



Analysis of submissions on *Smart meters: How households and the environment can benefit*

Briefing for Commerce Committee

The Commissioner for the Environment released her report on smart electricity meters in June 2009, and spoke to the Committee regarding its content in August 2009.

Since then the Committee has been hearing evidence from a range of interested parties. This document provides new information on smart meters and responds to the criticisms made of the Commissioner's recommendations.

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Recommendation 1: Home area network (HAN) functionality should be fitted to smart meters before they are installed

It makes sense to make meters HAN-functional before installation

- Even the cheapest retrofit is expensive because a technician will need to visit each house to install the functionality.
- A household does not need smart appliances to benefit – a simple in-home display is very cheap and effective in reducing demand.
- Smart appliances are being manufactured and current appliances can be easily made “smart”, with smart plugs and smart thermostats.

Low technology risk

- Common industry standard emerging: 100 million meters to have ZigBee HAN-functionality¹.
- If ZigBee is not the winner, households can just be supplied with a protocol converter.
- It does not matter if the smart meter is controlled by cell phone or Home PC – HAN-functional smart meters are still a necessary part of the system.
- ZigBee does not charge an annual licensing fee, so there is no ongoing cost.

Follow Australia’s lead

- Mandate the inclusion of HAN-functionality prior to installation, adopting the same communication protocol as Victoria (Australia), i.e. ZigBee.

Rationale for recommendation

According to the smart meters report, the advanced meters being rolled out in New Zealand do not contain a home area network (HAN) computer chip (or more formally, HAN-functionality). HAN-functionality can be retrofitted later.

HAN-functionality enables in-home displays (IHDs) to be installed in places where they are easily visible. Evidence shows that displays that are located in convenient places can help consumers reduce their electricity use.²

Smart meters that are HAN-functional can interact with smart appliances in the near term and electric vehicles in the medium term.

Householders could programme their smart meters to manage their household electricity consumption automatically, mainly shedding and shifting peak load. This would reduce the need for new power plants.

¹ The ZigBee Smart Energy Profile.

² Darby, Sarah. 2006. The effectiveness of feedback on energy consumption. Review for DEFRA of the literature on metering, billing and direct displays. Environmental Change Institute. University of Oxford.

If HAN chips must be retrofitted to household meters, the cost will be upwards of an estimated \$60 million more than putting them inside meters before the meters are installed.

Summary of submissions

Submitters focussed on seven main issues regarding this key recommendation. These are:

- i. How much does retrofitting HAN into a meter cost?
- ii. Is installing HAN now putting the cart before the horse? Don't we need smart appliances first?
- iii. Which makes more economic sense – HAN in before the meter is installed or retrofitting HAN later?
- iv. Isn't it too soon to pick a communication protocol?
- v. What about ripple control?
- vi. Could we use the internet instead of the meter to communicate with the HAN?
- vii. Who should pay for the HAN chip?

These issues are responded to below.

i. How much does retrofitting HAN into a meter cost?

Summary of submissions

Much of the debate has focused on the cost of retrofitting meters with HAN-functionality, with differing opinions (low cost/higher cost) offered to the Committee.

Low cost

The retail companies Contact and Genesis reported that retrofitting their brand of smart meter would not cost much. This is because these meters, supplied by Vector to Contact and Genesis, are modular and retrofitting HAN can be done by a technician instead of an electrician:

Genesis stated:

“The meters we are deploying are capable of accepting a modem that can communicate with an in-home display. In future, the same modem could potentially communicate with compatible smart appliances.”

The Electricity Commission said:

“Only one early type of advanced meter installed in NZ would require the replacement of the meter itself in order to interface with a HAN. Such meters are no longer being installed.”

Contact suggested that the retrofit cost would be similar to the cost of meter readings, which are currently carried out from four to six times per year. Vector believed that it is more efficient to retrofit HAN-functionality when consumers need it, rather than deploy HAN-functionality to all consumers at the outset.

Higher cost

The lines company WEL Networks suggested that retrofitting is a costly alternative:

“There has been significant debate around the viability of home area networks, in my belief the importance of communicating with customers should not be underestimated, and that the cost of retrofit of facilities to communicate and control within the premises is a costly alternative.”

Commissioner’s response

Meters vary, and the cost of retrofit will vary, but even the cheapest retrofit is expensive

- An indeterminate number of smart meters will need to be replaced entirely, with a very large cost.
- At least 14,000 meters will require a visit by an accredited electrician,³ costing around \$75-\$150 per visit, and maybe considerably more.



³ Parliamentary Commissioner for the Environment survey of main retailers.

- The majority will require a technician visit, ⁴ probably costing around \$50-\$75 per visit and maybe considerably more.



Given that HAN-functionality costs around \$20,⁵ even the cheapest retrofit visit will more than double the cost of the HAN upgrade.

Householders will not be able to upgrade the meters themselves

What exactly has to be done to the meter depends on the design. But it is likely to remain too risky for a householder to do themselves, especially as there are significant health and safety issues when modifying meters (e.g. danger of electrocution).

One-off upgrades of household meters will cost much more than meter reads

This is because meter reading relies on economies of scale – one meter reader visits an entire suburb. Piecemeal upgrades will not have this cost-saving advantage. A technician installing HAN on demand (e.g. prompted by a customer who switches retailer) would not be installing HAN for the surrounding households at the same time.

According to Bob Heile, chairman of the ZigBee Alliance (a non-profit association of companies who have developed the leading HAN protocol):

"Anything that requires a "truck roll" [visit from a technician] is expensive. Physically going out twice is costly."

ii. Is installing HAN now putting the cart before the horse? Don't we need smart appliances first?

Summary of submissions

A number of submitters said that widespread usage of smart appliances is needed before consumers will benefit from HAN-functionality, and therefore it is premature to include HAN-functionality now. All the electricity retail companies took this position.

We need smart appliances first

Genesis stated:

"It is possible that in the future there will be widespread availability of appliances with built-in ZigBee modems (or some other standard) able to communicate with in-meter modems for load management purposes. However, at present there would be little use for in-meter modems, so the extra cost is simply not justified."

⁴ Parliamentary Commissioner for the Environment survey of main retailers.

⁵ Energy Market Consulting associates. February 2008. Cost Benefit Analysis of Smart Metering and Direct Load Control. A Report to the Ministerial Council on Energy. Australia.

