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The Presiding Commissioner (Mr Neil Byron)
Australian Government Productivity Commission

Dear Sir

Submission to the Public Enquiry into Energy Efficiency

Congratulations on your Inquiry to date and observations that there are substantial information asymmetries acting as barriers to achieving energy efficiencies.

Nowhere is this more pronounced than with residential customers.

However, despite many references to the need for improved information, there is no definitive Finding or Recommendation, nor discussion of the form and delivery of it.

In my view, residential customers need an improved energy "dashboard" – a set of timely, accessible, simple and user-friendly measures of energy use that can help restore their sense of control over their energy use.

This paper argues for rollout of "Informative Meters", interval-capable meters programmed for time-of-use metering and equipped with a minimum standard of "Customer Information Display" that shows three standard measures of whole-of-house consumption ie;

- rising bill [$],
- yesterday's energy consumption [kW.h], and
- present power [kW].

This paper also argues for standard reporting of comparative figures for Average Daily Consumption, in the units of kW.h

Assertions

Some excerpts from your Report (*in italics*) along with my own assertions (<u>underlined</u>) show my particular interests and contentions.

Households do not deliberately waste energy, but there is clearly an identifiable *energy efficiency gap*, so if *rational consumers don't respond*, the *major barrier* could be *lack of information.* This is consistent with most electricity utilities and governments <u>having strategic and tactical disincentives to provide information</u> (not merely *split incentives*).

The Commission's preliminary policy position supporting *information being provided directly to customers,* and a *light-handed* policy approach of *subsidies,* can be an <u>appropriate, cost effective and practical approach with a good chance of success</u>.

Technologies already available can provide timely, accurate and convenient billing and energy usage information for customers. It would be feasible for the Queensland government to initiate a pilot project in support of national research in this area. The pilot project could incorporate testing of cost reflective tariffs (TOU), automated load controls, and Customer Information Display to achieve energy reduction AND demand reduction.

Desired Outcomes from this Submission

The outcome sought from the Inquiry Commissioners includes:

- a finding and recommendation that government controlled electricity utilities take the information needs of residential customers into account when purchasing electricity meters;
- a finding and recommendation that a minimum standard of information be provided and displayed on new electricity meters to help customers know and manage their energy use viz;
    - an estimate of the rising bill,
    - yesterday's energy usage,
    - present power consumption; and
- a finding and recommendation that regulators allow utilities a modest sum of around $10-$15 per meter for slightly higher purchase costs of meters equipped with a "Customer Information Display", OR that governments rebate such amounts to utilities as an environmental subsidy similar to rebates for gas and solar water heating systems.

My Interests

I am a residential electricity customer who believes I am poorly represented in development of energy policy initiatives. This should be close to all our hearts for who of us is not an electricity customer? Yet I consistently find that influential people allow their employer's interests to over-ride their personal interests.

My credentials are that I am an electricity utility engineer with nearly 30 years experience, and the last six of those years have been as a metering engineer and manager for national market metering. I have professional qualifications in engineering, accountancy and international business.

I believe energy policy-makers are overlooking simple, practical and readily deployable initiatives. A colleague working in the DSM arena for over 10 years lamented "it is like poking an elephant with a blunt stick" when what is needed is to "get behind the elephant with a red-hot poker."

