Inclining Block Tariffs for Electricity Network Services

Secretariat Discussion Paper

INDEPENDENT PRICING AND REGULATORY TRIBUNAL
OF NEW SOUTH WALES

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1 INTRODUCTION

The Tribunal is currently reviewing the regulatory arrangements to apply to the NSW electricity distribution businesses from 1 July 2004. Distribution Network Service Providers (DNSPs) made submissions to this review in April 2003. In those submissions and in other subsequent public fora such as the Tribunal's Pricing Issues Consultation Group, the DNSPs have proposed the introduction of an inclining block structure for network tariffs. This Secretariat paper examines the properties of the inclining block structure and its likely implications for cost reflectivity and pricing signals.

The focus of this paper is on network tariff structures and the benefits these might have in terms of managing demand growth and reducing network costs. This focus reflects the fact that the inclining block structure has been raised in the context of the 2004 network price review. However, stakeholders should note that the views expressed in this paper are not those necessarily of the Tribunal. Rather, the purpose of this Secretariat paper is to foster discussion on the important issue of tariff reforms.

The structure of the electricity market in New South Wales is such that DNSPs do not have a direct relationship with customers. Rather, network tariffs are charged to retailers, based upon the network tariff for the class of customer served by the retailer. The retailer then passes these network charges, along with energy costs and retail margins, on to final customers.

In the case of regulated default retail tariffs[1], the Tribunal's current determination treats network tariffs as a pass through item. Under that determination, the default tariffs offered by retailers should reflect the underlying network tariff — that is, the inclining block structure would be passed through in the default retail tariffs. For retailers servicing customers on negotiated contracts, there is no obligation to mimic the network tariff structure in final retail tariff offered to customers. A retailer may opt to average the inclining block network tariff structure across all its customers and retain the single, flat rate structure.

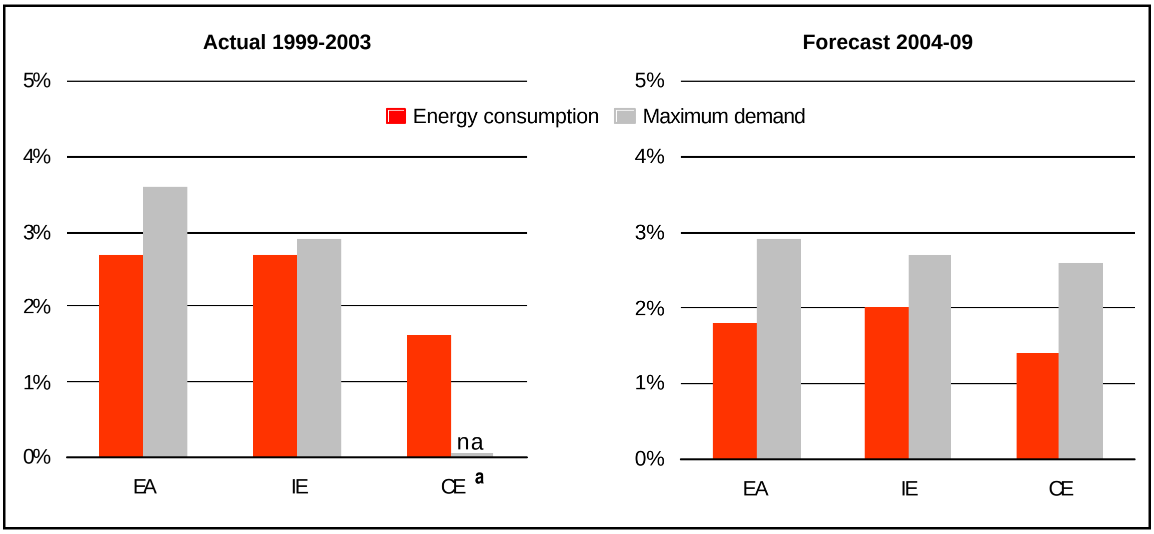
The following discussion generally assumes that any inclining block structure in network tariffs is passed through by retailers so that customers using the network will face an inclining block tariff structure in their retail tariffs. From 1 July 2003 EnergyAustralia has introduced a retail tariff with an inclining block structure. Consequently, many of these issues raised such as price responsiveness and optional tariffs are relevant to both the network component and the bundled end price. Where a retailer opts not to introduce an inclining block tariff structure in retail tariffs, any signal to final customers from an inclining block network tariff would be muted. In this situation, the direct price signal to customers is reduced but retailers then have an incentive to manage demand to reduce financial risks created by averaging across customers. Chapter 5, which discusses the price signals sent by the inclining block tariff structure, discusses this issue more fully.

1 These tariffs apply to customers that have chosen not to enter the contestable market and enter into a negotiable contract with a retailer for the supply of electricity.

1.1 The purpose of this paper

A number of the New South Wales DNSPs have experienced rapid growth in summer peak demand relative to overall energy consumption over recent years (Chart 1.1). The DNSPs have attributed much of this growth to greater penetration of air conditioner usage, particularly in the residential sector. In the absence of any price or non-price demand management measures, servicing this growing peak demand, will require greater network capacity, which might be drawn upon for a limited amount of time through the year. For example, EnergyAustralia currently provides 10 per cent of its network capacity to meet its peak demand that is utilised less than 1per cent of the year. This infrastructure delivers around just 20MWh of energy for every MW of capacity compared with 8,760MWh/MW for base load network capacity. This impacts on network costs by reducing capacity utilisation, resulting in higher average prices for customers.

Chart 1.1 Demand and energy growth



[a] Actual figures for 2000–02.
Note: Australian Inland omitted as submission did not include data on actual or forecast maximum demand.
Data source: DNSP submissions.

To address the growth in summer peak demand, the New South Wales DNSPs are exploring a range of price and non-price measures. In terms of price measures, EnergyAustralia and Integral Energy in particular have proposed or are considering a range of tariff reforms aimed at providing better signals to all customers about the cost of consumption during peak period of system demand.

Price and non-price demand management initiatives are strongly supported by the Tribunal. In its report into the role of demand management[2], the Tribunal highlighted the problems associated with peakier demand and resulting low capacity utilisation driving up network costs. In both that report and its Issues paper for the 2004 network price review[3], the Tribunal has indicated that it believes that price signalling can play an important role in signalling congestion costs and reducing the need for costly network augmentation. The

2 IPART, *Inquiry into the Role of Demand Management and Other Options in the Provision of Energy Services – Final Report*, Review Number Rev02-2, October 2002.

3 IPART, *Regulatory arrangements for the NSW Distribution Network Service Providers from 1 July 2004, Issues Paper*, Issues Paper DP58, November 2002.

Tribunal supports DNSP efforts to restructure tariffs in line with the objectives outlined in the Pricing Principles and Methodologies[4]:

- economic efficiency
- revenue sufficiency
- equity.

For residential and small business customers, options for network price reform are somewhat limited in the shorter term. These customers typically have accumulation type meters that do not differentiate when consumption occurs (peak or off-peak periods) and so the ability of DNSPs to set tariffs that directly target consumption during peak periods is reduced. However, the DNSPs have estimated that a significant proportion of the recent growth in peak demand has been due to growth in demand in the residential sector. In particular, rapid growth in the penetration rates of air conditioning among residential customers is likely to be a significant driver of peak demand among those customers.[5]

Within the constraints of widespread use of accumulation type meters, DNSPs have proposed the introduction of inclining block network tariffs for residential and small business customers in an attempt to curb the rapid growth from this sector and to support other price and non-price demand management initiatives. For larger customers above 15MWh a year, EnergyAustralia has also proposed roll-out of time-of-use metering and mandatory switching to time-of-use tariffs. The inclining block tariff levies a higher price for consumption above a specified threshold. As such, larger customers will tend to face higher bills — regardless of whether they consume large amounts of electricity in peak periods or not.

In recent public fora, the DNSPs have recognised that, in the absence of widespread time-of-use metering, the inclining block tariff is largely a second best means of sending price signals to residential and small business customers. However, their position is that an inclining block tariff sends better signals for reducing consumption than the current single flat rate structure. They suggest the benefits of introducing such a tariff for residential and small business customers would outweigh any costs associated with customers with low demands for peak capacity facing inappropriately high tariffs.

Further, the DNSPs argue that inclining block tariffs are one component of a package of tariff reforms aimed at providing better signals to customers of the cost of consumption during peak periods. As such, their introduction is likely to encourage customers that are able to manage their electricity consumption to switch to existing and new time-of-use based tariffs that reward customers for modifying their consumption patterns to avoid peak period consumption.

4 IPART, *Pricing Principles and Methodologies for Prescribed Electricity Distribution Services*, National Electricity Code Report No. 5, March 2001.

5 EnergyAustralia's submission (p 7) indicates that the number of residential customers with air conditioning increased from 29 per cent in 1997 to 43 per cent by 2002. It estimates that approximately 58 per cent of residential customers will have air conditioners by 2009.

To date, there has been little discussion of the properties of inclining block tariffs, aside from likely impact on customer bills, assuming current levels of consumption. In particular, there has been little information provided that would allow stakeholders such as residential and small business customers and retailers to assess whether the DNSPs' proposed tariff reforms are likely to lead to:

- more cost reflective tariffs that better signal the costs of providing network capacity and the full costs of customers' consumption decisions
- customers changing their consumption behaviour leading to lower capital and operating expenditure and lower average network prices
- an overall improvement in the structure of tariffs for residential and small business customers over the current structure.

The purpose of this discussion paper is to highlight some of the issues that need to be considered in assessing how the proposed inclining block tariffs might impact on customers and how they work toward achieving the DNSPs' objectives for their introduction. This discussion paper does not form a view on the merit or otherwise of the inclining block tariff proposal. Indeed, neither the Tribunal nor the Secretariat have formed a view on this issue. The aim of the paper is to encourage an open and transparent debate on the merits of the introduction of these and other price reforms and whether these reforms are likely to lead to improved outcomes for consumers.

