes need to address peak and overall demand and need to be targeted to vulnerable households. This could include designating priority groups to benefit from grants and low interest loans, plus tailored advice and information. It would be helpful to have a national framework that allows for some flexibility to meet different circumstances in different states.
- The concessions framework should be reviewed before flexible pricing is introduced to ensure the concessions will remain appropriately targeted and to examine the scope for harmonisation of concessions schemes between states.
- There is a need to clarify take up rates for concession cards and electricity rebates, along with measures to improve take up.
- All Governments should adopt the opt-in approach to time of use tariffs for all except the largest household customers (about 12 MWh per year).

Governments, energy retailers and welfare organisations

- Boost take up of concessions and rebates amongst vulnerable consumers.
- Increase understanding of peak and overall usage of different appliances. Particular efforts should be targeted to vulnerable households.

Energy retailers and welfare organisations

- Households receiving the off-peak concession in Victoria will need advice before switching to time of use tariffs that might result in them losing the off-peak concession.

Governments and energy retailers

- There is a need for research into low users, to identify if there are any problems such as "self-rationing" or under-claiming of concessions.

Energy retailers

- Agree not to market time of use tariffs to vulnerable customers unless the customer has had a smart meter for at least one year to ensure they have sufficient data to decide whether they would benefit. It would be good practice not to market time of use tariffs to any customer without this data.
- Make customers aware where they are paying more on a time of use tariff and hence should consider whether they can shift usage to off-peak times, reduce usage, or should opt out of ToU.
- Provide customers with clear information on demand response contracts , including any "lock in" periods and early termination (exit) fees.

Energy retailers and distributors

- Automation of response should be explored as a measure that may have potential for vulnerable households.

Conclusion

Addressing peak demand – through time of use pricing and other DSR methods -should bring the potential to reduce costs to the benefit of consumers.

It will be important than we make vulnerable households more resilient to a range of energy futures – including tackling peak demand.

Introduction

Electricity prices and bills to end consumers in Australia have risen substantially in recent years.

Rising peak demand (and the investment necessary to meet those peaks) is considered to be one of the key drivers of Australia's rising electricity prices. There are a number of potential solutions to smooth demand and thus mitigate the impact on prices. However, solutions can have differential impacts on different types of consumer and hence care is needed if they are to be fair and equitable for all Australians, particularly those who are vulnerable due to low income, financial stress, age, disability or other reasons.

For example:

- Time of use tariffs may benefit households who can take advantage of off-peak rates but disadvantage those who find it difficult to switch usage to off-peak periods. Evidence from a number of countries suggests that effects vary amongst vulnerable households depending upon a number of factors. [1]
- Direct load control can be a way of reducing peak demand that can be designed to have negligible impact on comfort (e.g. of air conditioning) or convenience (e.g. water heating) and deliver financial benefits (sharing the value of load reduction between customer and supplier).However, capital investment may be needed to introduce load control and some consumers are wary of handing over control of appliances in this way.

There is growing consensus on the need to tackle peak demand[2], although there is still considerable debate about the most effective and equitable ways to do so. This paper seeks to inform the debate by identifying potentail impacts of solutions to the peak demand problem on vulnerable households and making some recommendations. A more detailed programme of work, particularly on automation of demand response, controlled load electricity and low users, will be undertaken during 2013-14

1. For example see: Frontier Economics and Sustainability First. Demand side response in the domestic sector: a literature review of major trials. DECC. August 2012

2. Reports from the AEMC Power of Choice review (http://www.aemc.gov.au/Media/docs/Final-report-1b158644-c634-48bf-bb3a-e3f204beda30-0.pdf); the Productivity Commission draft report on electricity network regulation (http://www.pc.gov.au/__data/assets/pdf_file/0010/120043/electricity-draft-volume1.pdf); the Senate Committee report on electricity prices (http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=electricityprices_ctte/electricityprices/report/index.htm)

Nature of Electricity Demand in Australia (Peak and Overall)

Customers' electricity bills are made up of a number of different costs.

Networks (the poles and wires) account for around 51% of costs; electricity generation (power stations) for around 20% ; carbon price for around 9%; with the remaining 20% being the retail and environmental scheme costs (customer service, billing, renewables, energy efficiency etc).[3]

Costs in the electricity system (and hence impacts on customers' electricity bills) are driven both by overall demand (the total amount of electricity consumed) and peak demand (the maximum amount consumed at any one time). However, peak demand is a particularly important driver of costs. This is because building power stations and networks to serve demand for only a small number of hours of peak demand each year, means that this infrastructure is effectively unused for much of the time, yet the companies who have built it will still need to recover the high fixed costs. The Australian Government estimates that 25 per cent of retail electricity costs are derived from peak events that occur over a period of less than 40 hours per year. [4]

The rapid growth of peak demand relative to overall (or average) demand has been a major factor inluencing costs in the Australian electricity system.

Between 2005 and 2011, peak electricity demand increased at a rate of approximately 1.8 per cent a year, while total electricity demand grew at 0.5 per cent a year.[5]

Maximum summer demand in each mainland National Electricity Market (NEM) jurisdiction (New South Wales, Queensland, South Australia,Victoria) increased by between 20% and 38% between 2001 and 2012. During the same period, average electricity demand increased by only 15%.[6]

Households represent around 25% of total electricity demand but various studies have shown that the residential contribution to peak demand can be as high as 45 per cent on peak demand days across the system.[7] The peak demand time is typically between 4-8pm - the time of day when busineses demand is still high and household demand rises as people get home from work and school. One of the most significant drivers of peak demand is the use of air conditioning. Growth in the installation and use of air conditioning by households has been particularly rapid in recent years. 73% of households in Australia had an air conditioner in 2011 compared to 59% in 2005.[8]

3. Department of Resources, Energy and Tourism. Fact sheet – Electricity prices. August 2012 . This is the national average split of costs – state averages do vary.

4. National Energy Saving Initiative, Issues Paper, prepared by the National Energy Savings Initiative Working Group, Department of Climate Change and Energy Efficiency and Department of Resources Energy and Tourism, December 2011, p.71.

5. AEMC. Power of Choice. Final Report,. November 2012 p. 8

6. AEMO. 2011-12 NEM Demand Review Information Paper.

7. AEMC. Power of Choice. Final Report,. November 2012.p.9 The AEMC notes that "These figures extracted from various reports prepared for the Essential Services Commission of South Australia (ESCOSA), Energex and Ergon Energy".

8. ABS. Energy use and conservation survey 2011. October 2011. These figures extracted from various reports prepared for the Essential Services Commission of South Australia (ESCOSA), Energex and Ergon Energy including: Charles River Associates (CRA), Assessment of Demand Management and Metering Strategy Options, Charles River Associates, prepared

If we look at what has been driving residential bill increases in recent years, we can see that network charges have been the biggest component, on average responsible for 49% of the increase from 2007-11 (generation cost increases accouted for 7% of the increase; retail costs and margin for 26% and renewables costs for 18%).[9] These percentages do however vary from state to state.

Overall electricity demand fell by 1% nationally from 2010 to 2012. While peak demand declined in all jurisdictions in the summer of 2011/12, it should be noted that the number of high temperature days (over 35 degrees) was also significantly lower. For example, in Sydney and Melbourne, the number of high temperature days in 2011/12 were 9 and 6 respectively - down from peaks of 25 and 16 in the previous summers.[10] Commenting on the drop in peak demand from 2010 to 2012, AEMC recently noted that "It is too early to determine whether this fall represents a unique event or is part of a trend."[11]

Recent data from AEMO suggest that peak demand in the 2012/13 summer (significantly hotter than 2011/12) in New South Wales rose to 13.6 GW compared to 12 GW in 2011/12. However, this was still below the 2010/11 peak demand of 14.5 GW, but similar to peak demand in 2006/07 and 2008/09. In Victoria peak demand in 2012/13 has continued to fall slightly – and was 9.1 GW down from the high point of 10.4 GW in 2008/09.[12]

These data may sugest that peak demand may not be growing so fast as in the past or may even be on a downward path, for a number of reasons including a demand reduction response to rising electricity bills, penetration of solar PV (which replaces some network delivered electricity) and also some economic restructuring. Recent assessments published by the Australian Energy Market Operator (AEMO) suggest that peak demand will slow but will continue to grow.[13]

It would threfore be premature to conclude that peak demand is stabilising or falling – we will need to see the evidence over a number of years and it will also be important to disaggregate the possible reasons for changes in peak demand.

