REPORT

Prepared for:

Department of Primary Industries, Victorian Government

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Flexible pricing of electricity for residential and small business customers

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EXECUTIVE SUMMARY

This report provides the results of a study that has been undertaken by Etrog Consulting Pty Ltd into the production implementation and trials of flexible electricity pricing for residential and small business customers in various jurisdictions in Australia and overseas. Pricing of electricity for large industrial customers is outside the scope of this report.

Flexible pricing of electricity is used in this report very broadly to denote arrangements for the pricing of electricity that have different rates for the use of electricity at different times.[1] The most common form of flexible pricing is a Time of Use (TOU) tariff. TOU tariffs have rates that vary depending on time of the day when electricity is used. These tariffs may also vary depending on the day of week (for example there may be different rates for use during a weekday as against a weekend), and may vary by season.

Flexible pricing and the rollout of smart meters in Victoria

Interest is currently being shown in flexible pricing of electricity in Victoria in conjunction with the rollout of smart meters. While smart meters enable new types of flexible pricing, flexible pricing is not new. Pricing of electricity differently at different times has been happening for many years, well before smart meters were being considered. Many of the examples of flexible pricing that are discussed in this report have been implemented without smart meters.

Smart meters record the usage of electricity every half hour whereas in the past metering for residential and small business customers generally either did not record the time of use, or recorded the time of use only in preset blocks or based on separately measuring usage of electricity on controlled load circuits. The fact that smart meters record usage every half-hour enables pricing arrangements to be much more flexible than was previously the case. With half-hourly interval metering, pricing can be changed without change of meter, and the pricing can be much more granular. At the limit, smart meters can enable usage of electricity to be priced differently in every half-hour of the year – which is not to say that this would be appropriate or recommended as best practice.

Though they are outside the scope of this report, we note that large industrial customers in Victoria and elsewhere in Australia and overseas have had half-hourly interval metering for many years and are generally already routine being sold electricity based on tariffs and contracts with pricing the varies by time of use.

1 A factsheet on flexible pricing of electricity is available on the website of the Victorian Department of Primary Industries at www.dpi.vic.gov.au/__data/assets/pdf_file/0003/138918/SM-FS_FlexiblePricing_FA_WEB.pdf.

The smart meters that are being implemented in Victoria offer not only interval metering but also a communications infrastructure enabling two-way communications to and from the meter. This communications infrastructure enables the implementation of interactive devices such as web portals and in-premise displays, to give electricity customers more information on how they are using electricity. This information can help customers to compare different offers from electricity retailers, which may include flexible pricing offers. With more information, customers will also be able to gain better understanding of how their different patterns of use of electricity affect the overall price they pay, and they may be able to change their usage patterns to save money with flexible pricing.

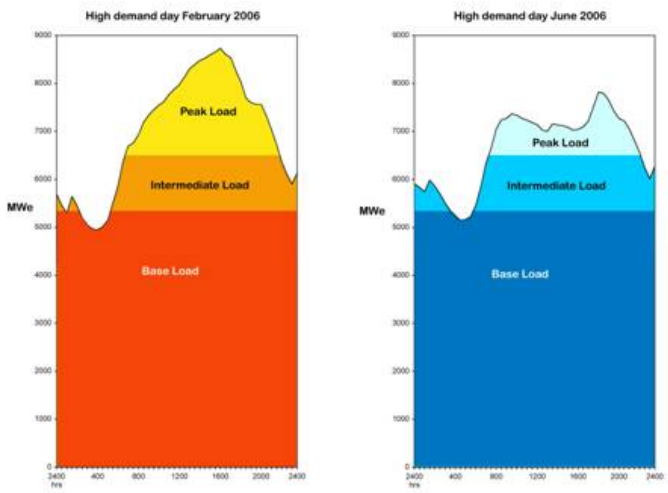
Reducing peak usage of electricity

Flexible tariffs have been deployed as a mechanism to provide incentives through price signals for customers to reduce demand at peak times and increase demand at off-peak times. Because electricity cannot be stored efficiently, it has to be generated, transmitted and distributed at the time of use. Generation and network capacity has to be built to meet peak requirements in each case, and the more “peaky” the load the less efficiently the capacity is being used. Spreading the demand for electricity more evenly across different time periods makes more efficient use of the generation and network capacity.

Spreading the demand for electricity more evenly across different time periods makes more efficient use of the generation and network capacity.

Figure 1 below illustrates load curves for high demand days in Victoria in summer and winter in February and June 2006 respectively.

Figure 1: Load curves for high demand days in Victoria in summer and winter in 2006



Source: The potential for renewable energy to provide baseload power in Australia, Research Paper no. 9 2008–09, Stewart Needham, Science, Technology, Environment and Resources Section, 23 September 2008, available at www.aph.gov.au/library/pubs/rp/2008-09/09rp09.htm

This figure illustrates the need for increased generation capacity to meet peak demands for electricity. If the peaks could be “flattened”, there would be less need for higher levels of generation capacity to meet peak demands. Network capacity requirements would also be reduced if the profile of network usage could be “flattened”.

Retail vs. network pricing of electricity

There may be times when generation is scarce and wholesale energy prices are high, but there is no shortage of network capacity. At these times, sending pricing signals in retail tariffs may be appropriate. Conversely, there may be times when there is adequate generation available and wholesale energy prices are not high, but network capacity is scarce. At these times, sending pricing signals in network tariffs may be appropriate. The needs and applications of network and retail pricing may conflict at times.

Retail tariffs may dilute the price signals in network tariffs, especially where there is no obligation for retailers to pass on network price signals to the end-use customer. Retailers may seek to absorb complexities in network tariffs in order to provide what they believe to be more attractive simpler propositions to customers. Alternatively there may be historic reasons for different network vs. retail tariff structures.

The retail tariff structure is often driven by the network tariff structure, i.e. whether the tariff is single rate, TOU, etc. But even then the full complexity of the network tariff may not be passed through in the retail tariff.

Work is ongoing in some jurisdictions to align network and retail tariffs where they were previously not aligned.

Changes in design of electricity tariffs over time

In the past, time-based tariffs were often geared towards providing cheaper off-peak electricity, rather than charging more for peak electricity. Thus for many years the controlled load tariffs in Victoria charged the same for the electricity used outside the controlled loads as would be charged if the premise was on a single-rate tariff.

Nowadays, time-based tariffs are being conceived as a means of discouraging peak usage, and we are seeing tariffs that charge considerably more for peak usage than the single-rate tariff.

Some of the modern tariff deigns specifically aim to address annual system peak usage as for example where there has been investment in air conditioning that is disproportionately driving up peak usage. We expect to see further tariff developments in future years as technology develops. These tariffs may be aligned with systems that control load to make optimal use of available generation and network resources.

Dynamic TOU pricing

Dynamic TOU pricing allows for the time when certain tariffs apply to be set "dynamically" as the need arises, perhaps with one or two days' warning. Implementations and trials of dynamic TOU pricing have centred on Dynamic Peak Pricing (DPP), otherwise known as Critical Peak Pricing (CPP). In these trials, the aim is to apply higher prices, often substantially higher, for a very limited number of days and hours per year, at times of particularly heavy demand, to give a strong pricing signal to consumers to reduce their usage of electricity in these periods.

Trials of flexible pricing

As documented in this report, some of the key findings of trials of flexible pricing and dynamic pricing include the following:

- Customer response to flexible pricing was not just a novelty but also persisted over time. Several recent dynamic pricing pilots have specifically tested the persistence of customer response when events are called across two or three days in a row and found persistence.

- Customers were reported to be satisfied with dynamic pricing once they experience it. Customers are already familiar with the idea of dynamic pricing, for example with cell phone minutes, airline tickets and hotel rooms, toll roads and bridges, and sporting events and shows. In the case of electricity, they tend to associate it with high prices and price volatility. When they are asked if they want it, in focus group settings or telephone interviews, the majority say no. When they have lived through it, either in full-scale programs or in pilot settings, the vast majority report high satisfaction and want to continue with the rates.

- Direct load control programs are not substitutes but complements to dynamic pricing. Traditionally, direct load control is only triggered by reliability events. In general, dynamic pricing can yield higher load responsiveness when combined with enabling technology than direct load control and it can be triggered by either economic or reliability events.

- Further research will provide more information on how consumer respond to flexible pricing and dynamic pricing, and might cover such aspects as how web portals, in-home displays and other communications media influence consumer response, as well as the impact of socio-demographic variables (e.g. income, education) on customers' price responsiveness.

1. INTRODUCTION

This report provides the results of a study that has been undertaken by Etrog Consulting Pty Ltd into the production implementation and trials of flexible electricity pricing for residential and small business customers in various jurisdictions in Australia and overseas. Pricing of electricity for large industrial customers is outside the scope of this report.

Flexible pricing of electricity is used in this report very broadly to denote arrangements for the pricing of electricity that have different rates for the use of electricity at different times.[2]

The most common form of flexible pricing is a Time of Use (TOU) tariff. TOU tariffs have rates that vary depending on time of the day when electricity is used. These tariffs may also vary depending on the day of week (for example there may be different rates for use during a weekday as against a weekend), and may vary by season. Other terms that are sometime used with similar meaning are Time of Day (TOD) and Seasonal Time of Day (STOD). This report uses the term TOU to refer generically to this type of tariff, in contrast to single rate tariffs that do not vary by time of day. Single rate tariffs may still vary by season, and like all tariffs they also change over time as rates are revised (often annually).

The remainder of this report is structured as follows:

- Section 2 gives background information on various aspects of flexible pricing.
- Section 3 sets out findings regarding the production implementation of flexible pricing in various jurisdictions in Australia and overseas.
- Section 4 sets out findings regarding the trials of flexible pricing in various jurisdictions in Australia and overseas.
- Section 5 provides overall summary and conclusion.

The exclusion of any particular jurisdiction or pricing arrangement from this report does not mean that there has been no implementation or trial of flexible pricing in that jurisdiction, but rather that the information was not to hand could not be readily sourced and included in this report in the time available to complete this study.

2 A factsheet on flexible pricing of electricity is available on the website of the Victorian Department of Primary Industries at www.dpi.vic.gov.au/__data/assets/pdf_file/0003/138918/SM-FS_FlexiblePricing_FA_WEB.pdf.

2. BACKGROUND ON FLEXIBLE PRICING

This report section provides background and context for flexible pricing and its proposed implementation in Victoria.

Sub-sections of this section cover:

- ***Flexible pricing and the rollout of smart meters in Victoria***: what is the connection between the rollout of smart meters and the implementation of flexible pricing in Victoria;
- ***How flexible pricing relates to both reducing peak usage and conservation***;
- ***Effects of tariff structures on carbon emissions and other environmental factors***;
- ***Retail vs. network pricing of electricity***: there may be different drivers for flexible pricing, and how they interact;
- ***Changes in design of electricity tariffs over time***: putting the implementation of flexible pricing in a historic context;
- ***Consideration of flat and block tariff structures***: block tariffs have in the past been used to create differential pricing structures as against flat tariffs – how do they fit with flexible pricing;
- ***Dynamic TOU pricing***: as against static TOU pricing – how do they differ;
- ***Metering to support flexible pricing***: this provides a more general discussion of the metering required to support flexible pricing, as against the specific context of the Victorian rollout of smart metering; and
- ***Comparison of production implementation and trials of flexible pricing***: this sub-section sets the scene for the following two sections of the report which consider production implementation and trials of flexible pricing in various Australian and overseas jurisdictions.

2.1. FLEXIBLE PRICING AND THE ROLLOUT OF SMART METERS IN VICTORIA

Interest is currently being shown in flexible pricing of electricity in Victoria in conjunction with the rollout of smart meters. While smart meters enable new types of flexible pricing, flexible pricing is not new. Pricing of electricity differently at different times has been happening for many years, well before smart meters were being considered. Many of the examples of flexible pricing that are discussed in this report have been implemented without smart meters.

Smart meters record the usage of electricity every half hour whereas in the past metering for residential and small business customers generally either did not record the time of use, or recorded the time of use only in preset blocks or based on separately measuring usage of electricity on controlled load circuits. The fact that smart meters record usage every half-hour enables pricing arrangements to be much more flexible than was previously the case. With half-hourly interval metering, pricing can be changed without change of meter, and the pricing can be much more granular. At the limit, smart meters can enable usage of electricity to be priced differently in every half-hour of the year – which is not to say that this would be appropriate or recommended as best practice.

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The smart meters that are being implemented in Victoria offer not only interval metering but also a communications infrastructure enabling two-way communications to and from the meter. This communications infrastructure enables the implementation of interactive devices such as web portals and in-premise displays, to give electricity customers more information on how they are using electricity. This information can help customers to compare different offers from electricity retailers, which may include flexible pricing offers. With more information, customers will also be able to gain better understanding of how their different patterns of use of electricity affect the overall price they pay, and they may be able to change their usage patterns to save money with flexible pricing.

2.2. HOW FLEXIBLE PRICING RELATES TO BOTH REDUCING PEAK USAGE AND CONSERVATION

Time-based tariffs are not new; they have been around for several decades, as a mechanism to provide incentives through price signals for customers to reduce demand at peak times and increase demand at off-peak times. Because electricity cannot be stored efficiently, it has to be generated, transmitted and distributed at the time of use. Generation and network capacity has to be built to meet peak requirements in each case, and the more “peaky” the load the less efficiently the capacity is being used.

It is useful to distinguish here between reducing peaks and increasing load factors on the one hand, and conservation on the other hand. They are quite different matters. For example, off-peak water heating as against instantaneous water heating may help reduce daytime peaks and use spare capacity at night. But because of heat losses, the total electricity consumed may be higher.[3]

3 It should be noted, however, that increasing the efficiency of the use of network infrastructure may also in itself have an energy production conservation effect, due to lower line losses. This is not reflected in the end-use data, but would be reflected in generation. These effects are often ignored and not measured.

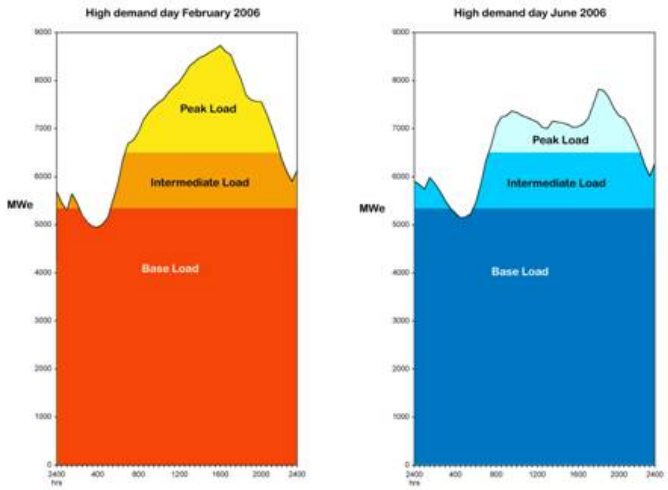
As discussed in section 3.3 below, TOU tariffs were originally introduced in England and Wales to stimulate off-peak use of electricity, to make better use of existing network and generation capacity, and not necessarily to promote reduction in peak use or conservation in the first instance.

Depending on how they are designed and implemented, flexible pricing can have effects on increasing load factors and/or conservation effects. Different designs have different purposes. Whatever the design, changing pricing arrangements is likely to focus consumers' attention on their electricity usage, which may bring consumers to reduce their usage and change their usage patterns. Even in the absence of flexible pricing, there is evidence that giving customers usage information can lead to changes in usage patterns. Additional usage information can be provided through such media as web portals, or in-premise displays, as mentioned in section 2.1 above. Detailed consideration of these means of information provision, and other means of providing feedback to consumers, is outside the scope of this report, though some reference is made in our discussion of trials in section 4 below.

Spreading the demand for electricity more evenly across different time periods makes more efficient use of the generation and network capacity.

Figure 2 below illustrates load curves for high demand days in Victoria in summer and winter in February and June 2006 respectively.

Figure 2: Load curves for high demand days in Victoria in summer and winter in 2006



Source: The potential for renewable energy to provide baseload power in Australia, Research Paper no. 9 2008–09, Stewart Needham, Science, Technology, Environment and Resources Section, 23 September 2008, available at www.aph.gov.au/library/pubs/rp/2008-09/09rp09.htm

This figure illustrates the need for increased generation capacity to meet peak demands for electricity. If the peaks could be "flattened", there would be less need for higher levels of generation capacity to meet peak demands. Network capacity requirements would also be reduced if the profile of network usage could be "flattened".