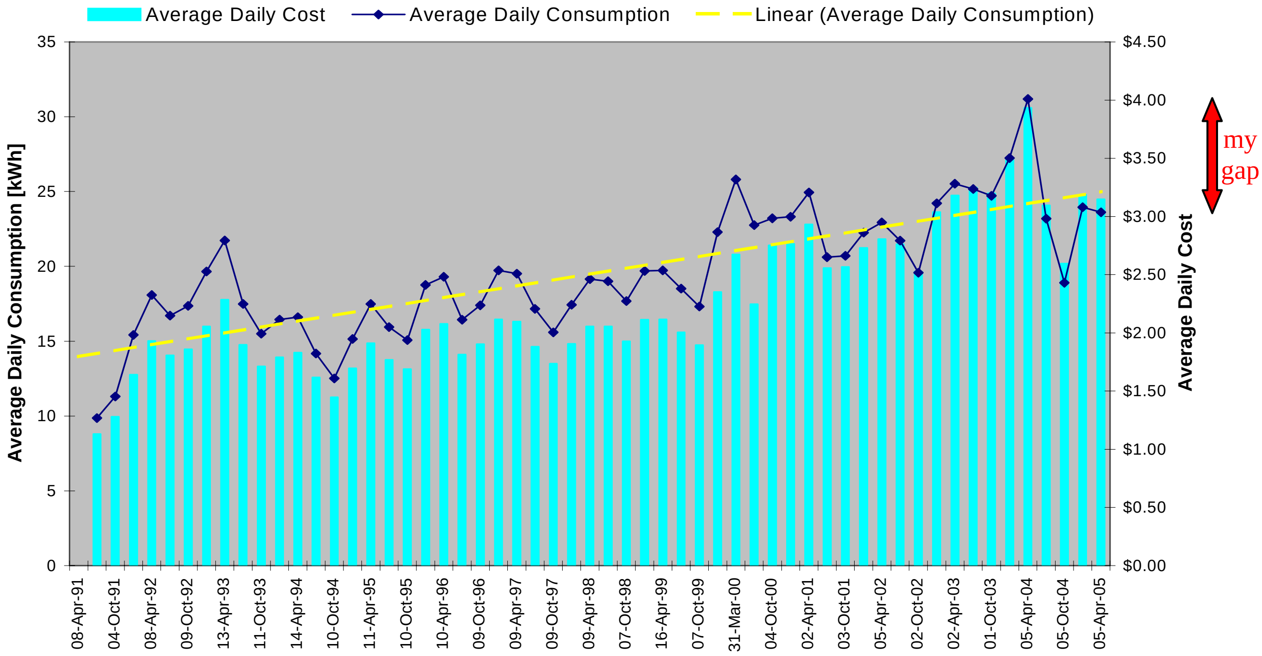
My Energy Efficiency Gap

In April 2004, I was astonished to find my quarterly electricity bill had jumped to 31.2 kW.h per day over Summer, up 88% from 16.6 kW.h ten years earlier (April 1994). That's a compound growth rate of 6.5% pa. I began paying attention to my energy consumption and one year later (April 2005), I have reduced consumption by 24% to just 23.6 kW.h per day (Summer 2005). This is with no substantive change in the services I get from electricity, and despite adding an extra air-conditioner to my house. I am continuing to make further improvements as well. Refer Figure 1. Note that I have had gas water heating and cooktop since 1990 so energy reductions were not sourced from those areas.

I found the absence of simple energy usage measures to be quite an impediment. Waiting for an electricity bill every three months was frustrating. Few householders would have the patience and resolve to follow my example. I used no special instrumentation other than a Cent-a-Meter that I was able to borrow late in the year. It was somewhat useful but in many ways frustrating as well, and I would not have used it if I had to buy it and have it installed for a total cost around $230.

The 24% reduction in my Summer bill saved me almost $80. Further savings will accrue through the year provided I can hold the gains already made. I expect overall to recover about 2/3 of the rise since 1994 or 31% reduction in energy usage as a result. That is quite some recovered energy efficiency gap in a short period of time.

Figure 1 - Historical Energy Cost and Daily Usage



My Contention

I believe that electricity consumption has increased for many people like myself because **"people act as though they have no control over their electricity usage and the bill is just something that has to be paid when it arrives."**

There is no useful information available between quarterly bills, and using the billing information requires one to make an effort to plot consumption over time; there is little to prompt good housekeeping, so waste just creeps back.

The measure I found most descriptive of my changing usage over time was Average Daily Consumption (ADC) – sometimes called Average Daily Usage or Daily kWh Usage. This measure has been shown on electricity bills in both text and graph format at least since 1991 (as far back as I have kept records), yet few fellow householders seem aware of it.