The focus of discussion paper has been limited to discussing the properties of inclining block network tariffs that would apply only to residential and small business customers. These tariffs have generated most discussion among the stakeholders and are likely to have the most widespread impacts on customers. While this paper has a limited focus, it is important that the inclining block tariffs be assessed within the wider context of other proposed tariff and non-tariff reforms. It is important that the interaction between the inclining block tariff and these other proposals be considered in assessing the merits of the inclining block tariff proposal.

Throughout the paper, a number of questions are raised. These questions are intended to identify where further or better information would assist the debate over the DNSPs' proposed tariff reforms. Formal submissions on these issues are not required. The intention is for these questions and issues to form a basis for discussion at future Pricing Issues Consultation Group (PICG) meetings[6] where these tariff reform proposals will be discussed.

It should be recognised that it is likely that DNSPs or others will not have the information available to answer all these questions. In this situation, whether or not it is worthwhile proceeding with an inclining block tariff for residential and small business customers, requires balancing the risks of proceeding on the basis of imperfect information against the consequences of not proceeding in terms of a continuation of the status quo and the implications of that for network costs.

6 See the IPART website for details on the PICG, www.ipart.nsw.gov.au/elec.htm#picg

1.2 The Tribunal's role

The Tribunal's current view is that as far as possible, network businesses should bear responsibility for determining network price structures. DNSPs have a greater understanding of:

- their cost structures
- user needs as reflected in demand patterns
- network utilisation and the likelihood of emerging congestion.

The Tribunal also considers that the ability for a monopoly to determine its price structure should be accompanied by the responsibility to disclose medium term pricing strategies and information concerning the basis for determining prices.

The current regulatory framework provides flexibility for DNSPs to determine structure and level of prices **provided** they are consistent with:

- the revenues allowed for in the current determination
- the DNSP having published a complying Price and Services Report
- the pricing principles contained in the Pricing Principles and Methodologies document
- constraints on price increases for customers imposed under the Tribunal's current determination and
- any other relevant requirements of the network determination.

The implication of this approach is that as long as a DNSP can demonstrate that the inclining block tariff and other proposed reforms are consistent with above requirements and any other relevant legislation or decisions, then the Tribunal has no role in approving the introduction of these reforms. The purpose of this discussion paper is to facilitate informed debate between customers and other stakeholders and DNSPs.

An issue for the forthcoming review is whether the Tribunal should take a greater role in regulating the individual prices set by DNSPs. In the present context, this would mean the Tribunal would be required to approve the introduction of an inclining block tariff (including the settings for the thresholds for the blocks and the differential between the first second block) and other price proposals. Stakeholders may wish to comment on this issue in their submissions to the wider network price review.

1.3 Structure of report

Chapter 2 sets out what the DNSPs' stated objectives for introducing tariff reform are. Chapter 3 describes the deficiencies of the current scheme in terms of meeting these objectives. The following chapter describes the DNSPs' proposals for inclining block tariffs in more detail. Chapter 5 considers how much better the inclining block tariff does than the current structure in meeting the DNSPs' objectives. The sixth chapter looks at how consumers are likely to react to the inclining block tariff structure. The final chapter canvasses other price and non-price demand management approaches.

2 WHAT ARE THE DNSPS SEEKING TO ACHIEVE?

As noted earlier, DNSPs in New South Wales are facing strong growth in maximum demand that is outstripping growth in energy consumption. Providing network capacity to meet this growing maximum demand is a key driver of capital expenditure for DNSPs. While network capacity is a key driver of network costs, revenue is largely driven by energy consumption. A disparity between costs and revenues, with costs growing faster than revenues, would put upward pressure on average network prices. Already, DNSPs have signalled the need for significant price increases over the coming regulatory period, partly as a result of the need to augment networks to keep up with growing peak demand.

By introducing the inclining block tariff and other price reforms, the DNSPs are seeking to better signal the costs of providing the capacity to meet this demand and provide incentives to customers to reduce peak demand. In their submission to the 2004 network price review, EnergyAustralia submitted that:

> Summer seasonal loading conditions are increasingly driving the need to augment the network, particularly due to the installation of greater numbers of residential air conditioners. This change has resulted in a significant increase in capital expenditure at various levels of the network to maintain acceptable performance.
>
> To help manage this demand, EnergyAustralia will adopt a price structure that has an inverted block structure, with an increased rate applying to consumption greater than 7000 MWh per annum and a 40 per cent increase in the energy rate (note this is a 25 per cent surcharge on the basic energy consumption). (EnergyAustralia submission, pp 77-78.)

Integral Energy also noted concerns about the current charging structure being inequitable:

> … in general, current network tariffs do not provide customers with right signals and are not equitable. At present customers who are not contributing to the network peak are bearing the costs associated with those that are. (Integral Energy submission, p 194.)

Integral Energy's submission also recognised that the inclining block tariff would only be part of a solution to addressing the problem of growing demand:

> While reforming the standard domestic tariff will improve price signals, it alone is unlikely to eliminate the cross subsidy between customers who contribute to the network peak and more who do not. Given the complexity of the problem and metrology constraints, an effective action plan is likely to consist of a range of measures, including:
>
> - demand management;
> - reforming other tariffs where there is a benefit for customers and Integral;
> - the possible introduction of new tariff, such as controlled load and tariff specifically designed for consumers with high peak demand consumption. (Integral submission. p 200.)

An important point about Integral Energy's proposal is that the inclining block network tariff that is passed through in retail tariffs is seen as a key element of a tariff reform package that provides an incentive for residential and small business customers to move off the standard domestic/small business tariff on to other more flexible tariffs that reward consumers for reducing consumption during peak times. These might include standard time-of-use tariffs or more innovative interruptible load tariffs. In effect, Integral Energy is promoting greater choice for customers, providing them with options that might better suit their consumption profile, and an incentive to make that choice (in terms of higher prices under an inclining block tariff).

In summary, the DNSP's submissions indicate that the proposed inclining block network tariff is aimed at improving the cost reflectivity and therefore equity in network tariffs for residential and small business customers. Ultimately, this improvement is seeking to provide an incentive to customers to reduce consumption during the system peak period to lower overall network costs. This could potentially be brought about in two ways:

- through customers paying a higher overall price for energy as a result of the inclining block network tariff, encouraging them to reduce their consumption in peak and non-peak periods and
- through the higher inclining block tariff rate encouraging customers to seek out other tariff options that reward customers directly for cutting peak period demand.

The strength of any customer response will be one of the key determinants of just how big the benefits of moving to an inclining block tariff are. This issue is discussed later in this report.

3 WHY IS THERE A NEED FOR REFORM?

Residential and small business customers generally pay for network charges in their retail tariffs based upon their 'anytime' or total energy consumption. While other customers also pay charges based upon the time of consumption (time-of-use tariffs, demand and capacity charges), most residential and small business customers have accumulation type meters that only identify how much energy was consumed between meter readings. Time-of-use, demand and capacity charges require interval or time-of-use metering, which identifies when energy consumption took place.

The charge levied on residential and small business customers typically has a small fixed charge component and a single flat rate per kWh of energy consumed. This structure means that the usage charge varies proportionately with the level of energy consumed but takes no account of the customer's demand for system capacity.

3.1 Is the current single rate system cost reflective?

The current single flat rate energy network charge structure for residential and small business customers means that customers contribute to the cost of providing capacity in proportion to their energy consumption. Larger customers pay a larger share of costs by virtue of their higher consumption. Underlying this charge structure is an implicit assumption that if a customer consumes say 20 per cent of total energy then they utilise 20 per cent of system capacity. If this were the case, then the single rate structure would likely be cost reflective. However, in reality, there is a wide variety of consumption profiles within the class of residential and small business customers. Some customers will place a greater burden on system capacity than reflected by their energy consumption and are paying disproportionately too little in network charges. For example, a customer may have a relatively low level of consumption but because they use equipment such as air conditioners, dishwashers, clothes dryers and other appliances intensively in the peak period, might contribute a much larger proportion of peak period demand. Other customers may impose less demand on system capacity and so, in principle, should pay proportionately less.

The current charge structure is therefore likely to lead to cross-subsidies across different kinds of residential and small business customers. Customers that impose demands on system capacity that are disproportionately less than indicated by their energy consumption will tend to cross subsidise those with disproportionately greater demand for capacity (Chart 3.1). For example, a customer may represent around 2 per cent of total energy but because they have a need for this energy during peak times, might represent around 5 per cent of system capacity. Under the current system, ignoring the impact of fixed service availability (access) charges, that customer would be facing only 2 per cent of costs. The remainder would be spread across other customers that utilise capacity disproportionately less.

Chart 3.1 Impact of current charge structure

Consumption of energy	Peak period demand for network capacity: Disproportionately lower[a]	Peak period demand for network capacity: Disproportionately higher[a]
Small customers	Paying too much	Paying too little
Large customers	Paying too much	Paying too little

[a]Disproportionately lower or higher than would be indicated by consumption of energy.

Integral Energy has attempted to estimate the extent of this cross-subsidy as it relates to customers with air conditioning:

> Modelling undertaken by Charles River Associates for Integral using a long run marginal cost approach for capital investment to meet peak demand indicates that the cross-subsidy is in the range $80 to $110 million per year — or some third of total sales to the residential and small business sectors. If this subsidy is smeared across all of the remaining consumption by these groups it equates to 1.5 cents/kWh to 2.0 cents/kWh relative to a marginal rate of 4.85 cents/kWh. (Integral Energy submission, p 195.)