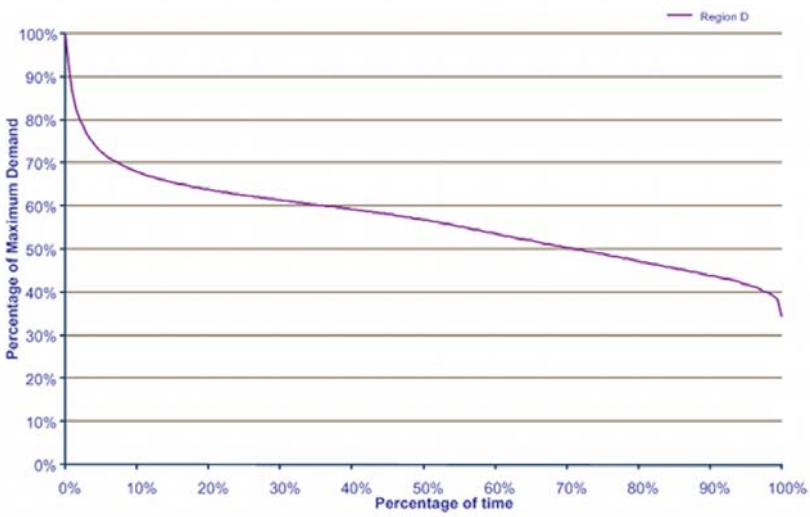
The “peakiness” of load is defined in electrical engineering by the load factor. The load factor of an electrical system or network is the average load divided by the peak load, over a period of time. It is a number in the range zero to one. The theoretically most efficient system would have a load factor of 1, corresponding to a completely flat load. Demand management techniques aim to increase the load factor, to increase the efficiency of use of existing infrastructure, and to defer augmentation of networks and commissioning of new generation by reducing peaks in demand.

The effects of peak load on capacity requirements can also be seen through examination of the annual demand duration curve (or load duration curve) for an area. Annual demand curves map the demand on the system through the year as a percentage (or some other fraction) of the maximum demand for the year. They are used to show how significantly demand throughout the rest of the year departs from the maximum.

The following hypothetical example is taken from an online tutorial on the AEMO website.[4]

Figure 3 below shows a hypothetical demand duration curve. This curve demonstrates that demand was 60% or more of the year's maximum demand for approximately 37% of the time, or put another way, the top 40% of demand only occurred during 37% of the time.

Figure 3: A hypothetic demand duration curve



4 See www.aemo.com.au/planning/ESOO2011_CD/tutorial/tut2/lessonB2.html

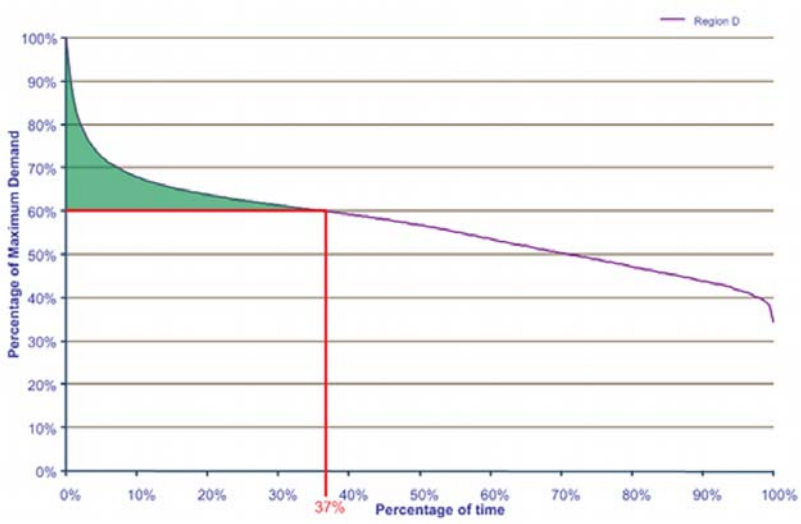
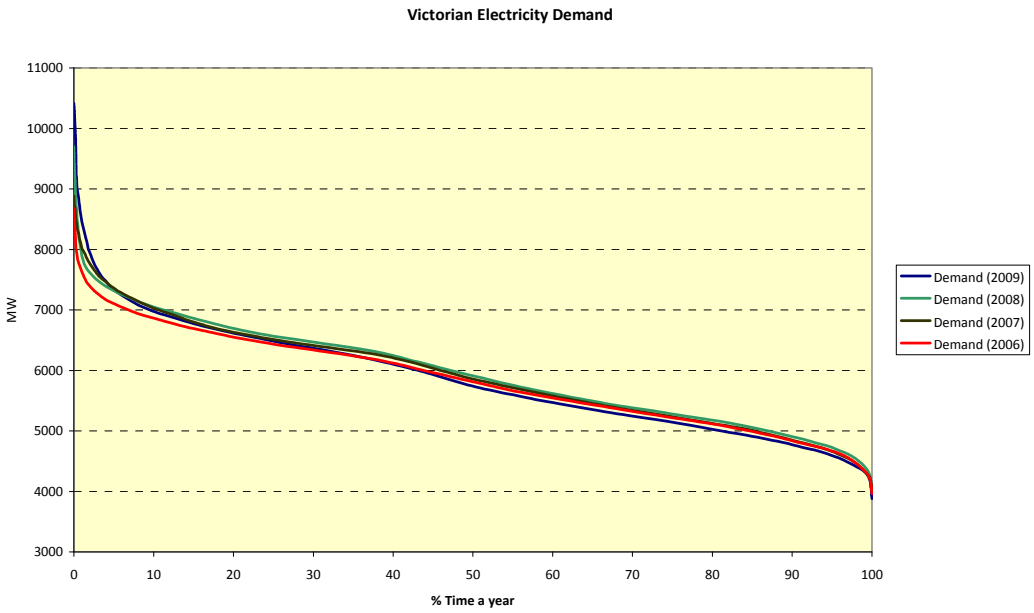


Figure 4 and Figure 5 below show some actual Victorian electricity demand duration curves for the years 2006 to 2009 inclusive. Figure 4 shows the full curves, while Figure 5 focuses on the periods of highest demand in those years.

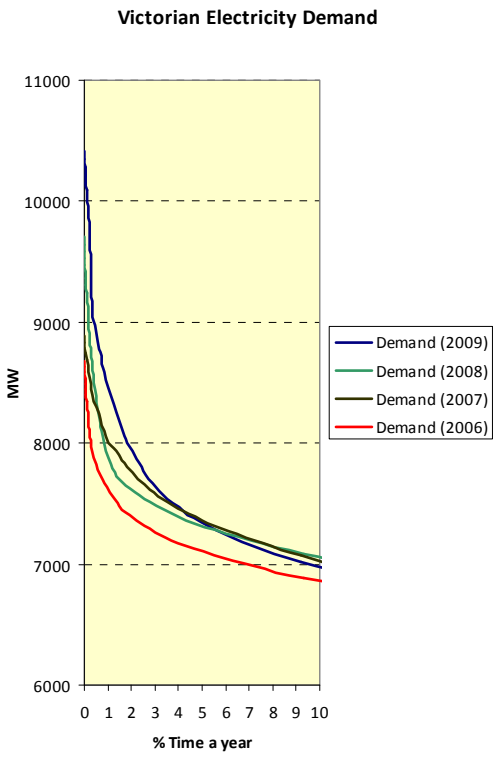
Figure 4: Victorian electricity demand duration curves for the years 2006 to 2009 inclusive



Source: AEMO data

Attention usually focuses on the far upper left area of the load curve. For example, this hypothetical curve shows that the top 10% of demand for electricity only happens in about 3% of the year. It becomes possible to see just how much demand occurs in only the top few half-hourly intervals of time during the year. Clearly it is inefficient to build capacity that is only required for a few half-hours each year. Demand management may therefore focus on the demands at these peak periods. Flexible pricing is one component of a range of demand management techniques that can be implemented.

Figure 5: Victorian electricity demand duration curves for the years 2006 to 2009 inclusive, focusing on the periods of highest demand

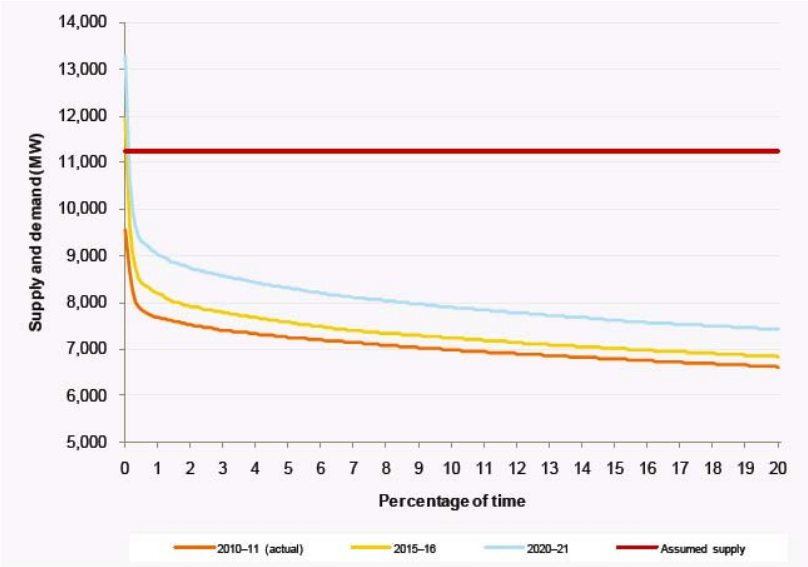


Source: AEMO data

Figure 6 below shows projected Victorian electricity demand duration curves for future years, as published recently by AEMO.[5]

5 Extracted from 2011 Electricity Statement of Opportunities for the National Electricity Market, AEMO, Figure 8-5 – Victorian projected demand duration curves, page 8-8, available at www.aemo.com.au/planning/esoo2011.html

Figure 6: Projected Victorian electricity demand duration curves for future years



These curves clearly show a fair proportion of Victorian supply and demand projected to be required in future years for only 1% of the year.

2.3. EFFECTS OF TARIFF STRUCTURES ON CARBON EMISSIONS AND OTHER ENVIRONMENTAL FACTORS

As stated above, flexible pricing can have effects on increasing load factors and/or conservation effects. These effects will have implications for the fuel mix of electricity generation and the total electricity generation. For example, if flexible pricing causes consumers to shift usage from peak periods to non-peak periods and thus there is less gas peaking generation and more baseload coal-fired generation, all other things being equal that will increase carbon emissions. On the other hand, displacing peak diesel-fired generation and replacing it with baseload nuclear generation would decrease carbon emissions.

It is not possible to generalise the effects of flexible pricing on carbon emissions without extensive modelling of the generation system and the fuel mix in place. Flexible pricing may also change the level and shape of demand to the extent that new generation investment decisions are changed, and that will also have effects on carbon emissions. There may also be other environmental effects, if for example the changing usage pattern affects decisions on investments in renewable generation. Again, it is not possible to generalise the effects without extensive modelling.

2.4. RETAIL VS. NETWORK PRICING OF ELECTRICITY

In the past, before electricity supply industries were restructured and disaggregated, there was little if any distinction between the retail tariffs that were charged to end use consumers of electricity, as against network tariffs that were charged by network businesses and solely covered the use of the network infrastructure, as against covering actual energy purchase costs. Therefore, the earliest tariffs, which pre-dated the restructuring and disaggregation of electricity supply industries, did not distinguish between generation and network capacity requirements.

Nowadays, restructured electricity industries differentiate clearly between generation and network capacity issues, and between retail and network tariffs. The aims of retail and network pricing arrangements may be quite different. Generation availability and capacity may not be aligned with network availability and capacity. Network pricing may be designed to provide pricing signals in more localised areas than is the case for other components of the price seen by end-use customers.

There may be times when generation is scarce and wholesale energy prices are high, but there is no shortage of network capacity. At these times, sending pricing signals in retail tariffs may be appropriate. Conversely, there may be times when there is adequate generation available and wholesale energy prices are not high, but network capacity is scarce. At these times, sending pricing signals in network tariffs may be appropriate. The needs and applications of network and retail pricing may conflict at times.

Retail tariffs may dilute the price signals in network tariffs, especially where there is no obligation for retailers to pass on network price signals to the end-use customer. Retailers may seek to absorb complexities in network tariffs in order to provide what they believe to be more attractive simpler propositions to customers. Alternatively there may be historic reasons for different network vs. retail tariff structures.

The retail tariff structure is often driven by the network tariff structure, i.e. whether the tariff is single rate, TOU, etc.[6] But even then the full complexity of the network tariff may not be passed through in the retail tariff.[7]

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6 This is generally the case in Victoria, and in other jurisdictions. When a retailer takes on a new customer, the retailer determines the applicable retail tariff depending on what they are informed by the distributor to be the applicable network tariff, be that a single rate tariff, the Winner TOU tariff, a controlled load tariff, or some other tariff structure. If a customer wishes to change their retail tariff structure, they generally have to work with their retailer to change the underlying network tariff as well. This may require change of metering and/or different wiring in the premise.

7 This applies in some cases in Victoria where, for example, some network tariffs have block structures that are not passed through to all consumers in retail tariffs. Some network tariffs have had maximum demand components for several years that have not been passed through to consumers in retail tariffs.

Work is ongoing in some jurisdictions to align network and retail tariffs where they were previously not aligned. For example, the Queensland Competition Authority recently undertook a review of regulated retail electricity tariffs and prices, based on the State Government having endorsed an inclining block network tariff for domestic customers commencing 1 July 2012, and seeking to pass that structure through to end-use consumers in retail tariffs.[8]

2.5. CHANGES IN DESIGN OF ELECTRICITY TARIFFS OVER TIME

In the past, time-based tariffs were often geared towards providing cheaper off-peak electricity, rather than charging more for peak electricity. Thus for many years the controlled load tariffs in Victoria charged the same for the electricity used outside the controlled loads as would be charged if the premise was on a single-rate tariff. The Economy 7 tariff in the UK was similarly conceived – though there the lower rate was purely time-controlled, and not dependent on being load on a distinct circuit.

Nowadays, time-based tariffs are being conceived as a means of discouraging peak usage, and we are seeing tariffs that charge considerably more for peak usage than the single-rate tariff. The Winner tariff was probably the earliest Victorian residential time-based tariff that sought to charge more for peak use at the same time as charging less for off-peak use. There are also five-day and seven-day small business tariffs in Victoria based on the same concept of charging more for peak and less for off-peak than would be the case for a single rate tariff.

Some of the modern tariff deigns specifically aim to address annual system peak usage as for example where there has been investment in air conditioning that is disproportionately driving up peak usage. We expect to see further tariff developments in future years as technology develops. These tariffs may be aligned with systems that control load to make optimal use of available generation and network resources.

Feed-in tariffs are another modern form of tariff. These provide increased recompense for renewable generation, to encourage investment. There are gross feed-in tariffs that pay for all generation at an increased rate, and net tariffs that pay the increased rate only for net exported generation, after taking into account any of the generation that is consumed on site.

8 See www.qca.org.au/electricity-retail/RevEPandTS. For more information on tariffs in Queensland, see section 3.1.3 of this report.

In Victoria, a net Premium Feed-in Tariff (PFIT) was implemented for small scale solar generation, which is not open to new customers, but which continues to pay a minimum of $0.60/kWh for net exported generation from solar PV panels to customers already on this tariff.[9] This means that the effective marginal cost of consumption of a customer on such a tariff is at least $0.60/kWh when their solar PV is generating, because that is what they are foregoing in export revenue by consuming the electricity on site. This is likely to be a much higher rate than any of the customer's other electricity pricing components for import of electricity for use on site.

2.6. CONSIDERATION OF FLAT AND BLOCK TARIFF STRUCTURES

Both single rate tariffs and time-based tariffs may have a flat structure or a block structure. Flat tariffs charge the same for all usage in any given time period, while block tariffs charge differently depending on how many units of electricity are used. For example, a block tariff may charge the first 1000 kWh consumed in a given month at one price, the next 100 kWh consumed in the month at a second price, and the remainder at a third price. If those prices increase as consumption increases, the tariff is known as inclining block; if they decrease as prices increase the tariff is known as declining block.

Inclining block tariffs are intended to provide conservation signals to encourage demand management. They also may be a means of implementing social policy, recognising basic rights to a base level of electricity use for essential use at a lower rate, while higher usage levels for non-essential use are charged at a higher rate. Inclining block tariffs may be intended to signal that higher levels of consumption necessitate capital expenditure in generation and network infrastructure, and therefore increased marginal costs of supply.

Declining block tariffs may reflect some fixed charges being recovered in the initial supply quantities, as against directly in fixed charges. In some markets, there are no fixed charges for electricity supply, or very low fixed charges that do not fully recover the fixed costs of maintaining the electricity connection and providing the billing and other customer service functions that are required even when no electricity is being consumed. This situation may arise when there is consumer antagonism to fixed charges, or other reasons why fixed charges are set at low levels. In some competitive markets, retailers find that the marketing of "no fixed charge" tariffs has high consumer appeal, particularly as fixed charges are often disliked by consumers who do not fully appreciate and understand what the fixed charges are meant to cover.[10]

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9 For more information on electricity pricing in Victoria, see section 3.1.4.

10 The banking industry provides analogous consumer offerings. Many customers prefer credit cards with no annual fee, even though the interest rate on purchases may be higher. Alternatively, consumers may prefer to pay an annual fee if that provides them with some additional rewards such as insurance products or frequent flyer points. Fee-free transaction accounts may also be attractive even if the charges for specific services (such as over-the-counter transactions) are higher, if the customer does not anticipate making many transactions that have higher fees associated with them.

In some ways, declining block tariffs also reflect economies of scale in using fixed existing infrastructure to deliver more electricity, within existing generation and network capacity limits. In some competitive markets, declining block tariffs and/or higher fixed charges may be a way of marketing to the higher usage and therefore higher value customers that the retailer would like to attract, while the lower usage customers who are not attractive to the retailer may be discouraged from using the services of that retailer.