Some submitters suggested that most households will not have smart appliances for a long time. Might River Power stated:

“Fisher and Paykel has stated that the technology on smart meter computer chips is a long way off ... Similarly other appliance manufacturers are looking at least 5 years ahead before HAN appliances would be readily available”.

Contact has said that it would take years before consumers upgraded their appliances.

Meridian state that there has been little investment by manufacturers and there were no standards across the appliance industry - HAN cannot be fully implemented until there are smart appliance standards.

The Electricity Commission and the meter company Vector both raised the issue that consumers would have to pay more for electricity to cover the cost of the HAN chip, but most would not be in a position to take advantage of the benefits because they would not have the necessary home appliances.

We don't need smart appliances first

In contrast, the lines company WEL networks pointed out that existing appliances can be easily adapted to work with a HAN:

WEL Networks:

“Wireless signalling can be extended to provide control of appliances through an adaptor or controller that can be plugged into selected appliances (overtime such control devices will be built into appliances).”

The submitters had conflicting views on how much householders are already willing to reduce peak load, without smart appliances. Genesis stated that householders already shift load. However, WEL Networks and Trustpower stated the opposite. WEL Networks said:

“Customers will generally not shift load every day, and from our experience would prefer to have a device to control load “in the background”. This calls for the in-home display and home area network capabilities to be provided with the meters.”

Pulse Utilities (an electricity retail and meter company) stated that other technology can be used to shift load, without the need for HAN-functionality, for example *“a simple delay switch on an appliance such as a freezer.”*

Genesis and the Electricity Commission submitted that people are resistant to the idea of an energy company controlling their appliances.

Finally, the Electricity Commission raised the issue of who pays if the load control fails and, for example, a faulty HAN-chip fails to turn a freezer back on and the food spoils.

Commissioner's response

A household does not need smart appliances to benefit

If smart meters are HAN-functional, consumers will be able to benefit immediately using in-home displays. Overseas evidence shows that in-home displays, delivering only simple consumption information to a readily accessible location, can lead to a 5-15 percent reduction in overall energy use.⁶

Importantly, simply displaying consumption information is very cheap and could be done straightaway. It requires no communication with the retailer's back office. The only cost is the HAN functionality in the meter (~\$20 at most) and the cost of a very simple IHD (\$5-\$50).⁷

Further, current appliances can be easily made "smart", as the lines company WEL Networks points out. Consumers can do this by adding a smart plug to their appliances, which can then turn appliances on and off when signalled by the smart meter. Similarly, smart thermostats can be added to existing heat pumps / air conditioning and water heaters.



Householders could also buy a controller to set preferences. An alternative would be for retail electricity companies to develop the "controller" functionality themselves, in their back office IT systems. Householders would then set their preferences via a web portal, for example. However, this seems a more costly option given householders without smart appliances would still be paying for a portion of this back office IT investment before they could benefit from it.

In the near-time, a better option would be for householders to purchase their own controller at the same time as buying their first smart device. This seems a much better option because households could buy a controller when they are in a position to benefit from their smart devices.

To get the most out of these smart devices (plugs and thermostats), retailers need to be able to communicate prices to smart meters – adding somewhat to the cost (although, at least one retailer probably already has this capability).



Deployment of smart appliances is happening now

For example, in the US, GE has just released its first smart appliance (a water heater) on to the US market.⁸ More are scheduled to follow next year. Meanwhile Whirlpool, who has a strategic alliance with Fisher and Paykel, plans to make one million smart driers by 2011 and make all their new appliances smart by 2015.

According to Kevin Nolan, a Vice President for technology at GE's consumer and industrial division:

6 Darby, Sarah. 2006. The effectiveness of feedback on energy consumption. Review for DEFRA of the literature on metering, billing and direct displays. Environmental Change Institute. University of Oxford.

7 Personal communication, Phil Perry, consultant to the Victorian Government.

8 Electric Energy Online. 18 November 2009. Available online at: www.electricenergyonline.com/?page=show_news&id=122894

“It’s kind of the chicken or egg. The first thing that’s rolling out is these meters, but we’re going to have to follow very quickly with appliances.”⁹

From 2011 in New Zealand, all new heat-pumps will be “smart”

New heat pumps will be required by the Minimum Energy Performance Standards (MEPS) to have “demand response functionality”. This means they will be able to “talk to” a HAN. The Energy Efficiency and Conservation Authority (EECA) is looking at extending this requirement to more appliances.

Unfortunately, because the new meters are not HAN-functional, householders cannot yet benefit from their smart appliances.

The Commissioner recently sent out a survey to the major electricity retailers¹⁰ who are installing new meters. All responded that they will not currently allow householders to have HAN-functionality, even if the householder requests it and is prepared to pay for it.

Overseas evidence has shows that peak load reduction is much greater when it is automated using smart appliances¹¹

International trials have shown by far the greatest peak load reduction is delivered by the combination of critical-peak pricing and automated control of smart appliances.

Alternatives, such as timer plugs, can help reduce load during regular peak periods but cannot help with critical peak events. Smart plugs are a much better choice. It is critical peak events that are the most expensive, environmentally, and financially.

Consumers do not have to give up control

In fact, HAN-functional smart meters give householders much more control over their electricity use. The smart appliances being manufactured by General Electric can be programmed to suit the householders’ needs.

Consumers can contract for lower prices in exchange for giving up some control

This is the same as ripple control for water heaters – consumers get a cheaper rate for the electricity used to heat their water if the water heater is connected to the ripple system.

Regarding who pays if a HAN-chip fails – this is no different to the issue if the electricity fails. Retailers do not pay for customer’s spoiled food in the case of a power cut.

⁹ G.E. Markets First ‘Smart Appliance’. November 11, 2009. New York Times. Available online at

<http://greeninc.blogs.nytimes.com/2009/11/11/ge-markets-first-smart-appliance/>. [Last accessed 10th December 2009].

¹⁰ Meridian, Genesis, Contact, and Mighty River Power.

¹¹ Faruqui, Ahmad and Sergici, Sanem. 2008. The power of experimentation. New evidence on residential demand response. Discussion Paper. The Brattle Group (2008). www.brattle.com

iii. Which makes more economic sense - HAN in before the meter is installed or retrofitting HAN later?

