EVC response to the:

Queensland Electricity Connection Manual

Service and Installation Rules

Version 4 Draft

July 2023

With reference to:

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Preamble:

The Electric Vehicle Council (EVC) is the national body representing the electric vehicle industry in Australia. As the market is emerging in Australia, our work is particularly aimed at increasing certainty for investment through policy, knowledge sharing and education.

Energy Queensland incorporates Ergon and Energex, who jointly have responsibility as DNSPs (Distribution Network Service Providers) to run the electricity distribution networks in Queensland, and update and maintain the QECM (Queensland Electricity Connection Manual). This document constitutes SIRs (Service and Installation Rules) in Queensland, and, in addition to a wide range of additional legislation, regulation, standards, and codes, places limits permissible electrical installations.

This paper relates to the most recent update to the QECM, open for public comment draft from 16 June 2023 to 21 July 2023. This draft is a significant re-write of document, containing many new elements.

The EVC has a specific interest in elements of this document related to the installation of EV charging equipment, supporting infrastructure, and long run outcomes for EV drivers and the EV industry.

Executive summary of EVC position:

Energy Queensland's proposed new rules, if emplaced, can be expected to negatively impact EV uptake in Queensland and more broadly in Australia in a variety of ways.

The positions taken in the QECM draft appear to be informed by a viewpoint that consumers cannot be trusted to manage their own EV charging in their own homes – that, if Queensland consumers are permitted to choose when they charge their cars, Energy Queensland will not be able to operate the energy system in an acceptable way. This viewpoint is not supportable by the data collected in multiple Australian trials, including Energy Queensland's own work, but it appears to remain an article of faith for Energy Queensland.

At the commercial scale, second lines of connection to commercial properties are one of the most efficient ways to deploy high power fast charging for public use. The QECM as written proposes that this should be very tightly restricted. A better regulatory approach here would be to emulate the Victorian regulations, specifically section 218 of the Electricity Safety (General) Regulations 2019. Multiple lines of supply to commercial premises can be done conveniently and safely, even if it is not Energy Queensland's preference to support it.

Looking to the future, Energy Queensland are also seeking to apply unique, state-specific technical standards with respect to Vehicle to Grid (V2G). This is concerning, because vehicle to grid is one of the pivotal technologies that will enable EVs to deliver massive benefit to the national energy system and (thereby) all consumers. To achieve this benefit, we will need consistent national standards, aligned with international standards. Queensland-specific standards will obstruct V2G uptake in Queensland. It will also limit the national market for V2G, impacting V2G uptake in other states.

Phase balancing requirements, outlined in section 8.4, place an impossible burden on the *"proponent"* – which, in the QECM, includes residential and commercial energy customers - to ensure that wherever they've got a three phase connection, there's never more than 20Amps of difference across the phases. The requirement as written would prevent the installation of industry standard 7kW and 22kW chargers. Phase balancing is important, but preventing the installation of EV charging equipment in order to achieve balanced phases across Energy Queensland transformers is not the right answer.

Outside the scope of the QECM, but key to the achievement of 'well behaved EV charging', is the availability to residential consumers of appropriate retail tariffs. Consumers in the Energex region have access to a robust competitive marketplace of off-peak arrangements that support cost-effective and energy-system-friendly EV charging outcomes. These offers are not as available in the Ergon region – a shortcoming that could be easily remedied by Energy Queensland. Rather than making these arrangements available to incentivise good outcomes, Energy Queensland is seeking to enforce control over EV charging in the home. This suggests a general failure of adequate cost-benefit analysis, which we recommend the OBPR or the OIA be engaged to address.

Many of these points have been raised multiple times, in multiple ways, by industry with Energy Queensland. This draft of the QECM demonstrates that Energy Queensland have not, to this point, listened to industry, or embraced the goal of the National Electric Vehicle Strategy to harmonise regulatory requirements around the country in support of EV uptake.

The EVC is happy to work closely with Energy Queensland over the coming months to fix these shortcomings in the QECM, so that Queenslanders, and all Australians, can more rapidly enjoy the benefits of a transition to EVs.

EV charging at home – why doesn't energy Queensland need control?