Integral Energy's submission and public presentations indicates that it is undertaking further work examining this area. In particular, it has commissioned a report by Charles River Associates (CRA) that examines the impact of air conditioning on Integral's network and canvasses a number of tariff based mitigation options.[7]

As well as the cross subsidy across users (discussed above), the CRA report highlighted that averaged prices lead to a 'deadweight loss' associated with over-consumption of network capacity during peak times and under consumption in off-peak times.[8] What this means is that since customers are paying less than the cost of providing peak capacity, they have no incentive to seek out other alternatives that might be able to satisfy their demand for electricity during peak times at a lower cost than network capacity. During off-peak periods customers pay more than the cost of supplying that capacity and will tend to consume too little. Both effects tend to reduce capacity utilisation and raise network costs. These higher costs are the 'deadweight loss' arising from a price structure that is not cost reflective.

How large are cross-subsidies within the residential and small business customer classes?

To what extent is it desirable to correct these cross-subsidies?

7 Charles River Associates, *Impact of Air Conditioners on Integral Energy's Network*, May 2003.

8 Ibid, p 17.

3.2 What signals are sent for customers to reduce demand?

An unattractive feature of the current pricing arrangement is that it sends the same price signal to residential and small business customers, regardless of their pattern of consumption. Network costs tend to be driven by consumption during peak periods. However, a customer pays the same amount for each additional unit of consumption regardless of whether this consumption occurs during the middle of the peak time or in the middle of the night.

If the DNSP's proposals for significant price increases were approved by the Tribunal, under the current single rate charge structure this real price increase would be paid equally by customers on all their electricity consumption. It seems likely that this real price increase (although muted by the retail charge) would encourage customers to economise to some degree on their electricity consumption (chapter 6 discusses some of the evidence on how customers respond to changes in price). Whether such a real price increase would reduce consumption during system peak periods (and by how much), reducing the need for capacity augmentation, will depend on the pattern of responses from customers. Consumption could be reduced during peak periods or during shoulder or off-peak periods or a combination of all three. However, there is nothing in the current flat rate charging structure (in both network and retail tariffs) that provides a stronger incentive for customers to cut their consumption during peak times than off-peak times — the reduction in consumption that is required to improve capacity utilisation and lower capacity related capital expenditures that are leading to higher prices.

These deficiencies in the current charging structure provide the impetus for tariff reform.

What impact would proposed real price increases have on demand for capacity during peak periods under existing charging structures?

4 THE INCLINING BLOCK TARIFF PROPOSALS

Given the relationship between system maximum demand and the capital expenditure required to meet this demand, in principle, a charge that varies with the individual customer's draw on capacity at peak times might best reflect the costs a customer imposes on the network. Such a charge would be cost reflective in that a customer with a larger draw on capacity bears a higher share of costs for a given level of energy consumption. The capacity charge would also provide an incentive for the customer to reduce their demands on system capacity in order to reduce their electricity bill.

The calculation of a capacity charge requires the customer have a more sophisticated meter than the standard accumulation meter. Modern practice is to use an interval meter that records consumption in half hourly increments. However, while larger commercial customers generally face tariffs that contain a capacity-related charge, typical residential and small business customers with non time-of-use (TOU) metering do not. Widespread application of tariffs based upon time-of-use will not be possible unless time-of-use metering were to be rolled out to the majority of residential and small business customers. Current New South Wales Government policy is to adopt load profiling rather than interval metering for residential and small commercial customers. A more widespread roll-out of time-of-use metering would likely require an assessment of the likely costs and benefits of more widespread time-of-use metering. In the absence of time-of-use metering and recognising the deficiencies of the current pricing structure (discussed in the previous chapter), the DNSPs have proposed the inclining block tariff as a more cost reflective tariff that provides better signals for demand management.

This chapter briefly describes the inclining block tariff proposals while the next chapter considers how cost reflective the inclining block tariff is and what signals it sends to consumers.

4.1 Proposals for an inclining block tariff

The DNSP's proposed inclining block network tariff, if passed through in retail tariff structures, would see customers paying:

- an initial lower price per kWh for energy consumed up to some prescribed threshold level of consumption
- a higher price per kWh for energy consumed above the threshold.

The DNSP's proposals have limited the application of the inclining block tariff to residential and small business customers. The size of the first block is a critical factor influencing how the inclining block tariff might impact on customers. In terms of indicative models outlined in EnergyAustralia and Integral Energy's submissions:

- EnergyAustralia has proposed that the higher block charge start at 7,000kWh annual consumption, with a 25 per cent differential between the first and second block tariffs and
- Integral Energy has proposed a higher block charge starting at 5,000kWh annual consumption, with an approximate 40 per cent differential between the first and second blocks.

The block structure would apply to quarterly bills, with the first block for each billing period calculated as a quarter of the annual block. In both the indicative models presented by EnergyAustralia and Integral Energy, the first block would attract a rate that is lower than the equivalent flat energy rate. That is, customers whose consumption is lower than the threshold for the second block would face lower network charges than they do now for the same level of consumption.

4.2 Indicative impacts on bills — other things equal

Integral Energy and EnergyAustralia have provided indicative estimates of how their proposals might impact on network charges paid by customers, given their current consumption patterns. As part of its presentation to the Pricing Issues Consultative Group (PICG), Integral Energy provided indicative impacts on customers of different sizes:

- customers with an annual consumption of 4,000kWh would benefit from a 3.7 per cent lower annual bill compared to what it would have been under the current flat structure
- customers with an annual consumption of 7,500kWh would face a small rise of 0.3 per cent reflecting a combined effect of lower charges on consumption below 5,000kWh and higher charges for the remainder, and
- customers with an annual consumption of 12,000kWh would face a rise of 3.6 per cent reflecting the majority of their consumption being in the higher block and attracting the higher rate.

To give some perspective to these numbers, Integral Energy's residential customers consume around 6,000kWh a year on average per customer, excluding controlled loads such as off peak hot water. Under Integral Energy's proposal, the inclining block tariff would not apply to controlled loads.

EnergyAustralia, in its presentation to the Pricing Issues Consultation Group, suggests that residential customers consuming below approximately 8,600kWh a year would face lower annual network charges under its proposed model which has a higher threshold than Integral Energy's model. This threshold equates to an annual retail bill for residential customers of around $1,000 a year or $250 per quarter at 2002/03 prices.[9] EnergyAustralia estimates that approximately 83 per cent of residential customers fall into this category.[10] Equivalent estimates for small business customers were not provided.

EnergyAustralia's estimate of the impact on residential customers appears to be based upon aggregate annual consumption — in effect, assuming that consumption is the same in every quarter. However, it is unlikely that this is the case — electricity consumption is likely to be higher in some quarters than others (eg in summer and/or winter). EnergyAustralia is proposing to apply the inclining block structure on a quarterly basis so the distribution of energy consumption across these quarters is likely to be an important influence on the outcome in terms changes in network charges. One question is if an average consumption profile were taken into account in the EnergyAustralia analysis, how different would the conclusions from their analysis be?

9 Based upon a service availability charge of 22.42 cents per day and a usage charge of 10.68 cents per kWh.

10 EnergyAustralia's residential customers consume around 7,200kWh a year on average per customer.

What proportion of residential customers and small business customers respectively will face a higher network charges under an increasing block tariff arrangement, given current consumption patterns across the year?

How much extra will small business customers be contributing toward network costs? Is this consistent with their demands on system capacity?

4.3 Other tariff proposals

EnergyAustralia has proposed the introduction of an inclining block tariff as part of a suite of tariff reforms aimed at addressing the growth in peak demand and to better reflect each customer's contribution to the costs of the network. The five other proposed reforms are:

- the introduction of mandatory time-of-use pricing and meter roll-out for sites consuming greater than 15MWh a year (approximately 82,000 residential and small business customers)
- summer seasonal prices for Time-of-Use customers — resulting in higher prices in the summer
- further development of interruptible and load control tariffs
- an increase in the demand/capacity components of tariffs for customers between 40-735MWh consumption, estimated to be approximately 10 per cent of the current charge, to better reflect network costs and
- the introduction of an Infrastructure Charge to apply to new and upgraded three phase or large installations that reflect a user-pays principle for the cost of providing capacity demanded with very poor load utilisation (EnergyAustralia submission, pp 76-80).

Integral Energy has indicated that it is considering the introduction of a seasonal surcharge as an alternative to the inclining block tariff. The surcharge would apply to energy consumed during the summer peak period from December to February.

Integral has also stated that it might introduce demand management measures and the introduction of controlled load tariffs and tariffs designed for customers with high peak demand consumption to complement reforms to the standard domestic tariff. The inclining block tariff would then be part of an integrated strategy aimed at encouraging customers to switch to more cost reflective tariffs and/or tariffs that allow those who are able to manage their demands to be rewarded for reducing their demands on the network at critical times.

In the absence of an inclining block tariff, to what extent could the other tariff reforms proposed by EnergyAustralia and Integral Energy deliver the objectives of reducing growth in peak demand?

Could the inclining block tariff deliver significant benefits (in terms of reduced demand) by itself?

4.4 Approaches in other states

Most Victorian distribution companies have introduced inclining block tariffs for their network charges. CitiPower and TXU have block structures with higher rates per kWh starting at 1,020kWh a quarter (4,080kWh a year). Powercor has a number of blocks at 4,000kWh, 20,000kWh and 50,000kWh for residential and medium sized customer such as small business customers. In Powercor's case at least, these tariff structures were introduced with an explicit demand management objective in mind, providing an increasing incentive to reduce consumption as the level of consumption rises.[11]

United Energy in Victoria also has a block tariff structure although is more complicated than those offered by the other distribution companies and is optional. Residential customers may face either a single rate tariff with a summer demand incentive charge or a winter economy block tariff with a second block commencing at 4,080kWh a year and a lower second block charge in winter. Regulated retail tariffs also have an inclining block structure in Victoria.

Is there any evidence on how successful inclining block tariffs have been in altering customers consumption behaviour in Victoria or other jurisdictions?

