

Response to the Energy Security Board Distributed Energy Resources Technical Standards Consultation Paper

Dr Martin Gill

Q1. Do you support the proposal to establish a DER Standards Governance Committee under the National Electricity Rules? If not, what alternative would you suggest?

No.

The presented proposal highlights the intention of the committee is to maintain the current status quo. The composition of the committee does not address multiple failures made by the very bodies included on the committee. The highly predictable result is consumers will be forced to pay even more for their electricity, just to implement solutions providing them with no benefit.

The proposal lists ONE market participant who may have a genuine interest in controlling DER in a way that directly benefits consumers (the "Market Aggregator"). Even that is faulty, because Demand Response Service Providers are not allowed to bid consumer loads. Hence this position does not represent the interests of consumers! (they instead represent the interests of large industrial customers).

The National Energy Market is supposed to use market forces to deliver desirable outcomes. Energy RETAILERS are the primary point of contact between consumer and these market forces. Retailers are not even included in this proposal! Retailers are already offering demand response programs, are already trialling the control of consumer installed DER but are excluded from the committee. Significantly retailers offer these programs using financial incentives. Consumers choosing to participate in these programs benefit, directly. Instead the AEMO rule change request intends to mandate an ineffective interface incapable of supporting consumer benefits. All costs of what has already been proven to be an ineffective interface are then recovered from consumers via existing regulatory frameworks.

As documented there are no consumer benefits arising from the creation of this committee. The technical standards being promoted on the AEMO website were never developed to benefit consumers. Development of AS4755 commenced in 2005 solely to address AEMO's concern peak demand was growing. Instead AEMO's forecast apocalypse never eventuated. In 2008 Government energy efficiency initiatives delivered lower consumer electricity bills and also stopped network peak demand growth. The problem is more than a decade later this proposal promotes solutions which have already outgrown their usefulness, while blaming others for the mistakes.

Another example of why the proposed committee will not work is provided by Australia's National Smart meter Steering Committee (NSSC). The NSSC included Government representatives, retailers, distributors and consumers. The NSSC oversaw the development of the Smart Metering Infrastructure minimum Functional Specification (SMI FS) based on financial analysis of the societal benefits. Immediately after COAG agreed to the SMI FS the AEMC declared it null and void and following the advice of AEMO developed their own specification. The lack of foresight shown by the AEMC and AEMO is highlighted by South Australia (and Western Australia) now considering installing meters offering functionality included in the SMI FS, but not in the AEMC/AEMO specification.

Q2. Do you have any feedback on the proposed functions of the DER Standards Governance Committee?

The intended function of the committee is to maintain the status quo. It will do this by mandating solutions which do not support consumer benefits while handing control of those resources to existing market participants. For example the AEMO rule change request intends to give the control of domestic solar systems to distributors.

A current problem is the lack of visibility of domestic solar systems, how is this being addressed? The first solution was an AEMO rule change to create the Distributed Energy Resources Register (DERR). Despite the DERR clearly not addressing the lack of visibility the AEMC approved its creation and all costs for this expensive (useless) database

were recovered from consumers. The next solution attempts to address the lack of foresight AEMO showed while developing the AEMC smart meter minimum specification (now mandated in the National Electricity Rules). This enhancement allows (some) meters to measure the output of domestic solar systems. The problem is it only works for single phase households and solar systems and incurs higher meter costs. So despite a proven track record of picking solutions increasing consumer costs these same organisations are now asking to be given even greater powers? NO!

Considering the same lack of visibility one international solution reveals it can be done with much lower cost impacts. Virtually all solar inverters measure their output and many are connected to consumer WiFi networks. The combination means readings are available remotely at virtually no cost. Consumers prepared to offer access to the readings made by their solar inverter then receive payment. AEMO has already indicated they do not require access to measurements from ALL inverters, so this offers lower costs, direct consumer benefits and in many cases could be implemented in only a few months (compared to the decade it will take for benefits to flow from a new standard).

This simple solution is not supported by the uniquely Australian control interface being promoted by AEMO. Their interface only supports *sending* commands to turn off the inverter. The interface does not support reading any data from the inverter (or any controlled appliance). It fails to describe useful data formats or additional functionality already shown to provide benefits internationally.

The lack of foresight consistently shown by the proposed committee members leads to the inevitable conclusion the committee will not make decisions in the long term interest of consumers.

Q3. Do you support the DER Standards Governance Committee being advisory or be determining? Please provide reasons.

The committee should not be determining. There is already plenty of scope for the various committee members to inflict their protectionist policies on consumers. Providing them with additional powers is unnecessary.

Q4. Do you have any feedback about the Committee determining standards in a subsidiary instrument under the rules?

Under no circumstances should the committee be setting standards. They could perhaps facilitate the development of standards but even that is unlikely to result in a positive outcome for consumers.

The discussion claims to identify an urgent need for a new standard but fails to recognise it will take almost a decade for any new standard to deliver benefits. Sufficient consumers must purchase and install equipment meeting the new standard before any benefits are delivered.

If (and it is a big if) there is a genuine urgent need to address “issues” then rather than rush through the development of a new standard the committee should be tasked with using existing standards. Above it was highlighted offering payments to access the measurements already being made by solar systems could be implemented in months rather than the years the proposal suggests. The Western Australian DER Roadmap indicates they intend to adjust existing inverter settings in those areas where problems have been identified. They intend to commence this program of work THIS year!

The Western Australian Roadmap also notes that benefits are likely to be maximised by targeting those areas in which issues are appearing. A nationally consistent standard may sound impressive but is likely to incur significantly higher costs while not delivering significantly greater benefits. This suggests providing support to programs targeting issues rather than trying to develop a single strategy, which due to the committee composition is likely to be unduly complex and expensive.

Q5. Do you have any feedback on the development of new compliance and enforcement arrangements for DER technical standards?

What enforcement? AEMO admits their testing has shown some inverters currently being installed do not comply with the Australian standard AS4777. The question is why this has only just been detected? The reason is because the existing compliance arrangements rely almost solely on self-regulation. The proposed committee does not address this.

It is not suggested self-regulation be removed. Instead where a failure to comply with requirements is detected mechanisms "encouraging" rectification are documented. This has nothing to do with technical standards.