What I have found by talking to others is a much broader interest in **saving money, reducing waste and helping the environment** than is commonly believed by most of my colleagues in the electricity industry. There also seems to be a 'psychological multiplier' working because the prospect of saving only small amounts of money did not seem a significant deterrent. The major problem was a **lack of useable information and restoring a sense of control over electricity usage**. I also found a more localised issue that many people want to be "part of the solution" to the problems of the Queensland Electricity Industry that received so much media attention in 2004.

What do we have to do to inform and empower willing customers?

A Better Dashboard for Knowing Energy Usage

Reducing my energy efficiency gap would have been made very much quicker and easier by having some timely, accurate and easy to use measures that help me make changes, note the effects, and check that waste doesn't creep back.

Quite simply, the electricity meter that is provided and maintained by the electricity utility could display three things;

1. an estimate of my electricity bill [$] as it rises since it was last read – so I know how I am going and can take actions to manage my bill before it is too late,

2. yesterday's energy consumption [kW.h] – so I can connect changes in behaviour to effects on energy usage, and I can compare this with past usage, that of relatives and friends, or against published benchmarks, etc,

3. present power consumption [W] - so I can check what total household usage is at any time, what effect turning specific appliances on and off has, and how much overnight consumption is as an indicator of standby power usage.

This is a **minimum standard for "Customer Information Display"** (CID) on a meter; enough simple information to help customers with their energy housekeeping.

Meters are generally located outside the house for reading by utility meter readers. An in-house display would be more convenient, but also much higher cost. As most customers would check their meter display infrequently, trading-off convenience cuts the cost of providing information considerably, assisting wider and rapid deployment; a more convenient and fuller featured in-house display could still be produced for those who want it. The information on the Customer Information Display at the meter is far more valuable than the billing and usage information I get on my present electricity bill every 90 days; that is too coarse and too delayed to be of any real use!

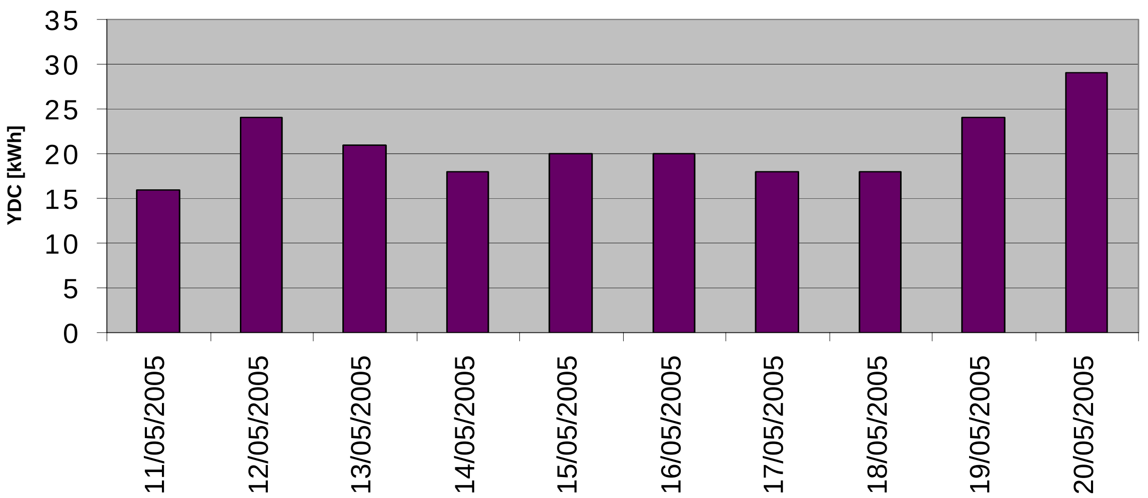
Table 1 – Proposed Standard Quantities for Customer Information Display

Quantity	Meaning	How To Use It	Benefit for Customers
Current Bill [$] (indicative)	The cost of electricity used since the last meter read.	It is a cheap, simple but meaningful way for customers to see how their bill is rising. (Meter readings mean nothing to most customers).	Budget conscious customers can be more aware of their electricity spend, and can see the effects of changing behaviours day by day.
Yesterday's Energy [kW.h]	The amount of energy used yesterday (midnight to midnight).	Customers can compare this figure with "Average Daily Consumption" and relate it to behaviours yesterday.	Learning what behaviours reduce this amount is critical to reducing energy waste, improving energy efficiency and sustaining gains.
Current Power [kW]	The power being consumed now.	The effect of turning particular appliances on and off can be seen immediately.	A simple way to know which appliances have big and small impacts on energy usage and bills. Could help purchase decisions.