Summary of submissions

The Electricity Commission engaged an economic consultancy, the New Zealand Institute for Economic Research (NZIER), to carry out a cost-benefit analysis of smart meter functionality (the NZIER report).

In its submission to you on 18 November, the Electricity Commission stated:

“NZIER’s analysis indicates that deferral of the inclusion of the HAN interface to when HAN-enabled appliances are more common in New Zealand is preferable to including the HAN interface as part of the rollout occurring now.”

Commissioner’s response

The NZIER report referred to by the Electricity Commission was only a draft. A copy of the NZIER report was obtained under s19 of the Environment Act 1986, which required them to provide the report. As a result, a Confidential Draft (dated 25 November) was supplied by the Electricity Commission.

Although the NZIER report is only a draft, the Electricity Commission cited the results of an earlier draft in its submission to this committee. Therefore, it is necessary to comment on it here.

However, it is impossible to undertake a thorough critique of the NZIER report since there is much in it that is not transparent and citations are incomplete. The description of the methodology is inadequate.

Overall, it appears to have a significant bias toward underestimating benefits and overestimating costs.

For example, when calculating benefits:

- The NZIER report estimates that the benefit of having a HAN-functional smart meter and smart appliances is trivial -- only 35 cents per meter per year. Although the New Zealand electricity system is significantly different from that in other countries, it is hard to believe it is so different from the systems in other jurisdictions that are insisting on the inclusion of HAN functionality.
- The NZIER report’s estimate of the underlying value gained by reducing peak power, which is used to help calculate the annual benefit, is significantly lower than estimates included in an earlier report by Concept Consulting (a report endorsed by the Electricity Commission during its submission to the Committee).¹² Unfortunately, the lack of

¹² Concept Consulting Group Limited (Concept). June 2008. Smart Metering in New Zealand. A report prepared for the Parliamentary Commissioner for the Environment. Wellington: Concept. Available online at www.pce.parliament.nz.

transparent documentation in the NZIER report makes it impossible to understand why.

There are also major issues with the cost estimates. For example:

- There are major discrepancies between cost estimates given in the report and those used in international analyses. For instance, the cost of a HAN chip is taken to be between four and ten times higher than in Australia.¹³
- The NZIER report assumes that there are ongoing costs of running a back office to support the home area network *from the outset*. But the back office would not be required until later, when externally-triggered control of household appliances becomes a reality. In the meantime, a HAN chip would enable householders to use an in-home Display (IHD) and other devices such as smart plugs.

iv. Isn't it too soon to pick a communication protocol?

Summary of submissions

Many submitters pointed out the fact that there is no standard protocol for HAN, and highlighted the risk of locking in the wrong technology. An alternative view was that these protocols should be determined *before* meters are rolled out.

Lack of a standard protocol

Mighty River Power states:

"There are multiple competing standards. Integrating a particular one into smart meters now runs the very real risk of making the wrong choice."

The meter company, Vector points out that:

"There is a risk of obsolescence ... it is possible that the Home PC or mobile phone may perform many of the functions of the smart meter. Under such a scenario the smart meter would be a subservient device controlled and operated through the cell phone or Home PC."

Standards New Zealand discussed the development of smart grid standards outside of New Zealand. It highlights the lack of standards for communications between IT backrooms and the meters in some jurisdictions.

ZigBee licence fee

The existence of an annual licence fee for the ZigBee chip is also quoted as a deterrent from rolling out HAN-functional smart meters. For example, Genesis stated that:

¹³ Energy Market Consulting associates. February 2008. Cost Benefit Analysis of Smart Metering and Direct Load Control. A Report to the Ministerial Council on Energy. Australia.

“The type of modem that we would be most likely to install is a ‘ZigBee’ modem. These currently attract a licensing fee (whether in use or not), in addition to the cost of the hardware.”

No roll out until protocol decided

The Domestic Energy Users Network’s (DEUN) view is that common protocols and standards should be decided on before these new meters are rolled out. They state:

“To prevent New Zealand being caught up a dead-end, there must be a moratorium on new meters until the essential ground work is done.”

Commissioner’s response

Common industry standard emerging: ZigBee

Internationally, the technology appears to be converging to a common industry standard of a wireless network with the open access protocol, ZigBee. ZigBee is on the US Department of Energy's list of the 16 consensus standards for the US SmartGrid, has been selected by several major utilities in the US, is contracted for deployment in over 40 million meters to date supplied by various metering manufacturers, and is specified by the State of Victoria for Smart Metering applications.

According to Phil Perry, a consultant to the Victorian Government who is in charge of leading their roll-out, inclusion of Zigbee has been announced for a further 60 million meters. This means 100 million meters world-wide will soon include ZigBee. The table below shows the planned deployments in North America, where the meters will include ZigBee.

Table: Planned deployments of smart meters that include ZigBee, North America¹⁴

Name	# electric	# gas
American Electric Power Service Corp.	10,000	
CenterPoint Energy Service Company LLC	3,200,000	
Consumers Energy Company	1,800,000	1,700,000
Oncor Electric Delivery	7,000,000	
Pacific Gas & Electric Company (PG&E)	5,100,000	4,200,000
San Diego Gas & Electric	1,400,000	840,000
Southern California Edison	5,300,000	
TXU Energy	2,100,000	
OG&E	765,000	
Pepco	1,900,000	
Hydro One	1,400,000	
SMUD	600,000	
Total	30,575,000	6,740,000

¹⁴ ZigBee Alliance. 2009. www.zigbee.org.

Also, 95 percent of meters with HAN have chosen ZigBee. Perry also stated:

“Choosing ZigBee was a very big decision for Victoria. However, they did a thorough analysis of alternatives. It is not the best one in terms of communications. But it is the ONLY option with an application layer for smart metering. There was no other choice.”

Standards New Zealand highlighted a lack of standards for transmitting pricing from IT backrooms to meters. Reportedly, one retailer is already able to transmit pricing information and another is developing this capability. However, even without the transmission of pricing information, major benefits from HAN-chips are still feasible (e.g. displaying consumption information on IHDs to motivate demand reduction).

Further, it would be very concerning if the retailers have rolled out meters without seriously considering the standards for communications between meters and back rooms.