Time-based tariffs may also include block tariff structures, but are less likely to do so, because the pricing signals can be given in the differentiation between different time-based rates, and therefore blocks become redundant. While technically feasible, combining TOU tariffs with block tariffs may unnecessarily increase complexity.

2.7. DYNAMIC TOU PRICING

Dynamic TOU pricing allows for the time when certain tariffs apply to be set "dynamically" as the need arises, perhaps with one or two days' warning. Implementations and trials of dynamic TOU pricing, which are discussed in sections 3 and 4 below, have centred on Dynamic Peak Pricing (DPP), otherwise known as Critical Peak Pricing (CPP). In these trials, the aim is to apply higher prices, often substantially higher, for a very limited number of days and hours per year, at times of particularly heavy demand, to give a strong pricing signal to consumers to reduce their usage of electricity in these periods.

2.8. METERING TO SUPPORT FLEXIBLE PRICING

As discussed in section 2.1 above, in the past, flexible pricing in the form of TOU tariffs were supported by complex metering arrangements, with multiple TOU meters and registers, and switching mechanisms that were generally based on mechanical clocks and calendars within the metering system, to ensure that electricity usage was recorded on the appropriate meter registers to allow the TOU tariff to be implemented.

For several years, it has generally been more economical to use a more modern interval electronic meter to support any kind of time-based tariffs, rather than using more complex multi-register or multi-meter arrangements with older Ferraris disk meters. Thus interval meters have become commonplace, whether or not they are remotely read.

This report is focused on tariffs rather than meters, and therefore it considers flexible pricing and TOU tariffs in general, whatever metering arrangements are supporting the tariffs.

TOU tariffs sometimes include control mechanisms. For example, controlled load tariffs in Victoria and elsewhere in Australia have been based on specific electrical circuits at the customer's premise being energised and de-energised only at certain non-peak times, and the use of electricity on loads attached to those circuits has attracted a lower charge on that basis. These control mechanisms may be based on time-switches onsite, or external signalling – using for example ripple control. This report considers flexible pricing and TOU tariffs as a whole, whether or not they are associated with control mechanisms and whatever the form of any control mechanism.

In recent years, there has also been considerable growth in on-site distributed generation, particularly renewable generation, with feed-in tariffs that reward renewable generation at a higher rate per unit of energy generated. Solar generation is often particularly rewarded with a premium feed-in tariff. Where there is such on-site generation with feed-in tariffs in place, metering is now required to be bi-directional to measure both import and export. There are many types of feed-in tariffs, both net and gross. Flexible pricing and TOU tariffs may apply to both import and export of electricity, and may have different application in conjunction with feed-in tariffs, but full analysis of feed-in tariffs is beyond the scope of this report.

2.9. COMPARISON OF PRODUCTION IMPLEMENTATION AND TRIALS OF FLEXIBLE PRICING

In using the term "production implementation" of flexible pricing, we are referring to pricing arrangements and tariffs that are implemented as part of the everyday business of an electricity retailer. They are intended to give the retailer a margin on its business. Because electricity is regarded as an essential service, tariffs also take into account government social policy. In a competitive retail market, tariffs have regard to competitive pressures as between retailers. In price regulated markets, the tariffs may be set by a government or regulator, or may be set by the retailer subject to meeting criteria that are derived from government or regulatory requirements. Even in the most deregulated competitive retail electricity markets, retailers do not always have full freedom to set tariffs; generally even in the absence of price regulation there are bounds to the retailers' freedom.

Trials differ from production implementation of tariffs in that trials are not for the purpose of providing a retailer with a margin. Rather they are, by definition, for the purpose of trialling. Trials involve different motivations, processes and outcomes:

- Customers can be given incentives to participate in trials, and these incentives can be at higher levels to encourage participation which would not be economic or sustainable in production implementation of tariffs.
- Tariffs in trials can be set to test consumer reactions, and may bear no resemblance to cost reflectivity or cost neutrality.
- Trials generally require little or no government / regulatory agreement to proceed, and are largely unregulated.
- Participation in trials is voluntary; there is no customer angst from being "forced" onto new arrangements.

- Costs in trials are generally borne by the party that wishes to run the trials; there is generally no attempt to pass those costs onto customers directly.[11]
- The party running the trials will generally put disproportionately more resource into a trial, at a level which is not economic in production, to try to assure success.

11 There are provisions in the National Electricity Law in Australia for cost recovery for certain smart meter related trials that are requested by a Minister. For more information on this subject, see the files listed under the heading *National Electricity Law and Rules Amendments* at www.mce.gov.au/emr/smart_meters/default.html.

3. PRODUCTION IMPLEMENTATION OF FLEXIBLE PRICING

This report section provides some examples of flexible pricing arrangements that we have researched that are in production implementation. As discussed in section 2.9 above, in using the term "production implementation" of flexible pricing, we are referring to pricing arrangements and tariffs that are implemented as part of the everyday business of an electricity retailer.

As mentioned in section 1 above, the exclusion of any particular jurisdiction or pricing arrangement from this report section does not mean that there has been no implementation of flexible pricing in that jurisdiction, but rather that the information could not be readily sourced and included here in this report in the time available to complete this study.

Almost all utilities (retailers and networks) that are undertaking rollouts of smart metering are offering flexible pricing, and one of the many reasons for rolling out smart meters is generally because of the capability for flexible pricing that smart metering offers.

Further, as discussed above, some flexible pricing arrangements can be implemented even without smart metering, so not all the flexible pricing arrangements mentioned here are backed by smart metering.

Examples are brought in this section from the following jurisdictions:

- Australia: Australian Capital Territory; New South Wales; Queensland; Victoria;
- Ontario, Canada;
- England and Wales;
- France;
- Arizona, USA;
- Baltimore, Maryland, USA; and
- California, USA.

3.1. AUSTRALIA

3.1.1. Australian Capital Territory

Residential flexible pricing

ActewAGL offers a residential three-part TOU tariff in the ACT, known as the Always Home@ActewAGL SmartSaver plan.[12] This plan is available to customers with a meter able to be read as a time-of-use meter and to recharge facilities for electric vehicles on residential premises.[13]

All new and replacement meters installed in ACT residences since March 2007 are recording consumption at Peak, Shoulder and Residential Off-peak times. Peak times are 7.00am to 9.00am and 5.00pm to 8.00pm daily, Shoulder times are 9.00am to 5.00pm and 8.00pm to 10.00pm daily and Residential Off-peak times are all other times. These are Australian Eastern Standard Times and are not adjusted for Daylight Saving. The Always Home@ActewAGL SmartSaver plan offers customers with these meters different energy rates for these times. If a residential consumer with a load of 7,000 kWh moves to this tariff and has an average mix of Peak, Shoulder and Residential Off-peak energy, their bill would be about 3.6% cheaper than the standard Always Home@ActewAGL plan. If they are able to shift load from Peak times to Shoulder and Residential Off-peak times, they can further reduce their energy bills. For example, the cost of electricity to run washing machines and dishwashers at Residential Off-peak times is 47% lower than the cost of energy to run them in Peak times.[14]

Table 1 below shows the Always Home@ActewAGL SmartSaver plan rates from 1 July 2011 in ACT.

12 See www.actewagl.com.au/Product-and-services/Prices/Residential-prices/ACT-residential-prices/ACT-residential-electricity-prices-2011-12.aspx#Always4

13 See www.actewagl.com.au/~/media/ActewAGL/ActewAGL-Files/Products-and-services/Retail-prices/Electricity-retail-prices/ACT-electricity-retail-brochure-2011-12.ashx

14 See www.actewagl.com.au/Product-and-services/Prices/Residential-prices/Pricing-FAQs.aspx

Table 1: Always Home@ActewAGL SmartSaver plan rates from 1 July 2011 in ACT

	GST exc	GST inc
Supply fee (per day)	51.00¢	56.10¢
Or, with direct debit discount	46.00¢	50.60¢
Usage rate (¢ per kWh):		
• Peak (7-9am, 5-8 pm)	19.30¢	21.230¢
• Shoulder (9am-5pm, 8-10pm)	14.00¢	15.400¢
• Off-peak (all other times)	10.14¢	11.154¢

The equivalent standard flat rate Always Home@ActewAGL plan has the same daily supply fee, and a single usage rate of 15.15/kWh exc GST (16.665¢/kWh inc GST).[15]

ActewAGL also has residential off-peak rates "Off-Peak 1" and "Off-Peak Saver Electricity plan" which are more traditional off-peak rates for controlled loads.[16]

Business flexible pricing

ActewAGL offers a business three-part TOU tariff, known as the Business Incentive plan.[17]

Table 2 below shows the ActewAGL Business Incentive plan rates from 1 July 2011 in ACT.

15 See www.actewagl.com.au/Product-and-services/Prices/Residential-prices/ACT-residential-prices/ACT-residential-electricity-prices-2011-12.aspx#Always4

16 See www.actewagl.com.au/Product-and-services/Prices/Residential-prices/Pricing-FAQs.aspx - "Can I have off-peak hot water on the Always Home@ActewAGL SmartSaver plan?" – Yes, customers on the Always Home@ActewAGL SmartSaver plan have the option of the Off-Peak Saver Electricity plan and/or the Off-Peak 1 Electricity plan. However, residential controlled off-peak energy rate is available only to consumers who do not have their meter read as an interval meter.

17 See www.actewagl.com.au/Product-and-services/Prices/Business-prices/ACT-business-prices/ACT-business-electricity-prices-2011-12.aspx#businessincentive

Table 2: ActewAGL Business Incentive plan rates from 1 July 2011 in ACT

	GST exc	GST inc
Supply fee (per day)	77.40¢	85.14¢
Usage rate (¢ per kWh):		
• Business times (7am-5pm weekdays)	26.70¢	29.370¢
• Evening times (5pm-10pm weekdays)	18.37¢	20.207¢
• Business off-peak (all other times)	9.40¢	10.340¢

The equivalent standard flat rate Business plan has the same daily supply fee, and a blocked tariff rate for the first 330 kWh per day of 19.50¢/kWh exc GST (21.450¢/kWh inc GST).[18]

ActewAGL also has business off-peak rates "Off-Peak 1" and "Off-Peak Saver Electricity plan" which are more traditional off-peak rates for controlled loads.[19]

3.1.2. New South Wales

EnergyAustralia

EnergyAustralia[20] introduced a PowerSmart Home TOU tariff that is now the standard tariff for residential customers with interval meters in the Ausgrid area in NSW.[21]

Figure 7 below shows the EnergyAustralia PowerSmart Home tariff periods.

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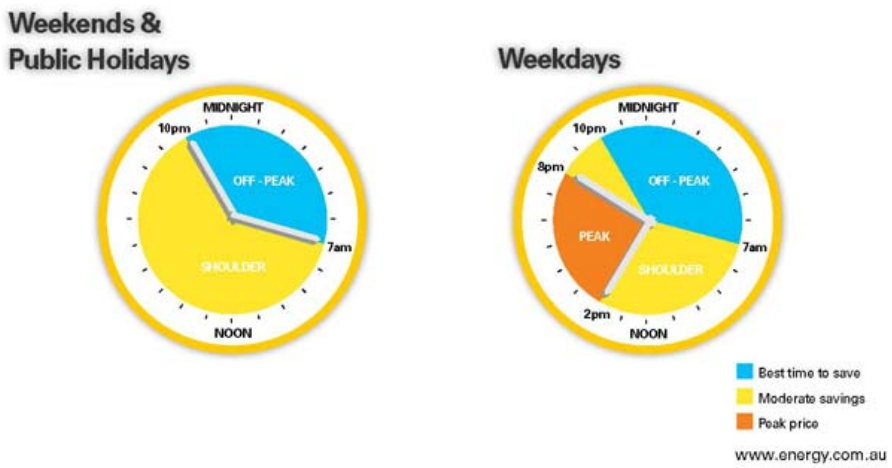
18 See www.actewagl.com.au/Product-and-services/Prices/Business-prices/ACT-business-prices/ACT-business-electricity-prices-2011-12.aspx#businessplan. A higher rate of 23.20¢/kWh exc GST (25.520¢/kWh inc GST) applies for usage above 330 kWh per day.

19 See www.actewagl.com.au/Product-and-services/Prices/Business-prices/ACT-business-prices/ACT-business-electricity-prices-2011-12.aspx#offpeak1 and www.actewagl.com.au/Product-and-services/Prices/Business-prices/ACT-business-prices/ACT-business-electricity-prices-2011-12.aspx#offpeaksaver

20 EnergyAustralia was a NSW Government state-owned retailer and distributor. Since 1 March 2011, the retail business has been owned by TRUenergy, and trades under both the EnergyAustralia brand and the TRUenergy brand. The distribution business remains state-owned, and now trades as Ausgrid. References in this report to Ausgrid are to the distribution business. References in this report to EnergyAustralia are generally to the retail business. Where this report uses the name EnergyAustralia to refer to the distribution business that was part of EnergyAustralia prior to March 2011, this is stated explicitly.

21 See www.energyaustralia.com.au/nsw/residential/products_and_services/electricity/powersmart_home for more information on this TOU tariff.

Figure 7: EnergyAustralia PowerSmart Home tariff periods



The rates on this tariff from 1 July 2011 are as shown in Table 3 below.

Table 3: EnergyAustralia PowerSmart Home tariff rates from 1 July 2011 in the Ausgrid area in NSW

Times	Ex GST	Inc GST	Unit
Shoulder 7am to 2pm & 8pm to 10pm working weekdays and 7am to 10pm on weekends and public holidays	16.4000	18.0400	cents/kWh
Peak 2pm to 8pm on working weekdays	40.6000	44.6600	cents/kWh
Off-Peak All other times	9.6000	10.5600	cents/kWh
Service Availability Charge	59.0000	64.9000	cents / day / connection point

Please note: in addition to the new PowerSmart rates, if you had Off Peak 1 or Off Peak 2 supply shown on your bills before you were billed PowerSmart Home rates, you'll continue to pay the regulated rates as published on our website for this supply.[22]

The tariff is based on an equivalent Ausgrid (previously EnergyAustralia) network tariff where the same time periods are defined for peak, shoulder and off-peak tariffs.

The tariff is largely supported by manually read interval meters which Ausgrid has been rolling out for several years.[23]

22 See www.energyaustralia.com.au/nsw/residential/products_and_services/electricity/powersmart_home/pricing

EnergyAustralia has stated that the reason for introducing the tariff is as follows:[24]

> Over time, there has been a substantial growth in electricity demand, in particular an increase at certain times, known as 'peak demand'. Increased usages of appliances such as reverse cycle air conditioners and the use of more and larger electrical appliances in people's homes together with increased business demand is driving this trend.
>
> If we do nothing to limit the growth in demand, investment is likely to continue to increase in the foreseeable future and this may lead to higher electricity prices.
>
> So, like many utilities around the world, EnergyAustralia wants to actively work with its customers to encourage more efficient use of electricity and help reduce peak demand.
>
> In moving to this system, EnergyAustralia understands that electricity customers want to be able to continue with household activities like heating and cooling, cooking, watching tv and using their computer when they want, while continuing to receive an affordable electricity bill.
>
> … PowerSmart Home was being introduced to make the way people pay for their electricity fairer for the majority of customers. Reducing electricity consumption during times of peak demand will help make future investment in expensive, new infrastructure more efficient. This is designed to help keep electricity prices down in the future.

EnergyAustralia has stated that over 70 per cent of its customers paid less on the TOU tariff than they would otherwise on a single rate tariff. Nonetheless, there were customers who were paying more on the TOU tariff than they would have done on a single rate tariff, and there was some adverse press coverage of these issues over a period of time,[25] leading to a decision by EnergyAustralia in April 2010[26] to allow customers to switch from the TOU tariff to a single rate tariff, acknowledging that the PowerSmart Home TOU tariff may not be right for all customers.[27] It is these customers which the press has highlighted, and not the large set of customers that are saving through TOU tariffs.

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23 See www.energyaustralia.com.au/nsw/residential/products_and_services/electricity/powersmart_home/metering

24 See www.energyaustralia.com.au/nsw/residential/products_and_services/electricity/powersmart_home/faq

25 An example of such press coverage is *Smart meters put heat on bills*, The Australian IT, 23 November 2009 – available at www.theaustralian.com.au/australian-it/smart-meters-put-heat-on-bills/story-e6frgakx-1225801980649

26 Examples of press coverage of the decision to allow customers to switch from the TOU tariff to the single rate tariff include:

EnergyAustralia's smart meters fail, Daily Telegraph, 22 April 2010 – available at www.dailytelegraph.com.au/news/sydney-nsw/energyaustralias-mart-meters-fail/story-e6freuzi-1225856611620

The press coverage referenced above also focused on the meters being the subject of discussion, rather than the tariffs. This highlights confusion in the media and in public perception generally between metering systems that have various functions including enabling TOU tariffs, and the TOU tariffs themselves.

EnergyAustralia has introduced similar TOU tariffs for business customers:

- PowerSmart for small and medium business customers who use under 40MWh of electricity per year.[28]
- LoadSmart for small and medium business customers who consume between 40MWh and 160MWh per annum which is approximately $7000 to $27,000 per year.[29]

The PowerSmart Business tariff times at which different rates apply, and the rates from 1 July 2011 are as shown in Table 4 below.

