

Measurement Law Review

Dr Martin Gill

The Australian Government is currently undertaking a review of Australia's Measurement Law. While they claim "the system is working well" [Ref 1] the truth is the law currently allows electricity bills to be calculated using inaccurate measurements and untested quantities. Even when electricity was affordable this was questionable. Now electricity prices have skyrocketed, it is totally unacceptable. The law needs to be changed.

Summary of Article

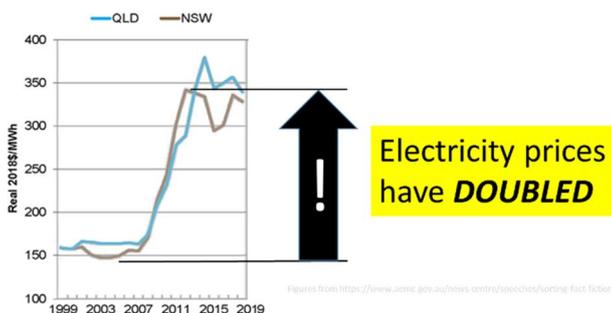
National Measurement Law is supposed to ensure Australian consumers are being billed correctly. For electricity consumers this means bills are calculated using accurate measurements. Evidence suggests this is not the case. The use of these questionable measurements suggests some customers are not being billed correctly for their electricity use. The issues include:

- Consumers are being billed incorrectly when harmonics are present
- Consumer electricity bills are being calculated using untested values

The above points highlight Australia's Measurement Law is *NOT* working well. To restore consumer confidence the law needs to be changed in order to give consumers the confidence their electricity bill is based on accurate measurements.

Introduction

Since the introduction of Australia's National Energy Market electricity prices have doubled (in real terms).



As prices continue to rise an increasing large number of consumers are being pushed into energy poverty. Now more than ever consumers need to be assured their electricity bill is accurate. It is suggested this is not the case.

Electricity Meters

Electricity meters are used to measure consumer electricity use. The readings are then used to calculate the electricity bill.

Historically electro-mechanical (spinning disk) electricity meters were read four times a year. Consumer bills were calculated by taking the difference between two readings and applying a (fixed) price per kilo-Watt-hour.

Increasingly consumers are being forced to install smart (electronic) electricity meters. These smart meters make 105,000 separate measurements every year. The bill is then calculated by applying prices to each measurement.

Australia's Measurement Law has failed to monitor this dramatic change. For example no testing is performed on the 105,000 values used to calculate typical consumer electricity bills.

There is a more fundamental problem. The way appliances use electricity has changed. Where older appliances drew constant current, e.g. resistive heaters and incandescent light bulbs, modern appliances constantly (and rapidly) adjust their current use, e.g. reverse cycle air-conditioners and LED lights. Despite this dramatic change to how electricity is used, meter testing continues to apply constant voltages and currents. This testing is largely irrelevant for modern appliances.

National Measurement Institute

National Measurement Law ensures electricity meter manufacturers submit documentation verifying their meters meet required accuracy standards. The required documentation is detailed in National Measurements Institute (NMI) M6 Part 1 [Ref 2]. Only once the meter vendor has submitted the documentation can the meter be used to bill consumers.

Testing detailed in existing Australian metering standards does not accurately represent energy use of modern appliances. This inadequate testing fails to give consumers confidence in the accuracy of the measurements.

Accuracy testing

Accuracy tests performed on electricity meters are described in a number of Australian metering standards. The vast majority of the accuracy testing involves applying constant voltage and current to the meter. Then a flashing light on the front of the meter is compared to measurements made by a (NATA certified) reference standard. The identified problem is this testing is no longer relevant or sufficient.

Most modern consumer appliances do not use constant current. Instead many modern appliances use “inverter technologies” which continuously, and rapidly, change their current use. Testing meters using constant current does not represent the actual current the meter eventually measures.

How Australian consumers use electricity is changing. Increasingly consumers are installing solar systems and energy management systems intended to reduce their energy costs. One example is solar diverters. Solar diverters use the consumer’s excess solar generation to heat hot water. Analysis shows solar diverters rapidly switch the current waveform resulting in significant harmonics [Ref 3]. While metering standards include some test waveforms containing harmonics, the number and level of the harmonics is significantly smaller than those generated by solar diverters.

The impact of harmonics on meter accuracy has been documented in an article published by Frank Leferink et al [Ref 4]. Leferink tested a range of different electricity meters all claiming to be 2% accurate. This testing revealed measurement differences of up to 500% when harmonics were present.

Huge measurement differences do not give consumers confidence their electricity bill is correct!

As the level of harmonics continues to increase across the electricity grid it suggests current meter testing is inadequate to ensure consumers are being correctly billed.

Reactive Energy and NMI M6

Utilities claim reactive energy measurements allow them to bill customers for the effect of their consumption on the electricity network. Unfortunately NMI M6 Part 1 does not cover reactive energy measurements. Instead it states:

The scope of this document is restricted to the metrological requirements of active-energy static electricity meters

Future editions may include meters which measure apparent and/or reactive energy.