There is also strong evidence to suggest independent spot checks of important functionality be considered. For example many attempts to deploy AEMO's preferred standard, AS4755, have been unsuccessful. The identified problem is the standard fails to define a consistent interface. The reason PeakSmart has been so successful is Queensland tests each brand of air-conditioner before it eligible for the \$400 incentive payment. This testing is in addition to the self-regulation outlined in AS4755. The additional testing is required to address (multiple) deficiencies in the AS4755 standard.

It is also important to ensure any standard complies with Government policy objectives. For example AS4755 is unique to Australia so appears to violate Government policy to use international standards and therefore risks creating a barrier to trade. At the very least unique Australian requirements reduce the number of vendors prepared to develop solutions for the small Australian market. The lack of vendor competition, combined with the need to recover unique development costs ensures Australian consumers end up paying more for compliant appliances.

Perhaps worse AS4755 functionality is so limited it is unable to support the future energy market. For example AS4755 control of a solar inverter is limited to turning it off. AS4755 does not allow an inverter to reduce its output to meet local energy needs (self-consumption), instead it turns it off forcing consumers to purchase all their electricity from the grid. This is not in the long term interests of consumers.

Q6. Do you support the proposed composition of the membership and nature of chair of the Committee? Please provide reasons or nominate alternative arrangements.

No. The committee does not represent the interest of consumers, it does not have the required skills and appears to be an attempt to maintain the current "NEM centric" outlook (which has been a total disaster for consumers). If this committee is truly in the long term interests of consumers then the chair should have the knowledge and skills to moderate deliberations rather than coming from one of the existing regulators.

Committee membership is also wrong.

Consider the majority of Virtual Power Plant trials currently underway are being undertaken with RETAILERS. But there is no retail representatives on the committee! Retailers are the primary point of contact for consumers. Innovative retailers are already offering incentives for consumers to participate in demand response programs, to offer control over their appliances, to allow storage (currently battery but in the very near future large amounts of EVs supporting vehicle-to-grid) and to encourage electricity use at different times (e.g. (capped) wholesale pricing and Solar Sponge). There is absolutely no justification for not including a number of retailer representatives on the committee.

The mandated control of vast amounts of consumer installed distributed load and generation raises significant cyber-security concerns. This real threat suggests a dedicated specialist cyber-security expert be included on the committee. Note while AEMO has experience in secure control of expensive dedicated systems they are unable to demonstrate the same experience implementing cost effective solutions. This is the reason for recommending a separate cyber-security expert be included on the committee.

The control standard AEMO is promoting raises significant consumer issues, especially those adversely impacting consumer health. Of particular concern is the standard does not give consumers the ability to override remote

control of their air-conditioner. When the consumer is feeling unwell they may need to temporarily override utility control. This is not supported. Similar draconian measures have been discussed for managing the charging and DISCHARGING of EVs. This suggests someone with a knowledge of human rights should be on this committee.

The inclusion of a DER Original Equipment Manufacturer is interesting. The discussion suggests this representative is supposed to cover solar systems, battery systems, EVs and EV charging infrastructure, air-conditioners, hot water heaters and pool pumps. To ensure this diverse range of products is covered it is suggested a better representative would come from a group offering solutions consolidating all these devices, for example someone involved in the design and operation of Virtual Power Plants or on a smaller scale, Home Energy Management systems.

It is concerning energy efficiency is not mentioned. The Government's highly successful Minimum Energy Performance Standards (MEPS) have addressed peak demand growth which is now static or falling. CSIRO testing has shown use of the AEMO demand response standard can increase appliance energy consumption and it can only turn solar systems off, reducing renewable generation. It suggests the inclusion of someone focussed on greenhouse gas emissions to provide visibility of desirable environmental outcomes.

The inclusion of a Standards Australia representative highlights a complete failure to understand the role of Standards Australia. Standards Australia does not develop standards, they facilitate the development of standards through a consultative committee process. More concerning is the Standards Australia representative must present the work of multiple committees (to name just a few EL-042, EL-054, EL-062 and EL-064). Most of these committees also have links to European standards development committees.

There is another problem with the inclusion of a Standards Australia representative. At the core is the potential for a conflict of interest in the promotion of Australian standards (for which they receive payment). It is highly relevant to note the majority of successful Virtual Power Plant trials have utilised the American standard (IEEE 2030.5). This is highlighted because Standards Australia only maintains a working relationship with European standards bodies.

Note: attempts to utilise the unique Australian demand response standard AS4755 being promoted by AEMO proved unsuccessful.

Aside: Suggestions alignment with the National Energy Objective (NEO) will protect consumers is incorrect. Specifically the NEO does not mention consumer privacy with the AEMC confirming they do not specifically consider consumer privacy in their decision making. The committee may have to consider including additional requirements beyond the NEO.

Q7. Do you support the proposed terms and selection arrangements? Please provide reasons.

It is fascinating to observe the inclusion of rigid terms without thinking about the consequences. As documented in six years the majority of the committee will be forced to vacate with subsequent loss of knowledge and insight. This should be avoided. Instead the listed requirements only confirm this will be viewed as political appointments paying lip service to representing the interest of consumers.

Q8. Do you have any feedback on the other elements of the proposed operation of the Committee?

The reason Standards Australia committees work is they bring together a range of experts in the field. For example when discussing battery storage installation standards the fire department was an active participant. Standards Australia also clarifies how votes are conducted, recognising votes may not be unanimous and more than a simple majority is required to release a standard for publication. As such a great deal can be learnt from Standards Australia processes, but that raises the question "Is the proposed committee required?". The answer to that question is NO.

AEMO's Power Grab

Retaining centralised control of an increasingly decentralised grid

Dr Martin Gill

The Australian Energy Market Operator (AEMO) has requested they be allowed to specify minimum technical standards for consumer installed solar (and battery) systems. Allowing AEMO to by-pass well proven existing standards development processes is not in the long term interest of either Australia's Energy Market or consumers. AEMO's claim this is the only way an urgent timeframe can be met is also untrue.

Introduction

The Australian Energy Market Operator (AEMO) has raised a rule change requesting they be allowed to write the technical standards covering the operation and control of consumer installed solar systems. Their primary argument involves the urgent need to ensure output can be reduced to ensure grid stability. Examination of their proposal reveals multiple problems.

Misalignment with the National Energy Objective

AEMO proposes to write a technical specification enforced through the connection agreements developed by Distribution Network Service Providers (DNSPs). As a legislated standard consumers are forced to pay more for equipment complying with AEMO's new technical standard.

