

Cost effective equitable metering

(Energy Measurements Part 2)

Dr Martin Gill

Increasing levels of noise across electricity networks have been shown to cause significant measurement errors. Internationally regulators are scrambling to address the problem. In Australia deregulation of our electricity market means nothing is being done.

Summary of Article

Globally it is acknowledged modern appliances have significantly increased the amount of electrical noise across electricity networks. Testing has confirmed this noise adversely affects measurements made by modern electricity meters. This is a major consumer issue when these highly questionable measurements are used to calculate consumer electricity bills. Some consumers pay too much and others too little.

Australian consumers face a problem: No one is prepared to take responsibility for the issue.

The Australian Energy Market Commission (AEMC) sets the rules governing Australia's electricity market. Staffed almost exclusively by economists and lawyers they do not have the technical background to understand the issue.

The AEMC therefore relies on experts at the Australian Energy Market Operator (AEMO) to provide advice on metering. When Dr Gill discussed the issues raised in his earlier article [Ref 1] with AEMO their response was:

Fixing the problem is too expensive

The response is unacceptable. Firstly because it reveals AEMO acknowledges there is a problem, but intend to do nothing to address it. More concerning is the response is based on an assumption revealing AEMO fails to understand the actual issue.

The following introduces the key points before highlighting a simple cost effective solution exists.

Meter Accuracy vs Measurement Errors

The AEMO response indicates a fundamental failure to understand the problem. They assume installing a more accurate meter results in lower measurement errors. They are misguided, with testing showing this is not the case.

Kotsampopoulos et al [Ref 2] compared a meter with an accuracy of 2% against a 1% accurate meter. When noise was added the measurement errors for the more accurate meter were six times larger (at 20.7%) than the measurement errors made by the less accurate meter (at 3.2%).

Meter accuracy is determined by testing outlined in metering standards. The testing applies constant voltage and current waveforms and compares meter measurements against those made by a reference standard. The magnitude of the measurement errors determines the claimed accuracy of the meter.

The result indicates claimed meter accuracy is unrelated to measurement errors observed when measuring actual domestic loads. It is deeply concerning that AEMO fails to understand installing more accurate meters will not fix the problem.

While many suggest the result is a clear indication testing defined in metering standards is inadequate some disagree.

Claim there isn't a problem

Measurement errors as large as 500% were reported by Leferink [Ref 3]. An early attempt to ignore the problem simply challenged Leferink's findings. Additional rigorous laboratory testing has now confirmed Leferink's results [Ref 4]. This testing was performed in a certified laboratory so the problem exists and cannot be ignored.

Blame someone else

The evidence noise is causing meter errors is undeniable. Rather than ensuring meters make correct measurements in the presence of noise, some metering experts blame the problem on the amount of noise appliances are allowed to generate. They want the amount of noise to be reduced.

Testing suggests this approach is unlikely to lower meter measurement errors. Kotsampopoulos [Ref 2] discusses ‘joined emissions from multiple domestic solar installations in the same area’ resulting in noise exceeding specified single system limits.

Kotsampopoulos also mentions the possibility of ‘amplification of emissions due to resonances’.

The conclusion is attempting to reduce noise levels ultimately fails to fix the problem. Across the modern electricity grid it is impossible to control every connected appliance. Hence the onus falls on the electricity meter to continue making reliable measurements even in the presence of noise.

Standards defined Meter Testing

Meter testing should ensure electricity meters used to calculate consumer electricity bills are accurate. That they fail to do so is concerning

The International Organisation of Legal Metrology (OIML) has added a new test waveform to their meter performance testing requirements [Ref 5]. This additional testing is significant for Australia, with discussions currently underway to replace the existing M6 meter testing with OIML’s R46.

International energy regulators are scrambling to restore consumer faith in their electricity bills. They have provided funding to a program investigating meter measurement errors in the presence of noise [Ref 6]. Part of this work aims to capture voltage and current waveforms proven to cause large measurement errors. This may eventually lead to test waveforms resembling actual consumer loads.

While creating test waveforms more accurately representing actual appliance loads is long overdue there is a problem. The application of a limited number of test waveforms can never ensure meter measurement errors always fall within acceptable limits. There remains the possibility interactions between different appliances, or some new waveform, will once again result in unacceptably large meter measurement errors.

An effective solution

A simple and cost effective solution able to avoid the adverse effects of noise can be identified. The solution is well proven having been used for over a century. So what is this simple solution? Filtering.

Filtering reduces the adverse effects of noise, thereby significantly reducing the magnitude of meter measurement errors.

Berrisford [Ref 7] adds a filter to a meter to show the effectiveness of the approach. Critical for this discussion is his note the firmware change incurs “**no additional hardware cost**”. That Berrisford makes the change to an off the shelf meter proves AEMO’s statement “fixing the problem is too expensive” is factually incorrect.

Who is responsible?

The AEMC oversees the rules governing Australia’s energy market. The AEMC changed who was responsible for the installation of domestic electricity meters in 2018. A direct consequence of this relatively recent change is no one is taking responsibility for investigating the problem.

- AEMO (who write the AEMC metering requirements) are choosing to ignore the problem.
- Metering Coordinators install (the cheapest) meters meeting AEMO/AEMC requirements.

AEMO is aware there is a problem, however while they incorrectly continue to advocate “fixing the problem is too expensive” nothing will happen.

Conclusion

Laboratory testing shows claimed meter accuracy is largely unrelated to measurement errors when measuring actual consumer loads. The result is consumers should have little faith in their electricity bills. Some consumers are paying too little and some are paying too much. Likewise those sending power to the grid will find credits are too little or too much.

When concerns about meter measurement errors were raised with AEMO they claimed “fixing the problem was too expensive”. This article has shown the AEMO response is totally incorrect. Cost effective solutions are already available.

What is genuinely intriguing is measurement errors affect AEMO. AEMO relies on the increasingly unreliable measurements to manage Australia’s complex electricity network. Perhaps if AEMO realised the magnitude of measurement errors it might take a more active role in searching for solutions.

Appendix: A word of warning

Australia's cripplingly high electricity prices have forced consumers to try to lower energy costs by installing 2.1 million solar systems and upgrading to energy efficient appliances. Testing shows noise generated by both solar systems and energy efficient appliances can cause meter measurement errors. The noise affects all meters in the local area, not just the consumer with the solar system/energy efficient appliance(s).

Consumers concerned their electricity meter is inaccurate can request it be tested. This testing applies the same standard waveforms already shown to be unrelated to meter measurement errors when noise is present. Without noise the testing will show the meter is acceptably accurate. If the meter is acceptably accurate the meter provider is allowed to charge the consumer for the testing.

The AEMC mandated rollout of smart meters does not include any features able to identify areas where noise may be causing meter measurement errors. This feature could be added without increasing meter costs, for example Berrisford [Ref 7] uses a comparison of the filtered and unfiltered values to detect areas where problems may exist.

References

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Citation

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Comments or Questions?

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

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 Australia's 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.