

In this chapter we contrast the lack of demand-side initiatives pre-reform with those emerging, at times under duress, post-reform. Retail electricity customers in New Zealand clearly now enjoy much greater choice as to their energy supplier (discussed in Chapter 5), even if their local lines remain monopolies. That this translates into greater competition in generation and energy retailing remains the case, even given New Zealand's somewhat unusual convergence on vertically integrated generators and energy retailers. Furthermore, despite this industry configuration, it has been possible for lines companies to elicit demand-side responses saving on network capacity, effectively uncoupling peak demand from energy growth. We then go on to take a critical look at the nature, purpose, objectives, and targets of demand-side initiatives such as those advocated by the Energy Efficiency and Conservation Authority (EECA).

In short, we argue that the most promising innovation in this area is the development of power exchanges at the retail customer level, which would augment an equally desirable innovation – load-limiting fuses with capacity subscriptions – discussed in relation to ensuring supply security in Chapter 10. The combination of such innovations would give smaller consumers (those who currently lack both price signals and a willingness to alter short-term demand patterns in response to price changes) the incentive and opportunity to profit by curtailing their electricity demand when supply is tight. The benefits of price-responsive demand are clear. What is less clear is whether consumers are interested in making the trade-offs required to achieve those benefits.

INTRODUCTION

An Increasing Focus

The nature and importance of electricity-user participation in the changing electricity industry equation is a matter receiving increasing focus. This changing focus can be seen as a long-overdue piece in the electricity reform jigsaw, or recognition that quality and supply certainty are more important in the e-world of a modern economy. It could, however, simply be an afterthought to the state-dominated supply-side focus in the New Zealand electricity sector of almost a century. Covering a range of matters as diverse as power exchanges and pre-payment meters, through to real-time electricity pricing and disclosure of all wholesale electricity market bids and offers, demand-side participation discussions can degenerate into circuitous debate. There are very real reasons to wish to encourage improved demand-side participation in the electricity sector, but it is essential that the suggested measures do not defeat the purposes they are intended to achieve.

Economic Issues

As summarised in Chapter 2, the relevant classical economic analyses fall into two areas. The first is to do with the impact on consumers of suppliers having market power, in the extreme case monopoly power. Conventional economic analysis predicts that consumers suffer both higher prices and lower supplies in the presence of such market power, and that suppliers with market power enjoy greater abnormal profits. These effects are worsened where demand is unresponsive to changes in electricity price. Thus, increasing demand's responsiveness to price should lessen the impact of any generator market power (less so for transmission and distribution market power, to the extent that their charges have fixed components). In turn, this reduces the need for distortionary market interventions, such as price caps, which hinder investment and worsen supply security.¹

The second relates to the relative burden of supply (or demand) shocks when electricity demanded by consumers is less responsive to changes in electricity price than that supplied by electricity suppliers, particularly in the extreme case where electricity demands (especially in the very short term) do not change at all in response to price changes.² Such analysis predicts that consumers bear the impact of sudden changes in supply (or demand) in the form of higher prices, and that suppliers enjoy both those higher prices and sustained levels of demand (which may or may not translate directly into higher profits, depending on whether, for example, the supply shock was due to rising supply costs). Both branches of analysis predict benefits of some magnitude to consumers in increasing the responsiveness of consumer demands to changes in price, which presumes both that consumers face changes in electricity prices (as opposed to fixed prices) and that they have the desire or cost-effective capacity to alter their consumption patterns when they do.³ Additionally, where demand becomes more price-responsive, requirements for new and/or peaking generation are reduced, with associated financial and environmental benefits. Simultaneously, price-responsive demand reduces the probability that electricity markets will not balance, thus improving supply security.

Main Demand-Side Thrusts

Accordingly, initiatives to improve the electricity sector's demand-side response have had two main thrusts. The first has been directed at providing electricity consumers with greater choice as to whom they buy their energy from – ensuring the sector is structured, and market rules are designed, to ensure competition among suppliers, and thereby to ensure that consumers are not captive to rises or volatility in electricity prices. In a sense this treats the problems of price-inelasticity in demand (and/or supply) as given. Instead it concentrates on ameliorating the adverse consequences to consumers

¹ See Meade (2005).

² Conversely, in such circumstances very small changes in demand (e.g. due to sudden weather changes) affect prices very considerably.

³ Additional considerations arise, for example, in respect of the more subtle yet important matters of risk-preferences, as well as time-preferences, and informational costs and asymmetries.

of any market power in generation (and also in transmission and distribution), or from market arrangements being “gamed” (see Chapter 9).

The second thrust, in effect, seeks to increase the price elasticity of demand, in other words increasing the ability of and incentives for consumers to alter their electricity consumption in response to short- or long-term price changes. Once again, this is both to encourage competition and to mitigate any market power effects. However, it runs up against the likely preference of at least some customers for low-risk, fixed-price supply contracts that enable them to insulate their consumption from changing supply circumstances.

In turn, both of these thrusts require other measures, such as efficient means of changing electricity suppliers, greater information on and incentives to invest in energy efficiencies as well as to respond to changes in electricity prices, and a transmission grid not giving rise to constraints that can lead to short-term and/or regional instances of market power (see Chapter 9).

HISTORY OF DEMAND-SIDE PARTICIPATION

Pre-Reforms

Moves to encourage greater demand-side participation in the electricity sector have not been easy or rapid, for understandable reasons. For most of the twentieth century the sector was largely centrally planned and controlled, and focused in the main on supply-side issues. Recurring supply shortages and increasing constraints on the funding required to ensure that supply kept pace with ever-growing demand presented ample reason for demand efficiencies to be achieved. However, in the absence of strong price-based signals for users to economise and a lack of political will to give such signals, consumers faced little reason to change their demand habits, and government had few means to give them any.