11 See Powercor's 2003 Network Tariff Report for discussion of this.

5 DO INCLINING BLOCK TARIFFS MEET THE DNSPS OBJECTIVES?

5.1 How much more cost reflective is the inclining block tariff compared to the current structure?

Network tariffs are charged to retailers. The retailer then passes these network charges, along with energy costs and retail margins, on to final customers. Larger residential and small business customers that face higher network charges under the inclining block tariff (these charges would be passed through by the retailer) would be covering a greater share of costs than under the current charge structure. An issue is the extent to which it is cost reflective for these larger customers to be bearing this higher cost. Chart 5.1 summarises how the different customer groups that were discussed in chapter 3 would be affected by the introduction of the inclining block tariff. The shaded cells represent the customer groups for which the inclining block tariff moves their network charges in the correct direction (in terms of reflecting their use of capacity and resulting network costs).

Chart 5.1 Impact of inclining block tariff

Consumption of energy	Peak period demand for network capacity: Disproportionately lower[a]	Peak period demand for network capacity: Disproportionately higher[a]
Small customers	Lower network charges (shaded)	Lower network charges
Large customers	Higher network charges	Higher network charges (shaded)

[a]Disproportionately lower or higher than would be indicated by consumption of energy.

Note: Shading indicates customer group for which network charges move in correct direction for cost-reflectivity.

As can be seen, in terms of capacity-intensive large users, the introduction of the inclining block tariff is an improvement in terms of better reflecting the network costs required to service these customers. However, large users that use disproportionately little network capacity (relative to the energy consumption) will also face higher network charges relative to the current structure. In terms of cost reflectivity, the inclining block tariff moves the network charges for these customers in the wrong direction. Smaller customers with (disproportionately) small demands on system capacity face lower network charges as a result of the reduction in the first block charge below the current anytime energy rate. The inclining block tariff improves the cost reflectivity of tariffs for these customers. However, small customers with large demands on system capacity would actually pay less under the proposed tariff, moving their network charges in the incorrect direction.

The net effect of the inclining block tariff is to improve cost-reflectivity for:

- small customers with disproportionately little demand on capacity, and
- large customers that make disproportionately large use of system capacity.

However, in doing so, larger, less capacity-intensive customers could be cross subsidising other customers to a greater degree than with the current charge structure. In particular, smaller capacity-intensive users benefit to a greater degree from this cross subsidy than before. Whether these outcomes could be considered an improvement over the current arrangements is a moot point. Is it more equitable that cross-subsidies are reduced between some groups at the expense of larger customers that demand disproportionately less capacity than other customers?

The significance of this re-distribution of costs among consumers depends upon how customers are distributed across the shaded areas of Chart 5.1. The fewer customers located outside the shaded cells, the more cost reflective the inclining block tariff will be. That is, the more higher consumption is correlated with intensive use of network capacity, the greater the degree of cost reflectivity. In this situation, there would be very few large users using little network capacity and small users using large amounts of network capacity, and the degree of cross subsidisation would be small.

DNSPs have asserted in broad terms that there is a correlation between high consumption and proportionate demand for network capacity. For example, EnergyAustralia submitted:

> Customers that have high consumption generally also have a more strongly seasonal usage pattern. Customers with air conditioners frequently fall into this category. Such customers use a disproportionate amount of network capacity and thus it is reasonable for them to bear a surcharge on excess consumption. (EnergyAustralia submission, p 78.)

However, the strength of this correlation has not been discussed. In particular, it is difficult for stakeholders to know how many large consumers with limited demand for peak capacity will face higher charges under the inclining block tariff. Similarly, there is a question over how many low consumption customers with large demands for network capacity would face lower network charges?

In terms of facilitating debate on the merits of the inclining block tariff, it would be beneficial if DNSPs could attempt to quantify the relative sizes of the various groups of customers affected by the switch to an inclining block tariff (high consumption/low peak demand customers, low consumption/high peak demand), using what information they have available. This would give stakeholders an idea of the likely extent of cross-subsidy and provide a point of reference in terms of assessing whether the re-distributive impacts are worthwhile, given the likely consumption responses and associated benefits in terms of reduced capital and operating expenditure.

To what extent do large customers above the proposed block tariff thresholds contribute to demands on system capacity disproportionately to their share of total energy consumption?

How many smaller customers (in terms of kWh of electricity consumed) have energy consumption that is skewed toward times of peak system demand?

Are the proposed thresholds appropriate? Do they reasonably reflect customers that impose greater costs on the network through their demands for capacity?

Should there be different thresholds for residential and small business customers?

5.2 Impacts on low income earners

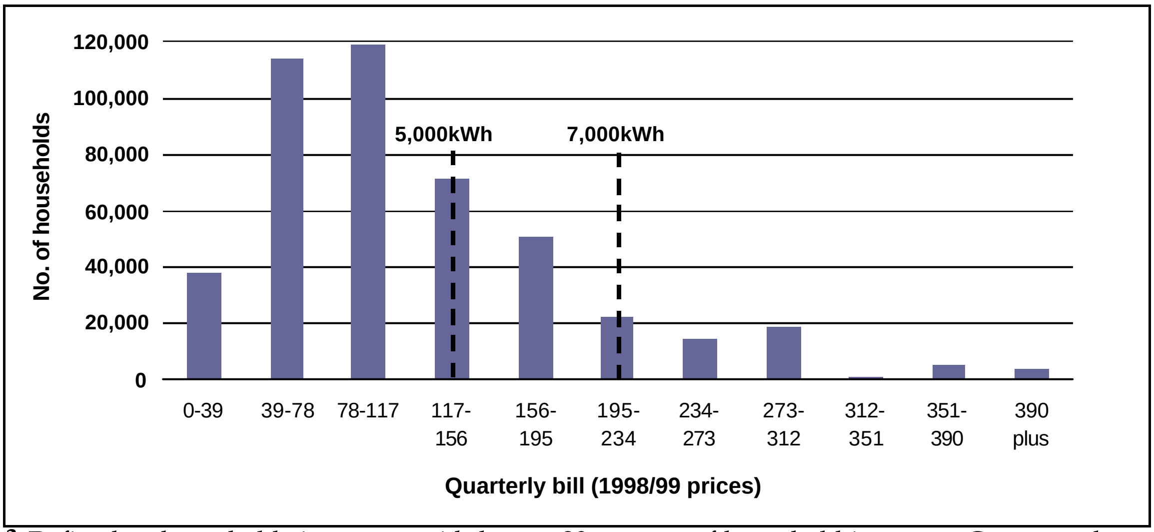
The previous section highlighted potential equity issues, depending on the consumption patterns of consumers, relating to the degree of cross subsidy between certain customer groups. Stakeholders have also raised concerns with the potential impact of higher electricity charges due to a network inclining block being passed through to consumers in retail prices, on low income households that consume large amounts of electricity for reasons unrelated to air conditioning or other capacity-intensive appliance use. For example, such consumers might be large households or are perhaps living in low cost energy inefficient accommodation. To address equity concerns, both Integral Energy and EnergyAustralia have identified a range of support programs that could assist lower income households to manage higher electricity costs. These include tailored payment plans, bill smoothed payment plans, Centrepay, 'REFIT' style programs, provision of energy advice and trials of prepayment meters.

At the present time, there has been little public information and discussion about the relationship between energy consumption and income in the context of a network inclining block tariff. It is therefore difficult to gauge just how significant the equity issue is. The Tribunal is in the process of conducting a survey of households that should, among other things, indicate how energy consumption and appliance use is related to income. The results of this survey should be finalised around August 2003. Integral Energy have also indicated that they have commissioned work to examine impacts on low income customers in their region, using income data from the most recent census and also their own billing data by postcode area.

Some analysis of the relationship between income and electricity consumption is possible based upon the 1998/99 Household Expenditure Survey (HES) conducted by the Australian Bureau of Statistics (1998/99 is the most recent survey). Chart 5.2 shows how the quarterly expenditure on electricity varies across households in the lowest income quintile (that is, the 20 per cent of households with the lowest incomes in New South Wales). In dollar terms, the ABS reports that this equates to households with total incomes less than $16,000 a year or less (in 1998/99 prices). Based upon 1998/99 prices, the dotted lines indicate where the two potential thresholds (5,000kWh and 7,000kWh) apply. The HES data indicates that approximately 64,000 low income households have electricity bills that fall into the second block of the inclining block tariff with a 7,000kWh second block, *if such a tariff were applied uniformly across the state*. The number of low income households in the second block is increased significantly with a lower threshold of 5,000kWh, with between 115,000 and 186,000 low income households with consumption above this level.