The federal government, through ARENA, has run multiple trials looking at the question of EV charging impact on the grid, and how orchestration might be achieved. Several of our energy networks have done their own studies in this domain as well, including Energy Queensland. C4NET has analysed Victorian smart meter data, looking at homes that acquired EVs under the Victorian government grant program, and comparing energy usage patterns before and after EV acquisition. Much of this data has been made public. The EVC also has access to a range of commercial-in-confidence data sources, and published a report last year on the topic:

https://electricvehiclecouncil.com.au/wp-content/uploads/2022/08/Home-EV-charging-2030.pdf

What they all indicate is that contribution to network peak demand from Australian homes with EVs, is about 0.25kW per EV. This reflects the fact that while a consumer might have 7kW or 11kW EV charger in their garage, it's generally not running at peak time. This is because a daily top-up on a 7kW or 11kW charger for a typical driver only takes an hour, and the drivers are generally choosing to charge their cars in the middle of the day from their own solar or setting their cars to charge in the middle of the night on off-peak rates. For anyone not familiar with EVs – this is very easy to do. Setting the preferred charging time in the car is similar to setting a preferred radio station. And of course, there's apps for it if that's what the driver prefers.

The ARENA project reports published to date on this topic also indicate that consumers, left in control of their EV charging and provided with price-based incentives, find it very easy to drop this average of 0.25kW per EV even further. Based on data published in the Origin ARENA report, and what we're excepting to see in the AGL ARENA report, it appears that giving consumers time of use pricing signals can drop the contribution at peak time of the average EV at a domestic home to about 0.1kW. At this level, it takes about forty (40) EVs to add up to the impact on the energy network of one domestic oven cooking dinner.

It's also worth noting that there is a floor level. Regardless of how hard we try, there will be some people who will charge their car at home at peak time. The irreducible minimum is likely on the order of 0.05kW, based on ARENA data seen to date – even if the EV charger is controlled, and the consumer is not provided with an override mechanism, they can still plug the car into the existing powerpoint on the garage wall, and some will. This is where orchestration of EV charging can potentially have a role - it can potentially bridge this gap between 0.1kW/EV and 0.05kW/EV of peak demand impact.

We know from surveys that average consumers aren't particularly keen on mandated orchestration of their appliances. In Queensland, specifically, we know this from practice as well in an adjacent class of appliance – the Peaksmart program enlists between 10,000 and 15,000 air conditioning units for orchestration each year…. Out of a total of about 300,000 that get installed. About 95% of consumers prefer retaining control of their air conditioning, over taking the financial incentives on offer from Energy Queensland for giving it up. In the transport domain, it's to be expected that consumers will generally prefer to be able to charge their car when they need to, rather than when the energy network gives them permission – and surveys of consumers bear this out. It is, however, worth exploring the potential economic value of the approach.

If we start with the 0.25kW per EV peak demand impact number – the average consumer behaviour today, as demonstrated in multiple real world Australian data sets, before we start tinkering with the system – the cost impact of home charging of an EV on the network is about $31/year, when the

Energex Long Run Marginal Cost of $125/kVA/year[1] is applied. The EV driver will be paying a few hundred extra dollars each year on their energy bill (the exact amount depending on how much driving they do, when they charger their car, and what retail offer they're on). Roughly one third of this 'few hundred dollars' will be network costs, which flow to Ergon or Energex by way of the retailer – so they're going to more than cover this $31. The cost imposed on the networks today by home EV charging is not a cost that is being inflicted on other energy users. As a group, consumers paying for at-home EV charging are already subsidising network costs for other energy users.

Encouraging EV drivers to increase the degree to which they schedule their charging – prioritising day time charging where possible, and middle-of-the-night charging where it's not – can get us down to the 0.1kW per EV number. At this level, the impact on the network per EV is about $12 per year.

If we mandate orchestration of EV charging equipment in all homes, to drive the average impact on peak demand per EV down to 0.05kW – then the cost becomes about $6 per year.

This brings us to the question of what the right approach is.

We can see clearly that the existing status quo isn't actually a problem. Impact on the network from EV uptake is small, at about 0.25kW per EV from home charging at peak time, and the EV drivers are more than paying their own way in terms of contribution to network costs through their existing energy bills. If we did nothing, impact of EVs on the energy network would be on the order of about a 1% increase in peak demand out to 2030 or so – and the increase in electricity bills for the consumers switching to EVs would more than cover it economically.

Some limited augmentation in specific locations may be needed, in the same way that if all the consumers in a street suddenly upgrade their air conditioning, an upgrade might be needed – but that's not a good enough reason to exert control over all EV charging equipment installed in homes across the state. That's a reason for Energy Queensland to monitor their network, and undertake localised upgrades when necessary, as a normal part of their day-to-day operations.

Promoting time of use pricing, and incentivising drivers to avoid peak times, while leaving them in control, is a great idea. There's negligible cost involved in doing this. Any consumer with a smart meter should be able to access a pricing structure of this kind. It'll let them save hundreds of dollars per year, it won't upset anyone (because the consumer retains choice), and it'll deliver the bulk of the available system level benefit.