Energy Australia allows users to ditch smart meters, ABC News, 22 April 2010 – available at www.abc.net.au/news/stories/2010/04/22/2879675.htm

27 See www.energyaustralia.com.au/nsw/residential/products_and_services/electricity/powersmart_home/faq.

Q7. How will I know if PowerSmart Home is right for me?

PowerSmart Home may not be right for everyone and may depend on your lifestyle. For example if you are at home all day then it is most likely not for you, but if you are mainly home on weekends or nights and you use the majority of your appliances outside the weekday Peak period of 2pm - 8pm then PowerSmart Home may be right for you.

Q8. If I am not satisfied with PowerSmart Home rates can I revert back to the Domestic All Time rates?

Yes, if you find that PowerSmart Home rates are not suitable you can then change back to Domestic All Time rates. We can also help by calculating to see if you would be better off on PowerSmart Home rates or Domestic All Time rates. Please note: We allow customers to change twice, so a PowerSmart Home customer can opt out and they can opt in. However, this is the maximum number of changes permitted.

28 See www.energyaustralia.com.au/nsw/business/small_and_medium/products_and_services/electricity/powersmart

29 See www.energyaustralia.com.au/nsw/business/small_and_medium/products_and_services/electricity/loadsmart

Table 4: EnergyAustralia PowerSmart Business tariff rates from 1 July 2011 in the Ausgrid area in NSW

Times	Ex GST	Inc GST	Unit
Peak 2pm - 8pm on working weekdays	40.1000	44.1100	cents/kWh
Shoulder 7am to 2pm and 8pm to 10pm working weekdays and 7am to 10pm on weekends and public holidays	17.0000	18.7000	cents/kWh
Off Peak all other times	9.4000	10.3400	cents/kWh
Service Availability Charge	72.0000	79.2000	cents / day / connection point

The LoadSmart Business tariff times at which different rates apply, and the rates from 1 July 2011 are shown in Table 5 below.

Table 5: EnergyAustralia LoadSmart Business tariff rates from 1 July 2011 in the Ausgrid area in NSW

Times	Ex GST	Inc GST	Unit
Peak 2pm - 8pm on working weekdays	27.1000	29.8100	cents/kWh
Shoulder 7am to 2pm and 8pm to 10pm working weekdays	22.3000	24.5300	cents/kWh
Off Peak All other times (including all day on weekends and public holidays)	11.2000	12.3200	cents/kWh
Service Availability Charge	200.0000	220.2000	cents / day / connection point

For customers on the LoadSmart tariff, a capacity charge has been introduced to contribute to the cost of network capacity required to deliver electricity to the customer's premises. This will be based on the maximum demand for the year to date. It only applies for the peak period (2pm - 8pm on working weekdays).

3.1.3. Queensland

For many years, Queensland has had in place residential off-peak rates of Tariffs 31 and 33 that apply to electricity that is consumer on particular circuits that are only energised for a certain number of hours per day.[30] Under Tariff 33, the circuits are energised for at least 18 hours per day, while under Tariff 31 the circuits are energised for a minimum of only eight hours per day. As would be expected, the rate under Tariff 31 is lower than under Tariff 33, which in turn is lower than the standard peak rate.

In all cases, the switching times are controlled by the local distributors Energex and Ergon Energy, who use ripple control systems for switching.

In the past, the Tariffs have only been available for equipment that is hardwired (permanently connected) into the controlled load circuits. However, the conditions for accessing Tariff 33 were changed from 1 July 2011 to allow pool filtration and sanitation systems to access Tariff 33 through a standard power point connected to the circuit that measures usage on this tariff. As stated by Energex: "It has long been argued that any saving made with pool filtration and sanitation systems on Tariff 33 is soon lost when a system requires repair (potentially more regularly than hot water systems) with the expense of a licensed electrician for connection and disconnection. This will make it easier for householders needing a pump repaired, as an electrician will no longer be required."[31]

The Queensland Competition Authority (QCA) recently undertook a review of regulated retail electricity tariffs and prices, based on the State Government having endorsed an inclining block network tariff for domestic customers commencing 1 July 2012, and seeking to pass that structure through to end-use consumers in retail tariffs.[32] The new tariffs from 1 July 2012 will include new voluntary TOU tariffs for which Energex has proposed structures as shown in Figure 8 below. These structures will be subject to approval by the AER. The QCA is intending to approve retail TOU tariffs that will be based on the network TOU tariffs put in place by Energex.

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30 The standard tariffs apply across Queensland, in both the Energex and Ergon Energy networks areas, and are offered by all retailers serving the relevant class of customers. As such, there are many websites that describe the tariffs. One example is www.originenergy.com.au/2087/Electricity-tariffs-QLD.

31 For more information on this change, see www.cleanenergy.qld.gov.au/documents/Demand-side/110708-pool-pump-tariff33-factsheet.pdf, www.energex.com.au/residential-and-business/contact-energex/frequently-asked-questions/changes-to-pool-equipment-on-tariff-33-faq and www.ergon.com.au/your-home/accounts--and--billing/electricity-prices/pool-pump-connections

32 See www.qca.org.au/electricity-retail/RevEPandTS.

Figure 8: Energex's new TOU electricity tariff structures proposed to apply in Queensland from 1 July 2012

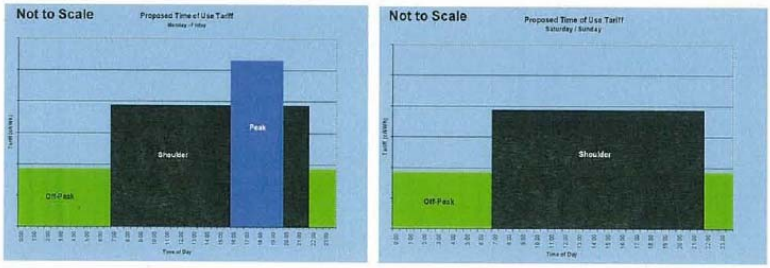
Proposed structure for the domestic time of use:

Fixed Service Charge (c/day)
+
Consumption charge (c/kWh) based on the following time of use structure:

Monday to Friday
- Off peak 10pm – 7am
- Shoulder 7am – 4pm, 8pm – 10pm
- Peak 4pm - 8pm

Saturday/Sunday
- Off peak 10pm – 7am
- Shoulder 7am - 10pm
- No Peak

The proposed structure is illustrated below:



Proposed changes to the times associated with business non-demand time of use:

Fixed Service Charge (c/day)
+
Consumption charge (c/kWh) based on the following time of use structure:

- Off peak 9pm – 7am
- Shoulder 7am – 12pm
- Peak 12pm – 9pm

3.1.4. Victoria

Historical and existing tariffs

As mentioned in section 2.5 above, the Winner tariff is a Victorian residential time-based tariff that has been in place for many years and has sought to charge more for peak use at the same time as charging less for off-peak use. There are also five-day and seven-day small business tariffs in Victoria based on the same concept of charging more for peak and less for off-peak than would be the case for a single rate tariff.

Table 6 below shows an example tariff of this sort in Victoria, which does not require a smart meter to operate.[33]

Table 6: AGL standard residential 5-Day Time-of-Use (Weekend Saver) tariff applicable in the Jemena distribution area from 1 January 2012

	Exc GST	Inc GST
Peak consumption	27.95	30.745 c/kWh
Off-Peak consumption	14.07	15.477 c/kWh
Service charge	109.64	120.604 c/day

Peak charges apply 7am to 11pm AEST Monday to Friday all year unless you have a remotely read interval meter, in which case daylight savings time will apply if relevant. Off-peak is all other times. Tariff closed to premises not already taking supply under this tariff, new connections and installation of interval meters.

Other existing controlled load tariffs charge less for off-peak use, and generally have charged the same for other (peak) use as would be charged under a single rate tariff. In recent years, however, some retailers have increased the rates for peak usage on controlled load tariffs above the rate that they would charge for usage on single rate tariffs.

Table 7 below shows an example controlled load tariff in Victoria.[34]

Table 7: TRUenergy standard controlled load tariff applicable in the United Energy distribution area from 1 January 2012

	Exc GST	Inc GST
All consumption other than controlled load	20.50	22.550 c/kWh
Controlled load consumption	13.70	15.070 c/kWh
Supply charge	88.00	96.800 c/day

In the above tariff, the equivalent standard tariff for flat rate usage in the absence of any controlled load would also be 20.50c/kWh exc GST; 22.550 c/kWh

33 This is an AGL standard tariff applicable in the Jemena distribution area from 1 January 2012, downloaded from www.agl.com.au/Downloads/AGL_VIC_Elec_Gazette_effective_1Jan12.pdf

34 This is a TRUenergy standard tariff applicable in the United Energy distribution area from 1 January 2012, downloaded from www.truenergy.com.au/PricingRatesPDFLookup/Data/Docs/PDFsNov2011/eSOT_UnitedEnergy_Res_Jan2012_v2.pdf

Table 8 below shows another example of a retailer's standard tariff for controlled load. In this case, the rates are the same with or without controlled load for the non controlled element of the charges, except that a higher fixed charge is levied in the case where controlled load is present (an extra 9c/day exc GST is charged if controlled load is present).[35]

Table 8: Red Energy standard single rate and controlled load tariffs applicable in the United Energy distribution area from 7 February 2011

Table 2: Offers applicable for single rate meters with or without controlled loads for customers in United Energy Distribution area.

		Excluding GST			
Applicable Distributor	**Residential Electricity Price Plans**	**Fixed Charge c/day**	**Peak Summer Tariff c/kWh**	**Peak Winter Tariff c/kWh**	**Controlled Off Peak Tariff c/kWh**
United Energy	Single Rate	59.00	21.000	18.500	
	Two Rate	68.00	21.000	18.500	11.700
		Including GST			
Applicable Distributor	**Residential Electricity Price Plans**	**Fixed Charge c/day**	**Peak Summer Tariff c/kWh**	**Peak Winter Tariff c/kWh**	**Controlled Off Peak Tariff c/kWh**
United Energy	Single Rate	64.90	23.100	20.350	
	Two Rate	74.80	23.100	20.350	12.870

Single Rate Plans: Applicable to single rate meter.

Two Rate Plans: Applicable for single rate meters with a dedicated circuit meter (available only to current installations).

Peak: Tariff applicable 24 hours per day, 7 days per week.

Off Peak: Generally a 6 or 8 hour period between 10 pm–7 am, Monday–Sunday, actual hours controlled at the premises by a timeswitch associated with the dedicated circuit meter.

Summer Tariff: Charge applicable for all electricity consumed during Peak between 1 November–31 March.

Winter Tariff: Charge applicable for all electricity consumed during Peak between 1 April–31 October.

Controlled Off Peak Tariff: Charge applicable during Off Peak for electricity consumed on all timeswitch controlled dedicated off peak meters for hot water and/or storage space heating.

The tariffs shown above are just examples of the many such tariffs that are available in Victoria across electricity retailers, and across all the

Rollout of Advanced Metering Infrastructure (AMI) in Victoria

With the rollout of AMI, the opportunity arose for TOU tariffs to be applied across all customers with AMI meters installed.

In 2009, some Victorian electricity distributors published new TOU tariffs that would apply to customers with new smart meters from 1 January 2010, and some electricity retailers also published in the Victorian Government Gazette corresponding retail TOU tariffs based on these network tariffs.

Table 9 and Table 10 below show by way of example AGL retail tariffs that were published for two network areas to apply from 1 January 2010.[36]

35 This is a Red Energy standard tariff applicable in the United Energy distribution area from 7 February 2011, downloaded from www.redenergy.com.au/docs/Gazette-Prices-Final-VIC-70111.pdf

36 These were published in the Victorian Government Gazette No. S436 dated Tuesday 1 December 2009, available at www.gazette.vic.gov.au/gazette/Gazettes2009/GG2009S436.pdf

Table 9: AGL North (Jemena area) residential Time of Use Interval Meter retail tariff as published to apply from 1 January 2010

AGL Time of Use Interval Meter*			
Supply charge	89.00	97.900	c/day
Peak (7 am to 11 pm Monday to Friday)			
All consumption	24.98	27.478	c/kWh
Off-Peak (All other times)			
All consumption	7.65	8.415	c/kWh
Available to customers with an interval meter.			

Table 10: AGL South (United Energy area) residential and business Time of Day retail tariff as published to apply from 1 January 2010

AGL Time of Day Tariff *			
Supply charge	66.00	72.600	c/day
Peak (3 pm to 11 pm Monday to Friday)			
All consumption	29.80	32.780	c/kWh
Shoulder (7 am to 3 pm Monday to Friday)			
All consumption	21.20	23.320	c/kWh
Off-Peak (All other times)			
All consumption	8.20	9.020	c/kWh
Available to customers consuming <20MWh pa			

At the same time, in the same Gazettal, AGL annotated its other existing residential and business tariffs in the AGL South area as either closed to premises not already taking supply under the tariff, or only available to new connections where the AMI meter cannot be remotely read and interval data is not remotely collected. This would have meant that new customers and connections with an AMI meter that could be remotely read would only have the above TOU tariff available to them in AGL's standard tariff offerings.[37]

The AGL retail tariffs have the same names and structures as the underlying network tariffs. The underlying Jemena area and United Energy area network tariffs are shown in Table 11 and Table 12 below respectively.[38]

37 Other offerings would be available from other retailers, and not all of these would necessarily have been TOU or other flexible tariff offerings.

38 These tariffs are available at www.aer.gov.au/content/index.phtml/itemId/732643

Table 11: Jemena area residential Time of Use Interval Meter network tariff as published to apply from 1 January 2010 (exc GST)

A10I / F10I*	Time of Use Interval Meter	
Available to customers with an interval meter		
Peak: 7.00 AM to 11 PM "Mon - Fri" ; Off peak all other times		
- Standing charge	$/customer pa	$19.800
- Peak Unit rate	¢/kWh	10.179
- Off Peak Unit rate	¢/kWh	1.957

Table 12: United Energy area residential Time of Day network tariff as published to apply from 1 January 2010 (exc GST)

Component	Day of Week	Time of Day	Time of Year
Fixed Charge	All	N/A	All
Summer Peak Energy Charge	Workdays	3pm to 11pm local time	November to March inclusive
Non Summer Peak Energy Charge	Workdays	3pm to 11pm local time	April to October inclusive
Summer Shoulder Energy Charge	Workdays	7am to 3pm local time	November to March inclusive
Non Summer Shoulder Energy Charge	Workdays	7am to 3pm local time	April to October inclusive
Off Peak Energy Charge	Workdays, all day on Week Ends and Victorian Gazetted Public Holidays	11pm to 7am local time	All

Schedule of Network Use of System (NUOS) Tariffs: 1 January 2010 (GST Exclusive)

Description	Tariff Code	Network Tariff Component									Eligibility (consumption/ category)		Minimum Chargeable Rolling Demand
		Standing Charge (c/day)	Summer Peak Energy (c/kWh)	Non Summer Peak Energy Block 1 (c/kWh)	Non Summer Peak Energy Block 2 (c/kWh)	Summer Shoulder Energy (c/kWh)	Non Summer Shoulder Energy (c/kWh)	Off Peak Energy (c/kWh)	Rolling Peak Demand c/kVA/day	Summer Demand Incentive Charge c/kW/day or c/kVA/day	kVA	MWh pa	kVA
Time of Day	TOD	5.000	15.487	9.647		5.500	4.300	2.600				<20	

This is a 3-part time of day tariff for customers who consume less than 20 MWh per annum (therefore, this tariff is predominantly for residential customers). UED have revised peak times as system load analysis has shown the peak load has widened to later in the day (previously finished at 7pm, and now finishes at 11pm). Furthermore, to encourage usage away from peak times, UED have devised a shoulder period (7am to 3pm) as well as an off peak period (11pm to 7am) which empowers customers to shift their load away from the main system peak period.