As a consequence, demand-side participation has meant historically in New Zealand little more than ESAs or government dictating to consumers when or how they could not use electricity. As discussed in Chapter 6, these “measures” have taken the form of rolling blackouts, cuts to television broadcasting hours, electric water heaters being turned off during supply shortages, or war-time regulation limiting the types of appliances that could be purchased and used. Little regard was had to the unequal burden of such impositions on different classes of users – consumers were simply “getting what they were given” and “doing what they were told”. Administratively determined electricity prices, particularly where they were maintained below economic levels, encouraged inefficient technologies and consumption – giving little incentive to conserve energy or invest in energy efficiencies – and required greater investment in generation to meet demand than was otherwise required. Their effect on consumer welfare would likely be even worse now in an e-economy where even the smallest electricity consumers rely upon the continuous availability of digital devices.

Industry Initiatives Post-Reform

The first winter supply shortage experienced by the reformed industry in 1992 illustrated that a fundamental shift in thinking had occurred. While the industry was still only partially decentralised and still under the dominance of state-owned monopoly generator Electricity Corporation of New Zealand (ECNZ), greater emphasis was placed on the need for consumers to determine how best to achieve required energy savings. Until very recently this has remained the main thrust of responses to winter crises, but the reserve generation requirements placed on the new Electricity Commission from 2004 (discussed in Chapter 6), and the Commission's imminent power to require electricity purchasers to hedge their exposure to wholesale electricity price movements, now provide a conflicting focus, dampening the price signals for required savings and reducing the incentive for investments in energy efficiencies.

Industry – meaning at that time ECNZ, a handful of major electricity users and the ESAs – did in fact initiate some of the most important measures to facilitate a demand-side response.⁴ As discussed in Chapter 5, the instigation of a major wholesale-market development study in 1992, and the formation of the Electricity Market Company (EMCO) in 1993, were industry-led steps resulting in the development of the wholesale electricity market operating from October 1996. By providing wholesale electricity price signals, this one development has moved the New Zealand electricity sector considerably closer to the objective of encouraging electricity users to conserve electricity when supply is scarce, and to invest in energy efficiencies, thereby reducing the need for new or peaking generation and their associated financial and environmental costs.

To facilitate customer changes of electricity supplier, industry developed a multi-lateral agreement in 1994 allowing the reconciliation of electricity inflows and off-takes,⁵ which were necessary requirements for determining whose contractual arrangements were associated with which actual electricity flows. For larger customers, where the installation of time-of-use meters was economic and facilitated supplier competition for customers, customer switching has been relatively forthcoming. However, for smaller customers, meters to record customer energy usage at different times of day were too costly and so it remained difficult for energy suppliers to accurately assess the demand characteristics of new customers (an essential characteristic for them to manage their pricing exposure). Accordingly competition between suppliers for new customers at the smaller end of the market was slow to develop, as was the ability of retailers to signal to smaller customers the changing value of the electricity they consumed.

As a result government became impatient with progress towards supplier competition, warning industry in 1998 that if it did not find a means of facilitating domestic

⁴ As suggested in Chapter 8, this was perhaps as much an industry reaction against ongoing political interference in the sector (despite its corporatisation), as specific government policy.

⁵ Metering and Reconciliation Information Agreement (MARIA).

retail competition then it would institute a means to do so. Industry responded by implementing a system of deemed profiling in April 1999, thereby better enabling it to manage its supply risks when acquiring or shedding customers without the need to install real-time energy usage meters. With a government-enforced split-out of lines businesses from their energy and other competitive operations, with the break-up of ECNZ into competing companies, and with generators rapidly acquiring newly available retail customer bases so as to hedge their exposure to wholesale electricity price volatility, customer switching from one energy supplier to another became an almost overnight phenomenon. At the same time, retailers improved their ability to tailor rebate schemes for un-metered customers who made energy savings during supply crises, a useful step for encouraging savings when required.

Supply-Side Structural Stalemate or Equilibrium?

Subsequent industry rationalisation, involving among other things generators becoming sufficiently vertically integrated so that further customer acquisitions were not an ongoing imperative, eventually resulted in a reduced appetite for supplier competition for customers.⁶ Interestingly, customer switching had become at least as much a supplier initiative – with generators and other retailers selling or trading their customer bases – as a reflection of customer decisions to change supplier to secure a better deal. While customer switching remains an ongoing activity – facilitated for example by the New Zealand Consumers’ Institute offering a free internet-based electricity pricing comparison service – a perception by some remains that consumers face little competition among energy suppliers and hence continue to have little effective choice when it comes to finding cheaper electricity suppliers.⁷ Curiously, this perception persists despite the evidence in Figure 5.5 showing that most retail customers are now able to choose from three or more energy suppliers in any given area.

An alternative explanation suggests that the rapid vertical integration of generation and retailing in New Zealand is in fact a natural and desirable outcome – a form of structural equilibrium – given the economics of generation and retailing. As suggested in Chapter 3, it must be seriously questioned whether stand-alone energy retailing is a viable business model unless and until a highly liquid long-term energy contracts market is in place (preferably naturally rather than as a regulatory artifice), or until

⁶ When generators scrambled to purchase customers off existing retailers in late 1998 they paid prices of between \$400 and \$1,200 per customer; in 2003 Genesis paid an average price of just \$120 per customer. “Low Price Paid for Customers”, *Dominion Post*, 24 October 2003.

⁷ On 27 January 2004 the chairman of the new Electricity Commission (see Chapter 8) described on National Radio how in many parts of New Zealand there are only two energy retailers for customers to choose from, and that often both such retailers charged the same electricity price (i.e. suggesting this indicated a lack of competition). Such an inference cannot be safely drawn on such facts, however, since a consistency of prices in any given regional market could equally reflect either a perfect duopoly gouging customers, or perfectly competitive suppliers serving them well under the threat of entry (or other scenarios besides). To infer uncompetitive pricing it would be necessary to compare prices across different regional markets, and to take great care in interpreting the results.

retailing provides new “value-adds” over and above simple risk-management. Overseas experience shows that the size and composition of any electricity market, let alone the New Zealand market, present inevitable obstacles to the achievement of either. In any event, as discussed in Chapter 3, there are sound reasons why vertically integrated “gentailers” should continue to represent a more viable model, given the natural risk-management complementarities between generation and retailing.