The EVC is working on material on this front, to help people considering EVs work out what the best approach is to charging their cars at home. In the Energex region (South East Queensland) consumers already have ready access to a wide range of competitive retail products that support this outcome.

In the Ergon region, residential consumers are limited to a much narrower set of retail options, because of a lack of competition in the market. If the goal is to encourage consumers to shift their behaviour, providing access to a broader range of retail tariff products, specifically inclusive of retail products that are targeted at EV owners and that incentivise good network outcomes, in the Ergon network area specifically, would be a very good idea.

This could be achieved either by adjusting the structural arrangements applicable to the Ergon region in order to encourage more retailers with a residential focus to enter the market (ie, a re-

[1] https://www.energex.com.au/__data/assets/pdf_file/0004/830488/Energex-TSS-Explanatory-Notes-December-2019.pdf page 49.

structure of the way the Community Service Obligation works), or by Ergon Retail reviewing the retail offers in other regions, and creating retail tariff products designed to drive the win-win outcomes that stem from at-home EV charging happening at off-peak times. Restructuring the CSO would require a significant amount of work, so we're not suggesting that as the preferred immediate approach. Ergon Retail creating and offering new tariff products, by comparison, could be executed quickly and relatively easily.

For clarity, in the Ergon network region, consumers have access to off-peak electricity, from July 1 2023, at about 27c/kWh. In the Energex region, consumers have access to tariffs with middle-of-the-night pricing as low as 9c/kWh. The ***difference*** between these two rates, for a vehicle driving 15,000km per year, and doing most of their charging at home, is $450 per year, per car, in savings…. For adjusting their preferred charging time in their car…. Once.

Before insisting on control of at-home EV charging in regional Queensland in particular, Energy Queensland should try offering consumers the same sorts of financial incentives that already exist in Brisbane. Failing to do this would constitute an insistence on regulatory control measures before market measures have been properly attempted.

Working towards requirements for all EV chargers installed to be communications capable – so that if consumers decide, in future, that they want to have their charger externally controlled or managed – is not a bad idea. It won't cost much, and it might prove useful down the track, so it's a good 'no regrets' idea. There is some devil in the detail on this one. If the requirements aren't carefully thought through, one of the outcomes could be that a lot of EV charging product currently on sale in the state would be removed from the market. The EVC is expecting to see this negative outcome in South Australia in June next year, with the proposed introduction of new requirements from the Office of the Technical Regulator – we're talking to the South Australian government about this, we don't expect it will affect the other states and territories. In the draft QECM, Note 2 at the base of table 44 will have a similar impact – more on this in the next section of this submission.

Forcing consumers to accept external control when they install an EV charger – for the marginal extra network cost saving of about $6 per year per EV – is not justifiable. In order to secure that benefit, the EV charger needs to be smart, connected, and cybersecure. The software system conveying the energy network's instructions to the chargers needs to be built and maintained. Consumers need to consent at wide scale to make it worth standing the system up and integrating it with the energy networks. The participating consumers need a helpdesk to call in the event that something doesn't work correctly – if they change their wifi password, for example, tech support will need to be available to make sure their EV charger keeps talking to the control system. Based on the programs run so far, the EVC would expect that the cost of securing the $6 per year per EV benefit would be, at minimum, several hundred dollars per year.

In addition to being concerned with the basic principle that Energy Queensland are seeking to take control of EV chargers from consumers, we're concerned that Energy Queenalsnd are seeking to derive the $6 per year per EV benefit, while mandatorily inflicting the hundreds of dollars per annum of cost on Queensland consumers – because it is ultimately the consumers that will pay for any new regulatory requirements, costs ***will*** be passed through in one way, shape or form.

The EVC takes the view that forcing consumers to accept external control of EV charging in their home is entirely unnecessary at a technical level – given that consumers are already self-managing their charging away from system peaks – and that it's also unjustifiable at an economic level.

It will only serve to reduce confidence among people considering an EV…. The question they'll rightfully ask, if this new requirement goes through, is "what if the network switches off my charger the day before I want to go on holiday, and stops me from fully charging my car?"

Clauses relevant to this requirement in the draft QECM are 8.5.2, 8.10.1, 8.10.4, 8.10.5, 8.14.4.

For the avoidance of doubt, the EVC does not object to Energy Queensland providing a range of supportive frameworks for consumers who wish to give control/management of their EV charging equipment over to Energy Queensland or other third parties. Our concern in the context of the domestic home is specifically that they should not be forced to do so.

The 20 Amp limit to single phase loads.