Moratorium

On 22 March 2010, the Victorian Government announced a moratorium on the introduction of TOU pricing. A media release of that data announced: "Electricity distribution businesses have agreed to delay the introduction of time-of-use pricing until more work is done to protect vulnerable Victorians". The media release further stated that "the moratorium would enable a joint assessment between government, industry and consumer groups to:

- Ensure the current best practice consumer protection framework for Victorians continued to apply in conjunction with new tariffs;
- Consider the need for electricity concessions in light of the costs of the roll-out and potential equity impacts of new tariff arrangements;
- Examine options for the introduction of time-of-use pricing arrangements, including a pilot pricing trial to assess impacts;
- Regularly review the impact of time-of-use tariffs on Victorian families; and
- Investigate the need for an extensive consumer education campaign to provide clear information about smart meters, the new tariffs and what this means Victorians."[39]

The Victorian Government has announced more recently, in December 2011, its agreement with the electricity industry to delay the widespread introduction of flexible pricing rates until 2013:[40]

> *The Victorian Government has reached an agreement with the electricity distributors to delay the widespread introduction of flexible pricing rates until 2013. This ensures that before such offers are widely available, consumers have the right tools in place to make informed energy choices. Tools like web-portals and in-home displays will allow customers to make comparisons of any new pricing options.*
>
> *Throughout 2012, the Victorian Government will also fully assess customer impacts and make any necessary changes to consumer protections to provide the best opportunity for households and businesses to benefit from flexible pricing.*

39 *Moratorium to ensure smooth smart meter roll*-out, Media Release from the Minister for Energy & Resources, 22 March 2010, available at http://archive.premier.vic.gov.au/newsroom/9853.html

40 See www.dpi.vic.gov.au/smart-meters/flexible-pricing

Small scale solar generation tariffs

Notwithstanding the moratorium, there were requirements for a customer to move to a TOU tariff when the customer requested to be put on the Premium Feed-in Tariff (PFIT), which was implemented for small scale solar generation. This tariff is not open to new customers, but it continues to pay a minimum of $0.60/kWh for net exported generation from solar PV panels to customers already on this tariff. A new Transitional Feed-in Tariff (TFIT) started 1 January 2012 and is open to new applicants. The Transitional Feed-in Tariff scheme provides a guaranteed minimum credit of $0.25/kWh for eligible customers feeding electricity back into the grid.[41]

Table 13 below shows an example of current solar pricing from one retailer for a customer with solar PV on a Transitional Feed-in Tariff or a Premium Feed-In Tariff.[42]

Table 13: Red Energy residential Time of Use retail solar TFIT and PFIT tariffs applicable from 1 January 2012

Transitional Feed-In Tariffs

TFIT Solar		Including GST								
Applicable Distributor	Residential Electricity Price Plans	Fixed Charge c/day	Peak Summer Tariff c/kWh	Peak Winter Tariff c/kWh	Peak Tariff 1 c/kWh	Peak Step Qty kWh/Qtr	Peak Tariff 2 c/kWh	Shoulder Tariff c/kWh	Off Peak Tariff c/kWh	Export Tariff c/kWh
Jemena Network	TOU	71.06			27.28				11.55	-33.00
Citipower	TOU	57.20			23.32				10.23	-33.00
Powercor (zone 1)	TOU	66.44			25.96	1000	26.62		11.00	-33.00
Powercor (zone 2)	TOU	66.44			26.51	1000	27.39		11.11	-33.00
SP AusNet	TOU	66.00			23.10				12.98	-33.00
United Energy	Single Rate*	60.28			19.91					-33.00
	TOU	64.90	35.20	24.20				24.20	10.56	-33.00

* UE Single Rate available to solar customers with accepted Network Tariff Change Request

These TFIT tariffs apply to TFIT customers with approved existing solar installations with a maximum capacity of 5 kW.

41 Further information on current and previous Victorian feed-in tariffs can be found at www.dpi.vic.gov.au/energy/sustainable-energy/solar-energy/solar-energy-for-consumers/feed-in-tariffs

42 These tariffs are available at www.redenergy.com.au/docs/Solar-PFIT-Pricing.pdf

Premium Feed-In Tariffs

Applicable Distributor	Residential Electricity Price Plans	Including GST								
		Fixed Charge c/day	Peak Summer Tariff c/kWh	Peak Winter Tariff c/kWh	Peak Tariff 1 c/kWh	Peak Step Qty kWh/ quarter	Peak Tariff 2 c/kWh	Shoulder Tariff c/kWh	Off Peak Tariff c/kWh	Export Tariff c/kWh
Jemena Network	PFIT Solar	71.06			27.28	N/A			11.55	-68.20
Citipower	PFIT Solar	57.20			23.32	N/A			10.23	-68.20
Powercor (zone 1)	PFIT Solar	66.40			25.96	1000	26.62		11.00	-68.20
Powercor (zone 2)	PFIT Solar	66.40			26.51	1000	27.39		11.11	-68.20
SP Ausnet	PFIT Solar	66.00			23.10	N/A			12.98	-68.20
United Energy	PFIT Solar	64.90	35.20	24.20	N/A	N/A		24.20	10.56	-68.20

These PFIT tariffs apply to PFIT customers with approved existing solar installations with a maximum capacity of 5 kW.

For both sets of tariffs (TFIT and PFIT):

Time of Use Meters

Peak: 7am-11pm Monday-Friday.

Off Peak: All Other Times

Peak Tariff 1: Charge applicable during Peak up to and including the Peak Step Quantity of electricity.

Peak Tariff 2: Charge applicable during Peak for each kWh of electricity consumed above the Peak Step Quantity.

Off Peak Tariff: Charge applicable for all electricity consumed during Off Peak.

United Energy Time of Use meters

Peak: 3pm to 11pm Weekdays only. Summer/Winter differential rates.

Shoulder: 7:00 am to 3:00 pm Weekdays only. Currently charged same Summer/Winter

Off Peak: 11pm to 7:00 am Weekdays & all day on Weekends.

Summer: 1 Nov - 31 March. Winter: 1 April - 31 October.

Powercor (zone1) applies in the following postcodes where Powercor is distributor (otherwise zone 2 applies):

3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3228, 3230, 3231, 3232, 3235, 3240, 3325, 3328, 3329, 3330, 3331, 3332, 3333, 3334, 3335, 3337, 3431, 3432, 3433, 3434, 3435, 3437, 3438, 3440, 3441, 3442, 3444, 3446, 3458, 3764

Daylight Saving Times

All United Energy Plans use Eastern Standard Time (AEST) with Eastern Daylight Savings (DST) time during Daylight Savings. All other networks use Eastern Standard time (AEST). AEST and DST are as defined by the Victorian State Government.

3.2. ONTARIO, CANADA

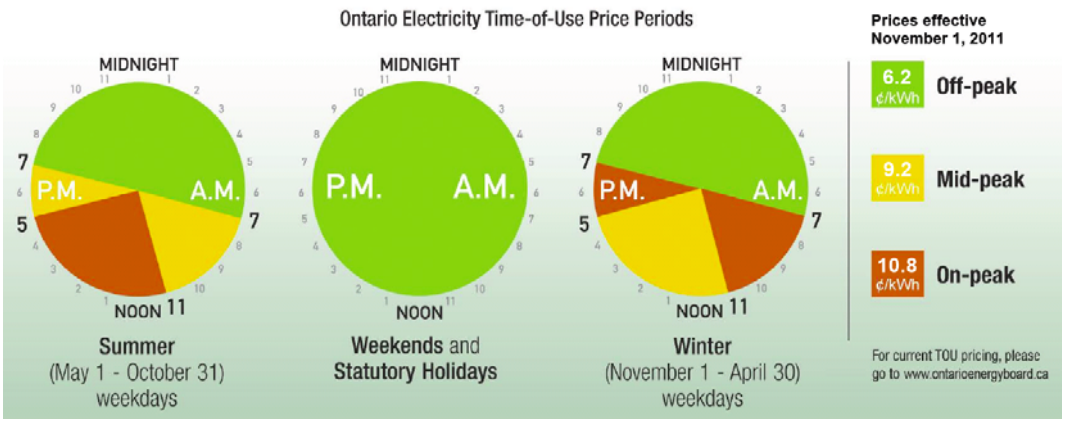
TOU tariffs are being rolled out in Ontario, Canada in conjunction with smart meter rollout. The smart meters being rolled out in Ontario record electricity consumption in hourly intervals. The Ontario Energy Board (OEB) has publicised that the smart meter rollout and TOU tariffs are intended to help customers to manage their electricity costs and be part of the province's conservation plan. Smart meters and TOU tariffs are described as new energy management tools that will help smooth peak demand for electricity. Both are being introduced across Ontario in a staggered fashion. The OEB advises that shifting your regular routine like when you do laundry can help smooth electricity peaks and create real supply and environmental benefits.[43]

The following tables and charts of tariffs were obtained from the OEB website.[44] These tariffs apply to consumers who purchase electricity from their local utility. They are set by the OEB as part of the Regulated Price Plan (RPP) for electricity prices in Ontario. For customers who instead purchase their electricity from a competitive electricity retailer, the prices they pay may be different and will be stated as stated in the individual customer-retail contract.[45]

Figure 9 below shows the TOU RPP electricity prices that were effective in Ontario from 1 November 2011. Prices are subject to change every six months.

On weekends and statutory holidays, all times of day are off-peak.

Figure 9: TOU Regulated Price Plan electricity prices that were effective in Ontario from 1 November 2011



43 See www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Smart+Meters

44 See www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Electricity+Prices

45 Ontario Electricity Retailers cater to consumers who want long-term electricity price protection. Electricity retailers in Ontario can provide a fixed electricity rate for up to five years. For residential consumers, electricity retailers generally offer one fixed price per kWh, regardless of when the electricity is used and how much hydro is consumed. See www.ontario-hydro.com

The RPP tariff applicable to customers that are not yet on TOU rates in Ontario is a single rate inclining block tariff (i.e. not time varying).

As shown in Table 14 below, the threshold that defines higher and lower electricity prices for residential RPP consumers is set at 600 kilowatt hours per month during the summer (1 May to 31 October) and 1,000 kilowatt hours per month during the winter (1 November to 30 April). This difference recognises that consumers use more electricity for lighting and indoor activity in the winter and that some Ontarians are reliant on electricity for their heating source.

Table 14: Seasonal summer and winter single rate inclining block tariff Regulated Price Plan rates in Ontario from 1 November 2011

Season	Your electricity use	The regulated price you pay (per kWh)	Applies to.
Prices effective November 1, 2011			
Summer (May 1 - Oct 31)	Up to 600 kWh	7.1 ¢	Residential consumers
	More than 600 kWh	8.3 ¢	
Winter (Nov 1 - April 30)	Up to 1,000 kWh	7.1 ¢	
	More than 1,000 kWh	8.3 ¢	
All seasons	Up to 750 kWh	7.1 ¢	Non-residential consumers
	More than 750 kWh	8.3 ¢	

The threshold for non-residential RPP consumers remains at 750 kilowatt hours per month for all seasons.

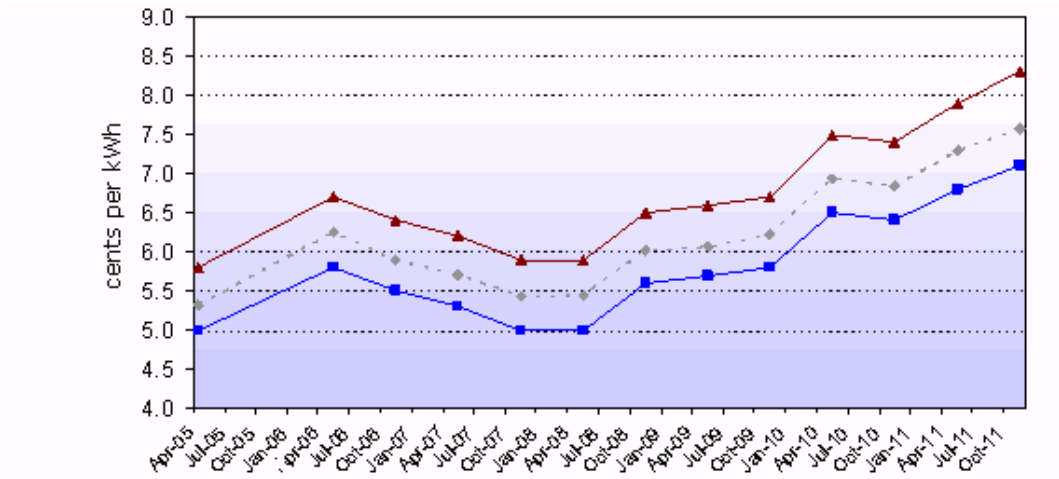
Table 15 below shows historic single rate inclining block tariff Regulated Retail Price rates and thresholds in Ontario.

Table 15: Historic single rate inclining block tariff Regulated Retail Price rates and thresholds in Ontario

Set By	Effective Date	Lower Tier Price (per kWh)	Residential Threshold for Lower Tier Price (per month)	Higher Tier Price (per kWh)
Ontario Energy Board	**Nov 1, 2011**	7.1¢	1,000 kWh	8.3¢
	May 1, 2011	6.8¢	600 kWh	7.9¢
	Nov 1, 2010	6.4¢	1,000 kWh	7.4¢
	May 1, 2010	6.5¢	600 kWh	7.5¢
	Nov 1, 2009	5.8¢	1,000 kWh	6.7¢
	May 1, 2009	5.7¢	600 kWh	6.6¢
	Nov 1, 2008	5.6¢	1,000 kWh	6.5¢
	May 1, 2008	5.0¢	600 kWh	5.9¢
	Nov 1, 2007	5.0¢	1,000 kWh	5.9¢
	May 1, 2007	5.3¢	600 kWh	6.2¢
	Nov 1, 2006	5.5¢	1,000 kWh	6.4¢
	May 1, 2006	5.8¢	600 kWh	6.7¢
	Nov 1, 2005	5.0¢	1,000 kWh	5.8¢
	Apr 1, 2005	5.0¢	750 kWh	5.8¢
Government Regulation	**Apr 1, 2004**	4.7¢	750 kWh	5.5¢
	Dec 9, 2002	4.3 ¢ per kWh/mo.		

Figure 10 below shows historic single rate inclining block tariff Regulated Price Plan electricity prices in Ontario.

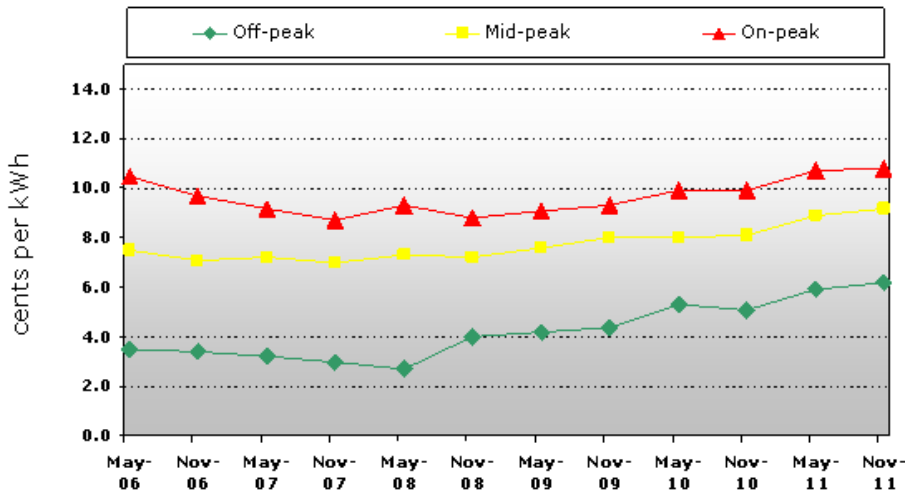
Figure 10: Historic single rate inclining block tariff Regulated Price Plan electricity prices in Ontario



	Apr-05	May-06	Nov-06	May-07	Nov-07	May-08	Nov-08	May-09	Nov-09	May-10	Nov-10	May-11	Nov-11
Ave RPP Price	5.318	6.256	5.896	5.704	5.429	5.450	6.020	6.072	6.215	6.938	6.838	7.298	7.565
Tier 1	5.0	5.8	5.5	5.3	5.0	5.0	5.6	5.7	5.8	6.5	6.4	6.8	7.1
Tier 2	5.8	6.7	6.4	6.2	5.9	5.9	6.5	6.6	6.7	7.5	7.4	7.9	8.3

Figure 11 below shows Regulated Price Plan TOU electricity prices in Ontario.

Figure 11: Historic Regulated Price Plan TOU electricity prices in Ontario



	May-06	Nov-06	May-07	Nov-07	May-08	Nov-08	May-09	Nov-09	May-10	Nov-10	May-11	Nov-11
Off-peak	3.5	3.4	3.2	3	2.7	4	4.2	4.4	5.3	5.1	5.9	6.2
Mid-peak	7.5	7.1	7.2	7.0	7.3	7.2	7.6	8	8	8.1	8.9	9.2
On-peak	10.5	9.7	9.2	8.7	9.3	8.8	9.1	9.3	9.9	9.9	10.7	10.8

Customer reactions

There have been some customer complaints about the new tariffs. This is to be expected; quite clearly some customers will pay more and some less on a TOU tariff as against a single rate tariff. Some of the complaints were found to be metering rather than tariff problems. In some cases, previous bills had been estimated, and the bill after the meter change and tariff change reflected an actual read and made up for a previous under-estimated reading.

An intriguing quote was reported from the Energy Minister in March 2011:[46]

> *Energy Minister Brad Duguid says on average, consumers are saving "modestly" with smart meters, but admits the majority are paying more, not less, for electricity since the meters were installed.*

It is unclear on what basis consumers were saving on average, but the majority were paying more. The same news story quoted the Opposition leader as saying that "people are paying more" with the smart meters (and hence TOU tariffs).

It was also reported at the time that about 4.5 million smart meters had been installed in homes and small businesses to switch them to TOU pricing for electricity and away from the old two-tiered system based only on total usage.