Unfortunately the AEMO proposal takes this a significant step further. It proposes to detail the solution, including how and who controls the implementation. This does not align with the principles of competition in the National Energy Market (NEM). A NEM aligned solution would document a capability. AEMO then procures this capability from those prepared to offer it.

Parallels with the Demand Response market must be drawn. AEMO has not developed a Demand Response technical standard, nor have they detailed who controls the implementation. Instead Demand Response Service Providers are left free to deploy multiple solutions, offering different response times, service levels and price points. Multiple market participants, including AEMO then procure the desired capability.

Instead the AEMO proposal intends to return to the 1950's with monopolistic DNSPs required to ["implement, own and operate \[the\] mechanism"](#). This

removes all competitive pressure. Worse existing regulatory processes ensure consumers bear all implementation costs. There is a better way.

Highlighting the similarity with Demand Response is quite deliberate. Future demand response markets will offer to turn loads off during peak times and turn loads on when there is excess generation. Viewed this way solar systems are nothing more than negative load. In this future market service providers should be free to bid both positive and negative loads. The AEMO proposal presents a barrier to achieving this.

Summary of Submission

The AEMO proposal is not in the long term interest of consumers. It limits the provision of future demand response services to a single method and single regulated monopolistic market participant. It forces consumers to bear all costs.

The AEMO proposal fails to clarify it will not deliver anything quickly. Benefits are only available once consumers purchase and install a sufficiently large population of inverters supporting the AEMO "mechanism". This will take 5, and more likely 10 years. Alternative solutions using existing inverter functionality can deliver benefits starting *this year*. Perhaps more significantly these autonomous solutions will deliver virtually the same benefits at a fraction of the cost of the AEMO "mechanism".

AEMO ignores risks raised by its attempt to short-circuit existing well proven standards development processes. This inclusive process ensures standards align with best practice. Instead the proposal implies AEMO, and no one else, understands what is required.

AEMO has a record of under-estimating development time frames and project costs. Their technical standards are generally equally lacking.

The validity of claiming it is “Urgent”

ASSUMING AEMO develops its technical standard what happens next? Developing a technical standard is only the first step. Further delays occur as manufacturers design, test and finally sell compliant equipment. Then there is a significant delay before a sufficiently large population of compliant equipment is installed. So “claimed” benefits are only available some 5, and more likely 10, years in the future.

Hence the development of the technical specification represents a fraction of the total delay in realising the benefits. The delay suggests it is more important to prepare a robust technical specification, meeting future requirements, rather than risk short circuiting existing processes for unlikely minute gains.

There is already a proven process overseeing the development of the majority of Australian technical standards. The Standards Australia committee process continues to review and update the minimum technical standards covering Australian inverters. Importantly Standards Australia offer an expedited development path for all standards.

Several inverter manufacturers are represented on the Standards Australia committee. They are able to discuss technical solutions already tried and tested overseas. Choosing these solutions ultimately reduces the time manufacturers require to develop new products.

To summarise the rule change request makes no sense because it fails to reduce the time before benefits are realised. More concerning is the significant risks raised by allowing AEMO to develop the standard.

Inverters can already be turned off remotely

AEMO has not hidden its desire to be able to turn off domestic solar inverters [e.g. Ref 1]. This capability is already supported by all solar inverters sold in Australia.

Why is AEMO developing a new technical standard to provide existing functionality?

Australian consumers have already paid to include functionality allowing their solar inverter to be turned off remotely. Rather than activating this existing feature AEMO is instead proposing to develop THEIR OWN technical standard providing the same

functionality. This does not appear to be in the long term interest of consumers.

Risks raised by AEMO writing the standard

The existing technical development process has shown it is able to document both desirable and achievable requirements. The Standards Australia committee process includes the full range of stakeholders ensuring an appropriate balance in the development of standards. The committee process draws extensively on international expertise and various equipment trials both in Australia and overseas. All of this is put at risk by allowing AEMO to rush the development of a technical standard.

Consumers are concerned about AEMO's intention to turn off domestic solar systems. While AEMO may argue this is untrue their own presentation indicates this is only a matter of semantics. The following is a snippet taken from an AEMO presentation covering the rule change request made to Energy Consumers Australia (ECA).

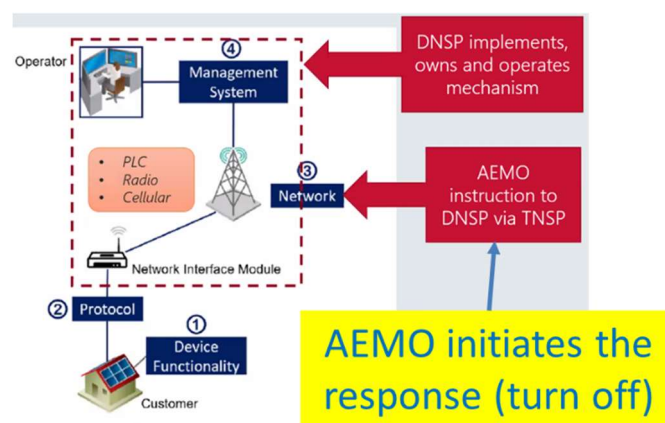


Figure from AEMO presentation to ECA

The above figure confirms AEMO will not turn off inverters. Instead AEMO will instruct Distributed Network Service Providers (DNSPs) turn off inverters. For consumers the result is the same!

Turning off inverters forces consumers to purchase electricity!

Consider a consumer with a solar system outputting 10kW. They are currently using 3kW with another 5kW being used to charge their plug in Electric Vehicle (EV). In this case only 2kW of power is sent to the network. When AEMO turns off their inverter they must purchase all 8kW they are using.

Turning off inverters can create the very network instability issues AEMO hopes to address. For example continuing the above example, turning off the 10kW

inverter suddenly imposes 8kW more load on the network (the disastrous consequences of this mentality are discussed below). Most operators know a far safer, cheaper and fairer option involves curtailing solar inverter output.

Curtailing Inverter Output

The American inverter standard, IEEE 1547 [Ref 2] requires inverters offer the ability to limit their active power output. For example “The DER [Distributed Energy Resource] shall not be required to reduce active power below the level needed to support local loads”.

This standard recognises consumers should be allowed to continue generating sufficient electricity to meet their requirements. In the earlier example: rather than turning off the inverter, its output would be reduced to 8kW, allowing consumers to benefit and also reducing sudden changes to network load.