9. E. O'Young. Australia's future electricity price environment. April 2011. Cited in Oakley Greenwood. Policy options for maximising downward pressure on electricity prices. October 2012. p.17

10. AEMO. 2011-12 NEM Demand Review Information Paper.

11. AEMC. Possible future retail electricity price movements: 1 July 2012 to 30 June 2015. AEMC, March 2013.

12. AEMO data based on analysis in : Sandiford, M. Our hot summer and peak demand – what really happened. Climate Spectator, 06 March 2013.

13. Australian Energy Market Operator, National Electricity Forecasting report, June 2012, at page i.

Options for reducing peak and overall demand

There are several options for reducing peak and overall demand of electricity in Australia.

As the AEMC notes in its Power of Choice report:

"It is also important to note the difference between system peaks and network peaks. System peaks occur when demand is highest across the state (as wholesale prices are set at a state level). However networks need to deal with peak demand at the circuit feeder and transformer level which can differ from the time of day from system peaks and also by location. The characteristics of peak demand for a network business will differ by location and season. Individual areas within the network may be summer or winter peaking and may have different proportions of residential versus commercial and industrial loads, leading to different peak demand profiles."[14]

This distinction between system and network peaks and the locational and seasonal factors are not only important for understanding what is causing costs in the system but also for assessing where action to reduce peak demand (or demand growth) will deliver benefits. For example, where a part of the network (e.g. a substaion serving an area of residential and business customers) is near capacity and investment is needed, there will be the potential to avoid or defer some of that investment if peak demand can be reduced (or at least not increased) by customers served by that substation. However, to take another example, where there is plenty of capacity at the susbtation level, the benefits of reducing peak demand may be much lower.

Actions needed to reduce peak wholeseale electricity costs may be different from those for networks. For example, as more wind power comes onto the grid, there may be value in demand response to balance peaks and troughs in wind generation. In these cases using storage (e.g. electric storage heating or hot water or electric vehicles) might be a good option – with these stores taking in electricity at times of peak wind output and reducing their intake of electrity at times of low wind output (again automation of response could make this easier for customers). Similarly, customers could be incentivised to use their solar PV output at times of high electricity prices (e.g. by running their washing machines, dishwashers, clothes dryeres) at those times.

Peak demand can also be either a year round or infrequent problem and therefore the types of solution may also need to vary. Demand side response initiatives can therefore be aimed at:

- delivering a consistent day-in day-out reduction at peak time – for example each weekday for a whole winter or summer season. This is most useful when systems are characterised by regular peaks of similar sizes; or
- delivering a reduction during critical peaks. This requires an occasional response from consumers, such as during exceptionally hot or cold periods. Exceptional events may in future also be driven by changes in wind generation output. [15]

14. AEMC. Power of Choice. Final Report,. November 2012, p.9

15. Definitions taken from p.10-11 of DSR in the domestic sector - a literature review of major trials by Frontier Economics and Sustainability First for DECC, August 2012 (http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/future-elec-network/5756-demand-side-response-in-the-domestic-sector-a-lit.pdf)

How customers could reduce demand

There are three main ways[16] that customers could change their electricity demand to save themselves money and potentially reduce costs in the electricity system:

- Customers can reduce some uses of electricity. For example, raising (air conditioning) or lowering (heating/water heating) thermostat settings, reducing the run time of air conditioners, dimming or reducing lighting, using efficient appliances.
- Customers can shift electricity consumption to an off-peak time period. For example, customers could pre-cool their property at off-peak (lower cost) times. Customers could also run certain appliances (notably washing machines, dishwashers, clothes dryers, electric water heaters) at off-peak periods when prices are lower.
- Customers can self-generate electricity - e.g. solar PV. Customers can run appliances using their own electricity at peak times (thus reducing their use of network-delivered electricity).

The methods to facilitate customer demand response include:

- Different types of tariffs. (see page 9)
- Contracts, (mostly for business consumers), to curtail load (at pre-agreed times or in response to changing conditions on the electricity network); and
- Automated devices including 'smart' controls, thermostats and appliances which respond to changes in the electricity network or a price signal.[17]
- Efficient appliances, lighting and insulation measures to reduce electricity demand.
- Information and feedback (for example, via in-home displays, web portals, information on bills) so that customers can identify ways in which they can reduce or shift their demand.

The nature of electricity demand, the drivers of costs and the scope to do something about those costs is therefore a somewhat complex issue. We need to bear these complexities in mind as we look for solutions. There are various different ways to incentivise and enable consumers to reduce peak demand. Some of these may be better for some consumers than others. . A number of retailers in some states are already offering time of use tariffs, in some cases passing on time varying charges from the networks. Victoria intends to move to more widepsread adoption of time of use pricing from July 2013 and the AEMC Power of Choice report suggested time of use pricing should be adopted in the future for network charges.

It is important, therefore, that we assess how best to deliver the optimal solution of reduced peak demand and customer benefits and incoprrate this into the development of this market. It will be particuarly important to establish which methods will work best for vulnerable consumers.

16. Based on Goldman et al. National Action Plan for Energy Efficiency. Coordination of Energy Efficiency and Demand Response, 2010.

17 Ofgem. op cit p. 10

WAYS OF INCENTIVISING DEMAND RESPONSE

TIME OF USE TARIFFS

There are typically three (off-peak, peak and shoulder) different prices applied to fixed periods during the day. Typical times in NSW are :

- peak - 1pm-8pm weekdays;
- shoulder – 7am-1pm & 8pm-10pm on weekdays; 7 am-10pm on weekends;
- off-peak – 10pm-7am every day

CRITICAL PEAK TARIFFS

Target periods of exceptionally high demand - eg. use of air conditioning at peak times on very hot days. CP Price tariffs charge a high price at the "critical peak". CP Rebate tariffs give consumers a rebate for reducing use during the critical peaks. As the dates of critical peaks are not known in advance, consumers are notified the day before by phone, text or email and/or real-time reminders on the day. Most CPP and CPR tariff trials have been accompanied by a ToU tariff. A few CPP and CPR tariffs have been trialled alongside rising block tariffs (where per unit prices increase with total consumption). For consumers on this type of tariff, critical peaks are the only times when they face a price signal to shift demand.

REAL-TIME PRICING

Prices would change in line with wholesale costs - for example, based on day-ahead hourly wholesale electricity prices. Real time pricing has not been used extensively and has been mainly for business customers rather than households.

AUTOMATION/ DIRECT LOAD CONTROL AND STORAGE

Direct load control involves the use of technology to reduce consumption from a given appliance during peak hours, such as air conditioning (e.g. by turning down the therostat or cycling it off for short periods). Automation can deliver day-in day-out or critical peak reductions in demand. One of the characteristics of electricity is that it cannot easily be stored as electricity. However, it can be stored in batteries, or as heat. DSR storage options are where consumers (usually via automated control) allow electricity to be taken in and stored on their premises during off-peak times and used later. This might be in the form of hot water (electric water heater and storage tank) or electric storage (slab) heaters; or electric vehicles.