Reactive energy measurements are already being used to bill commercial and industrial customers. It is unclear why NMI M6 does not include requirements for accuracy testing of these measurements.

NMI M6 should detail reactive energy requirements. The Australian Energy Market Commission’s (AEMC’s) smart meter rollout ensures all consumers will soon have meters making reactive energy measurements. It is asserted without appropriate accuracy testing the measurements are largely useless.

In a separate ruling the AEMC is forcing distributors to offer consumers ‘cost reflective network charges’ [Ref 5]. One possibility is consumers could be billed in a similar manner to existing commercial and industrial customers. Doing so would require NMI M6 to be updated to ensure appropriate testing of reactive energy measurements.

Other issues with reactive energy

Australia has two separate reactive energy standards, namely AS62053 Part 23 and Part 24 [Ref 6]. Analysis of the two standards reveals significant measurement differences when even low levels of harmonic are present.

Dr Gill [Ref 7] used a test waveform defined in Part 24 to demonstrate reactive measurement differences exceeding 19% at typical power factors. Note the 19% difference is the result of a single harmonic containing only 4% the energy of the fundamental.

Many modern appliances introduce more than one harmonic and at higher levels (e.g. solar diverters). Dr Gill’s analysis also investigated internationally defined test waveforms. These test waveforms address recognised deficiencies with the single low level harmonic used in Australian meter testing.

Implications for Active energy

While the above analysis focusses on reactive energy measurements there are implications for active energy measurement. Consumer appliances are designed to use the fundamental (50Hz). When harmonics are present the cost to run these appliances increases.

“Charging consumers for harmonics is controversial”

From AS62053 Part 24

The problem is Australian metering standards include harmonics in active energy measurements. So current metering standards charge consumers for harmonics even when the customer does not benefit.

Recognising the issues with harmonics AS62053 Part 24 limits measurements to the fundamental. This raises an important question.

“Why do Australian active energy measurements include harmonics?”

Existing active and reactive energy measurements do not identify the source of the harmonics. Consumers are charged whether they benefit from, or are penalised by, the harmonics. Unless measurements reveal the impact of the harmonics on consumers, their effect should be excluded from electricity bills.

“Measurement based transactions”

The vast majority of meter testing uses a flashing light on the front of the electricity meter. This light is not used to bill consumers. Meter testing includes one check the meter has correctly displays the number of times the light has flashed. Increasingly this value is also not used to bill consumers.

The AEMC’s mandated rollout of smart meters requires all consumer electricity meters support 5 minute measurements [Ref 8]. The new rule ensures virtually all consumers will be billed on the basis of these measurements and not on the total value displayed on the meter.

Despite this dramatic change to how consumer electricity bills are calculated, no testing is currently performed on the 5 minute measurements made by electricity meters.

The 5 minute measurements are an extreme form of Time of Use billing. When German utilities introduced Time of Use billing their regulator ensured the measurements were appropriately tested [Ref 9]. The

German regulator introduced this testing over 30 years ago, however Australian regulations still fail to require any testing of these measurements.

Using untested measurements to calculate consumer bills reveals Australia’s Measurement Law is not working.

Conclusion

Australia’s Measurement Law is failing to protect the interests of Australian electricity consumers. Meter testing is no longer relevant or sufficient.

- As the level of harmonics increases across the network studies show the accuracy of meter measurements falls well outside reasonable limits.
- Australia consumers are being billed for harmonics, despite expert advice questioning whether consumers should be charged for the adverse effects of harmonics.
- Increasingly consumer electricity bills are calculated using untested 5 minute measurements. Since these measurements are used for billing, they should be tested.

Australia’s Measurement Law does not give consumers confidence in their electricity bill. As the cost of electricity continues to rise consumers are right to question the accuracy of their electricity bill.

Citation

Please accurately attribute all quotes and references to this article including the title “Measurement Law Review”. It would be appreciated if references included the author’s website drmartingill.com.au.

Comments or Questions?

The author is happy to receive comments or questions about this article. He can be contacted at martin@drmartingill.com.au

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About Dr Martin Gill

Dr Martin Gill is an independent consultant specialising in the provision of consumer advice. This advice is based on a deep understanding of the Australian energy industry and strong analytical skills. As a consultant he has prepared advice for consumer advocates, government regulators, electricity distributors, electricity retailers, asset operators and equipment vendors.

Dr Gill is a metering expert. During the National Smart Metering Program he facilitated the development of a specification for Australian smart meters. Innovative metering products developed by his teams have been externally recognised with the Green Globe Award, NSW Government's Premier's Award and Best New Product by the Australian Electrical and Electronics Manufacturers Association.

He currently represents the interests of consumers on a range of Standards Australia working groups including metering, renewable power systems, battery storage and demand management.