Prototype Customer Information Display

I have pursued this idea with several meter manufacturers for some time, and now have a prototype meter on my house that demonstrates not just the concept but the reality. Appendix 1 shows images of the above quantities along with time, date and cumulative energy consumption (which I don't really need displayed). In just ten days of monitoring, I have already learned something new about my Average Daily Consumption (Figure 2); I was not expecting as much variability day-by-day at this time of year. Nevertheless, I am on track to produce 21% reduction in Average Daily Consumption in Autumn compared with two seasons earlier. That would translate to about $55 for the season ($135 for six months to date).

Figure 2 - Yesterday's Daily Consumption



An existing smart meter design has been used, a two-element interval meter with integrated load control relay. It really should be called an "Informative Meter" because the meter manufacturer has programmed additional information display software in it to do more than just measure my interval energy consumption. This meter displays the rising bill, yesterday's energy consumption and the present power. It doesn't do it exactly as I would like yet, but that is an improvement opportunity.

The manufacturer did not have to design and develop new hardware; this is an existing production meter. The existing metering software already did all the calculations for power and energy measurement. All the manufacturer needed to do was add the unit prices and the tariff algorithm to calculate the bill. The software engineering involved is trivial. How much extra cost did this really add to the meter?

Funding the Customer Information Display

I think it would be fair to pay $10-$15 per meter to compensate any manufacturer who supplies a meter meeting a minimum standard of Customer Information Display. At that price, it would be less than 10% of the installed cost of a typical metering installation for a Brisbane residence! In my case, I would have recovered $15 in just 19 days with the Summer savings made – an enviable payback period. The lower upstream losses, the coal left in the ground and the CO_2 and heat kept out of the atmosphere are community bonuses!

When I look at the hundreds of dollars of government rebates handed out to buyers of solar and gas hot water systems, or even the free compact fluorescent lights that were handed out in the early 1990's, \$10-\$15 extra meter cost is a pittance.

This \$10 – \$15 government subsidy could be paid to electricity utilities for each meter purchased meeting the minimum standard of Customer Information Display. Purchase specifications would declare the subsidy and its treatment in tender evaluations – open tendering. Meter manufacturers can build a business case for the (minor) development work involved. They do not have to take commercial risks in developing and offering higher cost meters to a market that has been fiercely price competitive; utilities have historically evaluated offers as commodity products with minimal feature sets. Utility purchasers can claim a rebate from government, so there is no direct impact on either utility profits or government dividends; the CID rebate becomes transparent and passthrough.

Sample Specification for the Customer Information Display

Figure 3 - Sample Specification for Customer Information Display

The meter shall have provision for programming (by the utility) of the calculation and display of the following three quantities;

- *total bill (\$xxx.xx) since last billing reset, according to gazetted Queensland tariffs for residential customers, and allowing for inclusion of a single additional fixed daily charge eg Ambulance Levy,*
- *yesterday's energy consumption (xxx.x kW.h) in the 24 hr period from midnight to midnight AEST of the preceding day,*
- *present power consumption (xxxxx.x W) averaged over the scrolling period (nominally six seconds).*

The customer information shall be displayed as the default display set with a two-second scroll rate, and each displayed item shall have a unique register identifier. Additional meter information shall be accessed via one or more alternative display sets invoked by a suitable button eg register readings for utility meter readers.

The addition of one more measure "Yesterday's Greenhouse Emissions [kg CO_{2e}]" would be straight-forward and could help give better focus to environmental benefits.