Another approach is being considered by the South Australian Government. They are discussing implementing *export limits*¹ [Ref 3]. The important difference is an export limit controls the amount of power the household sends to the grid. An export limits allow consumers to install large solar systems and provided they self-consume the output there is no impact. The limit only curtails solar output if they try to send large amounts of power to the network.

Importantly inverters offering export limits are already available proving the efficiency of existing standards development processes. These existing processes deliver viable solutions balancing consumer concerns and network stability requirements. The same cannot be said if AEMO is allowed to define their solution.

Unnecessarily expensive

The snippet taken from the ECA presentation hides another worrying detail. The figure shows a communications tower and the top red box states “The DNSP implements, owns *and operates* [the] mechanism”. The AEMO solution assumes there is sufficient financial justification to fit every solar system with remote communications. This then enables DNSPs to ‘control’ when inverters are turned off. The immediate observation is a significant

(unnecessary) expense for a capability which might be used once a year.

Forcing consumers to pay for communications is expensive and unnecessary

AEMO has bought into the fantasy communications supporting the Internet of Things (IoT) will eventually be free. The reality is significant costs remain including the initial cost of fitting every solar inverter with a suitable modem, ongoing fees for network access/data and the cost to develop and maintain required back office software. The problem is inverters can already support grid stability without incurring ANY communications costs.

The International Electro-technical Commission (IEC) standard 62786 [Ref 4] requires inverters to autonomously respond to changes in voltage and frequency. Once set “Active Power Response to Voltage Changes” and “Active Power response to Frequency Deviation” ensures solar inverters adjust their output to provide grid stability. The benefits do not require any communications.

Rule changes are supposed to consider the Long Term Interest of Consumers. This should include a Cost Benefit Assessment comparing using existing inverter features to provide grid stability to the minor incremental benefit achieved by adding expensive communications. Such an assessment would show the AEMO “mechanism” does not provide societal benefits.

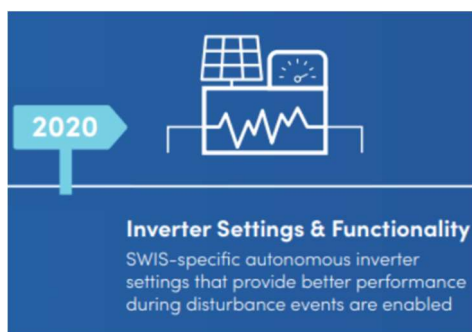
Unfortunately consumers should have little faith in AEMO benefit assessments. AEMO recently promoted another standard giving them the ability to turn off consumer appliances (AS4755). A review of the Cost Benefit Assessment by the Department of the Prime Minister noted the assessment did not adequately consider alternatives “*achieving the same objective at much less cost to the community*”. Even more damning the presented analysis was “*not adequate nor commensurate with the potential economic and social impacts of the proposal*” [Ref 5].

AEMO has a history of under-estimating costs, for example their early claim 5 minute settlements would “require the purchase of a few more disk drives”!!! Years later and after tens of millions of dollars has been invested, consumers continue to wait for the changes to deliver benefits [Ref 6].

¹ The AEMC would refer to this as an import limit since their rules consider flow to and from the pool

More questions about the “urgency”

Another document is worthy of review. Western Australia has presented its Distributed Energy Resources (DER) Roadmap [Ref 7]. The following figure shows a snippet from the roadmap.



The document clarifies Western Power plans to enable autonomous inverter settings providing grid stability commencing **this year** (2020).

The roadmap confirms many existing Australian inverters already possess the required functions and settings to provide grid stability. Adjusting the current settings provides network support.

The roadmap continues “There is likely to be benefit from a program targeting these existing installations [to adjust settings], either broadly or in specific locations on the network”. Rather than commence a major program of work to adjust inverter settings across their entire network, the roadmap suggests a targeted approach addressing those areas providing the greatest benefits.

The targeted approach offers multiple advantages:

- Benefits are delivered immediately (years before the AEMO proposal)
- Costs are reduced by prioritising problem areas
- No expensive communications options are required

So the Western Australian roadmap delivers benefits several years before, and at a fraction of the cost, of AEMO's proposed technical standard. Perhaps more revealing is the roadmap suggests assessing benefits rather than blindly jumping in.

Is AEMO's forecast apocalypse believable?

A key contributor to the AEMO apocalypse is the dramatic increase in the size of domestic solar systems. As solar systems have increased in size more energy flows to the network creating network issues.

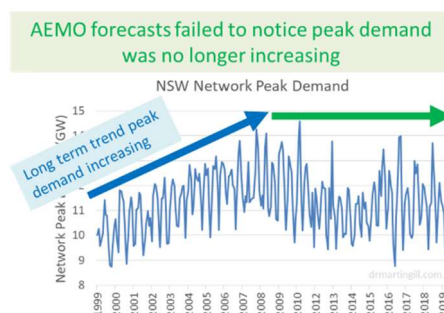
As solar system prices have fallen consumers have installed larger solar inverters, however this trend is unlikely to continue. The primary reason is single phase connections are limited to a maximum inverter size of 5kW. Installing systems larger than 5kW requires consumers to pay for a more expensive three phase inverter and upgraded network connection.

Then there are proposals to utilise existing inverter export limits, as published by the South Australian Government. Such limits allow consumers wanting to install large solar systems to do so, while limiting the potential impact of these systems on the network.

The price of domestic battery storage will continue to fall. In the 5 to 10 years it will take for the AEMO proposal to finally deliver benefits many households will be choosing to store their excess solar generation rather than sending it to the grid. Over this period there is also anticipated to be a significant increase in the number of Electric Vehicles providing consumers with another means of storing solar generation.

The AEMO proposal also pre-dates the impact of Covid-19. It is forecast many consumers will continue to work from home for sometime. Unsurprisingly working from home increases self-consumption of solar output. Something AEMO could not have considered when preparing their rule change.

The conclusion is AEMO's forward forecasts are failing to include easily predicted changes. This would not be the first time: AEMO's failure to note network peak demand had stopped rising led directly to significant and unnecessary network augmentation, with consumers left to pay for AEMO's mistake.



The suggestion there is too much solar and consumers should pay for expensive solutions just so AEMO can turn-off consumer inverters should be viewed equally sceptically.

Tariff Reform

Fundamentally Australia's energy market is supposed to provide an efficient means of balancing electricity supply and electricity demand. Traditionally the focus has been on ensuring there is adequate supply to meet demand (AEMO's primary role). Increasingly there is interest in providing incentives for adjusting demand to meet supply. For example the recent rule change formally recognising demand reduction offered by Demand Response Service Providers by placing them in the generator bid stack.

