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).

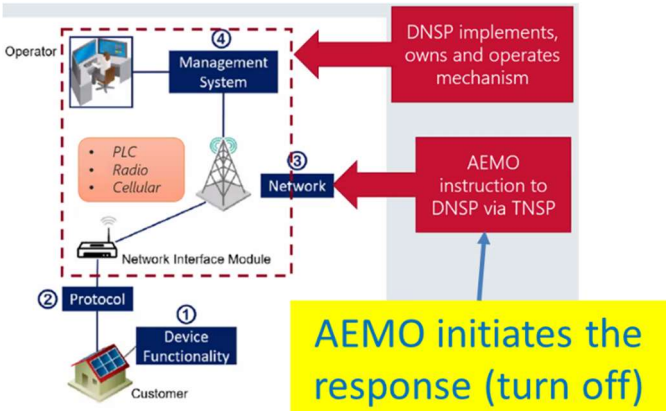


Figure from AEMO presentation to ECA

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.

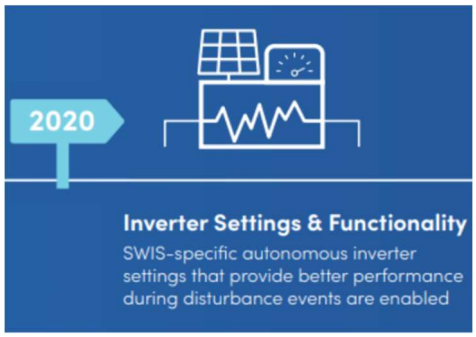
Unfortunately consumers should have little faith in AEMO benefit assessments. AEMO recently promoted another standard giving them the ability to turn off consumer appliances (AS4755). A review of the Cost Benefit Assessment by the Department of the Prime Minister noted the assessment did not adequately 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.

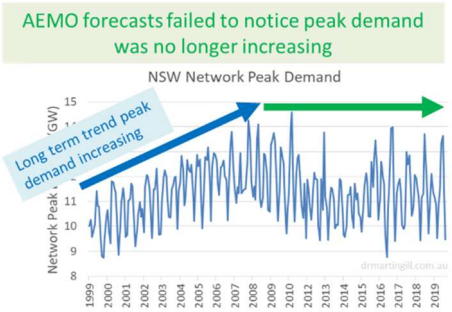
As solar system prices have fallen consumers have installed larger solar inverters, however this trend is unlikely to continue. The primary reason is single phase connections are limited to a maximum inverter size of 5kW. Installing systems larger than 5kW requires consumers to pay for a more expensive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

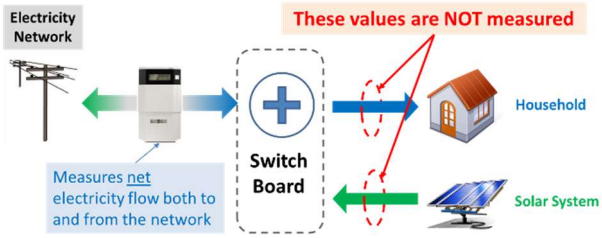
One consequence of these tariff reforms is likely to be greater uptake of the smart home. Many dishwashers, clothes dryers and washing machines now offer a simple delayed start so they can run during cheaper periods. Pool pumps timers can easily be adjusted to run in the middle of the day. South Australia 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. Of particular concern the lack of visibility adversely affects the accuracy of their load forecasts. This exposes a gap in the AEMO proposal: How does this method control solar systems when they have already admitted they can't measure them?

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.

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.

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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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.