Accuracy of the Displayed Quantities

Power and Consumption quantities will be highly accurate because of the metrology requirements for meters, but the Bill requires additional programming of tariffs. Theoretically, the Bill can be as accurate as that produced by the electricity utility, but this would require updating of tariffs before their effective commencement date. On occasions tariffs have not been gazetted much in advance of the effective date. Hence, I argue that the bill only needs to be promoted as accurate to say 2 ½%; this will be more than adequate for customer's needs and it will let utilities update the unit prices during routine meter reading following a typical annual tariff change. The marginal cost to maintain the program is probably around \$1 pa.

Objections

There are likely to be some hurdles.

- Electricity utilities are not in the business of cannibalising their energy sales – it is good business for customers <u>not</u> to have information or tools that significantly help them reduce their energy usage.
- Likewise it is not good business for government treasuries to encourage customer behaviours that cannibalise their electricity utility dividends - an important source of government funds.
- Government purchasing guidelines for utilities generally favour lowest cost purchasing (for minimum functionality needed by utilities) so this is the easier path for utilities evaluating tenders.
- Utilities can argue they are not in a position to know customers' information needs, and different segments could have very different needs, so that they cannot write specifications with certainty.
- Electricity utilities fear that loss of (marginal) revenues from reduced energy sales will not be associated with demand reductions that are major drivers of (marginal) utility costs.
- High request rates for such meters could lead to early retirement of serviceable metering assets, and delays in rollout due to resource constraints could cause customer dissatisfaction.
- Technologies in metering, communications and load control are evolving at a reasonably rapid rate so there is some reluctance to make decisions pending the next and better product release.

And so on…

A Finding and Recommendation of the Inquiry could put such a Customer Information Display squarely in the centre of energy policy debate and go a long way in addressing many of the above hurdles.

The writing down of existing serviceable metering assets is a hurdle that could have a genuine effect on profitability for utilities, and dividend payouts to government. Perhaps the early retirement of such assets could be treated as obsolescence, and writedowns could be funded out of asset revaluation reserves? This would be limited only to those meters actually replaced and retired as a result of requests from existing customers for new meters with Customer Information Displays.

Other Benefits of a Customer Information Display

Average Daily Consumption is a simple, useful and comparable measure. Its usefulness could be enhanced by making it **a mandatory reportable standard** on electricity and gas bills, Customer Information Displays, energy labelling, etc. Ubiquitous use will assist customers in connecting their usage with their energy-using behaviours and purchasing behaviours.

A whole-of-house measure avoids many problems associated with existing energy rating schemes. Average Daily Consumption is an accurate, independent, automated measure encompassing many variables affecting our individual household energy use ie occupancy, appliance inventory and usage, house design, location and climate.

Kilowatt-hours [kW.h] is proposed as the standard unit because everyone uses electricity. The conversion factor from gas usage is 3.6 MJ / kW.h.