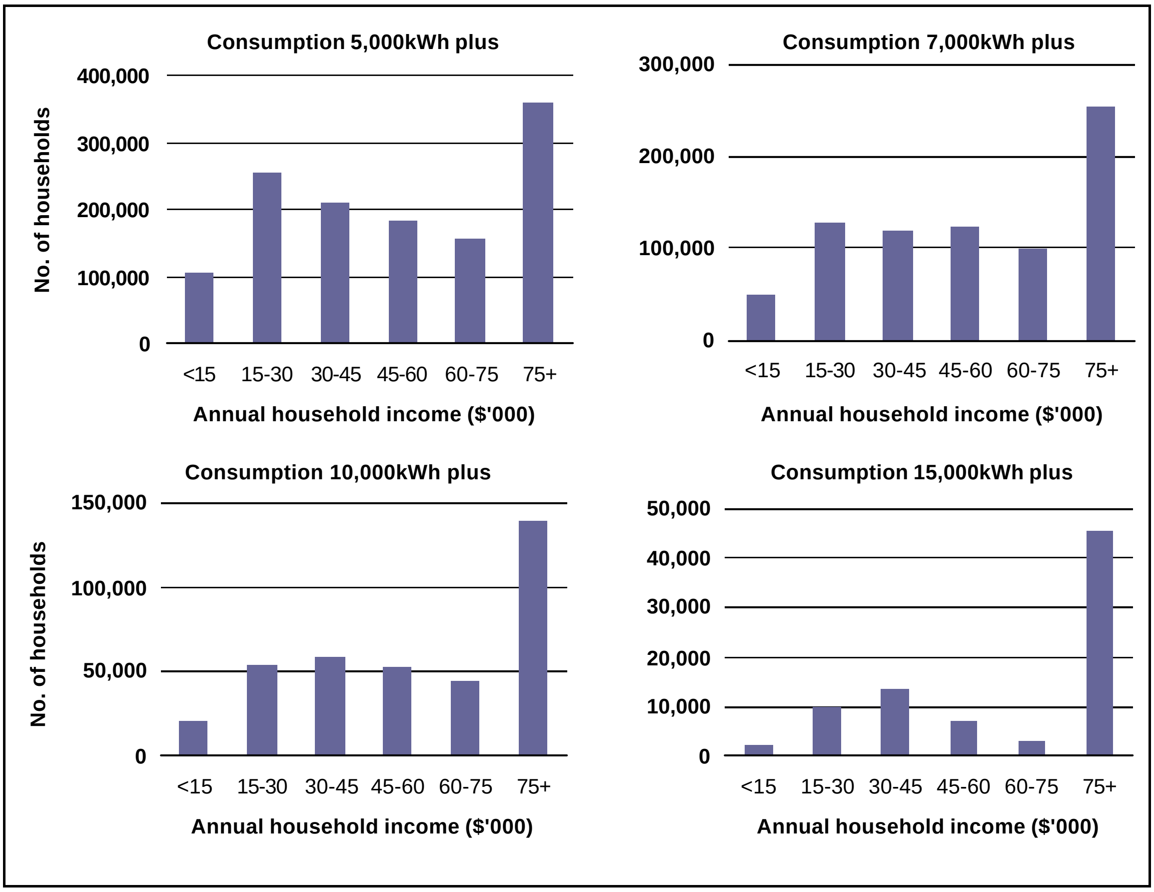
Another way of examining the HES data is to examine the income distribution of all New South Wales households with electricity bills above certain levels. Chart 5.3 shows this for four expenditure thresholds corresponding to annual consumption of 5,000kWh, 7,000kWh, 10,000kWh and 15,000kWh. As the threshold increases, the number of low income households, along with other households, with consumption in the second block falls. For example, at a threshold of 5,000kWh a year, around 106 000 households had household incomes (in 1998/99) less than $15,000 a year. At as threshold of 7,000kWh, this falls to 50,000 and falls to 21,000 and 2,000 for thresholds of 10,000 and 15,000. In today's prices, these thresholds would correspond to quarterly bills of around $150, $210, $290, $420 respectively.

Chart 5.2 Expenditure on electricity by low income NSW households[a]



[a] Defined as households in survey with lowest 20 per cent of household incomes. Corresponds to households with household incomes less than $16,000 a year in 1998/99.
Data source: ABS unpublished data from 1998/99 HES survey.

Chart 5.3 Income distribution by consumption level



Note: Household income levels are as at 1998/99 when HES survey was conducted.
Data source: ABS unpublished data from 1998/99 HES survey.

One question that needs to be considered is the extent to which the HES data reliably reflects current consumption patterns for low income households. Would recent strong economic growth, low unemployment and strong household consumption have significantly altered household consumption patterns? IPART's own survey and Integral's research are likely to provide more up-to-date analysis of how low income households would be affected by inclining block tariffs.

To what extent would instruments such as a tailored or smooth bill payment plan or prepayment meters address equity concerns associated with impacts on low income households? Would these measures assist all low income households or just sections of this group such as pensioners, welfare recipients and other readily identifiable low income households?

To what extent could impacts on low income households be mitigated by selection of the second block threshold?

5.3 What price signals does a network inclining block tariff send?

Like the current single rate structure, an inclining block tariff structure that is reflected in retail prices sends the same price signal to residential and small business customers regardless of when consumption occurs. As such, it does not provide any incentives for shifting consumption from peak to off-peak periods. Any signals for managing demand rely on larger customers located in the second block responding to higher prices by reducing consumption. The strength of this signal will depend upon the difference between the second block tariff and the current flat per kWh charge since this is what consumers currently pay.

In the case of small customers that consume entirely within the first block, these customers may face a lower price per kWh. As discussed in the next chapter, this may encourage greater consumption following the introduction of the inclining block tariff. This signal may be muted by any real price increases allowed under the regulatory framework at the start of the next determination period.

The inclining block tariff offers no direct incentive for reductions in consumption to be concentrated in peak periods. Whether consumption is reduced in peak periods, off-peak periods or a combination of both will depend on individual consumer preferences. To the extent that large consumers tend to consume disproportionately more in peak periods, then it is possible that any demand response would also concentrated in the peak. However, if consumers value peak consumption more highly than off-peak consumption, for example, air conditioning is valued most on the hottest days, then it is also possible that any reduction in consumption would be more focused on off-peak or shoulder periods. In this situation, there would be little deferral of capital expenditure but with reduced consumption during non-peak times, capacity utilisation could be worsened — the reduction in electricity consumption could lead to higher costs per kWh than current levels.

The behaviour of the retailer can potentially impact the nature of the signal sent by the inclining block tariff. Currently network charges are passed through to customers by retailers. It is possible that retailers may choose not to mimic the inclining block tariff structure in final retail prices and retain a flat per kWh rate structure. They may also offer payment options, like bill smoothing, which would negate the seasonal effects of the inclining block and other tariff structures. In this situation the inclining block network tariff would be averaged across the retailer's customers. Depending on the mix of high and low consumption customers, relative to the current flat network structure, retail tariffs may be higher or lower than the current level. For example, if the retailer has predominantly low consumption customers falling in the first consumption block, the network charge would likely be lower on average than currently (assuming DNSPs lower the per kWh charge on the initial consumption block). In this situation, the signal would be to increase energy consumption. In any event, because the network charge is just one component of the retail tariff, this effect is likely to be muted.

In a situation where the retailer passed on a higher averaged network charge (as a result of the block network tariff), the signal for all customers, not just higher consumption customers, would be to reduce consumption. However, for the high consumption customers that the inclining block tariff is intended to target, the signal will be less than if the retailer mimicked the block tariff structure in retail prices. That is, since the inclining block network tariff is averaged across all the retailer's customers, the price increase will be smaller than if only the larger customers paid the additional costs through a block tariff retail price. The experience in Victoria and also EnergyAustralia's recent introduction of an inclining block retail tariff suggest that retailers may see value in adopting an inclining block structure and so may be unlikely to pass through the inclining block network tariff as an averaged single rate.

The averaging of the inclining block tariff across customers by a retailer would create financial risk to it. For example, if larger customers purchased more than expected, the retailer would not raise sufficient revenue from an average network component to cover network charges under an inclining block tariff structure. The retailer then has an incentive to manage this risk and part of this risk management could be by way of demand management activities that focus on high consuming customers. Therefore, even if the signal to the final consumer is muted through averaging, the retailer has incentives to engage in demand management that cuts consumption. However, again, since there is no time dimension to the inclining block tariff, the retailer has no incentive to ensure any cut in consumption occurs during peak times.

To what extent would retailer mimic the inclining block tariff structure in retail prices?

If retailers were to retain present tariff structures, to what extent could they mitigate any financial risk through demand management actions?

5.4 Complementing other tariff reform

Integral Energy have indicated that the inclining block tariff is a key element of their strategy to encourage customers to take up other tariff offerings. The argument is that, faced with higher per kWh energy charges, customers with more favourable load profiles (for example, consuming more electricity during off-peak periods) or customers that can readily alter their consumption profiles will opt for this more flexible/cost reflective tariffs. EnergyAustralia also expect that there will be some migration of customers to other forms of tariff following the introduction of the inclining block tariff. EnergyAustralia suggested that it should

> … act as an incentive for these customers to both reduce that consumption and to request the installation of a Time-of-Use meter so that they may tailor their consumption patterns and potentially reduce costs by changing their usage patterns to avoid peak periods.

A benefit of the inclining block tariff, in terms of price signalling, is that it provides a positive incentive to customers to seek out more cost reflective tariffs — and alter their consumption behaviour. As discussed in chapter 7, the availability of innovative optional tariffs may encourage greater switching by customers and be a more cost effective means of introducing time-based charging than say a blanket roll-out of time-of-use metering.

In principle, the availability of a time-of-use tariff or other tariff alternatives could mitigate the impact of an inclining block tariff on large customers that do not have disproportionate amounts of consumption during peak periods — because these customers could switch off the inclining block tariff. If this were to occur, the inclining block tariff would likely be more cost reflective — the number of customers in the lower left quadrant of Chart 5.1 would be reduced. That is, there would be less concern about the inclining block tariff generating a cross subsidy borne by large customers with disproportionately little demand during peak periods.

The choice of threshold for the second block will be one factor determining how many customers might seek to switch off the inclining block tariff. The higher the block, the fewer the households that would face higher bills and have an incentive to switch.

Metering is one potential barrier to customers switching tariffs. Customers opting off the inclining block tariff onto other tariffs would require installation of time-of-use type meters. This raises questions regarding who should bear the cost of the meter installation and whether it would be worthwhile for customers to switch in the face of these costs. This decision will depend on the size of the potential cost saving relative to the cost of meter installation. The longer period against which the customer can write off the cost of the meter against electricity cost savings, the smaller will be the barrier posed by metering costs.

Large customer who are residents of tenanted properties may have a shorter time horizon than owner occupiers over which they might compare the benefits of switching (lower electricity bills) against the cost of switching (meter installation). The ability for these customers to switch might be more limited due to metering costs, leaving them to face higher charges under the inclining block tariff.

In regard to its proposed meter roll-out for customers consuming greater than 15MWh a year, EnergyAustralia, signalled that the cost of the proposal was contingent on securing additional technical staff to install the meters and the commercial release of an electronic half hourly meter that is still currently in development (EnergyAustralia submission, p 77). At issue is whether DNSPs have sufficient capacity to switch customers to time-of-use tariffs in a timely manner.