3.3. England and Wales

In England and Wales, the Economy 7 tariff was introduced in 1978 as a new off-peak tariff.[47] It featured a seven-hour night rate, and this was why the tariff was called Economy 7. When it was introduced, its night rate was said to be 20 per cent cheaper than most night-time tariffs that were available at that time, and was said to have been made possible by economies in the night-time operation of the system at that time.[48]

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46 *NDP, Tories complain smart hydro meters end up costing consumers more*, 680 News, 7 March 2011, available at www.680news.com/news/local/article/194055--ndp-tories-complain-smart-hydro-meters-end-up-costing-consumers-more

47 There is a Wikipedia entry for Economy 7 at http://en.wikipedia.org/wiki/Economy_7

48 For more information on the introduction of the Economy 7 in the context of other industry developments at the time, see for example *Electricity Supply in the United Kingdom – a chronology*, The Electricity Council, c. 1987, available at www.etk.ee.kth.se/personal/nt/elecpow/history

The Economy 7 tariff is still in use today, even though the England and Wales electricity supply industry has gone through significant changes in the intervening 33 years, including privatisation; restructuring to separate generation, transmission, retailing and distribution functions; changes to the fuel mix used in generation; the creation of a wholesale market; and retail competition.[49]

In earlier years, the Economy 7 tariff attracted higher fixed charges, and the same day rate as was charged on single rate tariffs. Therefore, it was fairly straightforward to decide whether one would be "better off" on the Economy 7 tariff than on the single rate tariff. If for example the additional fixed charge on Economy 7 was GBP10 per month, and the Economy 7 rate was say GBP0.05/kWh cheaper than the single rate tariff rate, the Economy 7 tariff would be more cost effective when the consumer used more than 200 night-rate units (kWh) per month (the break-even point calculation being GBP10 divided by GBP0.05).

More recently, the unit price for the day charge has increased above the single rate, meaning that the proportion of electricity used in the daytime vs. the night-time is the deciding factor. The rates during the night period can be approximately half the price of a single rate tariff. However, the price during the day period may approach double. By way of example, assuming no difference in the fixed charge, and no difference in total energy use on a single rate tariff vs. Economy 7, if the Economy 7 price is double the single rate tariff during the day period, and half the single rate tariff during the night period, to break even the consumer would need to use over two-thirds of their energy during the night period. Typically this is the case when space and water heating is electric rather than gas.[50]

For customers on Economy 7, storage heaters and hot water boilers are generally wired to be energised automatically only when the Economy 7 rate applies, but any appliances used during the seven hours of night rate attract the lower rate. Many people schedule their washing machines and dishwashers to take advantage of the lower rates – either using a built-in delayed start function, or via a plug-in timeswitch.

To support the tariff, a two-register Economy 7 meter was required – one to register day usage, and one to register usage during the seven hours when the night rate would apply. Most meters included a timeswitch to switch between the meter registers; in some regions radio teleswitching was deployed, based on data transmitted on a BBC radio signal frequency. Nowadays, interval meters can record the usage in the appropriate time periods to support the Economy 7 tariff, without switching between meter registers.

49 There are various up-to-date consumer guides to Economy 7 available online. See for example www.uswitch.com/gas-electricity/economy-7

50 This example was sourced (with some rewording) from http://en.wikipedia.org/wiki/Economy_7

In the earlier years, to encourage uptake to the tariff, there was no charge to a consumer wishing to install an Economy 7 meter to switch to take up the Economy 7 tariff. The cost of the meter change was effectively spread across all customers in regulated charges. Now in the competitive market there is more focus on cost-reflective pricing rather than having all customers bear part of the cost of another customer's decision, so there are fees for switching between tariffs.

A variant of Economy 7 known as Economy 7, and also known as Heatwise, was introduced more recently – in 2004. Similar to the Economy 7, this is designed to be used with high thermal mass heating such as storage heaters and under-floor heating, and is also used with electrical boilers driving radiators or water-based heat stores.

In contrast to Economy 7, which only provides off-peak electricity during night time hours, Economy 10 tariffs provide 10 hours of off-peak heating split between night, afternoon and evening. The advantage of this scheme is that by matching the storage periods better to the times when heat is required, less heat needs to be stored during the day, when there may be no demand for heating. The afternoon and evening periods also provide a top-up to heating systems at off-peak prices.

Off-peak electricity costs can be half of peak prices, but many Economy 10 tariffs levy an increased standing daily charge.

The structure of the 10 off peak hours is as follows:

- 3 hours in the afternoon (say 1pm - 4pm)
- 2 hours in the evening (say 8pm - 10pm)
- 5 hours overnight (say midnight - 5am)

Times vary between retailers and across regions.[51]

These TOU tariffs are purely voluntary; there is no requirement for a customer to take one of those tariffs rather than a single rate tariff. Rather, they were designed to encourage the uptake of storage heating systems that make use of off-peak electricity, and they serve that purpose. Economy 7 has been running for many years on that basis, and we are not aware of any significant consumer issues with its implementation.

51 Information on Economy 10 was sourced with some rewording from the Wikipedia article at http://en.wikipedia.org/wiki/Economy_10

There have been reports that Economy 7 has maybe been over-sold in some regions, causing a "1am peak" and putting unnecessary strains on the network at what should be off-peak times. It is understood that these have been resolved through staggering on times for the tariff, by resetting timeswitches or using differing tele-switching regimes.[52]

The UK is embarking on rollout of "smart meters" over the next few years, and we expect that more TOU tariffs will be offered in conjunction with the new meters.

3.4. FRANCE

Tempo is a voluntary EDF tariff which was launched in September 1993, and rolled out to be offered to all French households by the end of 1996. Before the official launch, EDF experimented with 800 households, over a three-year period from September 1989. The Tempo tariff remains in use today. The Tempo tariff sets network charges as high, low or medium in peak hours (6am to 10pm). High charges are designed red, medium charges are designated white and low charges are designated blue. These colours correspond to the colours of the French flag. Each day is designated as one of these colours. The colour for the next day is published on the EDF website at about 5.30pm the previous day,[53] it can be displayed on the meter in the customer's premise, and it can be sent to a customer by SMS or email subscription.[54]

There have been various studies of the Tempo tariff and its effects on consumer behaviour.[55]

3.5. ARIZONA, USA

The Salt River Project (SRP) in Central Arizona[56] has two TOU price plans, along with other price plans. SRP sets out high-level criteria to allow a customer to decide what plan might be most suitable for them.[57]

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52 See for instance the terms and conditions of one retailer EDF Energy at http://www2.savetodaysavetomorrow.com/Standard_Variable_further.html: "Night kWh will be supplied for a total of 7 hours between 10pm and 8am (actual times set by the local network operator) and these will be charged off the Night kWh rate". This gives the retailer and network operator some flexibility in the times of switching the tariff rates.

53 See (in French) http://bleuciel.edf.com/abonnement-et-contrat/les-prix/les-prix-de-l-electricite/option-tempo/la-couleur-du-jour-2585.html

54 For more information on the Tempo tariff as it applies today, see (in French) http://bleuciel.edf.com/abonnement-et-contrat/les-prix/les-prix-de-l-electricite/option-tempo/en-savoir-plus-52429.html

55 See for example *Real-Time Pricing of Electricity for Residential Customers: Econometric Analysis of an Experiment*, published in the Journal of Applied Econometrics, Vol 10, S171-191, 1995

56 The area covered by SRP is shown at www.srpnet.com/about/ServiceArea.aspx

The two TOU plans are called *Time-of use (TOU)* and *EZ3*.

Time-of-use is said to be good for customers who:

- Have an August bill (a peak summer month) of $200 or more
- Have a larger home or several people in the household
- Have a pool
- Can be flexible when using major appliances.

SRP claims that this *TOU* plan can save a customer up to 6% to 7% or more per year over the Basic Plan.

EZ3 is said to be good for customers who:

- Have an August bill (a peak summer month) of $135 or more
- Have a larger home
- Use major appliances daily
- Can limit or shift your energy use for just three hours.

SRP claims that this *EZ3* plan can save a customer up to 4% or more per year over the Basic Plan.

Clearly there is a common theme that a TOU plan may be best suited for those with high usage that they can shift away from peak use.

In contrast, the Basic (non-TOU) Plan is said to be good for customers who:

- Have an August bill (a peak summer month) of less than $135
- Have a small to average-size home
- Have someone often home during the day
- Use major appliances, but not on a daily basis
- Are a part-time resident.

As expected, these are customers with less usage that they can shift away from peak use.

57 See www.srpnet.com/prices/home/ChooseYourPricePlan.aspx

SRP Time-of-Use Price Plan

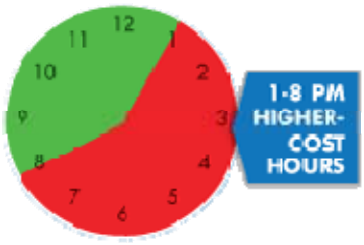
This plan prices energy higher for up to eight on-peak hours Monday to Friday. All other off-peak hours are lower-priced. On the SRP Time-of-Use plan:

- Customers save an average of 6%-7% annually over the Basic Plan by shifting some energy use to off-peak hours.
- Higher energy prices are charged for seven to eight hours Monday through Friday, depending on the season.
- All other off-peak hours are priced lower than SRP's Basic price plan.

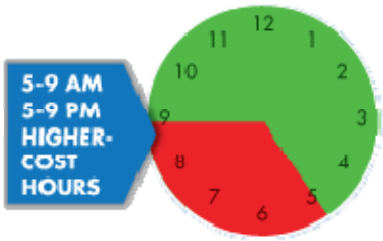
Figure 12 below shows the SRP TOU price periods.

Figure 12: Salt River Project in Central Arizona TOU price periods

Higher-cost, on-peak hours Monday - Friday



MAY TO OCTOBER
billing months



NOVEMBER TO APRIL
billing months

Lower-cost, off-peak hours include weekends, holidays and all weekday off-peak hours indicated in the green in the clocks above.

SRP provides a “90-day risk-free guarantee”:

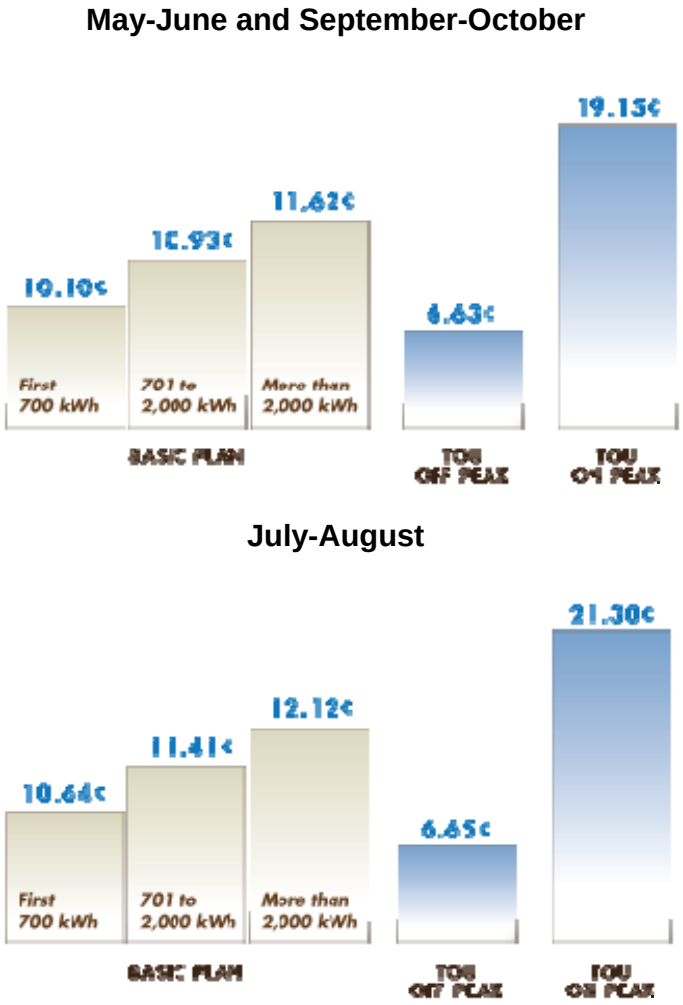
> *SRP Time-of-Use is a guaranteed way to save money on your energy bill. To start saving, simply switch to Time-of-Use between April 1st and Oct. 31, 2011, and shift your energy use to the lower-priced off-peak hours.*

> *If your first three bills exceed what you would have paid on the Basic plan, call SRP within 30 days of the third bill. You'll be credited the difference and returned to the Basic plan at no charge.*

Below are the current[58] energy prices per kilowatt-hour (kWh) for Time-of-Use compared to the Basic Plan under the present price plan.

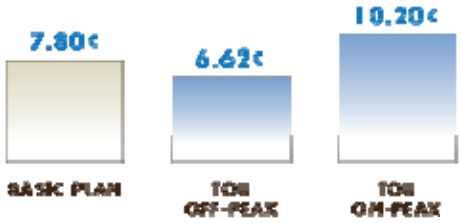
Figure 13 below shows SRP Basic Plan and TOU price comparisons.

Figure 13: Salt River Project in Central Arizona Basic Plan and TOU price comparisons



58 As at 20 February 2012

November-April



SRP EZ3 Price Plan

This plan charges premium energy prices during the on-peak hours of 3-6 p.m. Monday to Friday. All other off-peak hours are lower-priced.

- Customers save an average of 4% annually over the Basic Plan by significantly limiting on-peak energy use.
- A premium price is charged from 3-6 p.m. Monday through Friday.
- All other off-peak hours are priced lower than SRP's Basic Price Plan.
- Smart meters provide detailed information online to help customers manage energy costs.

Figure 14 below shows SRP EZ3 price periods.

Figure 14: Salt River Project in Central Arizona EZ3 price periods

Higher-cost, on-peak hours Monday - Friday

JANUARY-DECEMBER
On-peak hours apply year-round

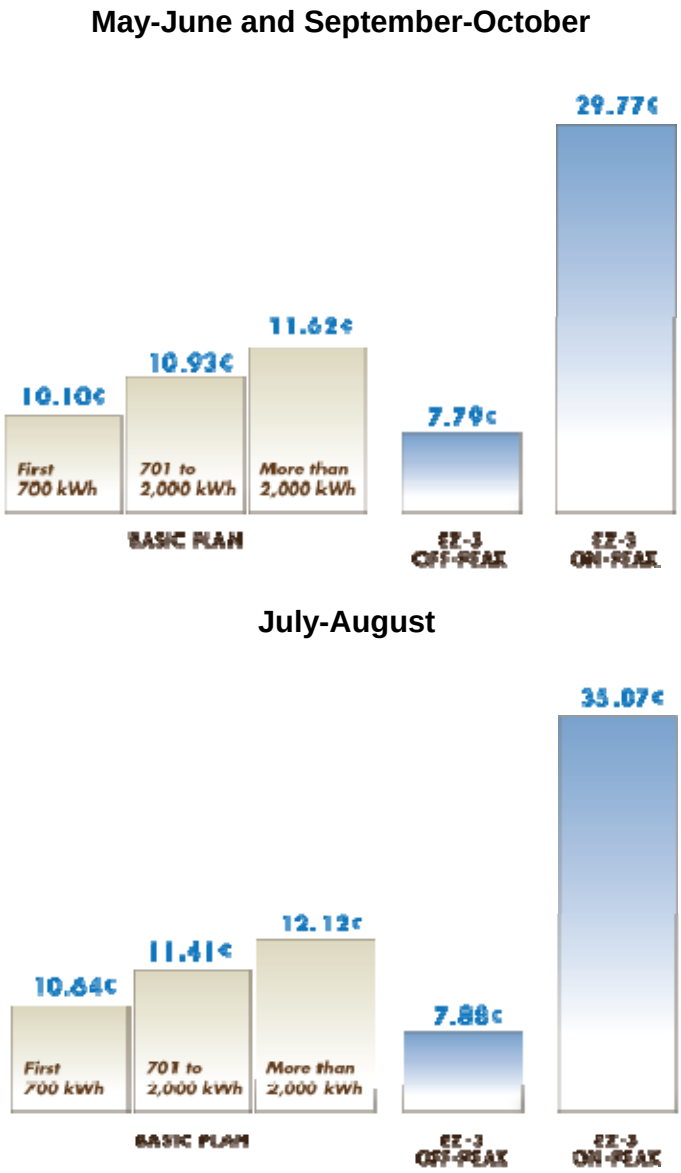
Lower-cost, off-peak hours include weekends, holidays and all weekday off-peak hours indicated in the green in the clocks above.

There is a 90-day risk-free guarantee, as for the TOU plan.

Below are the current[59] energy prices per kilowatt-hour (kWh) for EZ3 compared to the Basic Plan under the present price plan.

Figure 15 below shows SRP Basic Plan and EZ3 price comparisons.

Figure 15: Salt River Project in Central Arizona Basic Plan and EZ3 price comparisons



59 As at 20 February 2012

November-April

3.6. BALTIMORE, MARYLAND, USA

Baltimore Gas and Electric (BGE) have undertaken significant TOU tariff trials, the results of which have been written up by the Brattle Group and are discussed in section 4 below.