ON-SITE/ DISTRIBUTED GENERATION

Consumers generate their own electricity or heat rather than use network distributed electricity. For example, by using electricity from their solar PV system during the daytime to run air conditioner, washing machine etc ; or using solar thermal to heat water.

Energy vulnerability

Rising energy costs affect all households and businesses, but some are more vulnerable than others to the impacts.

Households may face :

- Financial vulnerability – low incomes can make it difficult to pay bills and make huseholds particularly likely to experience problems due to price shocks.
- Health vulnerability – households with occupants who may be at risk of health impacts if heating and/or cooling is inadequate or have high needs for hot water, due to age (very elderly and very young) or various health reasons

In addition, some households may be vulnerable due to low levels of education or literacy or may not have English as their first language. They may find it more difficult to identify and access ways of reducing their energy costs.

Concessions available to help with electricity bills

State based electricity concessions are designed to assist low income households to pay their energy bills. While energy concessions differ in different jurisdictions Victoria provides a useful example.

In 2007 approximately 38% (800,000) of Victorian households received the main year round electricity concession.[18] The concession is set at 17.5%[19] of the total bill, with no specific cap (the average rate in 2013 is around $300[20]). Households with controlled load electricity (for off-peak water heating and slab heating) are also entitled to the Off Peak Concession which provides a 13% reduction on the off-peak tariff rates on all quarterly electricity bills and can be received in addition to the Annual Electricity Concession. The total cash value of the concessions to households with controlled load therefore tends to be higher.

Households eligible for concessions include those with a Commonwealth Health Care Card, a Pensioner Concession Card, or DVA Gold Card. Most of these households are on low incomes. However a proportion of households with a Commonwealth Health Care card are retirees with higher income.

The above figures for Victoria suggest that substantial numbers of households qualify for a concession on electricity bills. Similar figures emerge for New South Wales. The NSW Government provides an energy rebate for eligible households of $161 per year paid through electricity bills. IPART found that between 30-44% of all households, in the regions that they surveyed, hold a concession card.[21]

However, IPART did also find that most people with concession cards are on very low incomes.

18. Roy Morgan Research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p v.

19. In July2012 a threshold for the electricity concession was introduced to offset the Federal Government's carbon tax compensation. The Victorian concession is not applied to the first $171.60 of a household's annual electricity bill. This is so that households are not compensated by two levels of government for the same expense.

20. Johnston, M. The relative value of energy concessions. St Vincent de Paul, January 2013. p.11

21. IPART. Residential energy and water use in Sydney, the Blue Mountains and Illawarra. Results from the 2010 household survey. December 2010.

In Sydney at least 61% of households with a concession card were in the lowest income group and a further 19% were in the lower-middle income group.[22] More than 70% of households that held a concession card in the Hunter, Gosford and Wyong areas were in the lowest income group

IPART also found that most low-income households held a concession card (78% in Sydney in 2010 and 86% in the Hunter, Gosford and Wyong areas in 2008) and most of these households were aware that they could claim rebates, and did claim them. Nevertheless, more than 20% of households that held a concession card in Sydney did not claim rebates. These non-claiming low-income households may be even more vulnerable to utility price increases than those that do hold a concession card.

Households in financial difficulties

Income is only one of thefactors that affect the likelihood of a household experiencing financial difficulties paying utility bills. In particular, IPART found that such households were also more likely to:

- have three or more occupants (and therefore to consume more)
- renting or have a mortgage (and therefore higher accommodation costs)
- use large amounts of electricity (more than 8 MWh per year)

Simshauser and Nelson found that amongst AGL customers, those classified as Hardship Customers (those with difficulties in paying bills who may or may not also be classed as vulnerable customers) are mainly within the 30-49 age bracket and tend to be larger (3 or more persons) households – i.e. families with children.[23]

ABS data show that of households receivding various forms of government pensions and allowances, more than 40% of unemplyed and low income family households report not being able to pay utility bills on time, as do 25% of households containing disabled people. However, only 5% of aged pensioner households report such problems. This might be taken as indication that older households who receive concessions are financially better off than other concession recipients. This may well be true for some of these older households. However, some of these older households may avoid payment difficulties due to other strategies – for example by rationing their usage to avoid the risk of bill shocks Vulnerabilty may therefore be visible (e.g. via debt and difficulty paying bills) or hidden (e.g. households who over-economise – and potentially risk their health – due to worries about large bills).

One piece of evidence that may suggest this is an issue comes from the 2007 utility consumption survey in Victoria. This found that aged concession households used their main heater slightly less frequently (44.3 times per month) than other concession households (46.2 times per month) during May to November.[24] The gap in knowledge, about those who may be managing their energy bills by "going without", is noted by Simshauser and Nelson.[25] This issue of "self rationing" would merit further research to establish whether it is a significant problem anongst some vulnerable householders.

22. The actual proportions might be slightly higher because 13% of households that held a concession card refused to provide income information.

23. Simshauser, P and Nelson, T. The energy market death spiral – rethinking customer hardship. AGL Applied Economic and Policy Research. Working Paper No 31. June 2012.

24. Roy Morgan Research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p.111

25. Simshauser, P and Nelson, T. The energy market death spiral – rethinking customer hardship. AGL Applied Economic and Policy Research. Working Paper No 31. June 2012.

Understanding the way households use electricity

There is a need to understand how people use electricity in order to assess their peak-time usage levels and their potential to shift usage to off-peak periods.

This includes an understanding of their ownership and usage of major electricity consuming appliances, insulation levels in their property and other factors.

The Independent Pricing and Regulatory Tribunal of NSW (IPART) analysed electricity and gas consumption data in NSW as well as data about the household, the dwelling and uses of energy.[26]

Of the households surveyed in Sydney in 2010:

- 27% were small electricity users (up to 4 MWh per annum)
- 60% were medium electricity users (with 21% consuming 4 to 6 MWh, 18% consuming 6 to 8 MWh and 21% consuming 8 to 12 MWh per annum)
- 13% were large electricity users (consuming more than 12 MWh per annum)

Large electricity users in Sydney had more occupants (3.8 compared to 1.7), and were more likely to consist of couples with children (70% compared to 16% of small users) rather than single people or couples without children and more likely to have higher incomes. Small electricity users were more likely to live in flats, to have lower incomes, to be retirees or pensioners (42% compared to 16% of large users).

Not surprisingly, households that use mains gas generally use less electricity, because some of their major uses (e.g. heating, hot water) are of gas rather than electricity. 63% of households without gas are large users of electricity compared to 49% of households with gas. However households with gas may be large users of household energy in total, when their gas and electricity consumption are taken into account.

Similar data are not available for Victoria but it is likely that households who are large and all users of electricity would have similar ownership and uses of electricity using appliances.

SMALL AND LARGE ELECTRICITY USERS IN NSW

Small electricity users:

- 45% have an electric hot water system (main source)
- 47% use only electricity for cooking
- 47% mainly use electricity for heating

Large electricity users:

- 70% have an electric hot water system (main source)
- 64% use only electricity for cooking
- 65% mainly use electricity for heating

26. IPART. Residential energy and water use in Sydney, the Blue Mountains and Illawarra. Results from the 2010 household survey. December 2010.

MAJOR ELECTRICITY USING APPLIANCES: COST OF USE

Higher electricity consumption is associated with having large electricity using appliances, and with more frequent use of these appliances. Large electricity using appliances are mainly : hot water heaters, clothes dryers, dishwashers, washing machines, microwave ovens, second refrigerators, air conditioners and swimming pools (pumps use energy).

There is considerable variation between households in the frequency of their use of major electricity using appliances (clothes dryers, washing machines and dishwashers). Not surprisingly, the more frequently households use their appliances the higher their electricity consumption. Clearly, usage also varies depending upon the efficiency of the appliance.

