Submission to AEMO Draft ISP 2024

Paul Schulz

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Abstract

The AEMO Draft ISP 2024 appears to minimally address the needs of consumers, in the renewable energy transition when they are a participant in the NEM with CER. A fundamental requirement is that that the retail consumer knows when and how they are using energy and how and what they are being charged for it.

Contents

> "If all you have is a hammer, everything looks like a nail." - Abraham Maslow, 1966

> "The political science analog is that if there is a government agency, this proves that something needs regulating." - Lee Loevinger, 1967

> "Make the requirements less dumb." - Step 1 of Elon Musks 5 step Deign Process[1]

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1 Introduction

This document is in response to the "Invitation for submissions on the Draft ISP"[AEM23b].

This submission would like to address the following issues:

- There is a minimal emphasis in the retail consumer sector and its differences to the other energy resources. The leading role of consumers with CER in the renewable energy transition are not adequately represented; and
- The push for behind the meter controls of consumer equipment (orchestrated CER) as a primary solution to network stability issues is not ideal.

The author lives in South Australia (SA), the state with the largest per-captita installation of rooftop solar[Par23]. This part of the NEM is a lighthouse for the direction of where the rest of the network is heading. with both risks and opportunities. As such, comments are focused on issues for SA.

1.1 Background

A lot of recent work has been put into researching the contribution of CER to the Renewable Energy Transformation. In particular the "AEMC Report into Consumer Energy Resources Technical Standards" says [AEM23a, p. 4]

> Existing and future technical standards for CER devices will be crucial in supporting CER's contribution to the NEM. This is because technical standards provide distribution network service providers (DNSPs) and the Australian Energy Market Opoerator (AEMO) with more certainty about the operation of CER connected tot he power grid. An alternative scenario, in which CER devices interaction with the power grid are unpredictable and unreliable, would leave owners unable to derive the maximum benefit from their investment in these zero or low emission assets and threaten the secure operation of the overall power system.

This document also describes the difficulty of getting compliance with the existing standards and how this is an issue with all of the NEM consumers.[AEM23a, p. 5]

The deployment of CER has continued to grow. It would be worth asking CER owners if they are currently able to make use of their CER investments (see an example of possible survey questions in Section 7).

Technical regulation and standards are being changed and updated in order to keep up with the perceived risk of CER to the network.

This raises the questions - Is this the only way? Is there a better way?

2 Response to posed Questions

In the Draft ISP 2024, five questions were asked.

[1] https://youtu.be/t705r8ICkRw?si=kveryI73BP0jDB8a&t=809

Question 1: *Does the proposed optimal development path help to deliver reliable, secure and affordable electricity through the NEM, and reduce Australia's gas emissions.*

- *If yes, what gives you that confidence?*
- *no, what should be considered further, and why?*

Answer **Yes** and **No**.

Yes, For large energy producers for commercial energy users, the Draft 2024 ISP appears to address the needs of this section of the economy; and

No. I feel that that an entire section of the NEM, vital to the transition, has been mostly neglected in the discussion.

As mentioned under "Risk that CER are not adequately integrated into grid operations."[AEM23b, p. 76]

I agree with the comment that

> "Consumer-owned assets offer significant system benefits and offset the need for grid-scale investment"

but not with the followup statement

> "These benefits would be forgone unless these steps are taken",

which then talks about putting these assets into VPPs and integrating into the network.

While large scale VPPs would be useful for providing stability services to the NEM, implementing them with consumer-owned assets, where control is given to a third party without guaranteed benefits is problematic. The NEM can benefit from these assets without implementing orchestrated CER.

- Household with both rooftop solar and a home battery or electric vehicle (with V2X) can be self sufficient in energy, certainly for a period of time.
- For those on a wholesale market based tariff, the choice of whether they import or export power, the choice is determined by the price on the NEM Wholesale Market, and/or what power they may require at any particular time.
- If the household default (fall-back) operating mode is zero import/export (or within a narrow band for example), the distribution network stability would always benefit should retail customers be in this state.
- Customers can decide themselves if they charge batteries with power to be used later, when they send the power back out to the grid.
- If the pricing signal is lost for a period (eg. an internet outage), households will fall back to a zero import/export mode, maybe with an option for a trickle battery charge option.