Section 8.14.2.2 of the draft QECM contains table 44, which defines the size of permissible switched loads that may be installed.

Per this table, single phase loads, which are controlled by the consumer, and which are not cooking equipment, are not permitted to by larger than 20 Amps.

About 90% of homes in Queensland are wired single phase. This means that the lowest cost solution for the homeowner who wants to install an EV charger will be to install a single phase one. An upgrade to three phase at the consumers home will cost several thousand dollars – either paid for by the consumer at the time of installation, or recovered from all consumers through increased energy bills over a period of years. Pushing consumers towards a three-phase upgrade that they do not need, in order to satisfy an Energy Queensland technical expectation, is not justifiable.

Globally standard domestic single phase EV charging equipment is sized at 32 Amps. This has been co-ordinated between global car markers and global electrical equipment manufacturers. 32A single phase is a power level that can support fully recharging a typical EV at home overnight. While the vast majority of consumers will very rarely need this much energy in one night to satisfy their transport needs, ***some*** consumers will ***occasionally*** need it, and a ***handful*** of consumers (for example taxi and rideshare drivers, routinely doing hundreds of kilometres of driving per day) will ***regularly*** need it. If they can't rely on it, they may prefer to stick with a petrol or diesel vehicle.

Note 2, to table 44, says: "Limit is based on nameplate rating of *electrical equipment*."

What this means is that even if the consumer is able to accept a 20A limitation on the energy delivery capability of their EV charging unit, they're not allowed to satisfy this requirement by installing a globally standard EV charger, adjusted down to 20A, with a 20A circuit protection over the top to keep the current draw within the defined limit. The consumer is expected to find an EV charger that has a nameplate rating of 20A – which most global manufacturers of EV chargers don't produce, because the rest of the world doesn't have this unique 'nameplate' rule. The way global manufacturers address this issue is to include methods such as switches inside the charger, which allow the installing electrician to set the EV charger to a lower power level. So, if the consumer wants (or the installation can only support) a 20A EV charger, they buy a standard 32A EV charger, the electrician installing it sets it to 20A using the internal switches and puts 20A circuit protection upstream.

Fixing this note, to allow the practice of installing 32A EV chargers as 20A EV chargers, would address the problem energy Queensland appear to be seeking to create, whereby the majority of EV

charging equipment being installed in domestic homes can only be installed if Energy Queensland have control via one of the methods described in the draft QECM.

Fixing this note, by itself, will not address the needs of the consumer who wants to be sure that they'll be able to fully recharge their car overnight – sorting out that part of the problem will require Energy Queensland to allow 32A single phase EV chargers to be installed, without Energy Queensland having control.

This could potentially be achieved with two specific changes to the table as provided:

Table 44 Switched load equipment current limits

Equipment	Switching arrangement	Phase	Limit (A)[2]
230V equipment – general		1 (line to neutral)	20
	Phases not switched simultaneously	2 or 3 (line to neutral)	20
	Phases switched simultaneously	3 (line to neutral)	40
230V equipment – with *active device management* Type 2 and Type 3[1]		1 (line to neutral)	35
	Phases not switched simultaneously	2 or 3 (line to neutral)	35
	Phases switched simultaneously	3 (line to neutral)	50
Commercial cooking equipment		1 (line to neutral)	35
	Phases not switched simultaneously	2 or 3 (line to neutral)	35
	Phases switched simultaneously	3 (line to neutral)	40

Note 1 – *Electrical equipment* may have both Type 2 and Type 1 or Type 3 and Type 1 *active device management options* (refer to clause 8.10.1); for these cases the higher current limits apply in this Table.

Note 2 – Limit is based on nameplate rating of *electrical equipment*.

Change 1: Where "Commercial Cooking Equipment" is listed in the table – change to "Commercial Cooking Equipment and/or EVSE (EV chargers)"

Change 2: Amend note 2 to read, "Limit is based on nameplate rating of electrical equipment *or* upstream circuit protection sizing, whichever is the lower"

Making both of these changes would bring Queensland into line with most of the rest on the country on this matter and would satisfy the expectations of the EVC membership base on this matter.

Making only change 2 would resolve part of the problem, whereby consumers are effectively prevented from installing EV charging equipment, at a reduced power level, that they have sole control over. It would still leave Queensland with the most regressive policy in the country on this matter, but it would be better than the wording in this draft, which we understand from written correspondence to also be the status quo position of Energy Queensland.

Assuming we have correctly interpreted the complex interplay of relevant clauses in this draft document, addressing these items in this manner ***should*** enable consumers to be able to have an

industry standard 32A EV charger installed in their home, on the same metered supply that they have sole control over.