IPART found that, on average :

- using a clothes dryer 3 times per week- 870 kWh per annum (3 x 290 kWh) At $ 0.22 per kWh this would cost $191.
- Using a dishwasher 6 times per week - 1,850 kWh per annum (6 x 309 kW) At$ 0.22 per kWh this could cost $407)
- Every hour of use of an air conditioner adds on average about 2.5 kWh to electricity consumption. So, using an air conditioner for 5 days per week, 6 hours per day for 6 months of the year uses 2,000 kWh (cost around $440 at $0.22 per kWh).

Electricity consumption by income level or concession card status

IPART found that on average, high income households (above $130,000 per annum) use more electricity and gas than low income households (below $33,800 per annum). Low-income households were less likely to own clothes dryers, dishwashers and swimming pools. However, there were significant numbers of both large and small users within each income category.

- Small electricity users (less than 4 MWh per annum) - 39% are low-income households; 6% are high-income households
- Large electricity users (more than 12 MWh per annum) - 6% are low-income households; 31% are high-income households

The table on the right shows the distribution of low income households in NSW at the various levels of consumption. It shows that low income households are concentrated at the below 8 MWh level (81% of low income households).

TABLE 1: Distribution of low income households in NSW survey areas within consumption bands (IPART)[27]

Household Income (before tax) < $33,800	Percentage
<4 MWH	34%
4-6 MWh	27%
6-8 MWh	20%
8-12 MWh	15%
12 MWH+	3%

As the table above shows, 18% of low income households use more than 8 MWh per year and therefore could be classed as high users, with 3% being very high users (over 12 MWh).

27. IPART. Residential energy and water use in Sydney, the Blue Mountains and Illawarra. Results from the 2010 household survey. December 2010.

Research in Victoria (2007)[28] showed that concession card holders tend to use less electricity than households on average.

TABLE 2: Average Electricity Consumption in Victoria, 2007[29]

Household Type	Average Consumption
Aged concession card holders	4000 KWh
Other concession card holders	4600 KWh
All concession card households	4300 KWh
Non-concession card holders	5300 KWh

Electric heating

In 2007 85% of households in Victoria had gas heating of some kind. 34% of households had some form of electric heating but for many of these this would be a form of secondary heating alonsgdie their gas heating (e.g,. a portable electric heater). Gas ducted heating was more common amongst non concession households (51%) than amongs concession households (31%). Concession households were more likely to have a gas built in heater (55%) than non concession households (35%). This may suggest that concession households could be more reliant on electricity for supplementary heating than non concession households, as the latter are more likely to have whole house gas heating, whereas concession households have gas heating only in one room. This would require more investigation to reach a conclusion.

More recent research by Deloitte found that in Victoria 15% of all households surveyed used electricity for heating and for most vulnerable groups the percentage using electric heating is similar to this or lower.[30] Use of electricity is higher in regional Victoria (22%) where there is generally less access to natural gas.

Air conditioning

About 59% of households surveyed in NSW by IPART had an air conditioner. Low-income households were somewhat less likely to have air conditioners than those with higher incomes. Nevertheless, more than half of low-income households had an air conditioner. However, IPART's view is that high-income households on average may have more powerful air conditioners than low-income households. In addition, IPART found some evidence that high-income households use their air conditioners more frequently than low-income households.[31]

72% of households in Victoria had some form of air conditioning in 2007 and, on average, concession households were as likely to have air conditioning as non-concession households. However, there is a marked difference between aged concession households where 74% have an air conditioner, compared to other concession households (61%).[32]

Use of electricity for hot water

The proportion of respondents in Sydney who had an electric hot water system in 2010 was 56% and 78% of those with any form of electric hot water had an off-peak system.[33]

In Victoria, in 2007, concession card holders were more likely to use electricity for hot water (21%) than non-concession households (18%).

28. Roy Morgan Research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p 75

29. Ibid.

30. Deloitte. Advanced metering infrastructure : consumer impacts study. Final report Volume 1 October 2011. Report for Department of Primary Industry and Resources Victoria.

31.IPART 2011 (Appendix C, section C.4.4).

32. Roy Morgan research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p. 117

33. IPART report on Sydney 2010 – (page 35 and Ch 4).

Around 2% of households in Victoria had solar hot water systems in 2007. [34] The majority (70%) of households with an electrical hot water system had an off peak system, while one in five had a standard system (19%). Compared with previous surveys (2001 and 1996), there was a slight increase in the incidence of having a standard system (19% compared with 15% in 2001). Aged concession households were the most likely sub-group to have off peak hot water systems – 83%, compared with 69% of non-concession households and just over half (53%) of other concession households.[35]

Controlled load electricity

Controlled Load electricity is remotely controlled by the network provider, and is usually switched on only at night. Most Controlled Load electricity is used for hot water, including both electric storage systems and electricity boosted solar hot water systems. But it can also be used for other purposes such as swimming pool pumps and certain types of heating ("slab heating"). In return for enabling the control of the relevant appliance usage to off peak times (typically 11pm to 7 am) , customers are charged a separate lower tariff for this controlled load. The controlled load tariff is usually far cheaper than the standard tariff – for example 10-12c/kwh, as opposed to 22c/kwh (2012 average rates). Customers with controlled load will continue to pay a rate similar to the standard rate for all other electricity uses. Controlled load customers have a dual element meter that can record the two different tariff rates.

The contolled load rate is not usually available for other uses of electricity at night.[36] This is different from the UK where households on the equivalent tariff (Economy 7) usually also benefit from lower priced night rate electricity for other appliances used at night time – so this can be very useful as a means of reducing the cost of using appliances such as washing machines, dishwashers and clothes dryers that can be used overnight (many of these appliances have built in timers).

Controlled Load (or off-peak) hot water systems generally use more electricity than standard electric ones because they need to have larger storage tanks as the water is heated only at night.[37] However, having a Controlled Load electricity supply can mean lower bills for hot water despite higher consumption because of the low unit rate for the night time electricity. For households without gas, IPART found that having a Controlled Load supply on average increases electricity consumption by about 510 kWh per annum but reduces bills by about $270 per annum compared to otherwise similar households without a Controlled Load supply.[38]

The issue of controlled load supply will be explored in more detail in a future paper.

Scope for demand response by level of consumption

Based on levels of demand in NSW, the box on the next page provides an example of how scope for demand response may differ amongst households who are low, medium and large users of electricity. This is purely indicative at this stage and will be the subject of further work.

34. Roy Morgan research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p 78

35. Roy Morgan research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008, p 103

36. Although a number of retailers are now starting to offer tariffs that do allow for off-peak rates for other appliances.

37. NSW Office of Environment and Heritage website, Choosing a hot water system, at http://www.environment.nsw.gov.au/energy/hwschoose.htm

38. IPART 2011. op cit.

POTENTIAL SCOPE FOR DEMAND RESPONSE BY SIZE OF CUSTOMER

Low users of electricity (below 4MWh per annum) have limited scope for load shifting and many of these households may already likely to be pretty frugal. But they could be offered measures (e.g. efficient appliances, lighting) to help reduce overall demand and bills. Some of these households may have enough off-peak use to benefit from ToU (would depend upon the tariff design)

Larger users (above 8 MWh per annum) will be the most stressed by electricity costs and could have load that could be shifted such as : a lot of large appliances; frequent use of such appliances; air con and frequent usage of it; using electricity for heating and/or hot water.

Medium users (above 4Mwh but below 8 MWh) with at least two of the following characteristics might also have scope to load shift : a lot of large appliances; frequent use of such appliances; air con and frequent usage; using electricity for heating and/or hot water.

Conclusions on use of electricity by vulnerable households

What do the availbale data for NSW and Victoria tell us?

It seems that most vulnerable and low income households would tend to be low or low/medium users of electricity. Very few low income consumers would tend to be in the large users catgeory, although it is possible that those who are may be particularly financially stressed (e.g. large low income households in larger properties).