The ISP needs to be distinguish between the treatment of commercial solar farms and domestic rooftop solar. The situation will improve with addition of energy storage behind the meter if handled in a way which treats this generation differently. Obtaining the social licence required for behind the meter control of CER will be difficult to achieve, but may not in the long term be required.

Question 2: *Does the proposed timing and treatment of actionable projects support a reliable, secure and affordable NEM? If yes, what gives you confidence? If not, what should be considered further, and why?*

Answer: No. In order to support the renewable energy transition for consumer, there needs to be an actionable item for smart meters to include a user accessible consumer port. See the discussion in Section 3.2 and Section 8.2.

Question 3: *Does the Draft 2024 ISP accurately reflect consumers' risk preferences? If yes, how so? If not, how else could consumers' risk preferences be included and what risks do you think are important to consider?*

Answer: No. A risk for consumers that is not being addressed is that of "inability to reduce the household energy bill" or "bill shock". The question consumers need an answer for is "What is the best approach for me to manage my energy bill?". Moving energy consumers to "time-of-use"

(ToU) tariffs, and orchestrated CER, where they are then not able to monitor and control their energy usage will only increase this risk.

A suitable response would be to provide consumers with real-time monitoring so that the information is available to make decisions for themselves. There is currently no standard method or approach for this this. (For a solution see answer to Question 2 above.)

Question 4: *Do you have advice how social license can be further considered in the ISP, or advice on how to quantify the potential impact of social licence through social licence sensitivity analysis?*

Answer: The amount of social licence that the energy sector possesses directly impacts the rate at which the renewable energy transition can occur. Without a suitable level of social licence and trust in the sector it won't be possible to progress the development of the infrastructure required for the renewable transition.

The social licence needs to be considered over the entire renewable energy network and industry. As an example, social licence and trust established in the generation of renewable energy (eg. the reduction of greenhouse gas emmissions though solar and wind power) can be leveraged to establish the transmission infrastructure in other regions. It needs to be established that everyone wins when renewable energy is used, in direct and meaningful ways, otherwise parts of the transition process may collapse. Every contribution to this process will help.

To increase the social licence in the renewable energy transition and trust by retail energy consumers:

- Stop the packaging of renewable or green energy by retailers. Renewable energy should be the default, and consumers should have pay extra for non-renewable power if renewable is not available. (Non-renewable energy should not be a cheaper option.)
- Give end consumers more information on how they are using their energy, and how their energy use affects their energy bill.
- Provide simplified tariffs and billing plans which can be better understood and verified.

Question 5: *Do you have any feedback on the Addendum to the 2023 Inputs and Assumptions and Scenarios Report (IASR)*?

Answer: No feedback given.

3 General Comments

3.1 The Renewable Transition

Consider the primary statement of 2024 ISP Draft[AEM23b, p. 44].

> Renewable energy connected with transmission, firmed with storage and backed by gas-powered generation is the lowest cost way to supply electricity to homes and businesses throughout Australia's transition to a new zero economy.

This statement focuses on the industrial and commercial energy generation side of the electricity network equation or assumes that the retail customer side (eg. rooftop solar, V2G) can be treated in the same framework. This explains the emphasis for VPP and orchestrated CER as this fits directly into this model.

These technologies are inherently unfair in the way they treat their customers. In this case, consumers need to both pay for the additional management overheads, as well as be required to give up the control of the energy they produce and store.

A more efficient model would be to specify the conditions and requirements at the customers network border (smart meter), and allow customers to decide how they wish to use their energy.

The proposed orchestrated CER introduces failure points (eg. communication network dependancies), making the system less robust to unforeseen circumstances.

The New Renewable Consumer

Consider a collection of homes, which have rooftop solar, home batteries and electric vehicles. If they also have access to real-time energy usage data from their smart meter, and wholesale market energy

pricing (including network tariffs) they have all the information they need to make sensible decisions about their energy usage.

Their fall-back operating mode should be zero (or minimal) import/export, where the batteries can give each house a minimum amount of uninterrupted power. In this scenario, consumers can extend the time their power is available by taking action, turning off appliances or by adding energy via rooftop solar, or EV battery power.