No technology risk

The risk associated with possibility that ZigBee does not become the winning protocol is easily dealt with, according to Phil Perry (consultant to the Victorian State Government). If ZigBee is not the winner in five years time, households can be supplied with a protocol converter. He said:

“Because the protocol can be converted, Victoria’s decision is a fairly bullet-proof one.”

It does not matter if the smart meter is controlled by cell phone or Home PC – HAN-functional smart meters are still necessary. A ZigBee chip, for example, installed into a meter could act as the 'controller' now but become subservient to a cell phone or Home PC 'controller' further down the track. According to Bob Heile, Chairman of the ZigBee Alliance:

“These devices can perform many of the same functions, but not as replacements but rather as devices that can augment the experience. AMI and Smart Metering in general assumes an always there connection and control for many functions. ... The phone can be an alternative to the in home display and might be a ready vehicle for running energy management applications and controlling things as a consumer convenience, but it does not replace the smart meter.”

He also points out that the HAN-functional smart meter is always in the home and always on - this is certainly not the case for a mobile phone and not likely to be the case for a home PC.

No annual ZigBee license fee

ZigBee does not charge an annual licensing fee. According to Bob Heile, Chairman of the ZigBee Alliance:

“There is no annual licensing fee. There would be a one time certification fee to prove the design, but that is not a per meter charge and is not that expensive (\$US2-4K in that range depending on how bug free the design was when testing was sought). There is also a one time certificate authority fee of a few cents per meter at time of manufacture for the unique encryption key needed for network security.”

The cost of the plug-in module for the meters that Genesis customers are being supplied has been given as a one-off cost of somewhere between \$10-\$50 per meter. Vector is apparently charging Genesis an annual fee to recover this cost. This may be the source of the confusion.

Open access standards do not become obsolete

Experience shows that technology based on open access standards does not become obsolete. A good example is the internet where the underlying standards developed in the early 1980s are still used today. Another example is Wi-Fi, which is an open access standard for wireless internet. Although the Wi-Fi standards have changed over time, the new standards are “backwards compatible” meaning the newer devices can still talk to the older ones.

Problems do occur with standards that are not open access. These are known as proprietary standards. The argument for not “picking winners” is often backed up by the battle for market dominance between two different videotape formats, VHS and Betamax. If the government “picks a winner” it may end up picking the loser – in this case Betamax. However, this example was actually a competition between two *proprietary* standards.

Follow Australia’s lead

An obvious way ahead is for the Government to regulate the same protocol as Australia. Choosing the same protocol as Australia makes sense; both Australian and New Zealand companies benefit from common Australasian standards because they increase our bargaining power internationally. And, increasingly, household appliances are being required to meet the same energy efficiency standards in New Zealand as in Australia.

The Australian state of Victoria has made the inclusion of the ZigBee chips mandatory in its smart meter roll-out. It would be very surprising if the other states do not follow their leadership.

There are two ways to address this issue of choosing the ‘wrong’ technology.

- Mandate the inclusion of HAN-functionality prior to installation, adopting the same communication protocol as Victoria (Australia), i.e. ZigBee.

Or, if significant doubts remain surrounding Victoria’s choice and therefore the best option for New Zealand.

- Halt the roll-out of advanced meters until those doubts are resolved.

Regulating a communication protocol makes sense in the same way as regulating electricity standards for 50Hz and 240Volts. Markets require rules within which to operate.

v. What about ripple control?

Summary of submissions

Some submitters pointed out that the existing ripple control systems can be used to shift load, without the need for smart meters. For example, the retail company Trustpower states:

“Existing ripple control signals can be utilised to provide peak and off-peak pricing options without the need for smart meters to be installed.”

However, the lines company WEL Networks discussed the degradation of the ripple control networks:

“Any degradation over recent years [of ripple control] is a result of damping of incentives to control through price regulation, and the fragmented ownership of ripple plant and relays in many areas.”

Commissioner’s response

Ripple control systems use hot water cylinders to help stabilise the grid by switching the cylinders off at critical times, relying on the heat storage capability of the cylinder to keep a household’s water hot enough.

Although ripple systems in New Zealand make significant contribution to grid stabilisation, many are aging and becoming increasingly less effective. A significant proportion of ripple injection plants are over 25 years old, resulting in reliability issues and problems with interference and signal absorption.¹⁵ Also, more than a third of ripple receivers are more than 30 years old, and many of these are associated with obsolete technology.

Further, increasingly less load is available for control. Some consumers have reportedly switched to gas water heaters, and solar and heat pump water heaters are increasingly being installed. And the level of unused ('stranded') ripple receivers is unknown.

Four of the five major electricity retailers have already decided to invest in advanced meters. Therefore, it makes sense to use the smart meter infrastructure for load control, rather than upgrading ripple systems.

HAN-functional smart meters will be able to do all that ripple control can, and much more -- sophisticated, subtler, and far less intrusive control of smart water heaters and other appliances.

¹⁵ Electricity Commission. June 2009. Presentation at the radio and conventional ripple control systems forum. Available online at <http://www.electricitycommission.govt.nz/opdev/retail/metering/forums> [last accessed December 2009].

vi. Could we use the internet instead of the meter to communicate with the HAN?

Summary of submissions

Some submitters suggested that the internet may turn out to be a better way to form the communication link. For example, Genesis states:

"... there are communication channels that can be used other than direct communication between appliances (or in-home displays) and meters. For example, our customer research indicates a greater interest in receiving information via the internet or cell phone. These communication channels make use of existing infrastructure, and devices that people already have in their homes and workplaces."

Mighty River Power also suggested that by the time smart appliances are widespread, the connectivity between appliances and HAN will be through the internet rather than the smart meter.

The Electricity Commission pointed out that there is no consensus on what the control hub for the HAN should be. For example, it could be the meter, the IHD, or an internet router.

Commissioner's Response

There are two separate issues here:

1. using web portals to inform householders and set preferences
2. using the internet to communicate with the IHD and home appliances.

Using web portals to inform householders and set preferences

Overseas evidence shows that using an *internet web page* or *email* is not as effective for reducing overall energy consumption as an IHD.¹⁶ The crucial factor is that an IHD located in a readily accessible place serves as a constant reminder of electricity use. This is a strong motivator.