How readily would customers switch tariffs in the face of an inclining block tariff.

Given the cost of switching meters, would there be sufficient incentive for customers to switch tariffs? Is this incentive weaker for customers in rental properties whose time horizon for the recovery of any change-over costs may be more limited?

Would there be sufficient resources available to DNSPs to install time-of-use meters for customers in a timely manner?

6 HOW LIKELY ARE CUSTOMERS TO RESPOND TO PRICE SIGNALS?

Both the current structure and the inclining block tariff rely on customers responding to higher prices to bring about reductions in peak period consumption. With an inclining block network tariff that is reflected in the retail tariff structure, a higher price signal is sent only to larger customers with consumption in the second block.

To the extent that this price signal is successful in encouraging customers to cut peak consumption, there should be benefits to all consumers in terms of lower capital and operating costs and lower average electricity prices. To gauge the potential size of these benefits requires judgement of how customers are likely to respond to this price signal. The size of the response will depend on how willing and able customers are to reduce their electricity consumption in the face of a price increase. This response can be captured through what economists term the 'price elasticity of demand'. The following section presents the results of a brief survey of the literature on how consumers react to price increases (that is, the magnitude of the price elasticity of demand) and discusses the implications for pricing.

6.1 The literature of price responsiveness of demand

How customers respond to a change in the price of electricity will depend upon a number of factors including:

- how large the *retail* price change is
- how much they value the activity that electricity is delivering (for example, keeping the house cool/hot, cleaning dishes)
- how important electricity is in terms of their weekly expenditures
- opportunities for replacing electricity as a source of fuel (for example, for cooking or heating)
- what existing appliances they have in their residence or premises.

The potential response that consumers have to changes in the price of a good or service can be quantified using the *price elasticity of demand (PED).* The PED is calculated as the proportionate change in quantity as a result of a 1 per cent change in the price. It is typically expressed as a negative number. For example, a price elasticity of demand of -0.3 means that a 1 per cent change in price would lead to a 0.3 per cent reduction in quantity consumed. Demand is said to be price 'inelastic' if a 1 per cent change in price leads to a less than 1 per cent change in quantity — that is, demand is not very responsive to changes in price. If the change in quantity consumed is greater than 1 per cent then demand is said to be price 'elastic'.

A large number of studies have examined the price elasticity of demand for electricity in a number of different locations and in a range of different circumstances. A brief survey of these studies is summarised in Appendix 1. Not surprisingly, the literature reveals variations in the estimates of the price elasticity of demand. However, some broad conclusions that can be drawn from the literature are as follows:

- consumption of electricity may be relatively unresponsive to price (the PED might be between -0.2 and -0.5 for New South Wales)

- responsiveness to price tends to be larger in the long run, albeit still inelastic, as the appliance stock turns over and building standards change
- households with air conditioning tend to be more price responsive than those without, although consumption is still price inelastic
- consumption in peak periods is more elastic than consumption in off-peak periods, in the context of time varying tariffs
- peak and off-peak consumption tend to be substitutes, a rise in the peak period price tends to lead to shifting of consumption away from the peak and into the off-peak period
- commercial customers tend to be more price inelastic.

6.2 Implications for pricing

The proposal of DNSPs to introduce an inclining block tariff will increase the cost of marginal consumption for higher end consumers of electricity. This would also increase the average network charge per unit of consumption for these consumers at a consumption level somewhere in excess of the block — for example, EnergyAustralia's proposed block of 7MWh would lead to higher total network charges at a consumption level of 8.6MWh. To the extent that these higher network charges translate into a higher retail price and if a range of between -0.2 and -0.5 can be taken as a representative elasticity of demand for New South Wales (as suggested by NIEIR), then this proposal would likely have some impact on consumption for these customers. However, given the relative unresponsiveness of demand to changes in prices (reflected in the low price elasticity) this response may be limited. The exact magnitudes would depend on the extent to which the marginal price (that is, the price paid for their last unit of consumption) is increased relative to the current single per kWh price.

Customers will respond to changes in the final retail price when making their consumption decisions. Since the network charge is only one component of the retail price, any signal from a change in the network charge structure will be partially muted when the other retail tariff components are added to it — that is, in percentage change terms it will be lower. In applying price elasticities to estimate impacts on demand, elasticity should be applied to the percentage change in retail price. This will require an estimate of how the inclining block tariffs for network charges affects the retail price of electricity. As discussed in the previous chapter the change is retail price will also depend on how the retailer passes through the inclining block tariff — either as a block structure or as a smeared average network charge.

The response to price changes may be larger in the long run. Given the existing appliances it may be several years before these customers may be able to fully respond to higher prices through replacement with more energy efficient appliances or even non-replacement of old appliances. In the short run, the greatest gains in terms of reducing growth in demand might be gained through targeting new or upgraded installations where appliance installation decisions can be more readily influenced by the structure of charges. EnergyAustralia's proposed infrastructure charge for new and upgraded services may have a greater impact on growth in peak consumption in the short run than inclining block tariffs.

As noted earlier, the inclining block tariff does not provide a direct signal to cut consumption in the peak. Instead it relies on a broad price signal for customers to cut consumption, which may or may not be during peak periods. One question is then the extent to which any price response would affect the level of demand in the system peak. The findings that households with air conditioning tend to be more price responsive and that demand in peak periods is like to be more elastic than in off peak suggest that any price response would likely have relatively more impact on peak period demand than off-peak. This would be consistent with the objectives of the pricing proposal. However, there are two important caveats to this. Firstly, the findings in relation to the relative responses during peak and off-peak periods was in the context of time varying tariffs — whether this finding would hold in the context of an increase in the 'anytime' or flat rate tariff as proposed under the inclining block tariff proposal is uncertain.

The second important caveat is that the elasticity estimates refer to energy rather than demand. At a recent Pricing Issues Consultation Group meeting, it was suggested that the inclining block tariff might lead to a situation where customers might attempt to constrain their usage to a more limited time frame, which would have the effect of lowering energy consumption (and revenue) but not have much impact on system demand at the peak (which drives cost). If this were the case, then the proposal would not meet its objectives. That said, a study by Kirkeide (1989) found that coincident peak demand was somewhat responsive to the price of on-peak electricity (with an elasticity of -0.28 (ESC 2002). The extent to which an inclining block tariff would have a similar impact is an important question in the current context.

Another consideration is that some customers, particularly lower energy consumers, are likely to face lower marginal prices as DNSPs reduce the price of the first block to offset the higher second block marginal price to satisfy the constraint of the weighted average price cap. The effect of this may be to stimulate energy consumption by these households, particularly in the peak period when demand is likely more responsive. This effect could work against the impact of the inclining block tariffs in terms of reducing peak energy demand. The effect of a price reduction on consumption could be relatively smaller than a similar price increase as there is some evidence in the literature that consumers view price decreases differently from price increases (a lower elasticity for price decreases) (NIEIR 2002). If the DNSPs are granted average price increases at the start of the next regulatory period, the impact of structural change on the lowering prices for low end customer would be mitigated to some degree.

The findings of the work by Filippini highlights a problem with the inclining block tariff proposal — it does not price according to the time of consumption. Here the objective is to reduce system peak period consumption and demand, but the tariff change is focused on anytime energy consumption. While there is likely to be some impact on peak period consumption and demand from the proposal, the impact would likely be greater if there were differentiation of peak and off-peak tariffs. Filippini (1995) found that peak consumption was more responsive to peak pricing than overall consumption was to an averaged price index. This is because consumers are able to substitute peak consumption for off-peak consumption (indicated by the positive cross price elasticities that Filippini identified). It is precisely this effect that DNSPs are seeking to improve capacity utilisation. If off-peak prices rise as well, as they would under the inclining block tariff proposal, then these substitution effects could not operate. The importance of these substitution effects lends support to the proposals to roll-out time-of-use metering by EnergyAustralia and Country Energy.

The limited price elasticities identified for commercial customers relative to residential customers raises some doubts as to the merits of extending the inclining block tariff to business customers that may not be able to respond to price signals.

6.3 Limitations of the price elasticity measure

The PED values identified in the literature review are typically average values for customer groups. These average values may not fully reflect the diversity within customer groups which might see some customers with more responsive demands than others. These customers may be more likely to respond to the inclining block tariffs by either reducing their demand or being encouraged to switch to more cost reflective time-of-use tariffs and be rewarded for improving their consumption profile.

The kind of studies that have generated the price elasticity estimates discussed above are unlikely to have captures this latter effect. The available literature provides few insights on how likely customers are to switch to optional tariffs in the face of inclining block tariffs. The ability to opt for an alternative tariff structure that rewards consumption outside of peak periods could mean that the estimates obtained from the literature might understate the true demand response in the current context.

Given the price structures proposed by DNSPs, what impact on retail prices would be expected? What change in consumption could be expected? Would this affect system peak demand?

How much lower will prices be for customers located entirely within the first consumption block? What change in consumption would be expected as a result of this price reduction? Would it have an impact on system peak demand?

How likely are customers to respond to the inclining block tariff by switching to alternative tariffs such as time-of-use or interruptible load tariffs.

How much of consumption covered by inclining blocks is for small business? How responsive would these customers be to changes in price?

7 ALTERNATIVE/COMPLEMENTARY APPROACHES

This section flags some alternatives to the inclining network block tariff proposal for residential and small business customers. Some of these alternatives such as optional tariffs may be most appropriately applied at the retail level. A question for both DNSPs and stakeholders is what benefits does the inclining block network tariff offer over these alternatives? Is the inclining block network tariff in combination with other proposed tariff reforms a better strategy to pursue than alternatives such as accelerating the roll-out of time-of-use metering or focusing more on non-price demand management alternatives? Could an inclining block tariff complement these other approaches making their application more effective? Could these alternatives complement the introduction of an inclining block tariff by mitigating any unattractive outcomes associated with inclining block tariffs? This chapter considers these issues.