The obvious market based alternative to limiting solar system output (supply side) is to utilise incentives to increase the use of solar generated electricity. This is already occurring but remains unmentioned in AEMO's proposal.

In South Australia the "Solar Sponge" tariff offers lower prices in the middle of the day when solar output is highest. Consumers who transfer some of their load to daylight hours can lower their electricity costs. More importantly higher daytime usage helps "soak up" the excess solar.

Some consumers are signing up to retailers offering wholesale electricity prices. Abundant solar generation typically reduces midday wholesale electricity prices allowing consumers to lower their costs.

One consequence of these tariff reforms is likely to be greater uptake of the smart home. Many dishwashers, clothes dryers and washing machines now offer a simple delayed start so they can run during cheaper periods. Pool pumps timers can easily be adjusted to run in the middle of the day. South Australia is looking at storing excess solar in existing hot water systems, including moving off-peak water heating from overnight to daytime and potentially subsidising solar diverters.

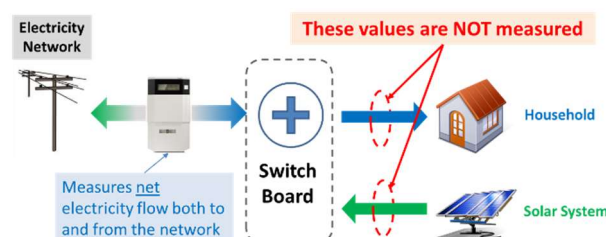
Other tariff reforms are also likely to encourage self-consumption, for example St Vincent de Paul's rule change of Clause 6.1.4 in the National Electricity Rules. This may result in charges applying for solar systems sending power to the network or consumers paying for firm access rights.

Consumer Education

One issue which has received virtually no publicity is the true value of solar system output. The vast

majority of consumers still (incorrectly) assume the only saving is the credit shown on their electricity bill. The result is too many consumers continue to try to minimise their use of solar generated electricity to increase this credit [e.g. Ref 8].

The end of heavily subsidised solar feed-in tariffs means for the vast majority of domestic solar systems the value of self-consumed solar generation is five or more times greater. The problem is the value is not measured. Installed meters only make net measurements, or the difference between solar system output and household use.



South Australia is looking to make the output of solar systems visible. The measurements can be used to educate consumers by showing the more solar generated electricity they use, the greater their savings. This education would help address the issue.

Another advantage is the lack of measurements has meant AEMO is unable to accurately forecast domestic solar output. To compensate for the lack of visibility they have admitted to over dispatching other generation assets risking increasing wholesale electricity prices and exacerbating the problem of "too much generation" (some of which is solar). If this was not upsetting enough, AEMO wrote the smart meter specification which fails to make the required measurements [Ref 9].

Alternatives to turning off consumer solar systems

The fact is AEMO already has the tools to address "too much solar output". Rather than focus on controlling millions of domestic solar systems (complex and expensive) they could choose to use network and stability constraints to dispatch less output from large solar farms.

The capability to curtail the output of large solar farms already exists. A relevant (but unanswered) question is why AEMO is trying to increase costs and reduce benefits for millions of consumer installed solar systems when they already have the capability to curtail large amounts of solar output?

Claims the technical specification will address local constraints also appear fictitious. As discussed these are far more effectively managed using existing autonomous inverter settings (as confirmed by the earlier discussion of the Western Australian Roadmap) or using export limits (as currently being discussed in South Australia). In addition to being more effective these solutions also incur significantly lower costs.

Inherent dangers presented by the AEMO “solution”

In September 2016 South Australia experienced a statewide blackout. AEMO has successfully deflected blame for their contribution to this failure by inferring the cause was too much renewable generation. The final straw in a sequence of events bringing down the entire South Australian grid was the forced disconnection of 400MW of wind generation due connection requirements AEMO developed!

Apparently having learnt nothing from the 2016 blackout AEMO is raising a rule change request allowing them to address network stability concerns by turning off large amounts of solar generation. Use of this capability across a large number of solar systems will inevitably destabilise the grid. What?

Only turning off solar systems in targeted areas also fails to stack up. Firstly because all consumers pay for the features even if it is never used. Secondly because when AEMO wrote Australia's smart meter functionality specification [Ref 9] they did not include meaningful network measurements, so the data they need to intelligently select the solar systems to turn off is unavailable.

AEMO's dumb meter specification(s)

Another example of AEMO's spectacular lack of foresight is demonstrated by their failure to include another feature. All inverters sold in Australia already provide the capability to be remotely turned off. The inclusion of a voltage free relay in the smart meter would have allowed AEMO to cost effectively activate this existing inverter feature. They failed to do so.

AEMO also provided input to the earlier Victorian Advanced Metering Infrastructure specification, specifically the inclusion of Emergency Supply Capacity limiting. The theory was if meters enforced demand limits it could avoid the need for rolling blackouts. Documented performance levels could not be met without a significant redesign of the

communications system increasing the cost of the rollout. Disappointingly despite the additional cost the functionality has never benefitted consumers (because it has never been used).

More on network stability

One issue AEMO raised during their presentation to Energy Consumers Australia is testing has revealed some inverters do not comply with stability requirements detailed in existing inverter standards. Specifically inverters are required to disconnect for large network voltage dips but “work through” minor voltage dips. The identified problem is some inverters are disconnecting during minor dips. Disconnection has the potential to further decrease network voltages, causing more inverters to disconnect.

Addressing this issue does not involve the development of a new standard, nor does it involve fitting all inverters with remote communications. It involves ensuring installed inverters comply with the current inverter standards.

Compliance with the existing standard can be tested using a short test. It is certainly significantly less expensive than the AEMO proposed solution.

Relying on communications

The devastating bushfires sweeping across much of Eastern Australia at the start of 2020 should provide another valuable lesson for AEMO. The bushfires caused network stability problems including outages. Unfortunately the outages also reduced the reliability of remote communications. Emergency services found they could not rely on mobile communications during blackouts because the cellular communications towers also failed.

The lesson is clear: Proposals claiming to address network stability issues relying on remote communications will fail. The issue may be addressed by installing separate utility owned and controlled communications networks. These independent networks dramatically increase systems costs.

By comparison the autonomous settings already supported by existing inverters will provide network stability even when communications fail.

In Violation of Australian Consumer Rights?