In addition to making these changes, we expect Energy Queensland to make any other changes necessary to serve this intent.

For the avoidance of doubt, the EVC and other large industry stakeholders have been engaging in detail with Energy Queensland on this matter specifically since 2022. We are very disappointed to see this approach being taken in a public comment draft of the QECM.

Multiple points of supply for commercial installations.

Deployments of high power public charging stations are a crucial element to support uptake of EVs. In addition to having less supportive tariff structures and allocation processes for sites of this nature compared to most of the rest of the country - which is a separate consideration to the problems in the QECM, and which will need to be addressed in the 2025-2030 regulatory reset - Energy Queensland are not doing enough in this draft QECM to support efficient deployment of this type of public infrastructure.

In existing commercial installations, such as petrol stations, retail premises, and shopping centres, there are established network connections and main switchboards.

The traditional approach to adding a large new electrical load to such a premises is to upgrade the existing network connection and modify the existing main switchboard to support the increased load. For context, at a premises like a petrol station, the existing connection might be on the order of 250A three phase. Adding a couple of 75kW DC chargers will roughly double the size of the supply. Adding a couple of 350kW DC chargers will typically increase the supply to site by a factor of between 3 and 5, depending on decisions relating to load management.

The traditional approach, when adding significant new loads like high power EV charging, will typically mean taking the site offline while the existing main switchboard is removed and replaced with a new one. The size of the additional load is such that the existing main switchboard can't just be 'modified a little bit' – it will often need to be replaced, typically well before it's intended design life is finished, and a new one installed. This is expensive for the parties concerned, highly disruptive, wasteful, and highly time consuming – requiring this traditional approach prevents the installation of high power charging equipment in many otherwise ideal locations, and adds time and cost to the deployment of others. This impact is ultimately felt by EV drivers, who have less options of places to charge their cars, and higher costs.

An alternative approach, which we expect Energy Queensland to better support, is the connection of additional lines of supply to existing premises. Under this approach, a premises like a petrol station or retail location leaves the existing network connection and main switchboard in place, and installs a new one, completely segregated from the existing electrical system, specifically for the new high power DC charging equipment. It's perfectly possible to do this safely, and cost effectively, with the cost borne by the party deploying the EV charging equipment - and it's been done in multiple other jurisdictions in Australia. This is often a much faster, and much lower cost, approach to deploying high power charging infrastructure at existing buildings. We stress here that this should not be mandated as the ***only*** option – what we are asking for here is flexibility, so that case by case, individual businesses can choose the least cost approach for all stakeholders, without compromising safe outcomes for anyone.

For clarity - the ask here isn't for networks to bear any cost increase associated with the deployment or accept any meaningful reduction in safety. The ask is for networks to allow an approach that in proven good in other states in Australia, and in other jurisdictions around the world, and which enables the organisations deploying high power EV charging equipment to get the job done quickly and efficiently, in order to better serve the public.

In the draft QECM, section 5.2.5 deals with this area. Table 14, in section 5.2.5.2 details specifically the requirements associated with additional DNSP service points, and creates a variety of options, all of which are relatively restrictive. For example, it is not clear from this document that a site like a petrol station, or a retail premises, would be able to secure a new network connection at their location, if the size of the property has less than 200m of street frontage, and they desire a different sized network connection for the EV charging component compared to the existing supply to the building.

The EVC suggests that this section should be re-written, starting from the first principle that Energy Queensland should be supportive of cases where a property such as a retail premises or petrol station wishes to install an additional line of supply.

Model regulation to draw from in this re-write should include consideration of the Victorian regulations – specifically section 218 of the Electricity Safety (General) Regulations 2019. Energy Safe Victoria could be engaged as part of this discussion. Energy Queensland could also draw on the experiences and knowledge in South Australia and NSW (specifically SAPN, Essential Energy, Endeavour, Ausgrid), where deployments of public EV charging stations using second lines of supply have been or are being supported.

The EVC notes that this issue has been raised by industry with Energy Queensland before, and that the EVC has previously co-ordinated engagement between Energy Queensland and charging network operators to try to progress this concern.

The EVC would be happy to participate in a working group, comprised of Energy Queensland representatives, Queensland government representatives, EV charging network operators, and representatives from other DNSPs where this is more or less a solved problem, to progress this specific issue in Queensland.

Phase balancing

Phase balancing requirements, outlined in section 8.4, place a significant burden on the *"proponent"* – which, in the draft QECM, includes residential and commercial energy customers - to ensure that wherever they have a three phase connection, there's never more than 20 Amps of difference across the phases.