Clearly more work will need to be done to obtain a fuller up-to-date picture of electricity usage by vulnerable and non-vulnerable households. Although Deloitte has done some modelling to produce load profiles for differert types of customers this does not tell us what appliances are used at what times of day and what uses might be capable of being shifted. However, even based on these data we can see that there are significant numbers of huseholds in Victoria and NSW with large electricity loads (heating, hot water, air coniditoning) who could be impacted negatively or positively by flexible pricing and other demand response measures such as load control.

Options for reducing peak and/or overall demand - likely impacts on vulnerable households

There are various options available to reduce peak and/ or overall demand of electricity.

Effects and customer response to demand side response (DSR)

There have been many trials in Australia and other countries of ways to secure demand response via time of use incentives and automation. A major review of worldwide trials of household demand side response was publishedby the UK Department of Energy and Climate Change in July 2012.[39]

Key findings included:

- Consumers do shift electricity demand in response to higher prices during peak periods even if accompanied by only basic information. However the size of the shift varies significantly. Basic information may include fridge magnets, information sheets, and basic bill inserts. The size of the shift achieved in trials: day-in day-out DSR: 0% to 22%; critical peak DSR: 5% to 38%.
- Automation delivers the greatest and most sustained shifts in demand, particularly where consumers have air conditioners or electric heating. Most automation trials aimed to reduce demand at critical peaks, rather than on a day-in day-out basis.
- After automation, a combination of price incentives and enhanced information generally delivers the greatest response. Enhanced information includes billing which breaks consumption down into different tariff periods, and real-time interactive information (such as in-home displays (IHDs)).
- Consumer feedback on tariffs and interventions aimed at encouraging DSR is generally positive. Although it should be noted that most trials have been voluntary with consumers choosing whether to opt-in.
- Savings made by some consumers are "passive" (i.e. without behaviour change) if they were already consuming less than average at peak times. For other consumers savings were achieved by reducing consumption and/or shifting to cheaper periods.

There are some areas where DSR evidence remains inconclusive:

- The response of vulnerable and low-income consumers to DSR initiatives.
- The impact of non-economic signals (e.g. information) alone. In some trials the messages were confusing for consumers – e.g. the difference between reducing electricity use in general as opposed to at peak times of day.
- Whether DSR persists over time if it is not automated or directly controlled, because many trials have been relatively short (one year or less).

Thus, whilst much has been learnt from trials, there are clearly many areas where understanding consumer responses and impacts of demand response is still being developed.

39. Demand Side Response in the domestic sector- a literature review of major trials, Final Report Undertaken by Frontier Economics and Sustainability First, DECC, August 2012

Automation/ direct load control

Peak demand reductions are generally much more significant with automation than without – a review of a large number of trials found peak reduction of 31% with automation (16% without) for CPP tariffs, 20% (12% without) for CPR tariffs, and 16% (5% without) for ToU tariffs.[40] Faruqui and Palmer also show that percentage reductions in peak demand (ToU, CPP and CPR tariffs) are greater with enabling technology, than without.[41]

The LIPA Edge Direct Control Programme (Long Island Power Authority in the USA) applied automation for air conditioning units, during critical peaks, without a peak price signal.[42] Consumers had the ability to override without a financial penalty, but overriding rates seem to have been low – around 21%.

Results from the OG&E Trial in the United States showed the provision of an in home display (IHD) or web portal access along with a CPP tariff produced smaller percentage reductions from low-income consumers than for higher income consumers. In contrast when the CPP tariff was combined with a smart thermostat, which provides an automated response to tariff rates, peak demand reductions were higher for low-income than high-income consumers.[43] This may be because low income households were less likely to override the settings than those on higher incomes. Other factors which may be correlated with income, such as the age of participants, may also have driven this result, but this may also indicate the potential value of the approach for vulnerable groups.

Impacts of DSR on vulnerable and low income consumers

Some key points to note when assessing impacts on vulnerable and low income consumers:

- Different definitions of vulnerable and low income are used. Sometimes the focus is just on low income households; in other cases other vulnerability factors (e.g. age, disability) are considered. In some cases, consumers have self-defined themselves as vulnerable; in others proxies such as eligibility for means tested benefits have been used.
- Not all trials have sought to differentiate between types of consumer – hence the limited nature of the evidence base.
- There is also a need to distinguish between impacts assuming no behaviour change (i.e. if the household makes no changes to their consumption for whatever reason) and the impacts of any behaviour change (response).

Without behaviour change:

A number of studies have found that many low-income consumers already consume a higher proportion of electricity at off- peak times, compared to the average consumer. These flatter loads (electricity use spread evenly across the day) mean that, before any behaviour change, low-income consumers may see a reduction in bills in a move from a flat rate tariff to a ToU or a CPP tariff.[44] Faruqui and Palmer simulated the impact on electricity bills of CPP tariffs and found that 65% of low-income consumers were immediately better off on the CPP rate than they would be on a flat tariff, before any behaviour change.[45] See also the Northern Ireland Powershift trial example in on page 19.

40. Vaasa ett, 2011, The Potential of Smart Meter Enabled Programs to Increase Energy and Systems Efficiency: A Mass Pilot Comparison; Short name: Empower Demand. Available at http://www.esmig.eu/press/filestor/empower-demand-report.pdf.

41. Faruqui and Palmer, 2012, The Discovery of Price Responsiveness- A Survey of Experiments involving Dynamic Pricing of Electricity. Unpublished paper submitted to the EDI Quarterly. (cited in Frontier Economics/Sustainability First paper for DECC.)

42. Frontier/SF paper

43. Demand Side Response in the domestic sector- a literature review of major trials

Final Report Undertaken by Frontier Economics and Sustainability First, DECC, August 2012

44. Faruqui, A & Palmer, J. "The Impact of Dynamic Pricing on Low Income Customers," IEE Whitepaper prepared by The Brattle Group, Inc., June 2010

45. Faruqui, A & Palmer, J. "The Impact of Dynamic Pricing on Low Income Customers," IEE Whitepaper prepared by The Brattle Group, Inc., June 2010

The timing of the peak and the differential between peak, shoulder and off-peak rates is clearly crucial. Some such variations are bound to occur as peak periods are not the same in all areas and there can also be differences between peaks on the networks and the generation side. Narrow peak periods (e.g. 4-7pm) or infrequent CPP peaks will have a different impact than longer peak periods (e.g. 1-8 pm). For example, there is currently considerable variation in rates and time periods for controlled load tariffs and the time of use tariffs already available in Australia.

With behaviour change:

Low-income consumers do respond to incentives to shift load, but their responses tend to be smaller than the responses for average consumers.[46] There are a number of possible reasons which include:

- Lower overall electricity use may limit the extent to which they can reduce demand at any time of day (including peaks). Low income households in Australia (as in the UK), tend to have lower electricity use than the average (although some larger low income households have high electricity usage)
- Flatter load shapes. Vulnerable consumers may be at home during the daytime (e.g. unemployed, retired or disabled) and thus have usage more spread out rather than "peaky".
- Other consumer characteristics. In the PG&E Trial in the US, the difference between low-income and average consumers was accounted for by differences in appliances used by these groups (notably air conditioners). Available evidence suggests that better off households in Australia may tend to make more use of air conditioners and have more powerful air conditioning units and so may have more scope to reduce usage.
- Smaller economic incentives. If low-income consumers receive a discount on the price they pay for electricity, the impact of the peak price differential may be limited. This was found to affect CARE consumers in the California State-Wide Pricing Pilot and the PG&E Trial. In the Ireland Electricity Smart Metering Trials, for households receiving the Free Electricity Allowance (elderly, carers, and disabled), peak electricity use fell less than the average consumer on ToU tariffs. In Australia it would be useful to examine the impact of bill concessions in this context.