A beneficial extended future scenario for the network operator, would be that it may eventually be possible to take the house(s) completely off the grid for a period (islanding), allowing maintenance work to be done on non-energised sections of the mains supply network, while customers still have energy to use.

The broad renewable energy transition options are:

- Keep existing monitoring, notices, signalling, controls and billing as it currently i, and live with the consequences;
- Improved the monitoring and signalling from the energy network and provide access to wholesale electricity market; or
- Full control of CER by network operators (orchestrated CER).

Of these, only one gives energy consumers and producers more freedom, access to resources and less barriers for building their own renewable energy resources.

As a result, from the 2024 ISP, it is felt that this will then make the likelihood of the "Green Energy Esports" scenario greater than the "Step Change" scenario, but this would need to be modeled.

3.2 Supporting the Renewable Energy Transition at the Smart Meter

Other than the appliances that that they use, customers interact with their energy provider is through their metering and their energy bills.

Smart meters enable electricity retailers to supply power with Time Of Use (ToU) tariffs, which increases the ability of customers to use cheaper, cleaner energy when it is available.

One international example of a successful smart meter roll-out is in the Netherlands[AP19], where a consumer port was included in the smart meter specification[Ned16]. Originally designed for use with an in-home monitoring display, the consumer port is now increasingly being used as an input to home energy management systems.

Consumer data port on Smart Meters

Consumer household smart meters in Australia are not currently required to have a locally accessible consumer port, or provide local access for consumer data.

Some of the issues around this:

- Some meters offer a pulsed output, or relay contact port, which provides counter pulses for the power used, but this is not sufficient for bi-directional operation;
- Energy retailers collect power usage for billing over 30 minute periods and make this available to their customers, usually on the next day, when the link for the customer between usage (cause) and cost (effect) has been broken;
- Customers can always implement energy monitoring hardware at their own expense. While it should agree with the results from the meter and the energy provider, it is measuring something different. Customers can't easily take their setup with them if they move, or expect that the same data will be available at a new residence. There is also currently no straight forward way for a renter to get this information making it difficult for them to participate in the renewable energy transition.

These issues are keeping useful and powerful information out of the hands of all ordinary consumers, and which has a negative effect on renewable energy transition. With this data it is possible for customers to justify making investments (eg. buying a home battery or EV). Having this data available over an extended period (eg. a calendar year) prior to any decision making would also allow seasonal variations to be taken into account. This implies that the sooner that this data is able to be collected by the consumer the better.

The need for this smart meter facility to be a general requirement in the NEM can seen even more when it is considered that:

- In-Home energy displays already part of the various renewable energy rebate schemes;
- There is a niche Australian industry, focused on installing and monitoring consumer energy;
- Amber Electric (a progressing Retail Energy Provider, providing access to the wholesale market prices) promotes its real-time energy usage App as its main differentiator. It is expected that more energy retailers will begin to offer the same facility if they don't already.
- Presently, smart meter characteristics and features cannot be specified by the end customer and are provided and installed as-is.
- If available, end customers may be able to pay an additional fee to have a smart meter consumer data port enabled when installed as an option, but this is not guaranteed.

3.3 Network performance, Demand, Pricing and Export Curves

Figures 1,2 and 3 (below) show the Energy Demand (MW), Whole Sale Price ($/MWh) and Export Power (MW) from the South Australian network on Thursday, 8 February 2024, and is reasonably typical of the daily summer curves for the South Australian part of the network at the time.[2]

The South Australian Demand curve (Figure 1) shows a significantly larger variation (minimum is less than 30% of maximum) then that shown for the NEM as a whole in the ISP (ISP Figure 20).

The wholesale pricing (Figure 2) is mostly negative during the solar generation period (08:00-18:00) indicating that energy should be used during this period.

For most of this period (09:00-18:00) energy is exported from South Australia (Figure 3).

This information is publicly available, but there are barriers to making it easily actionable for consumers with CER that can have a meaningful effect on their energy bill.

Irrespective of the specific method used (eg. increasing loads, charging batteries, solar curtailment or orchestrated CER), the situation for the network can be helped by improving the signalling and the metering available for end users.