Industry standard 32A, 7kW EV chargers cannot be installed under this limitation, because when they turn on, or turn off, they will change the loading on a specific phase by 32A. A load management system cannot solve this, because a driver can stop the charging process at any time, and any control system will take time to detect the imbalance and respond.

Three phase 22kW chargers can't be installed under this requirement either, because any vehicle that plugs in to such a charger which has a single phase rectifier on board, will draw 32A on a single phase. Phase balancing is important, but preventing the installation of EV charging equipment in

order to achieve balanced phases across Energy Queensland transformer assets is not the right answer.

This clause needs to be reconsidered, bearing in mind that the consumer cannot reasonably be expected to actively manage their energy usage in a manner consistent with this clause. At any installation, compliance with this clause would require dedicated equipment, automatically bringing on new load or shedding existing loads, to maintain a phase balance within specified tolerances.

Keeping in mind the relative costs imposed on relevant parties, a reasonable starting point could be to exclude connections less than 200A three phase from the requirement entirely. Where there are many small connections to a single network transformer, the phase balancing happens in the transformer, not the customer premises. This is why a typical street full of houses can mostly be wired single phase to the homes, with each single phase connection being much larger than 20A.

If phase balancing is genuinely important at larger connection sizes, and it is necessary for consumers to deliver this outcome for Energy Queensland, then consideration will need to be given to deployment of automated systems that include variable discretionary loads across phases.

To some extent, phase balancing through control of existing plant and equipment at site will be able to contribute to the solution. As an example, single phase EV charging equipment will be able to play a part, noting that the ability of EV charging equipment to deliver this outcome will be contingent on:

- The degree to which cars are plugged in to specific chargers. An EV charger with no vehicle connected to it cannot meaningfully change its load. If an installation comprises many EV chargers and many cars, which cars are plugged into which chargers will impact the utility of the EV chargers with respect to phase balancing.
- The state of charge of a particular vehicle at a given moment in time. A car with a full battery cannot soak up excess supply on a particular phase, and the drivers will not necessarily move the vehicles when they're full.
- The transport needs of the driver. If the car needs charging at a particular moment in time to support a transport outcome, it's not reasonable to expect modification to energy supply to that vehicle to balance a phase.

The least cost solution at a commercial or industrial premises is likely to be a bank of resistors and contactors, designed to present load that will lift the demand on the lowest consuming phase to within the tolerance level of the highest drawing phases. For the avoidance of doubt – this would constitute the deliberate wastage of electrical energy by the consumer, to serve a technical goal of Energy Queensland. The EVC does not endorse this as a good idea – it is a technical observation of the probable least cost solution to the requirement.

An alternative approach would be the deployment, at the cost of thousands of dollars to the consumer, of dedicated equipment designed to draw current on the under-utilised phases, phase shift it, and inject that current into the over-utilised phases. This type of equipment is available commercially off the shelf. It has similarities to power factor correction and active harmonic filtering hardware and is available from the same types of equipment suppliers.

Were Energy Queensland to seek to impose a technical requirement compelling the implementation of solutions of this type, it would be appropriate for Energy Queensland to first undertake a robust, consultative, evidence-based impact assessment to demonstrate that the requirements represent the least total cost solution for consumers, and that the specific tolerances (ie, the 20A level) is appropriate.

The EVC suggests that in addition to smaller installations not needing to be treated this way, at larger installations a 20A maximum imbalance is likely to be far more onerous than a robust evidence based review would determine to be appropriate. For example, at a commercial premises with a 2000A supply, a 50A differential between phases will likely have negligible impact. For these larger installations, a percentage of maximum demand is likely to be more appropriate than a fixed figure.

Vehicle to Grid (V2G)

In the short term, EV charging will add to the peak demand in our energy system – but as described above, not by much, not to a significant degree in the near term, and in a manner that is addressed economically anyway. This addition will be offset by massive improvements in utilisation in our energy networks. The delivery of large amounts of electrical energy through our existing network assets, to charge our cars at non-peak times, will drive down the network component of everyone's power bills. The benefit of EV charging at non-peak times is not just to the EV drivers, it's an economic benefit to everyone.

Longer term, many of our cars will be able to export to the grid. This will look like a person getting home from work or picking up the kids from school, and plugging in at home so that their car can discharge into the grid, in much the same way that solar export works – but at peak time, when the energy is needed. This export will continue for hours, until the demand from other energy users starts falling away – perhaps 9 or 10pm. After a brief rest, the energy will flow the other way, recharging the battery to full for the next day. The consumer will be well paid for this – because they're offering energy to the system when it's needed and drawing energy from the system when there's a surplus. And, if they don't want to participate in this way - they don't have to.