Further, logging onto an *internet web page* or *checking emails* are not solutions for everyone. Not only do these options require a householder to own a computer that has adequate internet access but who is also motivated to use the system. Evidence from the United States and Sweden has shown that only two to four percent of customers actually access the online data.¹⁷ In-home displays are much better for less technically-minded householders.

¹⁶ Darby, Sarah. 2006. The effectiveness of feedback on energy consumption. Review for DEFRA of the literature on metering, billing and direct displays. Environmental Change Institute. University of Oxford.

¹⁷ UK Department of Energy and Climate Change. 2009. "Towards a smarter future: government response to the consultation on electricity and gas smart metering". December 2009. London.

The internet is much slower and less reliable. According to Phil Perry, a consultant to the Victorian Government who is in charge of leading their roll-out:

“If you wanted to see the effect of, for example, the oven on your power consumption, you can see it instantly if you have HAN in the meter. But if the information comes through the internet, at best it will take 10 minutes for a response. This is not good enough.”

Using the internet to communicate with the IHD and home appliances

Retailers could send signals to home appliances via the internet rather than via the smart meter. However, it will cost more. Adding the HAN-functionality to the smart meters before they are rolled out will only cost \$10-\$50. In contrast, using the internet to create a HAN not only requires a household PC and broadband connections, but will also need other equipment (e.g. wireless router about \$200) and technical assistance in setting up the wireless network, another unnecessary cost. Upgrading the back office IT systems will probably cost roughly the same in either case.

vii. Who should pay for the HAN chip?

Summary of submissions

The Electricity Commission raised the question of who would pay:

“In the Commission’s view, customers should not be forced to pay for new technology that they may not immediately benefit from, or may never benefit from...”

Commissioner’s response

Householders already pay a rental for meters - it is part of their monthly bill

Currently, most householders are paying for very old meters, in some cases meters that are 80 years old. These meters will have been paid for many times over.

Adding HAN-functionality should only cost around 20 cents extra a month.¹⁸

Once the meters are HAN-functional, a consumer should be able to purchase a simple IHD for around \$50. Overseas evidence shows that, on average, IHDs motivate a 5 – 15 percent reduction in electricity use. This would save a household around \$120 - \$360 a year and also benefit the environment through reduced greenhouse gas emissions.

However, even if a householder asked for a HAN-chip and offers to pay for it, electricity retailers will not currently provide one.

¹⁸ Assuming \$20 HAN-chip, written off over ten years at a 6% discount rate.

Recommendation 2: Home area network (HAN) communication protocols should be open access

Automated control of smart appliances requires some form of communication network between the appliances and the smart meter within the home. For the communication to work well, however, any brand of smart meter must be able to communicate with any smart appliance.

If manufacturers all used different HAN communication protocols and are not required to share them, it would add unnecessary costs and hassle when moving house. It also would create discourage householders from switching retailers.

Submitters' views on this recommendation are summarised below along with the Commissioner's response.

Summary of submissions

The lines company WEL Networks, supported this recommendation, and stated:

"Standardised processes and geographically coordinated access is essential for full distributor benefits to be available to households."

Contact suggested that it is already in the retailer's best interest to ensure protocols are open:

"Exclusionary protocols would limit the value to smart meter providers' services. Likewise Contact does not want to create barriers or difficulties to customers who may switch to Contact or away from Contact."

Trustpower stated that ZigBee is not an open standard:

"ZigBee operates within that 802.15.4 [open] standard but is a trademarked set of products (software, firmware, hardware and development tools) that is openly available for sale, rather than an open standard."

Finally, the Electricity Commission submitted that it was *"not aware that customers are experiencing problems switching as a result of AMI [smart metering]."*

Commissioner's response

If manufacturers all use different HAN-protocols it would fragment the market for smart appliances and IHDs. The market would be further limited if proprietary standards are used.

Trustpower's assertion that ZigBee is not an open standard has been refuted by Bob Heile, chair of ZigBee Alliance:

"ZigBee is a fully open standard available to all comers. All elements were developed using recognized consensus processes for standards"

development. You can download it for free from the web site. There are multiple vendors implementing the standard at every point in the supply chain from chips to end products."

"The Alliance has additionally authorized three independent test houses to certify that manufacturers implementations comply with the standard and are interoperable. It is on the US Department of Energy's list of the 16 consensus standards for the US SmartGrid."

The Electricity Commission's statement above must be referring to potential barriers created by back office systems, not communication protocols for HAN chips, since advanced meters rolled out in New Zealand do not have HAN chips. Therefore, it is not relevant in this context.

Recommendation 3: Let householders know what the new meter can actually do

Consumers have very little awareness of the decisions around smart metering that are being made on their behalf by retailers. A public information campaign informing householders about smart metering is needed so that consumers can be fully informed.

Submitters' views on this recommendation are summarised below along with the Commissioner's response.

Summary of submissions

A number of the retailers have stated that they will be informing their customers about smart metering and the opportunities it will bring. The Electricity Commission did not see any benefit from a government campaign at this time and expected retailers to provide the relevant information.

However, WEL Networks and Vector supported this recommendation, although Vector believes that such a campaign should not be limited to discussing the benefits of HAN capability.

Commissioner's response

According to retailers, all customers receive a letter before the meters are installed, and have the opportunity to phone for more information if they choose. Reportedly, retailers are also questioning focus groups and conducting trials to assess what consumers want.

However, consumers cannot be expected to ask for functionality that they know nothing about. Further, retailers will not install a HAN-functional smart meter even if a householder is aware of its benefits and requests one.

The Government does not rely on the private sector alone to promote other ways to improve energy efficiency in households. An example is EECA's 'Energy Spot' advertisements.

Recommendation 4: Find out how effective in-home displays are, and if justified, promote them

A lack of good information has been widely identified as one reason householders do not use electricity as efficiently as they could. Without good information they cannot make a direct link between the electricity they use and how much it costs them, and as such is a fundamental failure of the electricity market.

Overseas evidence shows that in-home displays (IHDs) have a unique role to play in helping householders make this link and gain more control over their energy consumption.

Provided a meter is HAN-functional, adding an IHD is relatively cheap. IHDs are likely to deliver environmental and consumer benefits by motivating demand reduction.