Hedge Market Regulation – Demand-Side Distortions

Against this backdrop it is instructive to consider certain of the legislative changes enacted in October 2004 under the Electricity and Gas Industries Bill (discussed further in Chapter 8). Specifically, under this legislation, the Electricity Commission has been empowered to make regulations for generators to tender a minimum volume of supply contracts and make a market for energy hedge (including futures) contracts.⁸ It will also be able to require wholesale electricity purchasers (which would include would-be retailers, and possibly irrespective of their embedded generation) to maintain minimum levels of hedge and contract cover.

Any such moves have the capacity to upset any natural risk-management equilibrium achieved by vertical integration, supposedly to improve risk-management options for presumably those larger customers who access contracts and other hedge markets, and potentially by increasing the exposure of other (e.g. residential) customers. While this has the apparent merit of promising to expose residential and other customers to wholesale electricity price movements to a greater degree than present (something which should encourage a demand-side response), for reasons discussed below this in fact might be inefficient and contrary to the preferences of many, especially smaller consumers.

By increasing the volume of supply and other hedge contracts available to would-be retailers any such regulations might encourage the re-emergence of independent retailing. However, the sector’s viability as a business model would then arguably be a function more of regulation than of economics, since it is not apparently viable under current arrangements. While this might be argued to increase competition for contracts and other hedges by deepening their associated markets, it is not clear that this would represent a net gain on current arrangements – even if certain (e.g. larger) users should be expected to benefit. In any case, encouraging greater contracting and other hedging is likely to conflict with the goal of encouraging a greater demand-side response to changing electricity prices, since contracting and hedging insulate users from those very risks. To the extent they shift the risk-management options from smaller users to larger ones (for whom demand-management is a more natural exercise), they might in fact lead to a net decrease in demand-side price elasticity.

⁸ In January 2004, the four large “gentailers” (Contact, Genesis, Meridian, and Mighty River Power) started trialling a financial market using electricity derivative contracts to manage energy price risks. See www.energyhedge.co.nz.

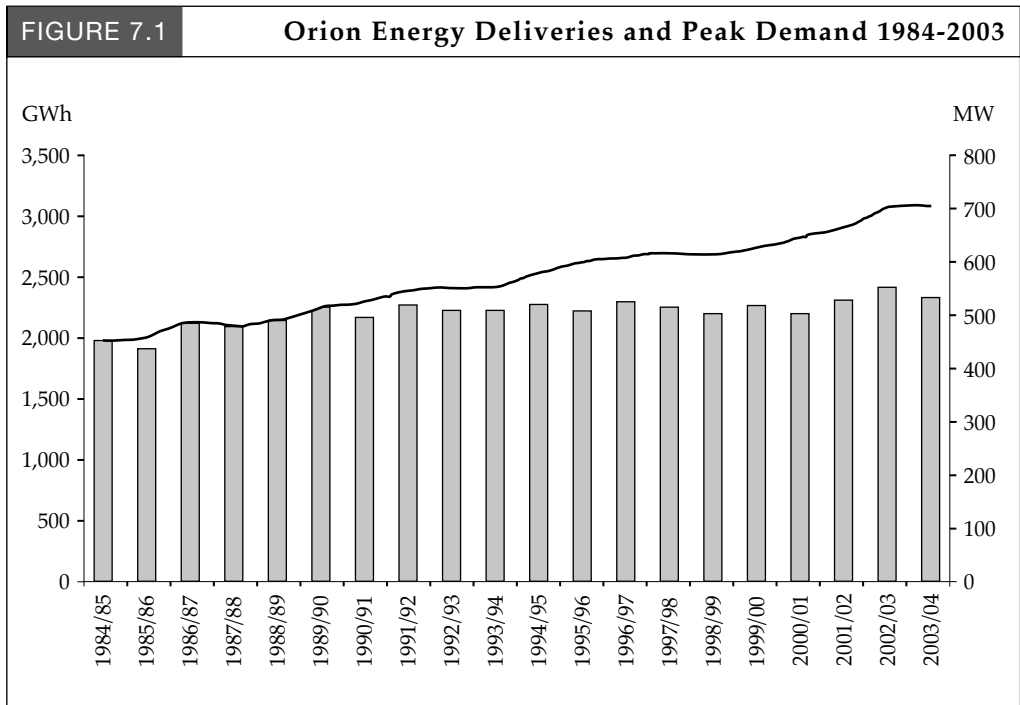
Co-Investments in Demand-Side Initiatives

One facet of vertically integrated gentailers alluded to but not developed is that competition within an oligopoly consisting of such firms imparts financial stability since they are less likely – certainly much less likely than small retail-specific firms – to be financially stressed to the limit by electricity market shocks. Backstop mechanisms for customers in the event of supplier insolvency can be given less weight in policy. In addition, the suppliers of electricity can take a longer-term view of customer relationships. Investment in demand-side management devices that share risk among supply and demand requires payback over time; and cooperating with customers installing such schemes is facilitated by an ability to budget on a longer-term view, albeit in a competitive environment.

Before the separation of lines and energy businesses in 1999, lines companies could interface directly with electricity consumers. Subsequent to this separation they do so indirectly, via the distribution tariffs they charge retailers (which maintain the direct customer relationship). These companies, via their predominantly local (trust) ownership and through the nature of their business, have a long-term interest in their customers that can facilitate the adoption of demand-side management, and they have an incentive to economise on costs by better utilisation of their networks. This is particularly the case in the management of demand volume, variations in which – e.g. peak loads – occur regularly; but it is less so in the management of price spikes arising from low lake inflows (here volume may be decoupled from energy price and the retailers' and lines companies' interests may diverge). Peak loads must be delivered across the local distribution networks and thus these loads set the capacity of these networks.