Typical single phase vehicle-to-grid inverters that we expect to see installed in residential homes will be able to deliver 5-7kW of export. This means that a single EV doing vehicle to grid will offset the energy consumption of 50-70 EVs during peak time if those other drivers are following the incentives, and contributing on average 0.1kW of load at peak time – or, 20-30 EVs behaving under today's business as usual conditions, with 0.25kW of load per EV at peak time.

In a future that involves vehicle-to-grid, the EVs will have a positive impact on the energy system, ***especially*** at peak time. That's why the EVC is working hard to clear away the roadblocks presently facing Vehicle to Grid uptake in Australia.

To the extent that the newly proposed QECM negatively impacts the ability of consumers to engage in V2G, Energy Queensland will:

- Prevent the EVs from correcting for their own (relatively minor) negative impacts.
- Prevent the EVS from being a significant part of the overall solution to meeting energy system peak demand
- Limit the value of EVs to consumers, thereby pushing back EV uptake.

Energy Queensland two employees that we're aware of engaged with Standards Australia's technical committee EL-042, which is currently working to improve AS4777, the relevant standard governing requirements for grid connected inverters, including vehicle to grid (V2G). Participation in these standards committees is typically by way of nominating organisation – so, these people are not

representing Energy Queensland in these committees, but rather are representing the interests of the organisation (often an industry peak body) that has nominated them.

This Australian Standard is not currently adequate for the purpose for enabling vehicle to grid uptake in Australia, but through the hard work of the technical committee, and with involvement from industry bodies like the EVC and government stakeholders, it's being taken in a direction of supporting V2G, in a manner that has the potential to be nationally consistent, and which is aligned with international standards. Public comment drafts of this standard are expected to come out later this year.

By contrast, in the draft QECM, Energy Queensland are proposing to require compliance to unique, Queensland-specific requirements for V2G. This is addressed in the draft QECM in clauses 8.16.2 and 8.15.1.

This concern is probably best resolved by re-writing the clauses in the QECM to make it clear that compliance with AS4777 parts 1 and 2 is adequate and sufficient. We would specifically encourage and expect Energy Queensland to make use of the people in their organisation who are directly involved in rewriting this Australian Standard when addressing this element of the QECM. This does not require the individuals involved to breach any undertakings with respect to committee confidentiality – it's simply that as experts in the domain, employed by Energy Queensland, their input should carry weight in the development of the QECM where it touches on V2G.

The consequence of Energy Queensland failing to properly support V2G, in a manner that is nationally consistent, is that engaging with V2G will likely remain a practical impossibility for consumers in Queensland. In addition to harming consumer interests, this will prevent the energy network from deriving the available benefits.

On the differences between various types of consumer energy resources.

One of the challenges in this space is conflation – the treatment of things that are very different in their nature, as if they are all the same.

An acronym that's become popular in the energy sector recently is 'CER' – Consumer Energy Resources. The acronym used to be 'DER' – for 'distributed energy resource' – and before that, the fashionable term was 'demand response'. Someone realised that consumer ownership of all these things probably belonged in the acronym, so that the engineers and economists don't forget who they're ultimately working for. When we're talking about vehicles, in the mind of the consumer, it is not a 'DER' or a 'CER'…. It's a C-A-R.

Solar panels on a domestic roof are considered a 'consumer energy resource'. So is the hot water service, the air conditioning equipment, and the electric car at the home – changing when these things use or export energy can have meaningful effects on the energy system, because there are (or soon will be) millions of them.

As a country, we love rooftop solar. We're installing enough of it each year to produce about 10% of peak demand in the National Electricity Market. We're connecting the equivalent in solar panels of the power output of the biggest coal fired power station in the country, every year. One of the challenges this creates is that we're already at a point that in some places in the country, at some times, there is more solar generation than there is demand – and for the energy system to work, generation and demand need to match.

Where generation exceeds demand, either demand needs to increase, or the generation needs to be cut back. We already do this with all the other big generating equipment on the network. Solar, aggregated across millions of domestic rooftops, has become big enough that we need system level control of it, in order to keep the energy system working. This is what's behind the emergency backstop mechanisms rolling out in the various states, including in Queensland.

So – why is this different to control for electric cars?

- First: Solar generation is concentrated in the middle of the day and concentrated by location according to the weather. It turns up in specific places in large amounts whenever the sun's out. Consumers cannot easily shift the time at which their solar panels produce electricity. This is in stark contrast to the load presented by their electric car, which the consumer can easily present as a load to the network at any time of day.