A pilot study should be carried out by the government in partnership with a power company, where IHDs are rolled out to a sample of households and the effects monitored. If the results are positive, IHDs should then be strongly promoted to householders, but not made compulsory.

Submitters have focused on three main issues:

- The effectiveness of IHDs
- The cost of IHDs.
- The fact that retailers are already running their own trials

Submitters' views on this recommendation are summarised below followed by the Commissioner's response.

viii. How effective are in-home displays - what does the international evidence say?

Summary of submissions

Both Vector and WEL networks agreed with this recommendation. However, Vector recommended that the pilot should also consider other media such as Home PCs and mobile phones.

Domestic Electricity Users Network (DEUN) stated that *"... the roll-out of meters that do not communicate with consumers keeps them as passive recipients of retailers' offers."*

However, a number of submitters suggested that information channels, such as the web and text messaging, would be just as effective as IHDs. For example, Contact stated:

“... receiving messages from their retailer by text, email, phone or website, customers will find different methods convenient for them.”

Pulse Utilities and Contact also referenced Australian trials that allegedly showed IHDs were not effective. Pulse Utilities stated:

“A metering and smart tariff pricing trial conducted by Integral Energy in Sydney 2007/08 indicates that there was a negligible difference in changing people’s consumption habits between those with IHDs installed and those without.”

Contact Energy stated:

“Trials in Australia have found ... the value of how the retailers communicated when peaks were occurring with customers in the survey was a lot less clear cut. The response of customers to text messaging was almost as good as that for those with in-home displays and the advantage of in-home displays decayed over time.”

But Contact also stated that it intends to provide in-home displays to those who want them in the future.

In contrast, Mighty River Power stated that in-home displays are effective:

“The information delivered through in-home displays leads to consumers changing consumption behaviour. This is well established internationally. We provide in-home displays to consumers already with GLO-BUG. We are looking at introducing another mass market in-home-display next year.”

Finally, Meridian points out that Powershop customers can already view their consumption data online.

Commissioner’s response

There is some confusion surrounding evidence of the effect of in-home displays. Submitters have quoted research relating to reducing *peak demand* – i.e. motivating householders to use less electricity at particular peak times. However, the real benefit from in-home displays appears to be from reducing *overall energy consumption* – i.e. motivating householders to use less electricity throughout the day.

Both Pulse and Contact discuss Australian trials that apparently show IHDs are not effective. They appear to both be referring to the *‘Integral Energy: Western Sydney Pricing Trial’* (the trial).

However, the trial is not relevant in understanding the effect of in-home displays on *overall energy consumption*. The trial was focussed on reducing *peak demand*, and did not include a group on standard pricing with an IHD.

Evidence of the positive effect of real-time in-home displays on reducing overall energy consumption comes from a review (the review) of a number of smart meter studies in the United States, Canada, Scandinavia, the Netherlands and the United Kingdom.

The review found that simply displaying real-time information about electricity use in a readily accessible place – *with no additional price incentives* – resulted in a lower overall electricity consumption. The response ranged from 5 to 15 percent. Most significantly, this was a sustained reduction, indicating that behaviour had changed.

According to the review, information delivered via a webpage is useful but not as effective as an IHD. This is because it is intermittent and therefore does not function as a constant reminder of energy use. Also, as noted earlier, international experience has shown that only two to four percent of consumers actually use a webpage.

ix. How much do in-home displays really cost?

Summary of submissions

Genesis suggested that the cost of IHDs is prohibitive:

“Our customer research shows that most people would not value having an in-home display at this time given the costs involved.”

Trust Power suggested IHDs would be more costly than suggested in the Commissioner’s report:

“Our meter and IHD vendors have supplied prices ranging from \$140 - \$500 for an IHD.”

Trust Power pointed out the risk to meter owners if they provide IHDs to customers for free:

“There is significant financial risk for the retailer of metering equipment owner in providing an IHD to a customer. ... There is the risk the expensive IHD’s could not only be damaged during use but may also shift premises with a customer and ultimately be thrown away as they will no longer function at those new premises.”

Finally, the Electricity Commission did not see a demand for IHDs:

“Consumers have not purchased existing IHDs on offer, presumably because they do not see the value in them.”

Commissioner’s response

Submitters questioned the accuracy of the cost estimates of IHDs in the Commissioner’s *Smart Meter* report. However, the submitters do not appear to understand how simple IHDs can be and still be effective.

Sophisticated IHDs may well be more expensive, in line with price estimates given by Trustpower. These high quality IHDs will be interactive and have a number of functions - for example, some IHDs can even show the weather forecast. The most expensive will probably be IHDs that allow householders to set preferences for smart appliances, by for example, tracking the electricity price in order to send smart appliances into energy saver mode at expensive times.



However, IHDs do not have to be sophisticated or expensive to be effective. Evidence shows that a display showing usage information only will have a significant effect on electricity consumption. This could be done with a simple in-home display, consisting of a LED display and a HAN-chip. A simple IHD such as this will cost very little. In fact, in the cost-benefit analysis conducted this year by the UK Department of Energy and Climate Change estimate the cost of the IHD cost to be NZ\$35. Australian estimates range from \$5 - \$50.¹⁹



Once HAN-chips are in advanced meters, consumers will not have to rely on retailers to provide in-home displays. The wider electronics market will provide much simpler and consequently cheaper in-home displays and householders can choose the IHD that suits them best. The risk to meter owners, pointed out by Trust Power, would not exist if householders buy the displays themselves.

The Electricity Commission's point that there has been little demand for IHDs in the past shows the importance of promoting IHDs as an energy efficiency tool. IHDs will not be purchased by householders, if they do not know what the benefits are. They may also not trust electricity retailers to tell them what those benefits are.

x. Retailers are already running pilots

Summary of submissions

The Electricity Commission considered that there may be some merit in this recommendation but noted that:

"... pilot studies [are] being undertaken by a number of retailers at present, as well as the large number of overseas studies going on."

Commissioner's response

Pilots conducted by retailers will not be primarily focussed on reducing overall energy consumption. The Government needs to work with companies undertaking studies to make sure that adequate information is collected regarding the effect of IHDs on overall energy consumption. To help understanding of the effectiveness of IHDs, the information collected by these studies will need to be; statistically significant, able to be generalised to other regions, for a range of household types, and made publically available.