Australian specific requirements disadvantage Australian consumers. Australian specific requirements limit the number of suppliers prepared to develop equipment meeting the requirements. Inevitably limiting competition results in higher prices. The problem here is Australian consumers ultimately pay to implement AEMO's "mechanism".

Australian Government policy states standards should not be used as barriers to trade. Where possible Australia should adopt international solutions, not enforce Australian specific requirements. There appears to be no justification for AEMO being allowed to write their own specification when existing Australian and International standards already provide the functionality AEMO hopes to enable.

The AEMO process intends to by-pass the existing well proven Standards Australia development proposal. AEMO argues ["the current arrangements of DER technical standards setting, through Standards Australia, has lagged in response to DER's uptake"](#). What AEMO fails to address is how consumer interests will be taken into consideration? Standards Australia recognises consumer groups as key stakeholders and ensures their views are discussed. These same processes ensure there is a period of public consultation. Clearly AEMO intends to shorten the development time by ignoring the rights of consumers. Since consumers ultimately pay for the AEMO "mechanism" they must be allowed to contribute.

Conclusion

AEMO's justification for this rule change request is the delivery of benefits in a shorter time frame. This is largely untrue. Network benefits will only be available once consumers purchase and install a significant population of devices complying with the AEMO "mechanism". This can be achieved faster using existing standards rather than allowing AEMO to develop its own specific method.

AEMO notes existing meter measurements do not provide sufficient visibility of domestic solar output. This exposes a gap in the proposal: AEMO intends to control solar systems based on measurements they admit they don't have? Addressing the lack of visibility would provide greater benefits, including making AEMO's current unreliable load forecasts more accurate.

Statements there is "too much solar" which "needs to be controlled" exposes another gap in AEMO's proposal. AEMO can already see and control the output of significant amounts of solar. Existing market rules and mechanisms allow them to dispatch and curtail the output of large solar farms. This is possible without the need to develop a new technical standard.

AEMO's claim there is "too much solar" ignores the anticipated rapid uptake of storage including batteries and Electric Vehicles. It also ignores the use of price signals encouraging greater daytime use of energy.

So to summarise the AEMO proposal

- Does not deliver benefits any faster
- Is expensive
- Ignores existing capability
- Is risky
- Violates consumer rights
- Does not align with market principles

The AEMO rule change should be rejected.

References

1. Concerns over plan to switch off household solar panels when grid is unstable www.abc.net.au
2. IEEE1547-2018 Standard for Interconnecting Distributed Resources with Electric Power Systems
3. Consultation on the Proposed Export Limit Requirements for Distributed Solar Generating Plants in South Australia May 2020
4. IEC 62786 Distributed energy resources connection with the grid
5. COAG decision non-compliant with its regulated processes (<https://ris.pmc.gov.au/2019/11/26/smart-demand-response-capabilities-selected-appliances>)
6. Critical grid reforms for power delayed, AFR 10 July 2020
7. Western Australian Distributed Energy Resources Roadmap April 2020
8. Richard Glover: The power of being a changemaker, Sydney Morning Herald 27 Sept 2019
9. Minimum Functionality of Advanced Meters, prepared by AEMO November 2014

Citation

Please accurately attribute all quotes and references to this article including the title "AEMO's Power Grab". It would be appreciated if references included the author's website 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.

Comments or Questions?

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

Making AEMC dumb meters smart

Dr Martin Gill

Meters mandated by the Australian Energy Market Commission (AEMC) are so sadly lacking in both functionality and features the meters can only be referred to as dumb. Managing the impact of increasing numbers of solar, and soon battery storage systems, requires measurements, however the dumb AEMC meters are not required, nor capable of, making the necessary measurements. The following discusses cost effective enhancements to the AEMC meters so they can assist our clean energy future.

Introduction

South Australia leads the world in the uptake of renewable sources of generation. This is not without its challenges. Managing high levels of both solar and wind requires measurements to identify and control the various network impacts. These measurements are made by meters.

There is an additional challenge when consumers are installing large numbers of solar and battery storage systems. This is the significant cost of installing 100,000's of meters at domestic sites. Fortunately the Australian Energy Market Commission (AEMC) has mandated the rollout of remotely read meters. As such consumers are already paying for meters fitted with communications. But there is a problem.

The AEMC made retailers responsible for the provision of consumer meters. The AEMC only requires the meters provide two functions (intended to benefit retailers).

- Remote reading of 5 minute interval data
- Remote disconnection and reconnection

Multiple Cost Benefit Assessments show the societal benefits delivered by these two functions will not recover the cost of the meter rollout. These same Cost Benefit Assessments show specifying additional functionality can increase societal benefits, without significantly increasing meter costs.

For example there is virtually no additional cost if the AEMC meters were required to make meaningful measurements of network voltage and frequency². Knowing the maximum and minimum voltage and when they occur, can quickly identify areas where distributed generation is impacting the network.

² The AEMC meters are only required to measure average voltage which is not a benefit because these values are of little assistance to network management

Summary of Article

The addition of several functions to the AEMC meters will address major deficiencies in the current specification. These minor modifications ensure data and methods are available to efficiently manage consumer installed distributed energy resources.

- Add specifications for two element meters with switched and unswitched load control terminals
- Specify an export capacity limit (monitoring energy flow to the network)
- Specify 2 Amp voltage free relay(s) so meters can control inverters
- Specify meaningful measurements of network voltage

A decade ago these features were readily available from smart meters being offered in Australia. Importantly industry consultation found the additional features did not significantly increase meter costs.

South Australian Proposals

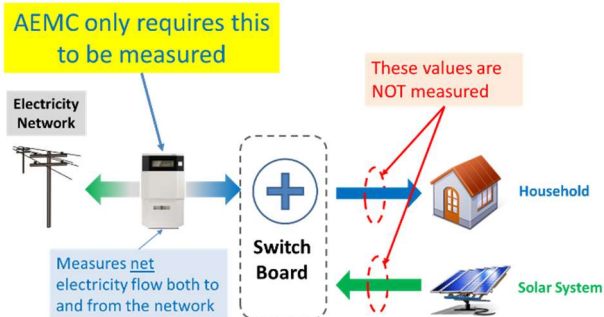
The South Australian Government has released a number of Consultation Papers. The two discussed here are:

- Proposed Smart Meter Minimum Technical Standards [Ref 1]
- Proposed Export Limit Requirements for Distributed Solar Generating Plants [Ref 2]

Jointly considering smart meters and Export Limits for inverter systems offers faster implementation at a significantly lower cost. The major savings come from utilisation of the remote meter communications avoiding unnecessary duplication. Also ensuring the AEMC meters can *and do* support network benefits, provides major savings.