- Second: The impact on the consumer. If the energy network switches the consumers solar export off, in order to keep the energy system stable, the consumer misses out on a small amount of money – and that's really the only impact.

Switching off a typical solar system for a couple of hours in the middle of the days will typically cost the consumer less than a dollar. If the network switches off the EV charger for a few hours one evening, when the consumer was depending on getting a full recharge to support a long drive the next day – then the next day, the consumer's travel plans will be impacted. This is likely to matter more than a dollar.

There is also consideration given to the possibility of the EVs soaking up this excess solar during the day. This is an excellent idea. Consumers are already incentivised to do this, through falling feed-in-tariff rates, and are already doing it, especially on weekends, as shown in that data from various trials.

It is important, however, to maintain a sense of perspective of the relative scale of solar, compared to the relative scale of EV uptake.

We are currently deploying about 3GW of rooftop solar each year. On a sunny day, this amount of solar panel can produce about 12GWh of additional energy. Each EV consumes on average about 8kWh per day. Very optimistically, about half of this energy (4kWh) could potentially be consumed when the solar panels are generating, because even if it's cheaper to charge during the day, it will often be far more practical for the driver to charge their car in their garage overnight, rather than during the day. The simple math is that it would take 3 million new EVs per year, to soak up the energy produced by the 3GW of new solar panels being installed.

Australia doesn't buy that many new cars – last year, we bought 40,000 EVs, and the total new light vehicle market in Australia, which will eventually be dominated by EVs, is about 1 million units annually. Once the market is saturated with EVs, the figure that matters isn't the new vehicle sales number – it's the growth rate of the on-road fleet – which is about 300,000 units annually.

EVs are a partial solution to the challenge of excess solar, but can only be a partial solution, because of the relative scale. System level orchestration of solar is going to be necessary, especially if we're going to keep deploying it at current rates. The EVC supports this because a reliable energy system is crucial to the transition to EVs.

What about 'clustering'?

Once it's clear that that data and the averages indicate that there is no wide-scale problem, some energy networks raise the topic of 'clustering'. This is the idea that if a lot of EVs all turn up in a single street, and all charge at once, it might present a localised problem well before wider scale energy system issues could emerge.

This is a reasonable consideration. The same thinking would apply to a group of houses in a particular street switching from gas to electric for cooking or heating, or switching from evaporative cooling to refrigerated air conditioning. We are, after all, going to electrify a lot of consumer loads over the next 30 years.

The answer to this problem isn't 'control all the chargers' - it's 'monitor the network'. Vehicle registration bodies in NSW, ACT, and Queensland already publish vehicle registration data by postcode – this can be used to identify localities with faster than average EV uptake. The EVC understands that Energy Queensland already monitors about half of its transformers – we'd strongly suggest that they should all be monitored, and the data shared publicly.

This will support both early detection of emergent load problems, and also efficient deployment of new connections of all kinds – including public EV charging. Essential Energy do an excellent job of the data sharing aspect of this, that the EVC strongly encourages Energy Queensland to emulate.

Timeframes and Governance

It is the EVC's understanding that after almost a year of development work, and a five week public comment process, it is Energy Queensland's intent to attempt to publish the new QECM in August.

We are seriously concerned that the substantive matters raised by us as an industry peak body and matters likely to be raised by others, cannot be adequately addressed by energy Queensland in such a short timeframe. Should Energy Queensland rush this process, we expect that we will likely end up with a substandard set of Service and Installation Rules, which will negatively impact consumers.

The EVC would strongly encourage Energy Queensland to invest the necessary time and effort in thoughtfully integrating industry stakeholder feedback from ourselves and others.

Further, the view of the EVC is that the draft QECM as written demonstrates a failure on the part of Energy Queensland to undertake a robust cost-benefit analysis in the creation of these proposed rules. It appears that the draft QECM has been written from an ideological standpoint to serve the preferences of stakeholders within Energy Queensland, rather than with a view to delivering the best outcomes at the lowest cost for Queenslanders.

At a state level, the Office of Best Practice Regulation (part of Qld Treasury) exists to ensure regulation is necessary, well-designed and fit-for-purpose. We recommend that following incorporation of stakeholder feedback to the QECM through this process, the Queensland Treasury OBPR is engaged by Queensland government to critically review the resultant document, inclusive of a consultation process with industry.

In the event that Queensland Treasury's OBPR is not able to undertake this work, the EVC would suggest that the Office of Impact Analysis (Department of Prime Minister and Cabinet) at the federal level could undertake this important piece of oversight work.