¹⁹ Personal communication, Phil Perry, consultant to the Victorian Government.

Recommendation 5: One meter for import and export

Micro (or distributed) generation involves electricity consumers, such as householders, generating electricity and feeding any excess back into the grid. Microgeneration by householders is rare, but may well increase especially if the cost of solar photovoltaic cells falls significantly. Micro generation can benefit the environment if it results in reduced carbon dioxide emissions.

To enable payment for the excess fed back into the grid, micro generation requires export metering. In the past, a specific export meter was needed as well as an import meter. If an advanced meter is capable of both import and export metering, the cost of installing a specific export meter can be avoided. It may be unnecessarily expensive, however, to install this functionality in all households, as only a proportion of them might ever engage in micro generation and this functionality can be retrofitted.

Submitters' views on this recommendation are summarised below followed by the Commissioner's response.

Summary of submissions

The Electricity Commission agrees with this recommendation.

They also noted:

"Some metering providers in NZ supply this functionality automatically, and some provide it upon request of the retailer."

Vector stated that they:

"disagrees with the recommendation that there should be a mandatory requirement for smart meters to have export and import functionality if micro generation is contracted for. Retailers should be left to offer this functionality in their smart meters as they see fit. Consumers, who wish to install micro generators will search out a retailer that offers this service. This will create a point of competitive tension and assist the functioning of the retail market."

Commissioner's response

It is encouraging to hear that retailers are offering this functionality. However, this issue needs to be monitored.

Recommendation 6: Intervene so that retailers offer smart tariffs

Inefficient use of electricity is, to some extent, related to the types of tariffs householders are charged. The tariffs offered by retailers do not reward households who reduce their electricity use when generation, transmission and/or distribution costs are highest. As a consequence, householders have no financial incentive to reduce their electricity consumption when the system is under pressure.

Smart tariffs better reflect the network and generation costs of the electricity being consumed at a particular time. Householders opting for such tariffs would be rewarded for reducing electricity use when the system costs of providing electricity are high.

Examples of smart tariffs include:

- time of use tariffs: Higher rates are charged during peak times and lower rates during off-peak times
- critical peak tariffs: An even higher rate is charged at short notice (for example, the evening before)

Submitters focussed on two main areas:

- how effective are smart tariffs?
- is intervention needed?

Their arguments are summarised below followed by the Commissioner's response.

xi. How effective are smart tariffs?

Summary of submissions

Many submitters pointed out that retailers are beginning to offer time-of-use tariffs. However, consumer advocate group DEUN pointed out that critical peak tariffs (shown to be very effective overseas) have yet to be offered in New Zealand.

The Electricity Commission suggested that critical peak tariff trials overseas are less relevant to New Zealand because they centre on management of air conditioning load. New Zealand's peak problem is in winter, mostly caused by heating demand. They say critical peak pricing is not:

"... a benefit each individual consumer will see, but rather, will be a feature of avoided generation and network investment."

The Electricity Commission also states that:

“CPP [critical peak pricing] is not about the householder managing their energy costs, but is about the system being able to reduce the impact of extreme events.”

Commissioner’s response

New Zealand is becoming capacity constrained as increasingly more of our electricity is coming from generation other than hydro.²⁰ This means the benefit from reducing peak consumption will continue to increase.

The Electricity Commission is correct in saying that the evidence of effectiveness of critical peak pricing tariffs from overseas is centred on air conditioning in summer, rather than winter peaks.

While this has been true in the past, to assume that summer peaks will not become a significant problem in the future is short-sighted, since New Zealand’s summer afternoon peaks are already an emerging problem.

Transpower has reported that unexpected power demand spikes are occurring during summer. Auckland, particularly, has shown an increase in power demand during hot weather due to heat pumps being used to cool homes. This will continue to get worse, since the rapid uptake of heat pumps is continuing and 60% of them are being used for air conditioning during summer.²¹

The effects of climate change are likely to have a significant impact on peak electricity patterns²². Climate change will impact both the demand-side and the supply-side of the electricity system. What this is likely to mean for the demand side is:

- increased demand for air conditioning because of hotter summers and an increase in the number of extremely hot days
- increased demand for irrigation due to drying out of pastures
- reduced demand for heating in winter because of warmer winters and a decrease in the number of extremely cold days.

On the supply-side, climate change is likely to mean:

- reduced transmission capacity, both overall and especially on extremely hot days
- problems with supply on summer afternoons when Huntly faces restriction on discharges to the Waikato river
- more water in the South Island hydro lakes; this is likely to assist hydroelectricity generation at the time of highest energy demand for heating

20 Concept Consulting Group Limited (Concept). June 2008. Smart Metering in New Zealand. A report prepared for the Parliamentary Commissioner for the Environment. Wellington: Concept. Available online at www.pce.parliament.nz.

21 According a recent study by BRANZ.

22 IPCC 4th assessment report.

On extremely hot days, higher demand compounded by restricted supply will mean increased risk of line outages and blackouts. At the same time, pressure may reduce during winter with lower demand for heating and increased water for hydroelectricity generation.

Summer peaks will increasingly become an issue in New Zealand. This makes the experience in California and Australia all the more relevant to New Zealand. Critical peak pricing may well have a very important role to play.

The Electricity Commission also claimed that individual consumers will not see any benefit from critical peak pricing. However, given that consumers ultimately pay for all generation and network investment, this surely depends on how tariffs are structured.

xii. Do we need to intervene?

Summary of submissions

Some submitters did not agree with this recommendation. For example, Pulse Utilities does not believe intervention is needed or enforceable, stating:

“We believe the best way to encourage the use of cost reflective tariffs is for consumers to switch to energy retailers that provide these tariffs. This allows the energy retailer the choice of the level of investment they are prepared to make in smart meters and just as important, how much they wish to invest in complete meter data management systems.”

The Electricity Commission pointed out that three retailers are already offering time-of-use tariffs. Meridian pointed out that Powershop, a subsidiary of Meridian, has introduced cheap weekend tariffs in Christchurch. Vector expected that more of these tariffs will be offered as the number of smart meters increase.

WEL Networks agreed with this recommendation but called for coordination. They pointed out that price signal dilution is one driver of eroded load control. The Electricity Commission pointed to its work in relation to scarcity pricing, suggesting that their work should result in increase incentives for retailers to offer smart tariffs.