7.1 Rolling out time-of-use/interval metering

Meters that record electricity consumption at the time it was consumed have the capacity to provide much more direct signals than inclining block tariffs do to consumers about the cost of their consumption during peak periods. Time-of-use and seasonal tariffs, with higher prices in the peak period have the capacity to encourage both reduced overall consumption and shifting of load to off-peak periods. Both customers and their retailers would have incentives to manage consumption to avoided costly peak periods. Time-of-use tariffs would also mean lower bills for large users that consume proportionately less during peak periods than under the inclining block tariff proposal.

The availability of time-of-use/interval metering would expand the range of tariff options that could apply to residential customers. In addition to a standard time-of-use tariff, CRA has identified a number of tariff options based upon interval metering:[12]

- coincident peak demand tariffs
- anytime maximum demand tariffs
- zonal and nodal pricing.

Currently interval meters are mandatory for customers consuming greater than 160MWh per annum, for competitive customers replacing their old meter and, in some circumstances, for new customers. Under current government policy, residential and small business customers (consuming less than 160MWh a year) have the option of using an interval meter if they choose. In its Inquiry into Demand Management, the Tribunal recommended that the government review the policy for the roll-out of interval meters and to consider a more rapid roll-out to provide better price signals and to increase the capacity for end-users to respond to signals by modifying consumption.

A potential barrier to greater time-of-use metering is the time and resources required to achieve a more rapid roll-out of metering are likely to quite significant. The penetration of time-of-use meters might be quite limited for a number of years. This suggests that a more targeted approach to metering might be more desirable.

12 Charles River Associates, *Impact of Air Conditioners on Integral Energy's Network*, May 2003, p 34.

As already discussed, EnergyAustralia has indicated that, in seeking the Tribunal's approval of associated expenditure, it intends to roll-out time-of-use meters to all customers consuming greater than 15MWh a year. EnergyAustralia estimates that this would cover around 82,000 customers. Penetration of interval metering could be increased if this threshold were lower than 15MWh. Other options for increasing the penetration of interval metering include:

- targeted roll-out to large users (for example, those with three-phase power, as currently done by EnergyAustralia) and/or those likely to have particularly 'peak' loads (for example households with air conditioning)
- a trial program of regional roll-out of interval metering which could be linked to regions where there is network congestion.

Even with a more extensive meter roll-out, there is an issue of how many customers would voluntarily switch to time-of-use *tariffs* from the current flat per kWh rate. As discussed in the next section it is not necessary for time based tariffs to be compulsory for residential customers, optional tariffs can provide for a more targeted approach to rolling out time-of-use meters that would reduce the cost of meter roll-out.

Could time-of-use metering be rolled out more extensively than current proposals? What would a realistic timeframe be for this to occur?

Is it practical to roll-out meters on the basis of whether households have air conditioning or not? Are there other criteria that might be applied that guide the roll-out of meters?

7.2 Optional tariffs

An alternative to rolling out time-of-use meters to all customers with consumption over a particular level would be to introduce optional tariffs tied to time-of-use consumption. Under this approach, customer would be able to choose among a range of retail tariff options — for example, the existing flat rate structure or say, a time-of-use variation with high peak pricing but low off-peak charges. Under this approach, customers that are best able to manage their consumption profile might opt for a time-of-use option, allowing them to reduce their bill if they can manage their consumption to avoid peak periods. Box 7.1 describes a successful example of optional tariffs from the United States.

Box 7.1 Optional tariffs in practice

An optional tariff has been successfully applied in Florida by Gulf Power[13]. Gulf Power's customers are able to choose between:

- the standard residential flat rate tariff structure
- a conventional time-of-use structure with a standard two part peak/off-peak tariff
- the Residential Select Variable Pricing Program (RSVP) with three standard time-of-use periods and substantially more expensive critical peak pricing.

The RSVP tariff offers a higher off-peak charge than the standard time-of-use structure but a lower peak price. The critical peak price can be dispatched by Gulf Power at any time on a need basis with 30 minutes notice for no more than 1 per cent or 88 hours a year. The RSVP relies on sophisticated metering and control devices which customers contribute to via a monthly participation fee. Gulf Power expects that approximately 10 to 12 per cent of its residential customers to eventually sign up for the RSVP price structure. Gulf Power report some significant demand and energy reductions among customers and high degrees of customer satisfaction.

An optional tariff approach would likely lead to more cost reflective tariffs. With lower cost customers opting onto the optional tariff, the remaining customers on the single rate tariff would tend to be higher cost customers that use the network more intensively during peak times. These customer tend to benefit from the cross subsidy created under the single rate approach when costs are smeared across all high and low cost customers. In principle, with lower cost customers opting off the single rate tariff, the average costs of meeting the demands of single rate customers would rise, which, under cost-reflective pricing, would justify a rise in the single rate tariff. This rising price would therefore provide a stronger signal to higher cost customers as to the true cost associated with their consumption profile. However, the impact upon smaller customers, as the standard rate progressively increases compared with the lower rate for small customers in an inclining block tariff, needs to be considered.

As discussed earlier, the willingness of customers to switch tariff may be inhibited by the cost of time-of-use meter installation if they are required to bear the costs. However, it might be the case that if the roll-out of meters is successful in generating a demand response, then it might be the case that the value of the deferred capital expenditure is greater than the cost of the meter. It would then make economic and financial sense for the meters to be funded by the DNSP. This would reduce any barriers to the take up of more attractive tariffs, while still yielding the DNSP a net reduction in costs. The extent to which the deferred capital expenditure is sufficient to justify the DNSP bearing the cost of metering would depend upon each DNSPs individual circumstances and the willingness and ability of its customers to respond to price signals.

An optional approach could be more cost effective than a blanket roll-out of time-of-use meters. By targeting time-of-use meters to those that 'self-select' to more cost reflective tariffs, the extent of the roll-out could be reduced, lowering overall metering costs. Although balanced against this would need to be any dissavings through any loss of economies of scale associated with a more comprehensive meter roll-out.

13 The program is discussed in detail in Borenstein, S., Jaske, M., and Rosenfeld, A. 2002, *Dynamic Pricing, Advanced Metering, and Demand Response in Electricity Markets'*, Hewlett Foundation Energy Series, http://www.ef.org/energyseries_dynamic.cfm.

As discussed earlier, EnergyAustralia and Integral Energy have in mind customers self-selecting a time-of-use or other optional tariff to avoid higher costs under the inclining block tariff. In this situation, the inclining block tariff is providing a sharper incentive for these customers to opt for a time-of-use tariff. A question is whether it is necessary to introduce the inclining block network tariff in order for customer to self-select time-of-use or similar tariffs. The experience of Gulf Power suggests it may be practical to design an optional time-of-use tariff that operates alongside a standard flat rate tariff, as is currently in place. Would this experience translate to the New South Wales context?

Another key issue is the extent to which network businesses would be able to influence choices of customers who typically choose from a range of retail tariffs. To what extent do the network businesses have to coordinate with retailers to develop retail tariff offerings that meet network objectives?

Would customers take up optional tariffs if they were offered alongside the current flat rate charge structure?

How critical would the inclining block tariff be in terms of encouraging the take up of such tariffs?

7.3 Load profiling

Currently, a reasonably aggregated load profile based upon average consumption patterns is applied to each customer class to determine the allocation of energy costs. In the absence of, or prior to, a more extensive roll-out of interval metering, there may be scope to send stronger signals to users through greater disaggregation of load profiling and assignment to more representative and cost reflective load profiles. Under this approach the assignment of a load profile could be linked to a physical action that guarantees that the customer has changed their load profile to one which is skewed more toward off-peak consumption. For example, customers could wire in their dishwashers or washing machines to off-peak circuits such as those used for off-peak hot water in return for being assigned to a load profile more skewed to off-peak consumption and lower average network costs. This option is currently available in the market place.

Such an option provides incentives to consumers to switch if they are prepared to accept more restricted times of use on such appliances.

To what extent is improved load profiling a feasible alternative to inclining block tariffs? How significant would changes in behaviour be under this approach?

Does the current availability of this option need to be more widely advertised?

7.4 Limited roll-out of inclining block tariffs on a regional basis

The introduction of the inclining block tariffs across the full customer bases of DNSPs may have a significant impact on the bills of all customers. As discussed earlier, the inclining block tariff is an imperfect signal of the cost of peak consumption and is not without disadvantages in terms of re-distributing the costs across customers. Further, there is considerable uncertainty over the likely reaction of customers to these tariffs — will they respond at all, will the response be as intended?

As an alternative to the full roll-out of inclining block tariffs, could the structure be implemented or trialed regional/zonal basis? That is, could the single rate tariff be replaced with a inclining block tariff on a trial basis in areas of network congestion where capital augmentations are likely to be required. Such an approach would have the advantage of limiting the impact of the proposal across customers but still signalling higher energy prices to customers. This limited approach would allow DNSPs to learn more about how customers are likely to respond to its introduction on a wider basis.

Could the inclining block tariff be introduced on a limited scale, perhaps in particularareas of network congestion, as a trial of its effectiveness?

7.5 Non-price demand management

The Tribunal's Inquiry into Demand Management highlighted the importance of price and non-price demand management in managing network usage and expenditure. CRA notes[14] that:

> …[t]he basic DSM approach for managing these loads is by offering customers some form of financial remuneration in exchange for the right to control the end-use contributing to the problem. Other utilities have found that it is often far more cost effective to incent customers to reduce load than to install peaking capacity that remains unutilised 99% of the time.

The Tribunal's inquiry highlighted the success overseas of voluntary demand response programs in which customers are paid to reduce load at time of peak demand. These programs do not involve penalties for failure to perform and so are quite popular among consumers. Examples include:

- The 'Cash for Kilowatts' program in California, which provided incentives to commercial buildings to reduce electricity load during peak times when the price of electricity is high or when the network operator calls for load reduction for grid reliability.
- A number of Curtailment Programs offered by ComEd in Chicago that offer financial incentives for businesses to reduce their energy usage on certain days during peak periods when the area-wide demand places maximum strain on the transmission and distribution system. Under these programs, participants can receive up to 20 times what they pay for electricity.