3.4 Models for CER Control

In the final section on "Further analysis", the 2024 ISP Draft mentions two cases for sensitivity analysis - passive CER and orchestrated CER[AEM23b, p. 81]. The above discussion suggested a third:

- **Passive CER:** Solar rooftop, with household batteries and possibly EV, none of which is controlled with messages from the energy network. eg. Batteries always charge from the rooftop solar and any excess energy is sent to the grid.
- **Active CER (suggested addition):** CER are controlled locally by an energy management system which includes signals from the grid in its automation decisions.
- **Orchestrated CER:** Direct CER control is given to network operators.

Active control of CER

There are several options for active CER, ranging from a customer manually switching their appliances (eg. putting their pool pump on a timer switch), to a local energy management system, or even a cloud based energy management service provider.

The essential difference proposed between active CER and orchestrated CER is that the later is controlled directly by signals from the network operator and is in direct response to network control conditions.

Effective implementation of orchestrated CER is highlighted as a risk[AEM23b, p. 77].

Active CER on the other hand is beginning to be adopted directly by consumers as they get access to the wholesale energy market. Energy retailers like Amber Energy (see Section 8.1). offer this. They also offer inverter and battery control through their "Smart Shift" software. The number and type of consumer energy resource appliances being supported is growing and the engineering effort is actively being supported through commercial investment[Jon24].

[2] This data was collected directly from the AEMO NEM dashboard API using Home Assistant.