Commissioner’s response

While it is a positive sign that retailers are beginning to offer some smarter tariffs, they do not face the right incentives to motivate them to offer the most appropriate tariffs.

Although it appears that some submitters interpreted “intervention” as only meaning price controls, a number of aspects related to the current *design* of the electricity system need to be fixed before the best smart tariffs will be offered.

Certain aspects of the electricity system significantly dilute the incentives that retailers face to offer smart tariffs. According to Concept Consulting, the price signal problems relate to:

- Inadequate scarcity pricing in the wholesale market
- Damped transmission price signals to consumers at times of peak demand
- Most lines companies not sending significant price signals to control load at times of system peak (This may be a consequence of the structure and operation of the so-called 'Thresholds' price-control regime operated by the Commerce Commission)
- Retailers 're-packaging' what pricing signals there are from distributors, further suppressing price signals to householders

The Electricity Commission has reported that it is dealing with these issues. However, these need to be addressed with more urgency than is currently being shown. Indeed, the Ministerial Review of the Electricity Sector has already called into question many of the current policy settings and the future is still in doubt. Ministerial intervention is needed on these issues.

Recommendation 7: Clarify the relationship between carbon dioxide emissions and electricity demand and supply patterns

Electricity generation is accompanied by greenhouse gas emissions, mainly carbon dioxide. Much of New Zealand's electricity is produced from hydro, but a large amount is also generated by fossil fuel power plants, and is proportionally greater during dry years. About a quarter of New Zealand's greenhouse gas emissions result from electricity generation. The more electricity consumed, the more must be generated. The more fossil fuels are burned, the more carbon dioxide is emitted.

However, the relationship between carbon dioxide emissions and electricity demand and supply patterns is not understood well enough. For example, it was not proven that the last Government's moratorium on new base-load fossil fuel generation would actually result in reduced emissions.

Policies to reduce carbon dioxide emissions that would sit alongside the Emissions Trading Scheme (complementary measures) must be based on a solid understanding of these interactions.

Submitters' views on this recommendation are summarised below followed by the Commissioner's response.

Summary of submissions

WEL Networks agreed with the recommendation.

Vector questioned this recommendation, suggesting that the Emissions Trading Scheme will mean that the cost of carbon dioxide emissions be captured through smart meter tariffs and *"consumers to a much greater extent than previously will be able to adjust their tariff and demand patterns"*.

Contact stated that the relationship has already been well established by Ministry of Economic Development and the Electricity Commission.

Trustpower stated that *"most customers are more focussed on their immediate needs and wellbeing."*

Commissioner's response

The submitters seem to have misunderstood this recommendation presumably because this is an issue for Government rather than an issue for business.

Recommendation 8: Continue to offer an average-cost tariff to households

'Fuel poverty' is exacerbated by the reliance of many poorer households on inefficient electric heating. Smart tariffs may disadvantage households that cannot be flexible in their electricity use. Poorer households, particularly, may respond to these tariffs by simply switching off heaters on winter evenings to save money.

A number of different measures could help mitigate fuel poverty. Until this issue is fully addressed, however, if smart tariffs for households are introduced, it will be essential to offer households the choice between these tariffs and a flat tariff.

Submitters' views on this recommendation are summarised below along with the Commissioner's response.

Summary of submissions

A number of submitters disagreed with this recommendation. Some submitters suggested that flat tariffs (also called average-cost tariffs) will be offered into the future, driven by consumer demand. For example Contact states that it:

"expects many customers are likely to prefer average cost tariffs at least for some years, and it therefore makes sense for retailers to continue to also offer average-cost tariffs to enable customer choice."

WEL Networks agreed with this recommendation but also suggests that making "two-meter rate" approach more widespread might meet the concerns raised in the report.

"WEL offers an uncontrolled rate of 10.02 c/kWh and a separate controlled rate (applicable to permanently connected water heaters and other approved appliances of 2.65 c/kWh. ... This price mechanism meets the concerns stated in the Report (Recommendation 8) for ongoing averaged tariffs – in a way that ensures the benefits of control are passed directly on to the customer – rather than being averaged through a compromise single meter rate."

WEL also stated:

"... there is no reason why a two-meter approach cannot be made more available. Most smart meters have multiple element as well as multiple register capabilities. This enables the value of control to be passed on."

The Electricity Commission noted that there may be a need to monitor this issue. They stated:

"It may well be important to protect those customers that are not able to either shift their consumption to off-peak times, or lack ability to reduce their overall consumption without negative impacts on their health and wellbeing (e.g. reducing the amount of heating). However, the

Commission's view is that it will take some years before there is sufficient penetration of cost-reflective tariffs to make average tariffs unusual."

Commissioner's response

It is encouraging to hear that retailers are planning to maintain the flat tariff option. The two meter approach, proposed by WEL, also seems a sensible option.

Recommendation 9: Maintain the requirement for retailers to offer a low fixed charge tariff to householders, until smart tariffs are widely available

Retailers are currently required to offer a low fixed-charge tariff. This encourages householders to keep their consumption low so that they can be eligible for the low fixed-charge tariff. This tariff option should remain in place, until in-home displays and cost-reflective tariffs are widely available.

Submitters' views on this recommendation are summarised below along with the Commissioner's response.

Summary of submissions

A number of submitters did not agree with this recommendation, pointing out that it is poorly focussed because it can result in higher-income individuals subsidising poorer individuals. For example, WEL Networks stated:

"...the benefits of a low fixed charge are not obvious. The incentive for customers to reduce consumption is often outweighed by the impact of added cost through averaging on household with limited ability to reduce load (e.g. families with young children), and a time of use of two meter approach is better."

Vector also pointed out that:

"It is an active deterrent for distribution businesses to promote alternatives to grid-delivered electricity, such as micro generation, because it impairs their revenue flows ... If the LUFC requirement was removed, Vector and other distributors would be better encouraged to promote delivered natural gas solutions (more efficient use of gas), solar hot water and other demand-side solutions."

Pulse Utilities, however, agreed with keeping this tariff.

Commissioner's response

While it does not meet the needs of all groups, the low fixed charge does provide householders with some choice. Once a wide range of smart tariffs are available, consumers can better choose what suits their needs taking into account individual circumstances and ability to pay.