Orion Energy – Decoupling Peak Demand from Demand Growth

One example of load management by a combined retailer/distributor (to 1999) and a separated lines company (from 1999) is provided by Orion (2002). The company is 88% owned by Christchurch City Council, but is a corporation in which operating efficiently and producing some profit is important. It reports that in 1990, confronted with growing demand peaks requiring network investment, it instituted demand-management schemes for its customers that included, among other things, direct shifting of water heating off-peak (in the period when it could trade electrical energy), facilitating insulation of houses, establishing a gas supply business, and peak-load pricing. The consequences are illustrated in Figure 7.1 where it is apparent that peak demand, and hence network capacity growth, has been decoupled from the growth in energy demand. Orion estimates that the effect of its measures has been to delay, perhaps for a very long period, the need for additional generation and the accompanying network enhancements, suggesting a saving of \$180m based on an infinite delay. These outcomes occurred during a period where the use of a prime winter household heating energy source, coal, was essentially removed as a consequence of environmental regulation.



Source: Orion Energy.

Note: Peak demand (MW) is represented by bars; energy deliveries (GWh) are represented by the line.

Orion attributes much of its success to peak-load pricing that has induced customers of various sizes to institute a variety of electrical energy conservation measures under actions taken without its knowledge. If so, it illustrates the benefit of confronting decision-makers with the prices of their actions. The effect on decisions and the outcome cannot be duplicated by centralised decision-making. Although Orion's programme has had its prime effect on network capacity, it is also likely to have affected the demand for electricity: after all, insulation and alternative fuels also provide benefits at other than peak times. Indeed, Orion (2002) presents evidence that electrical energy use has not grown as fast as has the local economy, which would be in contrast to the economy as a whole (as comparison with Box 3.1 illustrates).

Metering Advances

Reflecting a compromise measure but at least a useful first step, deemed profiling may yet give way to true time-of-use metering even for domestic customers as technologies improve and costs fall. Failing that, industry has demonstrated its ability to offer incentives for energy savings during supply crises, with Mercury Energy, and others, offering rebates to customers who made savings during both the 2001 and 2003 winters. To further enhance metering options, however, in November 2003 the state-owned generator Genesis announced that it and lines company Powerco

would start trials allowing it to measure half-hourly demands and monitor such information remotely (and hence more quickly than is possible with current manual meter reading). This in turn should enable it to introduce supply options that better reflect customer needs.

Power Exchanges

On another front, Meridian Energy introduced the country's first power exchange in August 2001, allowing nine larger customers to resell contracted energy supplies, with 90% of the resold energy being that arising from voluntary demand reductions (e.g. by changing production schedules). Such exchanges help non-wholesale customers to assess the relative merits of using contracted energy supplies for their own use or selling it to customers who ascribe it a higher value, thereby facilitating an increase in the price elasticity of overall electricity demand. In October 2003 the largest New Zealand lines company, Vector, launched the country's first nationwide demand-side power exchange, focusing on medium to large users.

Former NZEM Initiatives

In another industry initiative, the New Zealand Electricity Market (NZEM) Market Pricing Working Group (MPWG) in 2002 looked into a range of matters that had the potential to assist at least larger consumers – i.e. those typically at greater risk of wholesale electricity price increases. In the main concentrating on greater information disclosures on matters such as wholesale market bids and offers, transmission constraints, and data on the short-term reserve generation required to ensure system security, the group also investigated improvements in demand-side bidding and forecasting and the implementation of real-time pricing.

The motivation for greater information disclosures was that customers would be better able to detect anti-competitive pricing practices by generators, particularly when the wholesale market became fractionated by transmission constraints. It was also intended to enable them (i.e. mainly larger customers concerned with spot price movements) to better understand the relationship between final wholesale prices and factors such as hydro storage levels, fuel prices and demand.⁹ In part this reflected the fact that final wholesale electricity market prices in New Zealand – based on metered demand and other factors after the fact – are not yet determined in real-time but instead some hours after bids and offers have been finalised for any half-hour trading period. Market participants – both suppliers

⁹ Ironically such greater information disclosures have the potential to increase the risks of any anti-competitive generator behaviour. Sought by purchasers as a means of detecting misbehaviour, they carry the potential to facilitate that very behaviour by better enabling competing generators to infer the pricing strategies and reaction functions of their counterparts. While such knowledge has the potential to encourage competition among generators, it also has the potential to enable cosy non-competitive behaviour, based on implicit agreements or otherwise, in which the New Zealand banks and oil companies have historically been accused of engaging. This is but one instance of how measures directed at enhancing demand-side responses could in reality defeat some or all of their purposes.

and purchasers – therefore bear mis-pricing risks that distort their ability to accurately respond to changing electricity prices in the short term. The real-time market initiative, seeking to closer align actual final prices and market participants' bids and offers, had the potential to better facilitate accurate load control, such as manufacturers turning plant off to avoid high wholesale prices.¹⁰ With the NZEM's operations being taken over by the new Electricity Commission (see Chapter 8), however, that project is now on hold.

Electricity Commission Takes Over

With the new Electricity Commission having taken responsibility for the electricity sector from 1 March 2004, government has squarely assumed responsibility for carrying the demand-side torch. With the perception of the potential supply-side structural stalemate discussed above, it is possible that the Commission will be left to rearrange the proverbial deck-chairs on the Titanic, focusing on matters such as standardising minimum terms for retail supplier customer contracts, streamlining consumer switching arrangements, and developing procedures for resolving disputes between customers and suppliers. Without forcing generators to shed their retail customer bases and engendering a fresh hunger among suppliers for new customers, the Commission may find that other initiatives such as energy efficiency and wholesale market refinements will be its most potent tools in the continuing development of demand-side participation, although neither have quite the focus required to change the behaviour or options of smaller customers. Alternatively it might reshape the structure of the industry by regulatory interventions rather than price signals, potentially increasing retail-level competition at the expense of risk-management efficiencies (to the benefit of larger users but to the detriment of both smaller users and the goal of engendering greater price-elasticity in electricity demand). Alternatively, it might usefully be a catalyst for the development of retail-level power exchanges, a move more likely to elicit the desired outcomes.