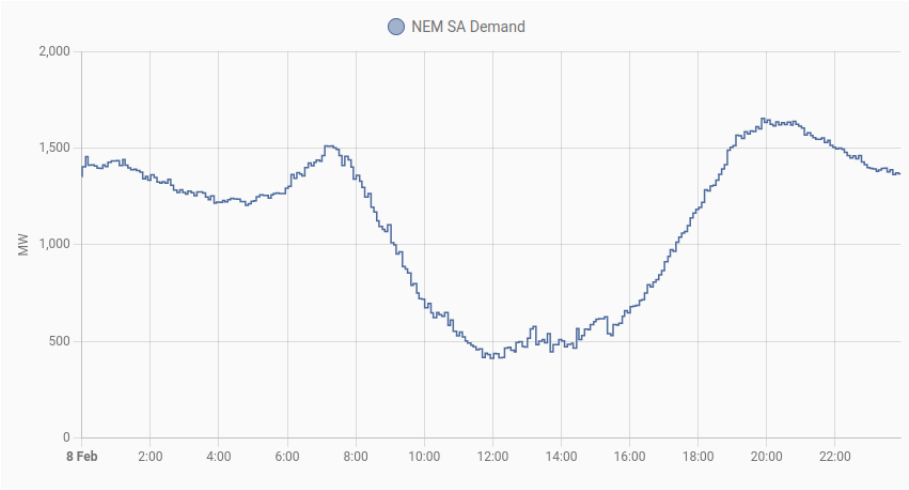

Figure 1: NEM Energy Demand Curve - 8 Feb 2024

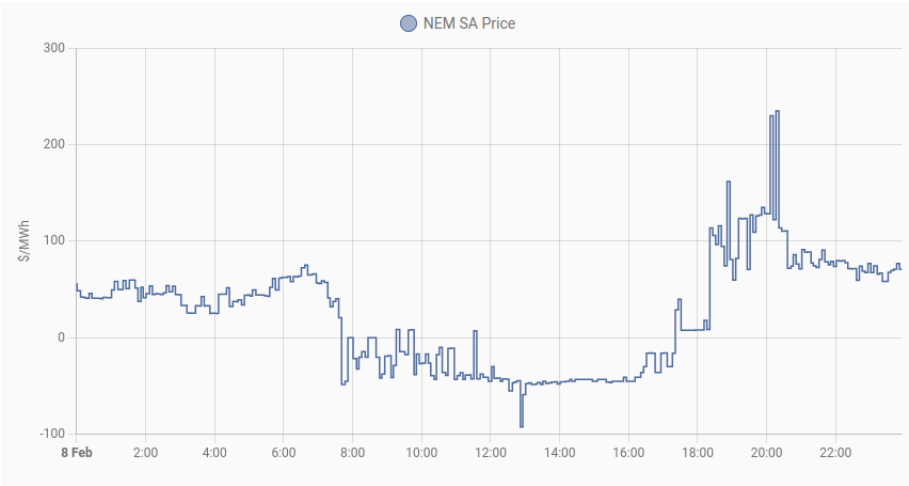

Figure 2: NEM Wholesale Energy Market Pricing - 8 Feb 2024

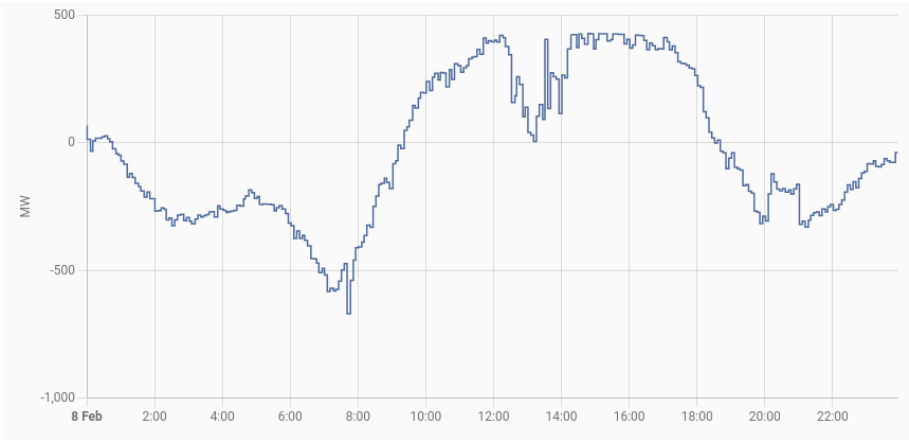

Figure 3: NEM Energy Export from SA - 8 Feb 2024

As well as this managed case, more consumers are taking the extra step of using a local energy management system, which can operate independently of internet access, any cloud infrastructure or third party service providers. An example of this is the HEHASS Plug-In for the Home Assistant home management system (see Section 8.3).

A possible benefit of Active CER over Orchestrated CER control is that Active CER, as defined above, includes inherent randomness in its operation. There is no synchronisation of start or stop times as each consumer acts independently, relying on the supplied network signals and their local situation. The contribution that this make to network stability needs be included in the investigation.

4 Specific Comments

The following are comments and suggestions based directly on the content of the 2024 ISP Draft[AEM23b].

Part A: The ISP is a road-map through the energy transition

1. The two-part energy transition and its benefits

In this section the figure (ISP Figure 4) would be better drawn with a single supply, to describe the representation of how the energy is transmitted to the CER as shown modified in Figure 4.

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Residential consumption to stay flat

Two cases are listed, but there is a third one:

> ① Many will continue to be without rooftop solar and draw electricity from the grid, ② while those with solar may export excess energy during the day and import from the grid overnight. ③ Batteries and EV's will charge during the day and export at night.

Increased use of household home batteries and EVs will reduce the demand swings during the morning and evening peaks. This will lead to the demand graphs in Figure 8 to be significantly different.

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2.1 The transition is well underway

> . . . and customers are investing heavily in their own resources.

This should be encouraged and allowed to happen. Setting up constraints on when customers can use their own equipment to generate and store their own energy will only slow down the transition, regardless of whether this is via orchestrated CER or other regulation.

Customers should be provided with the network signals they need so that they can manage their own energy.

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2.3 But there are inherent tensions

Four tensions are listed (①, ②, ③ and ④).

①Today and tomorrow

This section states

> . . .
>
> Yet rushing the transition is also risky. Market rules need to be in place and well understood, so that timely investments can be made. Global supply chains need to be negotiated so that equipment is available to deliver the transition at reasonable cost. Policies need to ensure that Australia has a skilled workforce to draw on as the transition ramps up.

More than just importing equipment, Australia also needs to make use of this opportunity of the increased availability and demand for cheap renewable energy, and use this to build up manufacturing industry (eg. The Whyalla steel works are being converted to electric furnaces; copper is mined and refined at Olympic Dam, Roxby Downs; and a Hydrogen Production facility is being built).

It may be possible to decouple South Australia's industrial energy market from the global market and international influences.