NORTHERN IRELAND TIME OF USE TARIFF TRIALS

The Keypad Powershift trial was undertaken with 200 Keypad (prepayment meter) customers from October 2003 to September 2004. 100 customers ("Price Message Group" PMG) were given the Keypad time of day (ToU) tariff(4 time bands, 3 rates). The ToU rates were 5.76p/kwh low; 8.64p/kwh medium; 15.36p/kwh high (9.146p / kWh was the comparable flat rate price for Keypad customers).

They were compared to a control group of 100 keypad customers who had a flat-rate tariff, but for whom the ToU bands were used to enable comparison. The average annual PMG spend was £371.98 compared to £393.54 by the control group on the standard keypad tariff.

But if the control group had had the time-of-day price bands applied to their usage pattern, they would have paid £377.60. This suggests that that much of the saving for the PMG may have been passive (i.e. reflecting lower use at peak periods by keypad customers) rather than an active response to the price signal. This may be because they are at home during the day (which was mostly off-peak) and thus using appliances more at lower cost times.

46. The Institute for Electric Efficiency (IEE) Whitepaper "The Impact of Dynamic Pricing on Low Income Customers" (2010)

Large households

Most trials have found that smaller households (1-2 people) are more responsive (and thus more likely to benefit) from time of use pricing than larger households. The reasons for this are unclear – it may be that it is less easy to control response with more people in the household or that it is less easy to be flexible about time of use. In an Ontario trial households with small children said they found it difficult to shift the times they did laundry.[47]

The one major exception was the Ireland smart meter trials where households with children responded most – this was attributed to the effects of educational initiatives in schools in Ireland, which may result in children driving behaviour change in their household.[48]

The potential impact on households with 3 or more occupants is an important consideration in the Australian context. Larger households tend to use more elecrtricity and thus may have particular problems affording their electricity bills. IPART found that larger households are more likely to have payment difficulties than smaller households. This is also the finding of research conducted by Simshauser and Nelson based on AGL customers in hardship.[49]

Likely impacts of time of use pricing in Australia

The most detailed work in Australia on time of use pricing and low income households was undertaken by Deloitte for the Department of Primary Industries (DPI) in Victoria in 2011 and 2012.[50] Deloitte modelled a number of time of use tariffs to test their impacts on different types of customer. They produced two reports[51] that assess the potential impacts on domestic and small business consumers of time of use pricing in Victoria, with a focus on vulnerable customers.

Deloitte's key findings included:

- The effects of Flexible Pricing on vulnerable customers are likely to be highly variable both among and within different groups. Effects are dependent on the structure and level of tariffs, existing tariff levels, whether customers currently have a controlled load off peak tariff, and how much customers alter their consumption in response to price changes.
- There were a broadly similar number of winners and losers under all the modeled ToU tariffs - although who wins and who loses differs according to the tariff design.
- Without elasticity (i.e. no change in usage) - 52-57% of all residential consumers are better off under the modeled tariffs. Deloitte also modeled the impacts of tariffs on different groups of vulnerable consumers.[52] For elderly consumers the range is 52-62% better off. For needs assistance households the range is 47-48% better off. For most other groups at least 50% of households are better off.
- Although the average customers in a vulnerable group were only slightly better or worse off, there was significant variation. Some customers may therefore experience large annual bill changes.
- Under the Stage 2 modeled tariffs, with zero elasticity, (no change in usage) average bill impacts for all residential consumers ranged from +1% to –2.5%. With non-zero elasticity (a change in usage), the average bill impacts ranged from –1% to –4.5%.

47. Hydro One Networks Inc. Time-of-Use Pricing Pilot Project Results. EB-2007-0086. May 2008.

48. Commission for Energy Regulation. Electricity Smart Metering Customer Behaviour Trials Findings Report CER/11/080a. May 2011.

49. Simshauser, P and Nelson, T. The energy market death spiral – rethinking customer hardship. AGL Applied Economic and Policy Research. Working Paper No 31. June 2012.

50. Deloitte. Advanced metering infrastructure : consumer impacts study. Final report Volume 1 October 2011. Report for Department of Primary Industry and Resources Victoria. & Deloitte. Advanced metering infrastructure : consumer impacts study. Stage 2. Final report. July 2012. Report for Department of Primary Industry and Resources Victoria.

51. In Stage 1 Deloitte collected data from electricity distributors and retailers. They combined these data with demographic factors to model the impacts on different types of vulnerable households of a number of different tariffs. The Stage 1 data varied in both definition and quality, so questions arose as to the applicability of identified time-of-use patterns. Stage 2 aimed to address these issues by using more data and market research. Stage 2 also included a quantitative telephone survey of 3,003 consumers to determine their sensitivity to price change and compare each vulnerable group with households not in any vulnerable group. Six focus group sessions were also held with vulnerable consumers, gathering their views on smart meters, Flexible Pricing and energy affordability.

52. Modeling was a multi- stage process. Firstly they obtained load profiles for all consumers in an area. Secondly, they obtained data on prevalence of types of vulnerable consumers (e.g. low income, disabled) in that area. For areas with a high prevalence of a type of vulnerable consumer (e.g. disabled) the load profiles for those areas were then averaged and the result assumed to be the load profile for that type of vulnerable consumer.

- Under the tariffs modeled in stage 2, 25% of all households would face bills at least 13% higher than at present. 5% of all households would face bills at least 60% higher than at present.
- For dual element meter customers, shifting to Flexible Pricing will mean that their hot water (and/or slab heating) use is charged at the new off peak rate, and so the impact will depend crucially on whether this new rate is higher or lower than their current controlled load off peak rates.

Deloitte survey and focus group findings

- In the survey, all vulnerable groups, except Health Care Card holders, expressed much higher sensitivity to bill increases than non-vulnerable households. The highest levels of sensitivity were amongst Regional and Single Parent households. All participants said it would be difficult to shift their heating and cooling from peak times. They were slightly more likely to reduce consumption rather than shift it, but said any change would be difficult.
- All participants of the focus group sessions said that more information was needed on household energy use, with many expressing frustration in understanding the connection between their own appliance use and their electricity bills. Some participants expressed a distrust of energy companies and a belief that government should provide more information, particularly to help them deal with the new pricing structures.
- Once the various concepts, reasons and issues were explained focus group participants seemed to view Flexible Pricing as 'fair' but in some cases 'difficult'. In general, Critical Peak Incentives or Rebates were viewed more favourably than Critical Peak Pricing, while Direct Load Control of air conditioning was viewed as problematic and unpopular. In Home Displays were considered useful, with around half the participants indicating they would be willing to pay a one off fee of $50-$100 to receive such a device

Findings

It is important to understand the nature of peak and overall demand to be able to design appropriate solutions that will deliver value to customers and the electricity system.

Firstly, we do not know how far it will continue to increase and hence it will be very improtant to review changes in trends and to try to disaggregate the reasons for changes (e.g. energy efficiency measuers, own generation such as PV, behavioural change, economic restrucuring). Secondly, we do not know how much value there will be to the energy networks or retailers in securing demand response – how will the costs and risks compared to supply side solutions such as more generation or network reinofocement ? Thirdly, we do not know how willin g customers en masse will be to provide demand response and demand reduction. Fourthly, we do not know what unintended consequensces ight result froma more active demand side – e..g loss of revenue for some market actors, differential impacts on customers who take up time of use tariffs and those who do not.

Understanding peaks and where reductions in demand will deliver value

There is clearly a considerable difference between peaks that are ocurring day in day out and peaks that occur for only a few occasions each year. If the main issue in a particular electricity market or state is critical peaks in summer (e.g. 4-5 pm on a few very hot days each summer) – something that may apply particularly to network peaks - then a year round time of use tariff may not be very useful.[53] A better soution in this case might be critical peak pricing or rebates for those times only – and maybe some automation of response from key appliances such as air-conditioners.