ComEd also operates an air conditioning cycling program, Nature First, which allows the company to cycle a residential customer's air conditioning compressor on and off, so it uses less power safely on the hottest days of the year. The fan stays on to circulate air, so homes stay comfortable. As part of the program the utility installs a control switch on the side of the home or on the air conditioner's compressor panel that allows it to cycle the compressor off, thereby helping manage electric demand and use resources more efficiently. Integral Energy has undertaken trials of cycling and load-shedding of air conditioners and found that significant potential exists to shed load from residential air conditioners during system peak.[15]

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14 Charles River Associates, *Impact of Air Conditioners on Integral Energy's Network*, May 2003, p 41.

15 Ibid, p 42.

These types of Demand Response Programs have received renewed interest overseas[16] because their dual hedge against reliability risks such as generation shortfalls and network congestion, as well as financial risks such as wholesale price spikes. The success of these schemes is likely to depend on building a critical mass in the portfolio of participants to ensure greater reliability of response.

CRA suggests that the introduction of air-conditioning control programs should be accompanied by alternate tariff options so that electing not to participate in the load program would expose the consumer to the true cost of their peak consumption.[17] CRA suggest that given the widespread use of accumulation meters, this would most likely be an inclining block tariff.

The use of interruptible load and load shedding contracts is another potential demand management response that could lower demands at peak time. Under these contracts, customers cede some control over their load in return for more favourable terms. In deciding whether to enter into such contracts, customers seek to strike a balance between lower costs and a higher risk of reduced supply at acceptable times. DNSPs in New South Wales are already implementing such contracts and finding they generate savings in network costs through avoided operating costs and deferred capital expenditure.

How successful would voluntary load reduction programs be in reducing load at peak times? How attractive would such programs be to customers?

To what extent would take up of such programs be influenced by the presence or absence of an inclining block tariff?

What kind of demand reduction is likely from more extensive use of interruptible and load shedding contracts?

7.6 Education

Experience overseas suggests that price and non-price demand management programs need to be supported by public information and education program that increase customers' awareness of the opportunities for reducing their consumption and reducing their electricity bills. In this regard, public information programs complement these demand management initiatives. A question is to what extent could public information programs substitute for say the introduction of an inclining block tariff or other price reforms — for example, would a program targeting higher temperature settings on air conditioning be effective in reducing peak demand?

How effective would public education programs be on their own? Do such programs need to be accompanied by financial rewards or penalties to be effective?

16 The CRA report (Ibid) identifies that at least ten utilities in the United States have either launched or are launching demand side initiatives to address air-conditioner driven peak demand.

17 Ibid, p 40.

APPENDIX 1 SOME EVIDENCE ON POTENTIAL DEMAND RESPONSES

Assessing the potential demand response requires some view on how customer's consumption will respond to changes in price — that is, an estimate of likely price elasticity of demand. The price elasticity of demand measures the responsiveness of demand/consumption to changes in price and is calculated as the proportionate change in quantity as a result of a 1 per cent change in the price. For example, a price elasticity of demand of -0.3 means that a 1 per cent change in price would lead to a 0.3 per cent reduction in quantity consumed. In this case, demand is said to be price 'inelastic' — not very responsive to changes in price. A price elasticity of demand less than -1 (ie greater than 1 in absolute terms) means that demand is price 'elastic'.

This section provides a brief survey of the literature on the price elasticity of demand for electricity.

A1.1 Australian estimates

NEMMCO commissioned National Institute of Economic and Industry Research (NIEIR) in 2002 to provide advice on the long run price elasticity of demand for electricity in the NEM region as part of the preparation of the 2002 Statement of Opportunities. Based upon a review of overseas and Australian literature, NIEIR (2002) recommended the following long run elasticities of demand:

- Residential -0.25
- Commercial -0.35
- Industrial -0.38

For New South Wales, NIEIR estimated that the long run PED lies in the range –0.22 to –0.52 with a mean value of –0.37.

Using ABS data from 1969 to 1999, Akmal and Stern (2001) have examined the residential PED across all types of energy in Australia. For electricity, they estimate a long run elasticity of –0.95. Akmal and Stern (2001) also report values from other Australian studies (mainly produced in the 1980s using data from 1960 to 1982). These studies estimated elasticities in the range –0.55 to –0.86.

In its position paper on the assessment of costs and benefits of interval metering for electricity companies, the Victorian Essential Services Commission (ESC) adopted a PED of –0.1 for Victoria. This was at the lower end of a range of between –0.1 and –0.3 identified by their consultants from a survey of studies largely from the United States (see below). The ESC felt this lower value was justified on the basis of lower penetration of air conditioning and electrical appliances in Victoria compared with the United States. For non residential customers, the ESC adopted a lower value of –0.025, consistent with the findings of its consultant's literature review.

A1.2 International estimates

ESC (2002) reports the results of a Charles River Associates survey of empirical studies that have been conducted primarily in the US to measure the responsiveness of customers to time-varying rates. The key findings of that survey were:

- the demand for electricity by time-of-use is inelastic in the short run, with most values for own-price elasticity of peak-period energy usage falling between –0.1 and –0.3
- the own-price elasticity of demand for on-peak usage is typically larger than the own-price elasticity of demand for off-peak usage
- price elasticities will be higher for households that have air-conditioning systems than for households that do not, and
- price elasticities for residential customers are significantly larger than for small to medium business customers.

Filippini (1995) examined how responsive demand is to time-of-use tariffs for peak and off-peak periods in Switzerland. He estimated that the short-run own price elasticities are -0.60 during the peak period and -0.79 during the off-peak period.[18] These elasticities are higher in the long-run, -0.71 and -1.92 during the off-peak period. Filippini also found that cross - price elasticities — that is, the responsiveness of peak period consumption to changes in the off-peak price and vice versa — were positive. That is, in response to a rise in the peak period price, consumers will tend to reduce their consumption in the peak period and increase their consumption in the off-peak period. That is peak and off-peak consumption are substitutes. Filippini concludes that time-of-use pricing seems to provide consumers with a strong incentive to find a substitute for peak-period consumption, serving to reduce the needs for extra capacity. A later study by Filippini (1999) found that the overall price elasticity (combined peak and off-peak) to be around -0.3. This suggests that when the overall price rises (in both peak and non-peak periods) opportunities for substitution are lessened and overall price response is lower.

Reiss and White (2002) examined household electricity demand in California using data from 1993 and 1997. In their study, they estimate a mean annual PED for electricity of –0.39. They suggest that their result is slightly higher than the typical range estimated using utility data of –0.15 to –0.35 and close to an earlier study of Los Angeles households which identified a price elasticity of –0.35.

Reiss and White (2002) also generate estimates of price elasticities for households of different characteristics. The key results are:

- households with electric space heating or air conditioning exhibit higher price elasticities (-1.0 for space heating and –0.6 air conditioning) than households without such systems (close to zero for households without either of these systems)
- lower income households tend to be more sensitive to energy prices than households with medium to high incomes (consistent with 'conventional wisdom')
- elasticities are lower for households that use high amounts of electricity (the authors recognise that this is a slightly unusual result in light of the two previous conclusions and suggest that it reflects both a weak correlation between household income and

18 This is in contrast to the finding reported by Charles River Associates that on-peak elasticity of demand is typically more elastic than off-peak demand.

ownership of space heating/air conditioning and the fact that households tend to substitute toward more price-inelastic electricity use as income rises).

Other studies that have estimated PED for electricity include:

- Miller (2001) which estimated a long run residential demand elasticity for the United States of –0.37
- Filippini and Pachauri (2002) which estimated a short run residential demand elasticity of between –0.16 and –0.39 for Indian households
- Wade (1999) which applies an estimated short run PED of -0.23 and a long run PED of -0.31 for the residential sector and -0.24 and -0.25 respectively for the commercial sector in United States Department of Energy modelling of the energy sector
- Fatai, Oxley and Scrimgeour (2003) which estimated a short run PED for New Zealand of between -0.18 and -0.24 and a long run PED of between -0.44 and -0.59
- studies reviewed by Sayers and Shield (2001) and Fatai, Oxley and Scrimgeour (2003) for various countries that yielded estimates of the short run PED of between -0.17 and 0.7 and for the long run PED of between -0.27 and 1.1795 (table A.1), and
- studies reviewed by Sayers and Shield (2001) examining the PED for commercial customers — Beenstock et al (1999) which identified a long-run elasticity of –0.435 and Nan and Murray (1991) which identified short and long run elasticities of –0.7814 and –0.8313 respectively.[19]

A.1.1 Demand elasticity estimates

Author	Elasticity estimates for residential customers	
	Short run	Long run
Nan and Murray (1991)	-0.611	-1.1795
Beenstock et al. (1999)		-0.579
Tiwari (2000)	-0.7	
Herriges and King (1994)	-0.2 (summer) -0.4 (winter)	
Archibald et al. (1982)	-0.4 (summer) -0.48 (winter)	
Barnes et al. (1981)	-0.55	
Dubin (1985)	-0.16	
Dubin and McFadden (1984)	-0.25	
Goett and McFadden (1982)	-0.17	
Houston (1982)	-0.28	
McFadden et al. (1977)	-0.37	
Chang and Hsing (1991)	-0.33	
Silk and Joutz (1997)	-0.62	
Bjorner et al. (2002)	-0.4 – -0.13	
Vaaga (1993)		-0.27

Source: Sayers and Shielf (2001) and Fatai et al (2003).

19 With the exception of Nan and Murray (1991) short run elasticity estimate, the elasticity estimates for commercial customers in these studies were lower than the corresponding elasticity for residential customers.

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