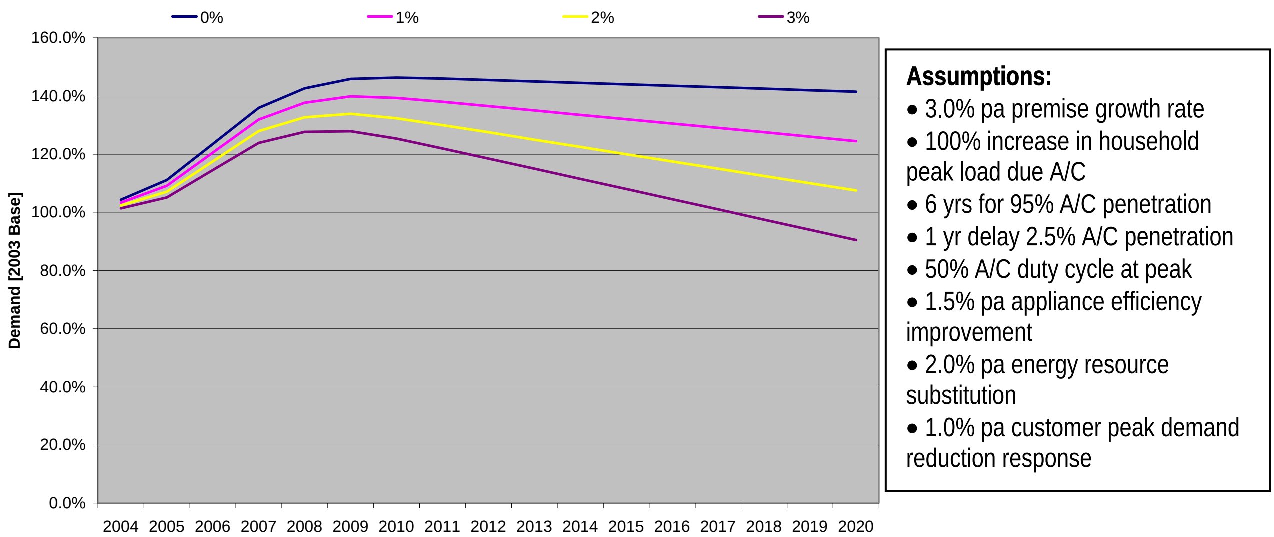
Need for Urgent Action

The Customer Information Display can help residential customers identify and appreciate energy efficiency improvement potential, and empower them to make improvements for themselves and the environment – a no regrets result.

What then might be the effect of widespread use of Customer Information Displays eg if 10% of customers each year made 10% improvement in energy usage? The Report cites evidence that there is a linkage between energy efficiency improvements and reductions in peak demand (p.295) ie a Customer Demand Response. The Report also indicates that fuel substitution and appliance efficiency improvements are material and could be expected to accelerate under a variety of energy policy initiatives. Coupling these factors with estimates of population growth and new appliance penetration, and developing a crude forecast of Network demand over time produces an unexpected scenario (at least as far as commonly held beliefs among my colleagues in the electricity industry).

Figure 4 shows that pressures reducing demand begin to exceed pressures increasing demand not too far in the future ie once the high market growth in energy hungry air-conditioners approaches saturation. What could follow is a profit and cash squeeze for utilities in less than a decade as network demands peak and then fall. Significant newly installed Network capacity (with long economic lives) could become stranded, and be 'optimised out' in regulatory determinations. This could leave utilities carrying the depreciation and maintenance costs with ever declining sales revenues. Even worse is the thought that customer demand response, fuel substitution and appliance efficiency improvements shape the 'tail' of the curve completely independently of utility actions.

Figure 4 - Annual Demand Growth Forecast vs Customer Response



The most likely consequence is rapid inflation of energy prices to realise sufficient funds for continued operation of utilities at mandated service levels. Customers who have had a significant effect in reducing energy use and demand could find their bill savings eroded by price increases!

The present haste to improve the reliability of the network with major capacity enhancement programs over the next few years could prove ill-considered from the future. The sooner we engage in significant demand side management efforts, the sooner we will develop an appreciation for the likely effects, and the more likely we will be able to bring-on benefits before we have constructed peak network capacity.

There is another problem – that of excessive reliance on energy volume as the sole base for revenue collection, when costs are driven much more by demand issues. The match between revenues and costs should be improved to reduce the exposure of both Retailers and DNSP's. Time-of-Use tariffs can offer a solution consistent with this objective. TOU tariffs are likely to be welcomed by residential customers who have access to a Customer Information Display because the varying rates within the tariff provide a further incentive to make bill savings. Perhaps TOU tariffs could be packaged with Customer Information Displays and innovative load control options for customers? Refer Appendix 2.

The model shown was developed in early 2004 and is fairly simplistic, but I hope it fosters interest and detailed study as a risk scenario with consequences too important to ignore.

If the scenario projections are correct, then a more interventionist approach may be warranted ie governments and utilities need to provide stronger leadership in assisting and guiding energy management and demand management efforts. Experience has shown that many energy savings efforts deliver concurrent demand reductions. I think many customers will respond positively to efforts aimed at helping the environment, helping improve reliability of supply and better matching revenues and costs for electricity supply.