Such an approach may be particularlyt beneficial for vulnerable households based on some research findings as cited earlier. Direct load control may also be better from the perspective of retailers and networks as it is more likley to provide certainty of response and thus to create fewer risks.

KEY FINDING: We need to be clear about what types of demand response are most appropriate to the problems that need to be addressed – day in day out or a more limited number of critical peaks and to tailor solutions appropriate to the problems identified – whether that be year round time of use tariffs, critical peak pricing or direct load control.

Impact of demand management on vulnerable households in Australia

Time of use pricing and other DSR methods may offer benefits that would be valuable to many customers. Price signals are important and do have an impact - for better off households the incentive of a gain or loss may be useful to motivate behaviour change. But for vulnerable consumers the position is more complex. Time of use pricing and other DSR methods will add complexity and risk into what is for many consumers an already complex electricity retail market, with many tariffs to choose from. Many low income and vulnerable households are stuggling to pay bills at present. Risks that might be acceptable for better off households are likely to be much more problematic for low income households.

53. If we are seeking to balance intermittent generation such as wind, for example, then demand response may be required year round. Even in these cases, however, automated demand response – e.g. using some form of storage –and/or dynamic pricing may be a more effective approach than year round time of use tariffs.

For some low income and vulnerable households there are also potential health as well as financial risks – e,g, if new pricing encourages them to curtail usage of heating and/or air conditioning to temperature levels that may be injurious to health.

The types of vulnerable household who are of most concern are those on low incomes who also have other vulnerability factors – young children, very elderly, disabilities, financial stress. Households with limited financial literacy, or understanding of their energy usage may also be particularly vulnerable, as they may be at risk of entering contracts that are inappropriate for their circumstances and/or may not be able to make the changes needed to benefit.

A key issue then is how to identify and target such households for any assistance. This is where proxies – such as bill payment difficulties and/or concession card status can often be important.

We cannot predict the impact of time of use and other demand management measures on vulnerable households in Australia without knowing their circumstances. Impacts are likely to vary between vulnerable households dependent upon key factors including:

- whether they use electricity for heating (and whether on peak or off-peak)
- whether they use electricity to heat water (and whether on peak or off-peak)
- possession and extent of usage of air conditioning
- possession and usage of major electricity using appliances such as clothes dryers and dishwashers
- number of people in the household
- whether they tend to be in the property in the daytime or out most days
- size of the property
- insulation levels
- any particularly high needs for electricity (e.g. health related)

Average impact assessments are therefore not very useful as the basis of policy decisions about how to implement DSR in respect of vulnerable households. There is such significant variation between and within vulnerable groups that policy needs to be more tailored to ensure that those who can benefit from DSR do so and that those would not benefit are protected from adverse effects.

KEY FINDING: We cannot rely on tariff design alone to avoid any negative impacts as any tariff design creates winners and losers – vulnerable households will be in both groups whatever the tariff design.

Are vulnerable households low users?

The data from NSW suggest that low income householkds tend to be lower electricity users than better off households. Few low income households in NSW use more than 8 MWh per year and most use less than 6 MWh per year. However, there are some high users amongst low income households and many of them may be particularly financially stressed. In Victoria, households with vulnerable elderly, single income, low income and health care cards each spend significantly less on electrcity than the average residential household.[54]

However, we need to see whether this distribution is also the case in other states and also how demand splits between peak and off-peak uses.

54. Deloitte, 2011 report p.xx

Recommendations

The following recommendations are divided into two sections:

1. Actions that need to be undertaken soon and before peak demand reduction measures, such as flexible pricing and load control are developed at scale.
2. Actions that need to be taken in the lead-up to and during the implementation of peak demand reduction measures.

ACTIONS TO BE TAKEN BEFORE DEMAND RESPONSE INITIATIVES ARE DEVELOPED AT SCALE

Energy efficiency measures

There needs to be a concerted effort to use energy efficiency measures to reduce overall and peak demand amongst all households, but with a special focus on targeting such measures to vulnerable households. Such meausres should in particular taregt those appliances that tend to be used at peak, such as air conditioning, on-peak (not slab) electric heating and on-peak electric hot water, lighting and making homes perform better thermally through insulation. These measures will help to make vulnerable households more resilient to the development of demand side management, help to reduce their electricity bills, improve comfort and deliver environmental benefits. It would be helpful to have a national framework, with incentives to reduce peak as well as overall demand, that allows for some flexibility to meet different circumstances in different states.

Recommendation to Governments:

To ensure that vulnerable households can benefit from energy efficiency will require effective peak and overall energy savings schemes targeted to vulnerable households. This could include designating priority groups to benefit from assistance such as grants and low interest loans, plus appropriately tailored advice and information.

Concessions framework

Deloitte found that, on average, there are not likely to be significant increases to vulnerable customers' bills caused by Flexible Pricing and that no changes were needed to electricity concessions in Victoria, "provided the ToU tariffs are offered on a voluntary or 'opt in' basis, and that consistent information is provided to vulnerable customers on how Flexible Pricing would affect them."[55] However, a comprehensive review of electricity concessions was beyond the scope of the Deloitte study. A recent report by St Vincent de Paul has highlighted that householods currently with a controlled load off-peak tariff could lose out if they moved to one of the new time of use tariffs because the Victorian off-peak electricity concession does not apply to these tariffs.[56] Furthermore, the Victorian concession framework has some notable differences from other states. The AEMC recommended that Governments review their concessions frameworks to see whether they will remain suitable in the light of flexible pricing. (Power of Choice final report).

Recommendation to Governments:

The concessions framework should be reviewed before flexible pricing is introduced to ensure the concessions will remain appropriately targeted and to examine the scope for harmonisation of concessions schemes between states.

55. Deloitte 2012 op, cit. p.11

56. Johnston, M. The relative value of energy concessions. St Vincent de Paul, January 2013. p.10

Recommendation to energy retailers and welfare organisations:

Households receiving the off-peak concession in Victoria will need careful advice before switching to time of use tariffs that might result in them losing the off-peak concession.

Under claiming of electricity rebates

The IPART study found that between 14-22% of low income households in their survey areas did not hold a concession card. They also found that more than 20% of households that held a concession card in Sydney did not claim rebates. IPART also found that low-income households that do not hold a concession card tend to use more energy and water (mainly because they have more occupants); and are more likely to be renting privately or paying off their homes, and thus may be particularly financially stressed. Thus it seems possible that more than 30% of households who might be able to claim an electricity rebate in NSW do not do so.

In Victoria, a considerable discrepancy between those who believe they are receiving a concession and those who actually receive one was found in a major survey undertaken for the DHS. In 2007, 78% of households who claimed to receive an electricity concession actually received one. It would therefore seem that there may be many people missing out on the help with their bills that is available under the concessions scheme.[57]

Recommendations to Governments:

There is a need for action firstly to clarify take up rates for concession cards and the electricity rebates that can be claimed. Secondly, to identify households not holding concession cards or not claiming rebates to improve take up amongst this group.

Recommendation to Governments, energy companies and welfare organisations:

Further work needs to be done to boost take up of concession cards and rebates amongst vulnerable consumers who are not claiming them.

Low users

For very low consuming households some research would be useful into why they are such low users. If it is one or two people in a very small flat, or a household using gas for heat, hot water and cooking or a household with a solar PV, then low consumption may be reaosnable. But there may be some low consuming households who do not have gas or solar PV, or are not in a very small property who are under consuming with potentail health risks. Note that Hardship programmes tend to focus on people having difficult paying bills so they may miss those who are under consuming to avoid getting into bill difficulty. In the UK this is well recognised as a problem particually amongst elderly people who tend to be more averse to getting into debt than younger people.