Figure 4 A power system with both grid and behind-the-meter energy supply

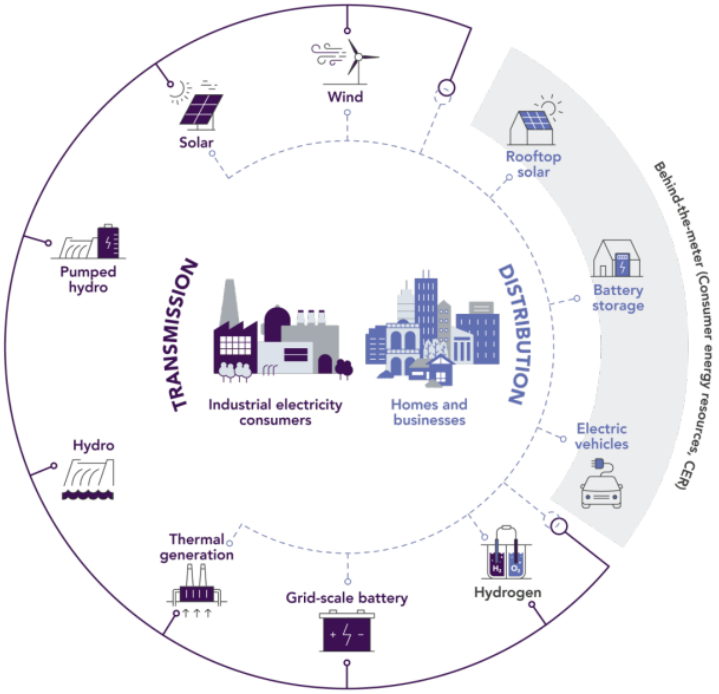

Figure 4 A power system with both grid and behind-the-meter energy supply

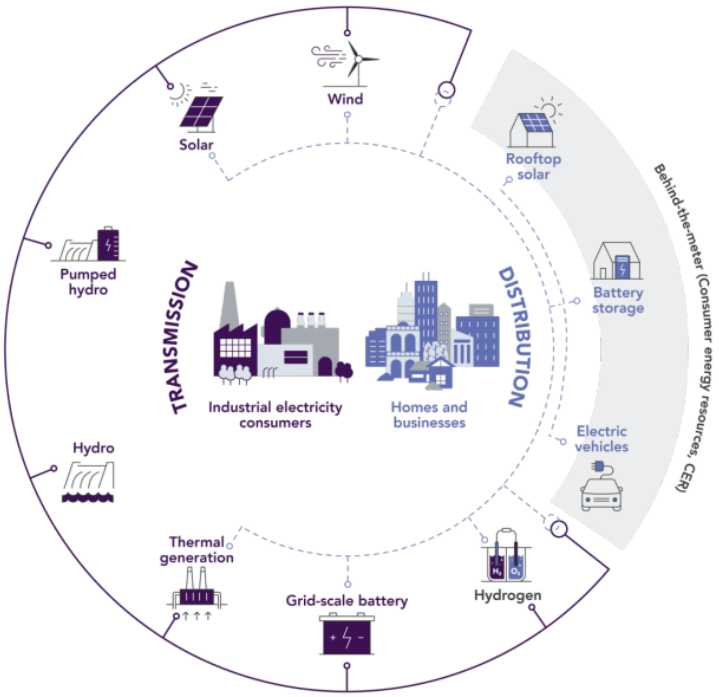

Figure 4: Modified diagram to better reflect energy flow to and from CER

> Communities must be engaged so that social licence for these rules and investments is earned. These issues take time to resolve as well.

Increased support for home owners to take more control of their own energy requirements through rooftop solar, home batteries and EV's will only help. This does not need to wait for large supply chains, and can be ramped up gradually.

②Parts and the whole

> Australia's processes to register, connect and commission new resources are highly regarded by overseas operators, and the times needed are shortening, but AEMO acknowledges that these processes need to be further streamlines.

These processes may be useful for large distributed commercial sites (eg. setting up a VPP consiting of the solar panels and batteries of a grocery store chain), but isn't necessary for home owners.

Consumers should be allowed to manage their own import and export.