Queensland electricity utilities operate probably the largest curtailable load programme in Australia – flexible control of residential electric water heating. Queensland is well placed to pilot a project testing a combination of cost reflective tariffs, innovative load control and Customer Information Displays within the existing regulatory framework. It is clearly in residential customers' interests to do this.

At present I fear we are moving ever further into an economic and environmental cul-de-sac; we need to get back onto a better track, to become "waste watchers" and understand that "it is not OK to go slow!" I implore you to make findings and recommendations in your inquiry report that promote the deployment of Customer Information Displays on residential electricity meters.

Comment on Full Retail Contestability

The benefits of contestability for large commercial and industrial customers are clear. Material benefits for residential customers from FRC are less clear. Nevertheless, the FRC "train" has departed. My proposals have been formulated to work compatibly with FRC, but are not dependent on it.

Comment on TOU Metering

The Report suggests TOU metering requires substantial investment with unclear worth (Overview page XL).

TOU metering can provide residential customers with additional opportunities for bill savings through shifted patterns of consumption, provided;

- tariffs are simple (fixed charges plus flat rates for up to three time periods),
- peak and shoulder periods are formulated sensibly (so that there are real opportunities to shift consumption), and
- relationships between the various rates are stable over time (because certainty of pricing is more highly valued than the absolute amounts of bills).

Note that Critical Peak Pricing experiments require customers to accept the risks of failures to receive alerts, and failures to enact load responses in time. It would be disheartening to see accumulated savings over some months wiped out in a short period because customers were unaware or unable to respond in time.

TOU tariffs require the taking of few readings. Customer-reads are viable for the increasing number of customers who have dog, privacy or security issues that constrain access by utility meter readers. Conversely, interval meters require electronic reading of data using either high cost remote reading equipment or special purpose handheld reading devices. Customer reads are simply not viable for interval meters.

Some misconceptions have contributed to beliefs that TOU metering requires substantial investment. This is not the case and, in fact, TOU metering is a simpler, lower cost and less error-prone alternative to interval metering and reading.

- Modern TOU meters are virtually interval meters so the installed cost is nearly the same; the meters are just programmed differently.
- Most interval meters can be programmed to store both interval data and TOU data concurrently. This gives DNSP's and Retailers a choice in reading a few TOU readings or several thousand interval readings (twice that in Queensland). It is a cost-benefit decision concerning the level of data needed. Mandating interval reading should be a decision made very cautiously.
- Some meters can have many more than the usual two or three TOU rate periods. More periods deliver better data for DNSP's and Retailers, while aggregation of rate periods in billing systems allows customers to still be billed according to just two or three rate TOU tariffs.
- Most utilities already have TOU billing capabilities as TOU tariffs are offered to commercial customers; there are few implementation and operations barriers.

There is much merit in installing interval meters (to facilitate settlement of contestable customers <u>if</u> jurisdictional regulators mandate settlement using interval data), but choosing to read TOU data until then can be a much lower cost option for DNSP's and Retailers, while helping customers make savings from load shifting behaviours based on simple TOU tariffs. With good design of the TOU tariffs, revenues and expenses can be better matched and cross-subsidies between users can be reduced.

On p296 of the Report, one of the most important benefits of TOU metering has been omitted from the dotpoints ie the customer savings from reduced usage that typically accompanies TOU metering.

Conclusions

The thrust of my arguments could be summarised in the following illustrative amendments and additions to the Draft Findings and Draft Recommendations;

DRAFT FINDING 13.1 (amended)
More cost-reflective pricing has the potential to improve energy efficiency by influencing both consumer and supplier behaviour, ~~particularly~~ in <u>the short term and</u> the longer term when consumers have both more information and opportunity to modify their behaviour, and producers have the opportunity to respond to changed market conditions.

DRAFT RECOMMENDATION 13.1 (amended)
Any mandated rollout of interval metering devices should be subject to a comprehensive benefit-cost analysis. Mandated rollout of technologies should not preclude choice in the device or competition between service providers. <u>*However, a class of interval meter – termed an "Informative Meter", that has a minimum standard of "Customer Information Display" – should be given regulatory support via subsidies for supply and installation on residential premises on a new and replacement basis.*</u>

DRAFT FINDING 7.4 (additional)
Measurement of "whole-of-house" electricity and gas usage would create better, standard and independent measures for comparing the holistic effects of house location, design, customer appliance usage, etc. Local display of the measure would assist customer improvement efforts.