Recommendation to Governments and energy companies:

There is a need for some research into low users. This would help to indentify whether this group faces any particular problems such as "self rationing" or whether they are in fact adopting sensible energy management strategies that might be useful for other hoseholds. The extent to which they are claining concessio0n couild also be assesssed.

Information, advice and data

All consumers should make decisions about demand response options (load control and flexible pricing) based on an understanding of their electricity use and clear information on the options avaiolable.

This is even more impirtant for vulnerable households. Smart meters, in home dispalys and web portals should enable consumer to have more data on their current usage profile. A key issue is how to ensure that households get acces to devides such as in home displays – schemes such as VEET are helping the diffusion of these devices, but there may be need for a more systematic approach.

57. Roy Morgan research for Department of Human Services, Victorian Utility Consumption Household Survey 2007, Final Report, April 2008

In Great Britain, all households will get an in home display free of charge with their smart meter – the displays being installed at the same time as the meter as part of the roll-out.

For some households comparison sites (which need to be accredited to ensure they meet certain standards) will be sufficient – the household could input their data from their smart meter and work out whether a time of use taruff would be a good option for them. Some low income and vulnerable households will be as able to make their own choices, provdied they have sufficient information, as are other households . For others however, there will be a need for a qualified advisor to provide an energy audit, and advice on the options based on their circumstances. In some cases this advice will be best performed in the home.

Recommendation to Governments, energy companies and welfare organisations:

There is the need for a concerted effort to increase energy awareness and understanding of peak and overall demand usage of different appliances amongst households. This will include information and advice, in home displays etc. Particular efforts to be targeted to vulnerable households.

ACTIONS TO BE TAKEN FOR IMPLEMENTATION OF DEMAND RESPONSE

Marketing of Time of Use tariffs

When ToU tariffs are markted to customers then it is likely some who will not benefit will end up signing up, given the experiences to date in retail energy markets of poor customer choices where customers switch to a worse deal. IPART's 2010 review of the retail market in NSW found that outcomes for customers who had entered the competitive market were not uniformly positive. For example, some customers were unknowingly paying rates higher than the regulated rates.[58] In 2008-09 almost all customers surveyed by Ofgem said they switched to save money but as many as one third may not have achieved a price reduction. This was higher for consumers who switched as a result of a direct sales approach.[59]

Recommendation to energy retailers:

Retailers should agree not to market time of use tariffs to a defined group of low income and vulnerable customers unless the customer has had a smart meter for at least one year to establish their load profile - one years's data - that will help them make the decision as to whether they would benefit. It would actually be good practice not to market time of use to any customer without this data.

Opt-in to Time of Use tariffs

In Victoria customers will have to opt-in to time of use tariffs. The AEMC, in their Power of Choice review, proposed different approaches for network charges for household customers (which retailers are then likely to pass on to households), according to whether they are for low, medium and high users. The default for low users will be no time of use tariff unless they opt in, the default for medium ussers is a time of use taruff unless they opt out, and high users will have to have a time of use tariff. The AEMC did not specify the levels at which these consumption bands should be set as they consider this should be determined stater by state in the light of state charactertistcs. However, they did say that the threshold for consumers (Band 1) who would have madatroay time of use pricing should be substantially above the average consumption, so that it captures those consumers with multiple heavy load appliances such as electric vehicles, or large air-conditioning systems.

Recommendation to Governments:

Adopt the opt-in approach to time of use tariffs for all except the largest household customers (about 12 MWh per year) at least in the early years of such tariffs.

58. Review of regulated prices and charges for electricity 2013-16. Electricity issues paper. IPART, November 2012.

59. Ofgem. Op cit.

Recommendation to retailers, networks, regulators and Governments:

Need to ensure effective co-ordination of policy and practice on the use of time varying charging to ensure that an opt-in policy works effectively.

Opt-out of Time of Use tariffs

The Victorian Government proposal to allo customers to of opt out of time of use tariffs after one year if the tariff is not beneficial could be helpful – but customers may need advice on interpreting the bill and making this decision. It is however, important to note the potential for customer inertia which may mean that many customers who should opt-out do not. For this to be an effective protection therefore, cusomers may need prompting to check whether they should stay on the time of use tariff.

Recommendation to energy retailers:

Make customers aware where they are paying more on a time of use tariff and hence should now consider whether they can do more to shift usage to off-peak times, to reduce their usage (e.g. through energy saving measures) or should be opting out of 'time of use'.

It is also worth noting that the ability to opt-in and out of time of use tariffs could potentailly raise risks and hence costs for retailers, if they have purchased electricity on an assumption of time of use response and/or are paying network charges on this basis. It is therefore possible that retailers would seek to mitigate these risks by including exit fees for early termination of time of use contracts.

Recommendation to energy retailers:

Provide customers with clear information on time of use contracts , including whether they include "lock in" periods and early termination fees.

Automation/ direct load control

Automation offers the potential to deliver DSR (at least for major loads such as air conditioning, hot water and heating), with minimal price risk and inconvenience to the customer and this may be particularly beneficial for vulnerable customers.

However, there is evidence of some consumer reluctance to accept automation. Direct Load Control of air conditioning was viewed as problematic and unpopular by particpants in the focus groups of vulnerable households conducted by Deloitte in Victoria.[60] In some trials it has been found to be more difficult to recruit households to take part in direct load control than time of use pricing options. Yet there are also considerable numbers of households who do already have experience of controlled load hot water and heating in Australia and other countries.

The results of some trials also suggest that initial doubt about participation can be mitigated by providing consumers with the options to override any automated response – even if many consumers in fact do not use the override function. Thus it may well be that automation could be a more acceptable measure for many households, provided that it is discussed with them fully (including the scope to override), the benefits (bill savings) are understood and they are able to choose whether to accept it or not. Automation may offer the potential to deliver DSR (at least for major loads such as air conditioning, hot water and heating), with minimal price risk and inconvenience to the customer and this may be particularly beneficial for low income and vulnerable customers.

Automation may also require capital investment, which some vulnerable households may not be able to afford. It would therefore also be necessary to consider whether and how these costs could be funded.

Recommendation to energy retailers and distributors:

Automation of response should be explored as a measure that may have considerable potential for vulnerable households.

60. Deloitte 2012 op cit.

Research agenda recommendations

We need much better data on household electricity use amongst different types of household to identify where demand response initiatives can deliver benefits to the electricity system and consumers. Our future research programme will contribute to this. In particular we intend to conduct research into low users, controlled load electricity and the potential future role of automation.

There is also need to make better use of the findings of research and trials conducted to date by Governments, energy companies and others. There is an important data curation and sharing task to be undertaken to obtain maximum benefit from this investment.

Conclusions

Peak demand presents a challenge for the electricity system and addressing it should bring the potential to reduce costs to the benefit of consumers. However, it is important that we tackle it sensibly and in ways that do not disadvantage vulnerable households.

There is clearly a considerable difference between peaks that ocur day in day out and peaks that occur for only a few occasions each year. We therefore need to be clear about the peak demand problems that need to be addressed to enable us to better to tailor appropriate solutions, whether that be year round time of use tariffs, critical peak pricing or direct load control.

Time of use pricing and other DSR methods may offer benefits to many customers. Price signals are important and do have an impact - for better off households the incentive of a gain or loss may be useful to motivate behaviour change. However, time of use pricing and other DSR methods could add complexity and risk into what is for many consumers an already complex electricity retail market. Many vulnerable households are struggling to pay bills at present.

Risks that might be acceptable for better off households are likely to be much more problematic for low income households. It will therefore be important than we take effective action to help make vulnerable households more resilient to a range of energy futures – including tackling peak demand.

FURTHER INFORMATION

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