ENERGY EFFICIENCY AND CONSERVATION AUTHORITY (EECA)

In parallel with industry-based initiatives to increase demand-side participation, the government body EECA was formed in 1992 to encourage voluntary public- and private-sector behavioural and attitudinal changes required to achieve government's goals for energy efficiency and conservation. Sensibly it recognised that the greatest scope for achieving such demand-side efficiencies is by targeting the industrial and commercial sectors (together accounting for 65% of annual energy demand, of which 90% is accounted for by just 300 organisations). It should be expected that if any parties are able to bear the costs of implementing energy-efficient technologies and other demand-side measures, they would be found among such companies. By contrast, the remaining 35%

¹⁰ Counsell and Evans (2003) suggest that an ability to lock in prices a day ahead via a formal day-ahead market would benefit demand-management and price discovery. Such a market would supplement the effect of longer term hedge contracts, by covering additional unhedged throughput, albeit just covering day-to-day risks.

of annual electricity demand represented by domestic users is a considerable source of energy usage; but the dispersed, low level of that demand makes the economics of change less compelling (e.g. unlike ripple control of hot water systems, individual time-of-use meters are yet to be generally feasible). Overall the role of EECA appears to have been to facilitate initiatives that lack an apparent and compelling business case (which electricity users would likely have discovered for themselves) or that give rise to aggregate gains (private and societal) which justify their adoption despite individual parties having insufficient incentive to undertake these themselves.

Some Obstacles

Identifying a potential aggregate demand-side response from the 300 largest electricity users of between 250-900 MW, and estimating a practical target of 400 MW, EECA estimates potential annual savings from such a response of \$10-\$100 million, with an additional saving of \$340 million if the construction of a 400 MW peaking plant could be avoided. At the same time such an analysis suggests a key problem in achieving this response – that of private costs versus public gains.¹¹ A significant share of the benefits of demand-side participation identified by EECA (see Box 7.1) and the specific gains identified here represent system-wide or third-party gains whose sharing need bear little relation to the specific initiatives undertaken by any one party. Such diffusion of incentives and potential for free-riding presents an obstacle to change. In simplest terms, the most reliable means of ensuring energy users have an incentive to conserve energy is likely to be that they both understand, and get to enjoy, sufficient private benefits from doing so.

As such, the enduring preference for many electricity users for fixed electricity prices over exposure to the spot price presents an important obstacle to change. And while power exchanges are developing for medium and large users, and rebates are available to some such customers during winter power crises (sharing risks and rewards between customers and suppliers), residential electricity customers are yet to enjoy opportunities to resell surplus energy for gain to other parties valuing that energy more highly. Ongoing improvements in metering and communications technology should eventually be expected to lower the transaction costs of small-customer power exchanges, but we are not there yet. Until we do, it will be hard to expect active residential-level power savings and efficiencies on a sustained basis: the cost-benefit calculus does not favour broad adoption at the present time. However, as the Orion experience illustrates, more energy-using households may use alternative fuels and insulation and thereby affect their demand for electricity in the longer term. To achieve this, it is necessary that electricity costs – through prices – are incurred directly by the users of electricity.

¹¹ Indeed, EECA's role might be regarded as one of addressing a number of perceived externalities, such as electricity users' lack of information, or the aggregate importance despite individual-level insignificance, of their electricity-consumption decisions.

BOX 7.1**Benefits and Means of Increased Demand-Side Participation****Benefits:**

- 1) Improved system reliability through reduced demands during emergency situations.
- 2) Reduced wholesale electricity prices (with cost:benefit ratio of 10:1 where “economic”).
- 3) Market efficiency improved when consumers receive price signals and demand more aligned with true costs.
- 4) Energy retailers can reduce their exposure to wholesale electricity prices.
- 5) Environmental benefits from reduced need to use peaking thermal plant, and cost benefits of deferring transmission and distribution enhancements.
- 6) Consumers gain greater control over their electricity bills.
- 7) Market power of generators can be mitigated where it arises from supply shortages or transmission constraints.

Means:

- 1) Managing peak loads – reducing load or shifting it to lower-priced times of day.
- 2) Load control – lines companies using ripple control to signal peak loads and/or shed load.
- 3) Instantaneous reserve – grid operator contracts with customers to shed load automatically and at short notice as a means for it to maintain system operation standards.
- 4) Voluntary demand-side participation – allowing consumers, with appropriate price signals, to respond to changing prices by altering demand.
- 5) Other – e.g. power exchanges, self-generation.

Source: EECA (2002b).

Fonterra and NZAS Initiatives

Indeed, the importance of the price of energy flowing through to decision-makers and engendering sharper energy management is illustrated by the examples of two companies that consume a great deal of energy (reported in the *National Business Review*, June 2004, as achieving EECA Energywise awards). NZAS reports that 40% of the cost of producing aluminium is attributable to electricity, and that although the company had improved its energy efficiency steadily since its establishment, it assessed that energy in New Zealand would be more expensive than in the past and it changed emphasis from expanding output to “optimising power efficiency”. An extensive internal energy audit precipitated a set of energy projects now underway. Just one of these – one of the most successful projects, involving re-welding all electrical connections through the reduction plant to reduce resistance – is estimated to produce \$1.2 million per year savings on an investment of \$0.6 million.

Similarly, Fonterra Cooperative Group Limited is New Zealand’s dominant manufacturing dairy company. It processes about 96% of New Zealand’s milk, has 4,500 staff and 26 manufacturing sites, and is the second largest user of electricity in the country. It too reports that it has responded to prospectively higher energy prices resulting from the run-down of New Zealand’s prime gasfield, by adopting energy-efficiency programmes. It has identified savings of 8-10% at some existing plants, and considers that it is possible to take these to 15%, or savings of the order of \$20 million per year.

Firm and Day-Ahead Prices

In part the ongoing preference of major users for fixed electricity prices over exposure to spot prices reflects their lack of use of alternative energies, and their operational inflexibilities. Plant cannot be shut down or production rescheduled at whim, given technical requirements and/or employment, environmental and customer obligations requiring at least forward notice of any such changes. Research by EECA indicates that commercial and industrial users have capacity to reduce loads, and that they prefer voluntary reductions to interruptible contracts. However, the lack of firm prices being available under current wholesale electricity market arrangements complicates demand-side decision-making, and a useful practical innovation would be the introduction of firm day-ahead electricity prices better allowing users to plan for changes in response to price changes.¹² Complicating the picture further is the fact that only larger users have the resources to acquire wholesale electricity market data and to implement measures to alter demand in response to price changes.