DRAFT RECOMMENDATION 7.4 (additional)
Average Daily Consumption should be mandated as a standard reportable measure of performance in all bills issued to residential customers, any Customer Information Display, and all Energy Rating Labels. It is recommended that kW.h be adopted as a standard unit for this quantity so customers may aggregate electrical and gas usage to develop total energy usage, and may compare electrical, gas and solar alternatives in appliance purchasing decisions.

Thank you for the opportunity to contribute to the Inquiry.

Yours sincerely

Jeff Beal

Attachments:
Appendix 1 – Customer Information Display
Appendix 2 – Smart Meters for the Smart State

APPENDIX 1: CUSTOMER INFORMATION DISPLAY

Figure 5 Time

Figure 6 Date

Figure 7 Cumulative Energy

Figure 8 Power

Figure 9 Cumulative Bill

Figure 10 Yesterday's Energy

The images are from a meter installed at my house for seven days. The Cumulative Bill algorithm has an error that is being rectified; this is the reason for the low value shown. Some improvements include;

- elimination of Time, Date and Cumulative Energy from the display sequence,
- suppression of leading zero's and addition of one dp to Yesterday's Energy,
- addition of a $ symbol to the Cumulative Bill display (rather than Eb),
- reduce the scrolling interval from three seconds to two seconds.

The improvements will create a simple scrolling display of just the three quantities argued for in this submission; sufficient to help most customers manage their energy usage and electricity bill.

APPENDIX 2: SMART METERS FOR THE SMART STATE

The following information shows how smart meters (with or without a Customer Information Display) may be justified for residential customers in Queensland. The arguments are NOT as strong in other States of Australia.

- Queensland tariffs include two controlled water heating options for residential customers, T31 and T33.
- This is probably the largest curtailable load operated in Australia, and is a major component of network load management.
- It requires provision of a remotely controllable relay at each customer's premise.
- 2/3 of one million South-East Queensland households have a light and power tariff, and at least one of these controlled tariffs ie ≈ 660,000 customers.
- So, most customers have a need for two meters and one load control relay.
- The total installed cost of three traditional meter and relay components is almost the same as a modern integrated meter (that can do more and is FRC ready).
- It seems logical that all new customers get these meters. With premise growth rates around 3% pa, this would be about 30,000 integrated meters pa in SEQld.
- Since it is generally accepted that the life of traditional meters and relays is about 25 years, one could expect to replace meters and relays at another 26,000 premises per annum (4% of 660,000).
- Some additional replacements could be warranted for other reasons as well.
- So, if just SEQld had these policies applied, meter manufacturers could supply at least 60,000 such meters pa.
- This is a substantial base of meters for spreading the minimal development costs of a Customer Information Display.
- If a policy of reading TOU data from the meters is established, then reading and billing costs can be held very close to present levels and there will be minimal impact on utility resources. Note that mandating reading of interval data would require reading some 8,600 interval readings per quarter (twice the number typical of other States) because of the predominance of two tariffs per premise.
- A small incremental reading cost would arise for changing tariffs from time to time if this is done during routine quarterly reading.
- The technology exists, the market exists, and the management tasks are understood, so it is only regulatory approval and funding holding up deployment of a Customer Information Display.
- While the impacts on energy usage and demand will only be developed from experience, evidence cited in the Report supports the contention that both energy reductions and demand reductions are achievable.
- Queensland is clearly very well placed to conduct a pilot project to develop knowledge in this important area, arguably better placed than other States of Australia, and with some unique characteristics that may not be fully considered in the deliberations of southern regulators.

Recommendation: That Queensland regulators initiate a pilot project to test cost reflective (TOU) tariffs, automated load controls and Customer Information Display with the objective of demonstrating energy reduction and demand reduction for the benefit of customers, DNSP's, Retailers and the community.