In June 2010, a BGE smart meter plan which included mandatory TOU pricing for residential customers was rejected by Maryland's Public Service Commission (PSC).[60] In denying the application, the PSC stated in regard to the proposal to impose mandatory TOU rates on all BGE residential electric customers that it agreed with Maryland Energy Administration witness Fred Jennings that before transitioning to TOU rates:

> *It is critical that customers: 1) Are provided sufficient education so as to understand the new tariff and how their behavior and decisions will affect their energy bill, and 2) Are provided the equipment and technology, such as in-home displays, orbs, electronic messaging, etc. to receive the requisite information that triggers behavior changes.*

The PSC decision added:

> *Yet the Proposal contains no concrete, detailed customer education plan, includes no orbs or other in-home displays, and provides for grossly inadequate messaging, in our view, to trigger the behavior changes contemplated under the Proposal. Moreover, we are persuaded that some of the Company's most vulnerable residential customers, such as low-income households, elderly customers, customers with medical needs for electricity that cannot be shifted to off-peak hours, or other customers who are "stay at home" are less likely to realize the potential benefits of TOU pricing than would the "average" residential customer. Any future BGE AMI proposal should be supported by alternative business cases reflecting both opt-out and opt-in TOU scenarios, and should address, in detail, whether and to what extent those scenarios would affect the Company's business case.*

60 Order no. 83410, available at http://webapp.psc.state.md.us/intranet/casenum/NewIndex3_VOpenFile.cfm?filepath=C:%5CCasenum%5C9200-9299%5C9208%5CItem_59%5C%5C59.pdf

BGE subsequently submitted a revised application which was accepted by the PSC in August 2010.[61] This revised application allowed customers to opt into TOU rates on a voluntary basis, and included a 66-page "Smart Grid Consumer Education and Communication Plan". BGE budgeted $66 million for communications and consumer education over the fourteen-year life of the Initiative, approximately $31 million of which will be spent during the initial deployment period. This total includes not just consumer education but also the cost of notifying customers of impending Peak Time Rebate opportunities as well as the development of the web portal.

3.7. CALIFORNIA, USA

A November 2010 presentation[62] explained that Pacific Gas & Electric (PG&E) is introducing various types of TOU pricing:[63]

- Standard TOU where energy costs vary by periods throughout the day which are defined as Peak, Part-Peak[64] and Off-Peak;
- Peak Day Pricing (PDP) where a surcharge is paid for usage on "event" days during peak "event" times, offset by lower prices on non-event days;[65] and
- Peak Time Rebate (PTR) which offers rebates for usage reductions on "event" days during peak "event" times.

PG&E is rolling out these tariffs to its residential and small business customers over a period of several years.

PG&E is marketing these plans under the *SmartRate* trade mark, and refers to them as a Summer Pricing Plan.

These tariffs form part of a Statewide initiative involving all Investor Owned Utilities (IOUs) and all customer classes. Customers will have a choice of plans and are to be provided with a bill comparison that evaluates the impact of different plans.

61 Order no. 83531, available at http://webapp.psc.state.md.us/Intranet/sitesearch/CN9208.pdf

62 *Dynamic Pricing and Customer Experience – a view from California*, Helen Priest, PG&E, at Smart Utilities Australia & New Zealand in Melbourne, Australia, November 2010

63 Information on PG&E's new TOU rates can be found at https://www.pge-smartrate.com.

64 The term Part-Peak is similar to Shoulder used in other jurisdictions

65 This is equivalent to what has been described in this report as dynamic peak pricing

Previously the tariffs were all single rate (not time varying) inclining block tariffs, and most customers are still on those tariffs. PG&E reported that customers were finding time varying pricing to be complicated and that it needs to be communicated multiple times and through multiple channels. Given that there was no previous experience of TOU rates, the introduction of these tariffs is a substantial change, affecting all customers. The program of introduction of the new tariffs aims to change customers' awareness of energy use and to change customer behaviour.

The new tariffs are supported by the rollout in California of "smart meters", and enabling technologies for energy management, including Home Area Networks (HANs) and automated demand response systems.

Customers' willingness to participate in new tariff programs is as expected driven by their perceptions of whether they will pay more or less under the new tariffs. The ability of customers to shift or shed load is a primary driver. Customers are also concerned about bill volatility and limited advance notice of higher priced "events".

PG&E also offers first year bill protection. To ensure that customers do not pay more with its Summer Pricing Plan, they receive automatic bill protection for their first full summer on the plan. At the end of the *SmartRate* summer season, PG&E will evaluate the customer's monthly savings and surcharges to determine if their participation resulted in overall bill savings. If the cumulative costs under the *SmartRate* Summer Pricing Plan exceed what the customer would have paid on their regular residential pricing plan, the difference will be reimbursed to the customer with a credit on their November energy statement (i.e. after the end of the Northern Hemisphere summer period). After the customer has completed their first full Summer Pricing Plan, bill protection will no long apply. The customer will receive two notifications before their bill protection expires.[66]

PG&E's efforts to publicise the tariffs and the high-priced events to consumers, and to gauge consumers' reactions have included:

- Pre-event bill review;
- Pre-event courtesy calls;
- Post-event courtesy calls;
- Post-event first bill review with load drop and shift recommendations;
- Post-season review; and
- Bill stabilisation expiration review.

66 See https://www.pge-smartrate.com/smartrate-details/smartrate-details-overview

4. TRIALS OF FLEXIBLE PRICING

As discussed in section 2.9 above, trials differ from production implementation of tariffs in that trials are not for the purpose of providing a retailer with a margin. Rather they are, by definition, for the purpose of trialling. Trials involve different motivations, processes and outcomes:

- Customers can be given incentives to participate in trials, and these incentives can be at higher levels to encourage participation which would not be economic or sustainable in production implementation of tariffs.
- Tariffs in trials can be set to test consumer reactions, and may bear no resemblance to cost reflectivity or cost neutrality.
- Trials generally require little or no government / regulatory agreement to proceed, and are largely unregulated.
- Participation in trials is voluntary; there is no customer angst from being "forced" onto new arrangements.
- Costs in trials are generally borne by the party that wishes to run the trials; there is generally no attempt to pass those costs onto customers directly.[67]
- The party running the trials will generally put disproportionately more resource into a trial, at a level which is not economic in production, to try to assure success.

This section provides information on trial results that have been collated by the Brattle Group, and conclusions that have been drawn by the Brattle Group, as these usefully compare and contrast results and draw conclusions.

There are many papers, presentation and reports that have been written by Brattle Group staff, which analyse findings including behavioural responses from many trials of various designs of TOU tariffs, some with and some without dynamic pricing components. Some of the material also considers the effects on behavioural responses from feedback such as In Home Displays, and other feedback mechanisms.[68] The material below is taken from several of these recent papers, presentation and reports.[69]

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67 There are provisions in the National Electricity Law in Australia for cost recovery for certain smart meter related trials that are requested by a Minister. For more information on this subject, see the files listed under the heading *National Electricity Law and Rules Amendments* at www.mce.gov.au/emr/smart_meters/default.html.

68 Many of the reports can be found on the webpage of Dr Ahmad Faruqui of the Brattle Group, at www.brattle.com/Experts/ExpertDetail.asp?ExpertID=164

69 This report draws in particular from the following resources:

Table 16 below shows a summary of time-based pricing products.

Table 16: Summary of time-based pricing products

Rate	Description
Time-of-Use (TOU)	Charges a higher price during all weekday peak hours and a discounted price during off-peak and weekend hours
Super Peak TOU	Similar to the TOU with the exception that the peak window is shorter in duration (often four hours), leading to a stronger price signal
Critical Peak Pricing (CPP)	Customers are charged a higher price during the peak period on a limited number of event days (often 15 or less); the rate is discounted during the remaining hours
CPP-TOU Combination	A TOU rate in which a moderate peak price applies during most peak hours of the year, but a higher peak price applies on limited event days
Peak Time Rebate (PTR)	The existing flat rate combined with a rebate for each unit of reduced demand below a pre-determined baseline estimate during peak times of event days
Flat Real Time Pricing (RTP)	A rate with hourly variation that follows LMPs, but with capacity costs allocated equally across all hours of the year
Critical Peak RTP	A rate with hourly variation based on LMPs and with a capacity cost adder focused only during event hours, creating a strong price signal at these times

The current state of dynamic pricing deployment

- TOU is the most commonly implemented time-based rate option for all customer classes and is largely deployed as a full-scale offering.
- CPP is more commonly tested through pricing pilots at this stage – although there are full-scale implementations.
- RTP is most typically deployed as a full-scale offering for C&I customers.
- PTR has only been tested through pilots as of yet – but this is likely to change.
- C&I customers are offered time-based rates much more frequently than the residential class and are more likely to be exposed to dynamic rates like RTP and CPP.

The Rediscovery of Demand-Side Management, by Ahmad Faruqui, The Brattle Group, Inc., presented at the TVA Board of Directors Meeting, 19 January 2012, available at www.brattle.com/_documents/UploadLibrary/Upload1006.pdf

The Tao of The Smart Grid by Ahmad Faruqui, The Brattle Group, Inc., 24 August 2011, available at www.brattle.com/_documents/UploadLibrary/Upload973.pdf

Dynamic Pricing: Past, Present, and Future by Sanem Sergici and Ahmad Faruqui, The Brattle Group, Inc., 14 June 2011, available at www.brattle.com/_documents/UploadLibrary/Upload956.pdf

Figure 16 below illustrates various flexible pricing designs, showing TOU with a small price increase at peak times, CPP with a very large differential in peak vs. off-peak prices, and Real Time Pricing (RTP), each contrasted with a flat rate in the absence of flexible pricing.

Figure 16: Illustrative flexible pricing designs

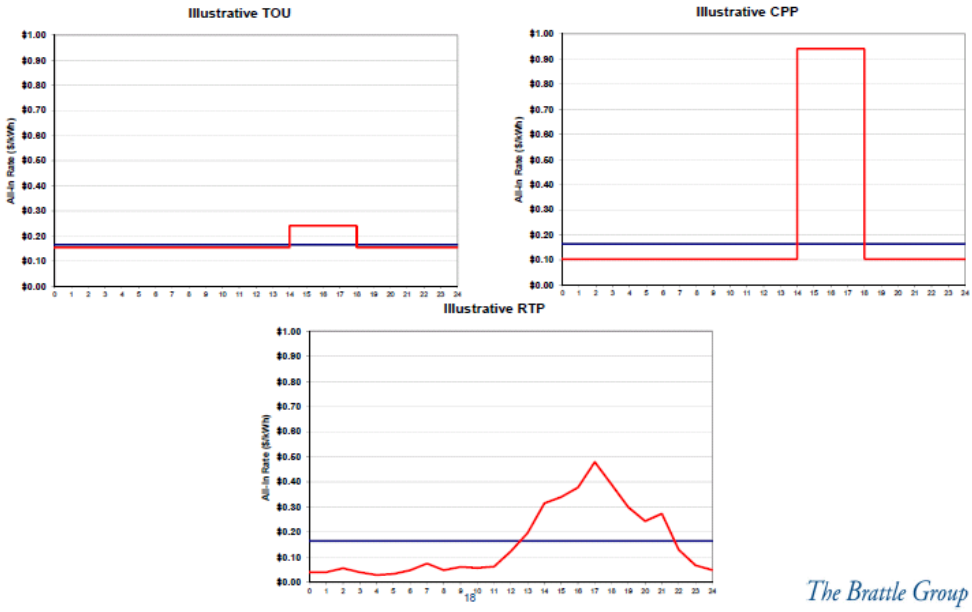
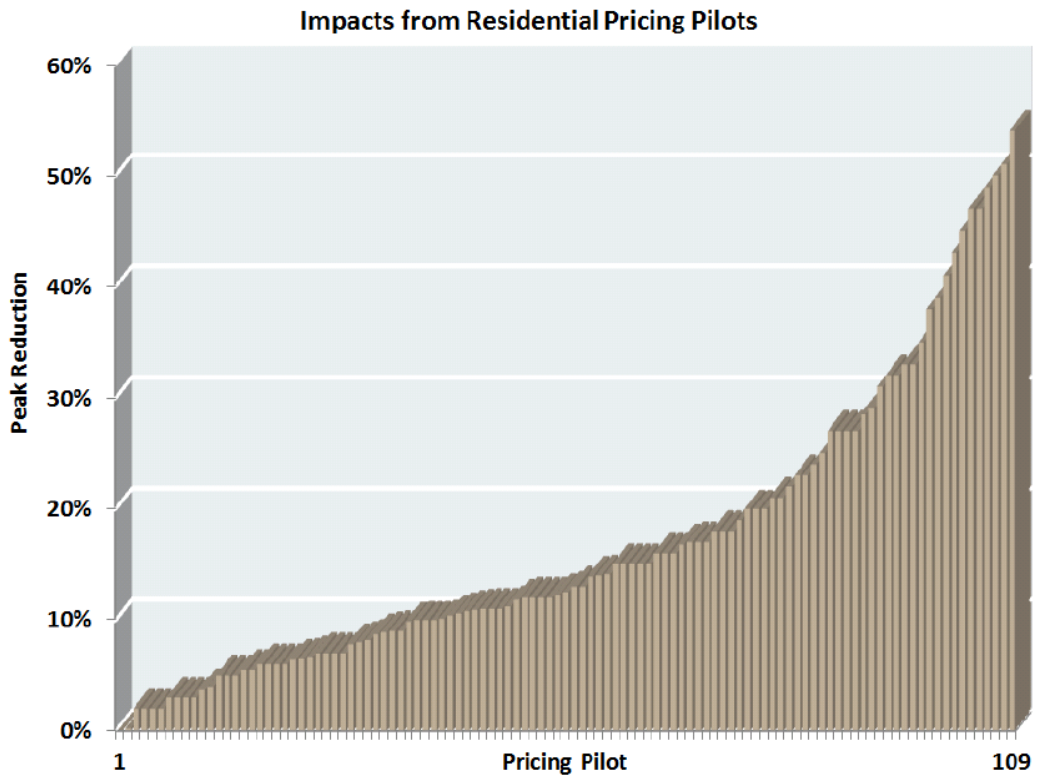


Figure 17 below shows peak reduction impacts from 109 residential pricing trials, ordered by the magnitude of the peak reduction achieved in the trial. As can be seen, the peak reductions range from more or less zero, to peak reduction over 50%.

Figure 17: Peak reduction impacts from residential pricing trials



Why are there variations in impacts?

Rate, technology, and pilot design are only part of the puzzle.

Other factors include:

- Price signal;
- Central-air conditioning (CAC) saturation;
- Other appliance saturation;
- Type of enabling technology;
- Weather;
- Socio-demographic factors; and
- Marketing/incentives/education.

Figure 18 below shows peak reductions from 109 trials, ordered first by the type of flexible pricing that is deployed (rate design), and with and without enabling technology. Then within each of these categories, the trials are ordered by the size of the peak reduction. This figure illustrates the range of peak reduction that can be achieved for each type of flexible pricing, and how enabling technology can further enhance consumer engagement and response.

Figure 18: Peak reductions by rate and technology

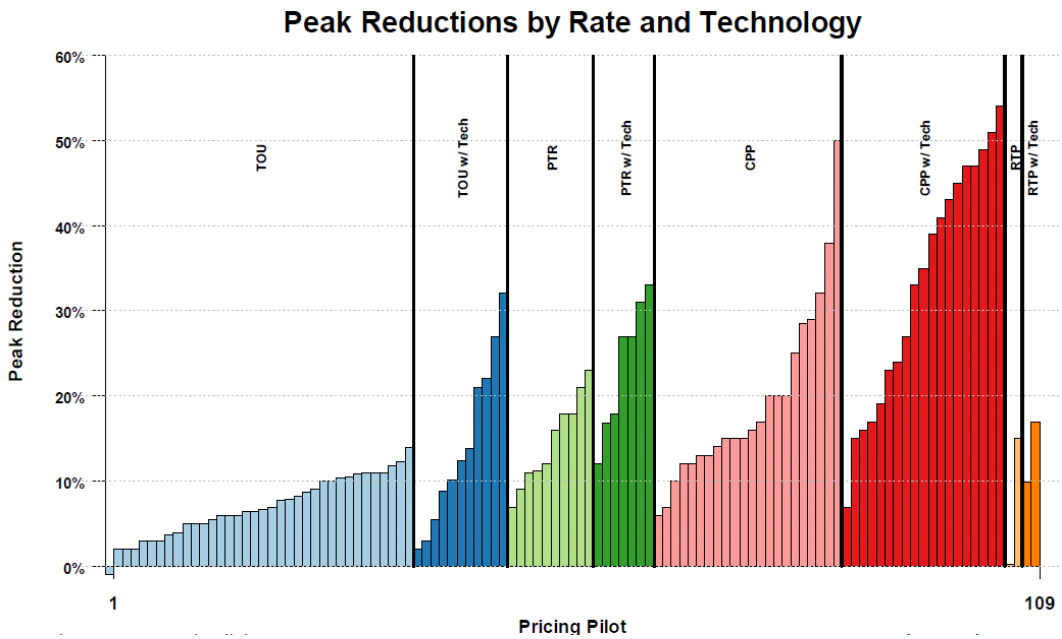
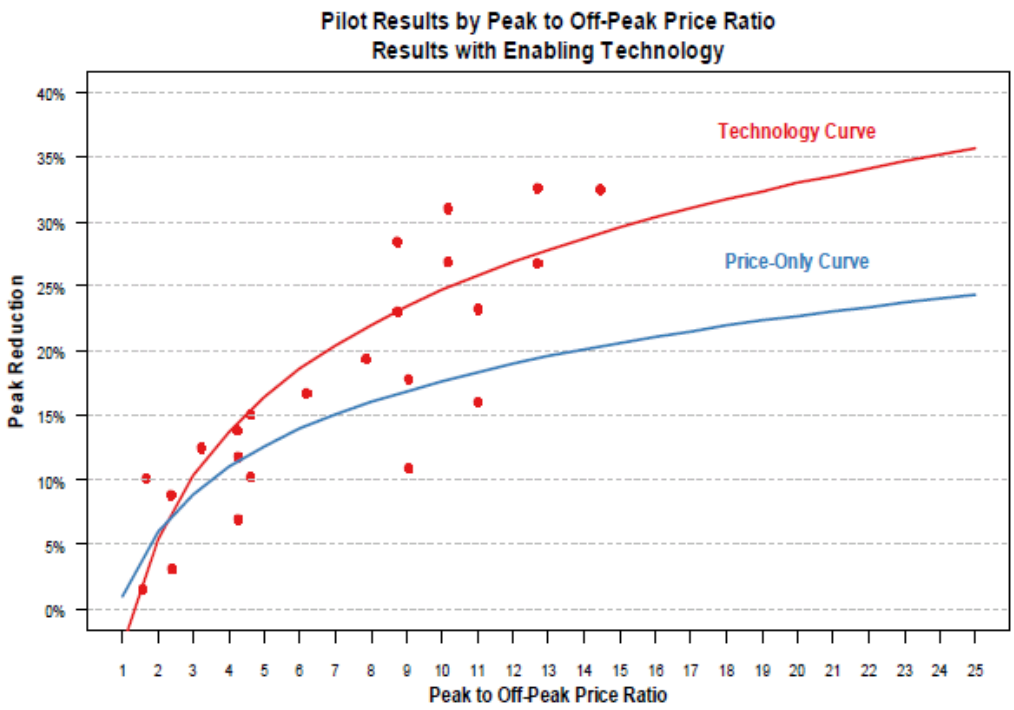


Figure 19 below plots pilot results by peak to off-peak price ratio, with enabling technology, and shows best-fit curves for pilot results with and without enabling technology.