Given such considerations it is no surprise that resorting to exhortation, education and facilitation by bodies such as EECA remains a favoured means for encouraging

¹² See Counsell and Evans (2003) for a discussion of the merits of introducing a day-ahead market.

greater demand-side participation. Until widespread customer rebates for power savings or power exchanges (and some form of transmission-capacity market) are developed, consumers face no appropriate “carrot” – and, in many cases, not even a “stick” – to conserve or invest in energy efficiency. Indeed, as long as competition and regulatory policies serve to constrain electricity prices, particularly for smaller consumers, EECA will face fundamental conflicts in achieving its goals.

WHOM TO TARGET?

As noted above, EECA has sensibly targeted its initiatives for encouraging a greater demand-side response at the larger industrial and commercial electricity users. Its data indicate that electricity costs account for 17% of total costs for basic metal producers, and up to 40% for some forestry processors.¹³ Such producers and processors can be expected to be acutely aware of the need to economise on electricity demands and otherwise manage their exposure to electricity prices. This too might be suggested for commercial users, representing 22% of total annual electricity demand, but to a lesser extent. For each group, demand-side initiatives should be expected to be (and to a significant extent initiatives undertaken to date have been) both effective and economic.

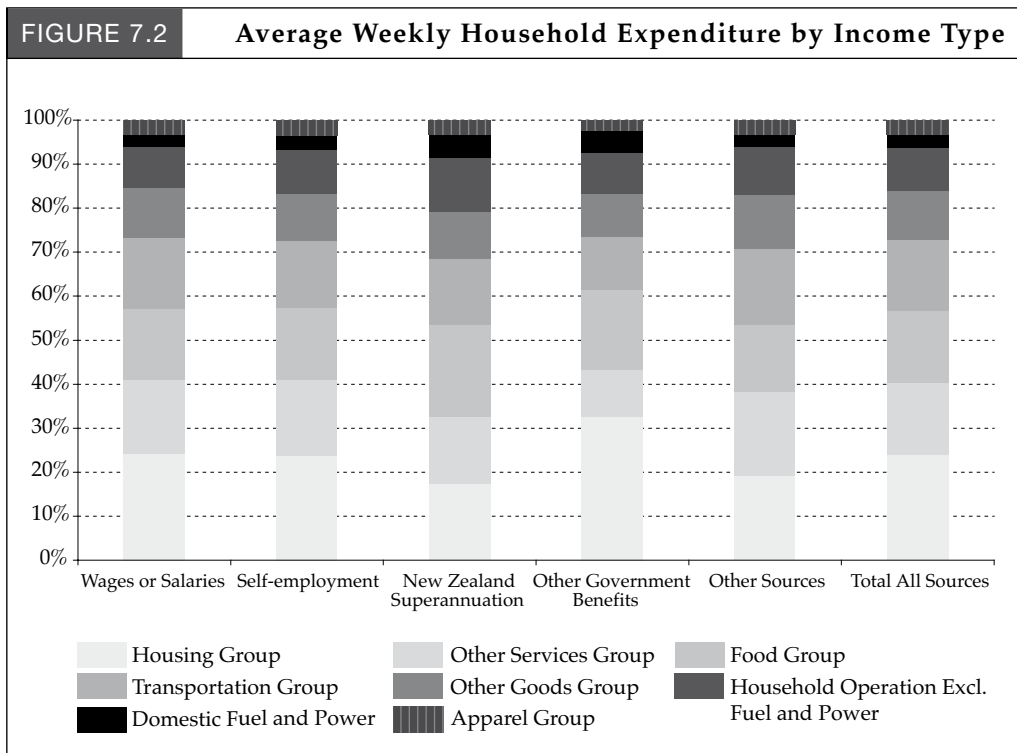
For domestic consumers, however, who represent around 35% of total annual electricity demand, demand-side initiatives are presently hard to justify on customer-specific economic grounds, but they continue to attract significant political focus. Certainly, domestic consumers account by number for the vast majority of electricity users (indeed, the voting ones), and so a political sensitivity to the plight or progress of this sector can well be understood. On closer examination, however, it is tempting to suggest that such a political and consumer-lobby focus is misplaced, and that the real political-economy pressures lie elsewhere.

In July 2004 the Government announced its intention to introduce limited price controls into the retail market, by requiring retailers to offer a contract containing a fixed charge of no more than \$0.30 per day for residential users who consumed less than 8,000 kWh per year (the average level of household use). The regulation will also require retailers to provide “equal advertising effort” for such products. The stated aim of this regulation was to address equity concerns particularly for

¹³ Indeed, electricity comprises a substantial part of NZAS’s aluminium smelting costs. With NZAS accounting for 15% of national electricity demand, it represents the single-greatest candidate for effective demand-side response, although its long-term electricity supply contracts with Meridian provide it with a temporary measure of protection against wholesale price movements (and temporary closures of pot-lines are very expensive). Encouraging the smelter to turn off just one of its three potlines in the 1992 crisis enabled energy savings of 5%. To the extent that Meridian is exposed to wholesale price movements in future supply crises – e.g. if it is a net purchaser – it might rationally contract with NZAS to reduce its demand in exchange for a share of its avoided wholesale purchase costs.

superannuitants – but many beneficiaries will not be low-income users, many low-income households will not benefit, and it may lead to small price increases for other customers.

As illustrated in Figure 7.2, New Zealand households typically spend around 3% of their total weekly expenditures on electricity (both distribution and energy) and other domestic fuels combined, approximately the same amount that they spend on apparel. By contrast, on items that would more properly be regarded as “essentials” – such as housing and food – households typically spend around 24% and 16% respectively of their weekly expenditure. In the grand scheme of things, power bills account for a negligible share of household expenditures. Even if all households were to implement four simple energy saving measures suggested by EECA, representing a combined 19% saving in total and recognising that water and space heating constitutes 65% of most household power bills, this would shave little more than half a percent off weekly household expenditure, despite reducing annual electricity demand by around 5%.