Two element metering

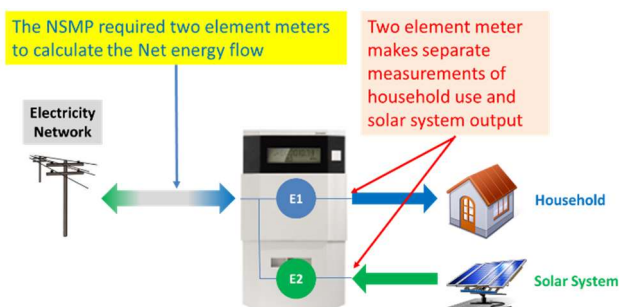
After investing in a solar system most consumers are then forced to install an AEMC meter (under the AEMC's mandatory replacement policy). Many are then surprised to find the new meter does not measure the output of their solar system. Instead it only measures the difference between solar system output and household use, so called net metering.



To address the gap consumers are opting to pay for additional metering. This additional metering measures the actual output of the solar system and energy sent to the network. Forcing consumers to pay for this additional metering is wasteful when in most cases their (useless) AEMC meter could easily make these measurements.

There is another reason for adding this functionality to the AEMC meter specification. The Australian Energy Market Operator (AEMO) has stated their load forecasts are becoming increasingly inaccurate due to their inability to monitor domestic solar output. AEMO forecasts still rely on lessons from the meters installed to support the NSW Solar Bonus scheme. The NSW meters did separately measure solar system output and household electricity use (so called gross measurements).

The National Smart Metering Program (NSMP) foresaw the advantages of a single meter providing both net and gross solar measurements. The Smart Metering Infrastructure Functional Specification (SMI FS) [Ref 3] described a two element meter.

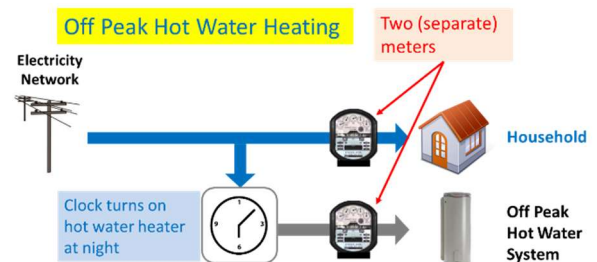


Importantly the SMI FS requires two element meters internally calculate the net flow of energy from the separate (gross) measurements. The separate measurements provide direct consumer and AEMO benefits. The cost of the additional metering element was around \$10.

Three element metering – Why?

Two element meters are not new. They were first developed to support off-peak hot water heaters. Since the 1960's electricity distributors have offered lower energy prices to consumers prepared to only run their storage hot water heater at night.

In South Australia the hot water heaters were controlled using a time switch. Overnight the time switch turned on to heat water. Lower prices could be offered for hot water heating because it kept the coal fired power stations burning.



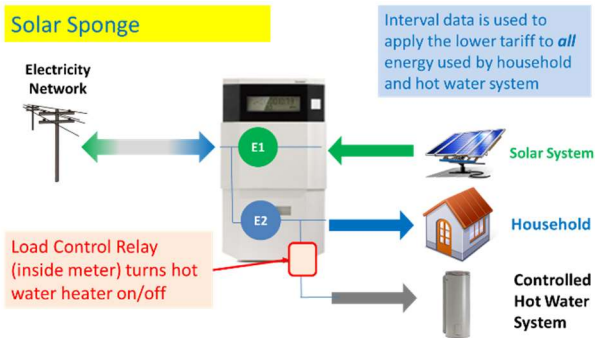
With high levels of renewable generation it is no longer valid to assume electricity prices are lowest at night. Evidence shows abundant supply in the middle of the day is resulting in lower prices in the middle of the day.

Indeed South Australia is currently offering a Solar Sponge tariff to encourage people to shift their electricity use to the middle of the day. The Solar Sponge offers low prices for electricity used in the middle of the day.

The above are important considerations when challenging the assumed need for three element meters. Solutions using existing two element meters are possible.

Should cheaper tariffs only apply to water heating?

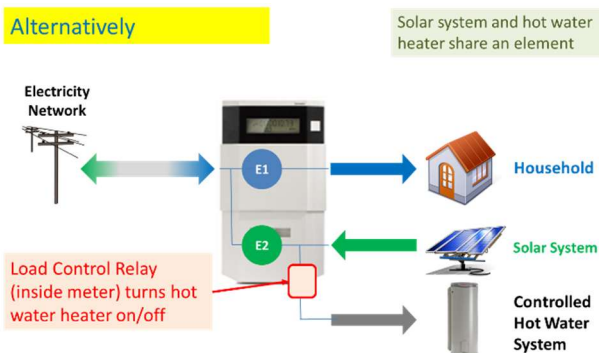
The following shows household electricity use and the hot water heater sharing one element. Bills are calculated using the 5 minute interval data. Specifically during the off-peak period both household use and hot water use are charged at the lower price.



While historically cheap electricity was only offered for controlled hot water heaters, this restriction no longer seems appropriate.

Use bi-directional energy flows

An alternative is to place the solar system on the same element as the hot water heater. This allows household electricity use during off-peak periods to be charged at a higher rate than electricity use by the hot water heater.



Technically it is still possible to separately measure household use, solar output and hot water system use. The restriction is the hot water heater must only be turned on when there is no solar output. If the hot water heater is turned on when the solar system is generating electricity the element will measure the net energy flow.

Two element meters are readily available from a number of vendors allowing both of the above solutions to be implemented immediately. By comparison vendors have offered three (and more) element meters but the incremental benefits may not justify limited availability and higher price.

Note the AEMC meter specification does not describe two element meters or load control relays. It also fails to describe meter configurations. South Australia will need to describe the required functionality and meter configuration, specifically the load control relay needs to provide both switched and unswitched outputs.