Figure 19: Pilot results by peak to off-peak price ratio, with enabling technology



Customer response over time

Customer response was reported not to be just a novelty but also to persist over time. Several recent dynamic pricing pilots have specifically tested the persistence of customer response when events are called across two or three days in a row and found persistence. At least two pilots that have run for multiple years have tested persistence across years and found persistence. Two utilities in Arizona have observed persistence in customer response to time-of-use rates across decades.

Pilots as indicators of impacts in full-scale deployments

Pilots were reported to be good indicators of the impacts in full-scale deployments when they are carefully designed. In the best pilots, treatments and control customers are randomly selected to be representative of the population at large.

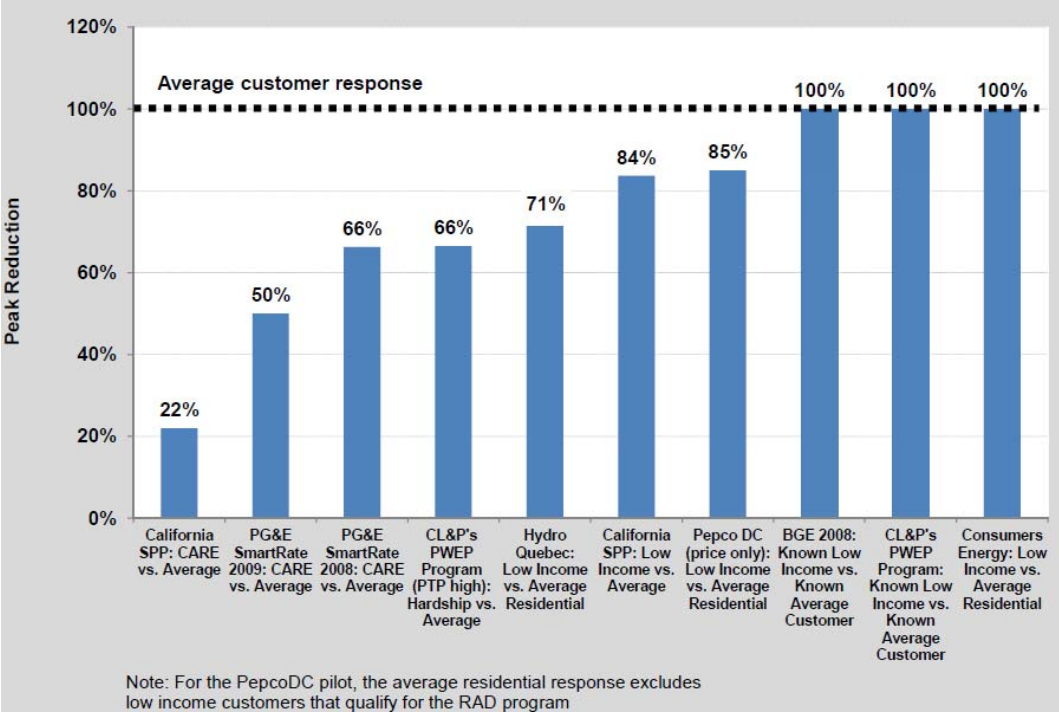
Pre-treatment measurements were taken to net out any pre-existing differences between the treatment and control groups.

Pilot design and roll-out approach must mimic utility's full deployment approach as much as possible.

Low income customers' responsiveness to dynamic pricing relative to average customer response

Figure 20 below shows that low income customers do respond to dynamic pricing.

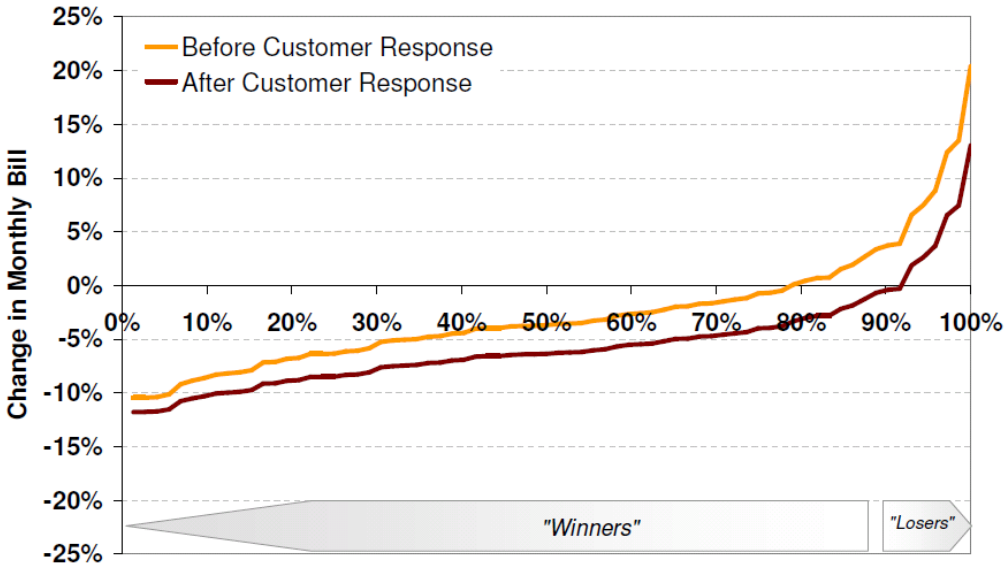
Figure 20: Peak reduction correlated against income



Distribution of dynamic pricing bill impacts for low income customers on CPP rate

Figure 21 below shows that most low income customers will be better off under dynamic pricing due to their flat load profiles.

Figure 21: Distribution of dynamic pricing bill impacts for low income customers on CPP rate



Notes: Bill simulation results for a large urban utility. Assumes an average of 10% load response for low income customers.

Customer satisfaction with dynamic pricing

Customers were reported to be satisfied with dynamic pricing once they experience it.

Customers are already familiar with the idea of dynamic pricing, for example with cell phone minutes, airline tickets and hotel rooms, toll roads and bridges, and sporting events and shows.

In the case of electricity, they tend to associate it with high prices and price volatility. When they are asked if they want it, in focus group settings or telephone interviews, the majority say no. When they have lived through it, either in full-scale programs or in pilot settings, the vast majority report high satisfaction and want to continue with the rates.

The relationship between dynamic pricing and direct load control

It was presented that direct load control programs are not substitutes but complements to dynamic pricing. Direct load control only applies to customers who have air conditioning or water heating; other end-uses in the home are not incentivised to respond during critical events. Payments are made whether or not events are called, and without smart meters, it is hard to verify that the controlled load has actually responded.

Traditionally, direct load control is only triggered by reliability events. In general, dynamic pricing can yield higher load responsiveness when combined with enabling technology than direct load control and it can be triggered by either economic or reliability events.

Further research required

The presentation suggested the following areas where more research is required:

- Conservation impact of dynamic pricing needs more research.
    - Several recent pilots suggest 0% to 1% savings.
    - Other studies have suggested 2% to 4%.
- Customers respond equally to peak time rebates and critical peak pricing in some tests and unequally in other tests.
- Customers respond to informational feedback about energy usage, prices and utility bills.
    - By how much they respond remains uncertain.
    - The impact on peak demand is uncertain.
    - Whether either energy or peak demand response would persist over time is also uncertain.

- The specific impact of web portals, in-home displays and energy orbs needs more research.
- Impact of socio-demographic variables (e.g. income, education) on customers' price responsiveness also need more research.

5. CONCLUSION

Interest is currently being shown in flexible pricing of electricity in Victoria in conjunction with the rollout of smart meters. While smart meters enable new types of flexible pricing, flexible pricing is not new. As researched and documented in this report, pricing of electricity differently at different times has been happening for many years, well before smart meters were being considered.

Smart meters record the usage of electricity every half hour whereas in the past metering for residential and small business customers generally either did not record the time of use, or recorded the time of use only in preset blocks or based on separately measuring usage of electricity on controlled load circuits. The fact that smart meters record usage every half-hour enables pricing arrangements to be much more flexible than was previously the case. With half-hourly interval metering, pricing can be changed without change of meter, and the pricing can be much more granular. At the limit, smart meters can enable usage of electricity to be priced differently in every half-hour of the year.

Though they are outside the scope of this report, we note that large industrial customers in Victoria and elsewhere in Australia and overseas have had half-hourly interval metering for many years and are generally already routinely being sold electricity based on tariffs and contracts with pricing the varies by time of use.

The smart meters that are being implemented in Victoria offer not only interval metering but also a communications infrastructure enabling two-way communications to and from the meter. This communications infrastructure enables the implementation of interactive devices such as web portals and in-premise displays, to give electricity customers more information on how they are using electricity. This information can help customers to compare different offers from electricity retailers, which may include flexible pricing offers. With more information, customers will also be able to gain better understanding of how their different patterns of use of electricity affect the overall price they pay, and they may be able to change their usage patterns to save money with flexible pricing.

Flexible tariffs have been deployed as a mechanism to provide incentives through price signals for customers to reduce demand at peak times and increase demand at off-peak times. Because electricity cannot be stored efficiently, it has to be generated, transmitted and distributed at the time of use. Generation and network capacity has to be built to meet peak requirements in each case, and the more “peaky” the load the less efficiently the capacity is being used. Spreading the demand for electricity more evenly across different time periods makes more efficient use of the generation and network capacity.

In the past, time-based tariffs were often geared towards providing cheaper off-peak electricity, rather than charging more for peak electricity. Nowadays, time-based tariffs are being conceived as a means of discouraging peak usage, and we are seeing tariffs that charge considerably more for peak usage than the single-rate tariff. Some of the modern tariff deigns specifically aim to address annual system peak usage as for example where there has been investment in air conditioning that is disproportionately driving up peak usage. We expect to see further tariff developments in future years as technology develops. These tariffs may be aligned with systems that control load to make optimal use of available generation and network resources.

Dynamic TOU pricing allows for the time when certain tariffs apply to be set "dynamically" as the need arises, perhaps with one or two days' warning. Implementations and trials of dynamic TOU pricing have centred on Dynamic Peak Pricing (DPP), otherwise known as Critical Peak Pricing (CPP). In these trials, the aim is to apply higher prices, often substantially higher, for a very limited number of days and hours per year, at times of particularly heavy demand, to give a strong pricing signal to consumers to reduce their usage of electricity in these periods.

As documented in this report, some of the key findings of trials of flexible pricing and dynamic pricing include the following:

- Customer response to flexible pricing was not just a novelty but also persisted over time. Several recent dynamic pricing pilots have specifically tested the persistence of customer response when events are called across two or three days in a row and found persistence.

- Customers were reported to be satisfied with dynamic pricing once they experience it. Customers are already familiar with the idea of dynamic pricing, for example with cell phone minutes, airline tickets and hotel rooms, toll roads and bridges, and sporting events and shows. In the case of electricity, they tend to associate it with high prices and price volatility. When they are asked if they want it, in focus group settings or telephone interviews, the majority say no. When they have lived through it, either in full-scale programs or in pilot settings, the vast majority report high satisfaction and want to continue with the rates.

- Direct load control programs are not substitutes but complements to dynamic pricing. Traditionally, direct load control is only triggered by reliability events. In general, dynamic pricing can yield higher load responsiveness when combined with enabling technology than direct load control and it can be triggered by either economic or reliability events.

- Further research will provide more information on how consumer respond to flexible pricing and dynamic pricing, and might cover such aspects as how web portals, in-home displays and other communications media influence consumer response, as well as the impact of socio-demographic variables (e.g. income, education) on customers' price responsiveness.

Finally, for further reading, we also suggest a Brattle Group paper that attempts to dispel with evidence what it calls seven myths of dynamic pricing.[70] Some extracts from that paper are provided below.

Myth #1: Customers do not respond to dynamic pricing

The first myth is that customers do not change their behaviour when faced with dynamic rates. However, almost all analyses of pilot results show that customers *do* respond to dynamic pricing rates by lowering peak usage. The demand for electricity does respond to price, just like the demand for other products and services that customers buy. The contention that electricity is a necessity with zero price elasticity, and thus is not subject to the normal rules by which a market economy functions, is based on opinion and not fact.

Myth #2: Customer response does not vary with dynamic pricing

Not only do customers respond, but the magnitude of their response varies with the price incentive. The higher the incentive, the greater their demand response.

Myth #3: Enabling technologies do not boost demand response

During the past few years, a variety of new technologies have been introduced to help customers understand their usage patterns (web portals and in-home displays, for example), to automatically control the function of their major end-uses such as central air conditioning and space heating equipment (smart thermostats), and to manage all their other appliances and plugloads (home energy management systems). Critics contend that such hardware is unnecessary and not cost-effective. Once again, this is contrary to empirical evidence.

Myth #4: Customer response does not persist over time

Some critics accept the above evidence on customer response but argue that responses will not last across multiple days, such as the demand pattern that might be experienced during a heat wave. They also argue that customer response is something that may not last across multiple years.

Persistence in demand response across multiple years has been demonstrated in pilots in California and Maryland. Even in full-scale rollouts, significant peak reduction impacts appear to persist over time.

70 *Dynamic Pricing of Electricity and its Discontents*, by Ahmad Faruqui and Jenny Palmer, The Brattle Group, Inc., 3 August 3 2011, available at www.brattle.com/_documents/UploadLibrary/Upload967.pdf

Myth #5: Dynamic pricing will hurt low-income customers

Even when people agree that dynamic pricing works and is beneficial overall, there is disagreement about the impact of dynamic pricing on low-income customers. Some people speculate that because low-income customers typically use less power, they have little discretion in their power usage and are thus unable to shift load depending on price. As a result, low-income customers would be negatively affected by a dynamic pricing model.

However, empirical evaluation of this speculation has indicated that most low-income customers would immediately save money on their electricity bills from dynamic pricing.

Myth #6: Customers have never encountered dynamic pricing

Customers experience dynamic pricing in a wide variety of everyday purchases. Today, dynamic prices are used consistently by airlines, hotels, rental car companies, and railroads. Customers understand that they will have to pay more when demand is higher; for example, plane tickets cost more on Friday nights, and hotel room rates are higher on Friday and Saturday nights. At the same time, customers also understand the benefit: price-sensitive customers can plan trips around low-priced times and save significant amounts of money.

Myth #7: Customers do not want dynamic pricing

Some critics assume that customers are simply happy with the status quo and have no desire to switch to dynamic pricing. Naturally, there is some inertia that makes customers reluctant to actively desire to switch pricing plans. However, among customers who have experienced dynamic pricing in pilots, customer satisfaction is strong.

Related to the myth that customers do not want dynamic pricing is the idea that customers will have to resort to extreme measures to save money on dynamic rates, such as getting up at 2 in the morning to run the laundry. Unless a rate were designed such that the peak period was during all waking hours, customers have no need to change their sleeping schedules to save money.

Conclusion

Customers do respond to dynamic pricing, and the response varies depending on the intensity of the price signal. The response persists over time, and improves when enabling technologies are added. Dynamic pricing does not hurt low-income customers; on the contrary, many low-income customers would benefit from dynamic pricing. When appropriately informed, customers see the value of dynamic pricing.