Source: Statistics New Zealand, 2000-01 Household Expenditure Survey.

A closer look at the official statistics for household expenditures shows that superannuitants and beneficiaries each spend less each week on power and domestic fuel than they do on vehicle ownership expenses. Salaried households (and those living on interest, rents, dividends, etc) spend only slightly less each week on alcohol than they do on domestic energy, and the self-employed spend more on takeaway and ready-to-eat foods. Overall New Zealand households spend slightly less or around the same each week on electricity distribution and energy, along with other domestic fuels, as they do on takeaways, apparel, or overseas travel.

Since any outcries about rising power prices are typically their loudest on behalf of beneficiaries and those on fixed incomes (such as superannuitants), it is fair to inquire into how electricity costs affect their weekly outgoings. The official household expenditure survey statistics reveal that these two groups (reflecting patterns for low-income earners in general) spend 5% of their weekly expenditures on both power and other domestic fuels, more than the 3% figure for groups having other income sources. Once again this figure is small, and compares with much higher expenditure shares for food and housing. For this reason alone the efficacy of the July 2004 regulations, imposing low fixed-tariff options for smaller power users, can be questioned. The data suggest that equity grounds are no proper basis for a fixation with power prices, in either relative or absolute terms.

And even if they were, food suppliers (for example) do not face threats of price regulation, market intervention or, in the extreme, nationalisation – despite the common volatility in food prices (particularly fresh), and the clearly greater share of household budgets they constitute. When food prices rise – for example, and ironically, when it rains too much – any regressive impact this has on lower-income earners and those on fixed incomes is, more properly, treated as a matter of incomes and welfare policies. Food is not singled out as an example of market failure and a need for industry reform. Regulations are not imposed to fix food prices for smaller consumers. It remains curious that the electricity sector, insofar as power prices are a cause for equity concerns, should continue to face such popular and political attention.

It should be emphasised that while residential customers each face little exposure to increases in electricity prices, this is not to suggest that the overall welfare consequences of generator market power or otherwise excessive prices are immaterial. In aggregate they can amount to significant welfare losses, suggesting good reason to consider demand-side improvements at the residential level. Additionally, aggregate residential electricity demand accounts for around 35% of the total, which represents a significant opportunity for savings and avoided need for new generation. The difficulty is that the costs of encouraging a greater residential-level demand-side response – such as new metering or the transaction costs of a small customer power exchange – remain disproportionately high. This is only compounded by the relatively small benefits accruing to individual residential customers should they take the trouble to better manage their electricity consumption and/or invest in alternative fuel technologies or energy efficiencies.

Furthermore, the rebalancing of tariffs in favour of commercial entities over households could just be a reflection of the advantages of concentrated over diffuse interests in political processes. Alternatively, it simply suggests that the households are paying for insurance against short-term swings in electricity prices. Indeed, as a matter of principle, commercial entities are generally held to be less risk-averse than households and better able to manage risk. Thus, the situation we observe of relatively fixed prices for households is in accord with a plausibly appropriate sharing of short-term risk. It need not much affect household investment in longer-term savings through insulation and alternative fuels, because these depend more upon the longer-term direction of prices rather than short-term price fluctuations.

A Stocktake

Considerable cost has been imposed on or otherwise borne by the New Zealand electricity sector in implementing demand-side initiatives aimed at the residential sector – not least the imposed ownership separation of distribution from competitive business activities in 1999 – and such initiatives remain an important focus for government-led industry change. As argued above, for industrial users, and to a lesser extent commercial users, some such measures have had the potential to pay for themselves, and users have had ample incentive and at least some opportunity to undertake the initiatives. Industry, for its part, has not been unresponsive in providing relevant solutions. For the remaining 35% of annual electricity demand, however, increases in electricity prices higher, and maintained for longer, than any observed to date would be required to materially alter residential consumption and encourage energy efficiencies – and thereby to reduce significantly their combined annual energy requirements (in the absence of small customer power exchanges). Since 1996 households have been insulated from short-term fluctuations in electricity prices and, given the current state of affairs, this is not apparently inefficient.

THE ULTIMATE GOAL?

It must be asked what precisely these initiatives are trying to achieve, and what harm they are attempting to avoid. Certainly a long experience of state-owned and controlled monopoly generation and transmission did not result in a surfeit of electricity customer options – that is to be expected – but is engendering an array of customer choices going to materially alter the lot of small consumers? Alternatively, is the goal to give consumers more options to choose from, or to find better ways to serve their current needs and preferences? While increasing the range of options available to consumers cannot be a bad thing (provided undue costs are not incurred in doing so), what incentives do they have to exercise this choice?

Such questions go to the heart of what really matters to electricity customers. Certainly a competitive, innovative generation and distribution sector resulting in the lowest possible wholesale electricity prices and greatest possible freedom from market power and gaming of industry arrangements is a desirable objective. To the extent that this objective is frustrated by the vertical integration of generation and retailing that has occurred since 1999, a case might be made to force the de-integration of these operators; but for reasons discussed above and expanded on below this might in fact be counter-productive. Straining to give electricity customers greater choice of energy supplier may be neither necessary nor sufficient for materially improved consumer welfare.

Even now the wholesale electricity price directly influences short-term purchasing decisions of only a fraction of the electricity market (despite the potential for it to do so more widely), but arguably with exceedingly good reason. Electricity consumers typically prefer a certain electricity price and ongoing supply security, even when both cannot be simultaneously guaranteed, and are prepared to pay a risk-premium in their electricity price to do so. Much electricity supplied in New Zealand is purchased through long-term fixed-price supply contracts, and there is a conspicuous absence of calls by consumer advocates for small users to be exposed to spot-price-based pricing plans. Only a fraction of consumers are either willing or able to change their short-term consumption patterns in response to wholesale electricity price changes. And even if better arrangements such as a day-ahead electricity market were instituted to allow consumers the choice of responding to price signals by changing their energy consumption decisions, it must be questioned whether they would in fact do so. Given the minimal share of household expenditures represented by power costs, households face limited gains from even 100% energy savings and hence have little incentive to even inform themselves as to energy alternatives let alone respond to price changes.