Export Limit Control

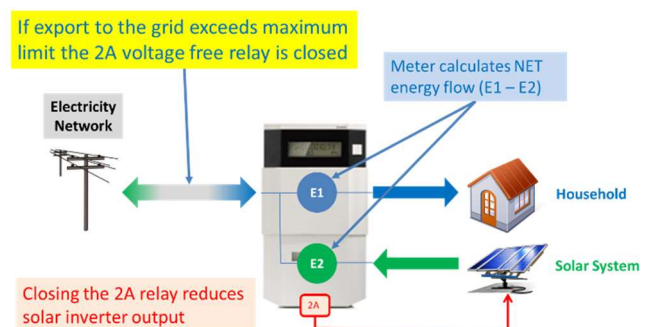
Only a few inverters currently support Export Limit Control [Ref 2]. Supporting this feature requires the installation of a separate additional sensor. The external sensor is easily tampered with to defeat the set Solar Export Limit.

There is no standard way to communicate with inverters. Different inverter manufacturers offer a range of incompatible interface standards (Canbus, USB, WiFi, etc). Even inverters offering the same interface then use incompatible command protocols. The result is it will take years to define a common interface standard and command protocol to support the desired Export Limit Control.

The NSMP considered a potential solution. The SMI FS described the inclusion of 2 Amp voltage free relays intended to control external equipment.

The reason this is significant is because all inverters described in Australian Standard AS/NZS 4777 [Ref 4] provide an interface compatible with the voltage free relays documented in the SMI FS. The interface can be used to reduce the output of solar inverters.

The following depicts a two element meter complying with the SMI FS. This meter calculates the net energy flow from the separate measurements and compares it to a programmed limit. If the limit is exceeded then the meter closes the 2 Amp relay.



As described there is the potential for undesirable (repeated) on/off switching of the inverter. When the 2 Amp relay is closed the inverter output is reduced and net energy flow falls below the Export Limit. The 2 Amp relay should remain closed for a suitable time period to avoid repeated rapid on/off switching.

Functionality to implement a demand limit and also to avoid rapid switching was included in the SMI FS. The appropriate section was "Supply Capacity Limiting". The meter was required to calculate how long to close

the relay to achieve the (remotely) programmable demand limit.

So to summarise the proposed implementation of Export Limit Control.

- The solution is low cost, using the existing inverter interface and 2 Amp voltage free relays
- No changes to inverter software are required, instead using functionality already proposed for smart meters (not included in the AEMC meters)
- The demand limit is fully programmable using the existing meter communications, avoiding duplicating expensive remote communications

Importantly the proposed solution can even be applied to existing inverters, enabling its immediate implementation in areas where Export Limit Control can deliver societal benefits.

“But communications are cheap!”

There is a fallacy the Internet of Things (IoT) now allows free communications to connected devices. While prices may have reduced there remain significant challenges. Primary among them is the number of competing IoT standards (NB-IoT, LoRaWAN, etc). Picking the wrong standard may result in large numbers of stranded assets.

More significant is the lack of suitable standards to send commands to inverters. While there are currently a number of proposals to address this deficiency it will be years before inverters supporting any standard can be installed. More years will be required before there is a significant population of controlled inverters. It will be more than 10 years before this approach delivers any network benefits.

Addressing the desired functionality using smart meters presents a timely and significantly cheaper solution. A major impediment is the current dumb AEMC meter specification which fails to describe any of the required functionality.

Other issues created by the AEMC

The AEMC meter specification fails to define a meter protocol. This is not a problem for retailers because they are only interested in the interval data for which a common market format has been defined. The lack of a common protocol is a problem for distributors wanting to obtain meaningful network voltage measurements.

The lack of a common meter protocol means Meter Data Providers (MDPs) can provide voltage data in any format they like. The problem then falls to SAPN who must develop software to convert each provided data format into something useful. It would be far simpler if a common format was specified.

There is conflicting advice about the availability of gross measurements made by two element meters. The AEMC advised they require MDPs provide the On Market data, or net measurements. Visibility of solar systems requires access to the separate (gross) measurements, referred to as Off Market data. There is no obligation MDPs provide Off Market data.

MDPs can choose to provide access to other meter measurements, including voltage measurements and Off-Market data and are free to charge for this access. SAPN acknowledges it intends to pay for access to voltage data, however they may also have to pay (more) to access the Off Market data, but this assumes the MDP is prepared to make it available. There should be a requirement MDPs will make the Off Market data from two element meters available and at a sensible price.

Another issue the SA Government may want to address has been created by the AEMC. An update allows consumers to request meter communications be turned off. The meter still collects the same data and can even be used to implement Export Limits, but data is only collected during manual meter reads. Any meter not fitted with communications is a dumb meter and ultimately fails to support the goals of improved network visibility and management. The SA Government may want to consider not allowing communications to be disabled.

Other issues

Metering standards do not specify or test the accuracy of voltage measurements. Voltage measurements should only be considered meaningful if they are tested, including influence factors. This was considered during the preparation of the SMI FS. The final specification referred to existing voltage measurement standards.

Testing shows meters can make unacceptably large measurement errors when harmonics are present. Internationally test waveforms have been defined intended to provide greater confidence meters are not adversely affected by harmonics. The SA

Government may want to consider including some of these waveforms in their enhanced specification.

Conclusion

The AEMC proposed the mandated rollout of meters under the banner of “Power of Choice”. The AEMC promise was consumers would be able to choose the metering solutions they wanted. Instead the reforms have forced consumers to pay for meters incapable of delivering consumer or network benefits.

The lack of benefits was easily predicted. The National Smart Metering Program consulted extensively with all stakeholders. The consultation identified, discussed and addressed multiple smart metering needs. The final specification (SMI FS) delivered retailer, network and consumer benefits.

The lawyers and economists at the AEMC failed to understand the SMI FS. They instructed AEMO ‘simplify it’ so AEMO removed technical functions providing network and consumer benefits. The final AEMO/AEMC dumb meter specification [Ref 5] is so lacking in both features and functionality compliant meters do not support Australia’s clean energy future.

The South Australian Government should be commended for challenging the lack of network benefits provided by the AEMO/AEMC dumb meters. Minor functionality enhancements can deliver significantly greater network benefits with minimal impact on meter costs.

References

1. Consultation on the Proposed Smart Meter Minimum Technical Standards in South Australia
2. Consultation on the Proposed Export Limit Requirements for Distributed Solar Generating Plants in South Australia
3. National Smart Metering Program (NSMP) Smart Metering Infrastructure Minimum Functional Specification (SMI FS).
4. Australian Standard AS/NZS 4777: Grid connection of energy systems via inverters
5. Minimum Functionality of Advanced Meters, prepared by AEMO November 2014

Citation

Please accurately attribute all quotes and references to this article including the title “Making AEMC dumb meters smart”. 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

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.