Conversely, given the considerable spikes in wholesale spot electricity prices that can arise during times of tight supply, smaller customers might be significantly more interested in trading energy savings for profit.¹⁴ Since these profits would in absolute terms easily outweigh the energy cost savings available through conservation and energy efficiency investments (which involve cost) in the normal course, small customer power exchanges offer the most likely means of eliciting a greater demand-side response from residential customers.

As discussed in Chapter 6, electricity users exposed to the wholesale electricity price – typically those with a significant share of their costs represented by electricity costs – face strong incentives to either hedge their price risk, adopt more energy-efficient technologies, or ensure they have the capacity to reduce their demand when spot prices rise (a question of technology as much as contract). Failing such measures, they face the risk of substantial financial costs in the event of such price rises. Only a

¹⁴ Wholesale prices have demonstrated an ability to increase by factors of around 2,000%, but at most can fall by only 100%.

subset of even large energy consumers are naturally able to bear an exposure to volatile electricity prices – even in the longer term, where switching to more energy-efficient or multiple-energy technologies might be considered feasible.

For smaller customers this is especially so. Except for residential customers building or renovating their homes, most customers have already invested in water-heating, space-heating, cooking and other energy-dependent technologies, and are unlikely to alter these investments even in the face of significant short-term swings in electricity prices. Indeed, many household appliances simply cannot be run except on electricity. While short-term responses to such price swings might involve changes in consumption patterns if consumers were exposed to, or at least aware of, those swings, some research indicates that the responsiveness of demand to price changes is relatively insensitive even when electricity price signals are available.¹⁵ People will still tend to take a shower, cook their toast or boil their kettle in time to get to work, irrespective of the short-term electricity price.

To the extent that most small customers, and even many large ones, have not switched to alternative or multi-energy equipment, changes in energy efficiency technologies and electricity consumption patterns are more likely over the longer-term than the short. For it to be economic for a consumer to install gas appliances rather than electric, for example, they need to see either sufficiently large short-term electricity price spikes or sustained premiums in electricity prices, relative to gas prices, to warrant the high fixed cost of gas installation.¹⁶ Alternatively, they require opportunities to profit by effectively reselling energy savings (e.g. via rebates or power exchanges) – a form of energy recycling from low-value to higher-value uses – when wholesale electricity prices rise. To date these have arisen to some extent.

CONCLUSION

Encouraging demand-side participation is both natural, and in many cases, desirable. Structural reform to encourage competing generation and retail is an obvious first step, particularly when combined with targeting major electricity users. Indeed, with

¹⁵ Ham *et al.* (1997), for example, discuss experimental research showing that small commercial users are not responsive to time-of-use pricing, although some sub-groups – such as those without electric heating or air-conditioning – show significant responsiveness over short peak periods and with large differences between peak and off-peak prices. EECA has sponsored a trial of demand-side energy management practices on selected commercial and industrial sites, setting out to find if real-time or near real-time access to electricity consumption data can help businesses to reduce electricity costs. Its preliminary findings indicated that savings were indeed achievable, although this should probably be considered a natural consequence of trying. The more telling question is whether it is worth businesses altering their behaviour to reduce electricity costs, which hinges as much on having the capacity to do so expeditiously as it does on the consequences of doing so.

¹⁶ That this formula is accurate can be seen in changing consumer preferences towards energy-efficient motor vehicles following oil price shocks.

competitive generation and retailing, even if vertically integrated, such users have considerable incentive to seek out opportunities to reduce electricity costs themselves, should they have the flexibility to do so, and to bear the costs of doing so. This should mitigate any problems of market power and encourage lower electricity prices; it may also mitigate consumer incentives to save power or invest in energy efficiencies.

The potentially conflicting but desirable alternative is to pursue initiatives that increase the price elasticity of electricity demand. This is at least as much to provide consumers with profit opportunities as it is to achieve cost savings, since the former are potentially much greater than the latter under fixed-price supply contracts. Legislation enacted in October 2004 empowering the new Electricity Commission to regulate the minimum amount of generator output and wholesale purchases covered by supply and other hedging contracts might hinder the delivery of price signals that encourage cost-effective electricity conservation.

The seeming complication is that small electricity users presently are content to insure themselves, in their tariffs, against volatile price levels (e.g. because electricity costs represent such a small share of their total costs, and it is costly to do otherwise), and by design face electricity costs that are relatively fixed (e.g. through hedge contracts or prices fixed by energy retailers). The question is whether the balance of customers and the benefits and costs of demand management by the (typically larger) consumers enable such insurance to be offered at a price that is consonant with risks and rewards in the electricity sector. This can only be discovered by decentralised interaction of the various parties. It is important because in a modern e-economy involuntary interruptions (savings) by any subgroup can yield very large losses in society's welfare.

Notwithstanding the evolution of power exchanges for energy, this remains particularly the case in respect of savings available to transmission and distribution. For as long as most users (if not the larger ones) continue to see bundled electricity charges comprising energy, transmission and distribution elements, and as long as electricity users have no ability to resell transmission savings, a transmission-related demand-side response will be hard to encourage. Internalising the costs of transmission congestion to distributors is likely to be an important first step in remedying this.

Encouraging greater demand-side participation will remain a challenge unless users are persuaded to expose themselves to the true cost of electricity and competing fuels and fuel substitutes, at which point the appropriate balance of risk sharing is struck. Until then the "cajole, inform and facilitate" approach of EECA continues to have some purpose. Ironically, however, this approach represents – in effect – a protracted version of the short and sharp energy-savings campaigns that government no longer wishes New Zealanders to bear in future winter crises, but without the benefit of the urgency and sense of collective responsibility that a crisis creates.