> . . . AEMO and other planning bodies are fast learning what innovations and standards are needed for a power system to run on high levels or renewables. This includes learning from and sharing with system operators and research institutions around the globe.

One innovation that it should be looking at is the way that the Netherlands did their Smart Meter roll-out[AP19], and in particular their specification of a local consumer data port (P1) in their Smart Meter standard in 2016[Ned16]. While the initial motivation for the consumer port was for an in-home energy usage display, it has since found use in providing the timely data required for local energy management.

③People and populations

From this section

> . . .
>
> Communities acceptance of projects is fostered when organisations priortise trust, and deliver promised benefits.

This comment can not be understated. Community acceptance and trust is not built in isolation, and the acceptance or otherwise of project will be the holistic result of all the interactions with the industry. The entire energy industry should be on notice and act accordingly.

> The second place where 'people and populations' meet is where households, businesses and communities have invested in their own resources. At times, rooftop solar offers so much electricity to the grid that action is needed to ensure power system security.

AEMO have introduced the Contingency and Minimum System Load (CMSL) alert messages, including the "Notice 3 - Notify that curtailment of rooftop solar is occuring"[3].

It would be worth considering adding a "Notice 3a" (or "Notice 2.5") which requests that there is zero import/exports at consumer sites, as measured by a customers meter. This would allow customers to continue to still use their own generated power.

> However, if owners allow some coordination of their assets, including batteries and EVs, it will help them, and the power system as a whole in balance.

It can be argued that it would be even more beneficial asset owners not to be part of orchestrated CER, where they can control the energy in their batteries and EV's themselves (with automation and assistance).

> With the right incentives and systems, these assets can reduce the need for utility scale investments, and materially reduce the cost of the energy transition.

It should be noted that any addition of properly managed consumer energy resources would reduce the pressure for additional utility scale investments, not just orchestrated CER.

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④Australia and the world

This section begins

[3] https://reneweconomy.com.au/aemo-installs-early-warning-system-for-surplus-solar-and-rooftop-pv-shutdowns/

> Australia is not the only country transforming its energy system, with the whole world competing for the same investment, equipment and engineering skills.

To make the most of this opportunity we need to create a local ecosystem of users which understand how the renewable energy works and how the renewable energy transition operates; investment needs to be made in local training in all aspects[4]; and all barriers to participating in the renewable energy future need to be removed.[5]

The section ends with

> The enormous demand for green technology will continue to influence costs, stretch and grow supply chains, and test delivery schedules. Managing these tensions will take the industry's collective planning, and the disciplines to carry these plans through.

Here, the ISP ignores the second biggest asset that Australia has. The first is our abundant supply of solar and wind resources. The second is Australia's people. South Australia has proven this in that we will step up and invest in our future ourselves, as shown by the high rate of roof-top solar installations in South Australia.[Par23]

The next stage needs to be the broad installation of home batteries and then integration of EV's into the grid, both as both load and supply.

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Part B: An optimal development path for reliability and affordability

This section starts with the stated aim:

> Renewable energy connected by transmission, firmed with storage and backed by gas-fired generation is the lowest cost way to supply electricity to homes and businesses throughout Australia's transition to a net zero economy.

A change in the emphasis of this statement would make it read:

> Renewable energy connected by transmission, firmed with storage, backed by gas-fired generation **and supported by notices and signals,** is the lowest cost way to **distribute** electricity to homes and businesses throughout Australia's transition to a net zero economy.

Adding "notices and signals" describes the processes of informing the network of operational events (notices) and providing an indication of current network state (signal). Signals for the network would include the wholesale market price, as this effects the behaviour of producers and consumers who have access to wholesale energy pricing.

In the renewable energy transition, the network is more than just a way to supply electricity, but also re-distribute energy from distributed energy resources.

At the end of the renewable energy transition, the statement could read:

> Renewable energy connected by transmission, firmed with storage and supported by notices and signals, is the lowest cost way that electricity is distributed to homes and businesses throughout Australia's zero economy.

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4 Transition to renewable generation

Please refer to the previous comments about the primary statement in the previous section.

4.2 Four times today's consumer energy resources

This section starts with

> Many consumers are taking more direct responsibility for their energy needs, particularly as they rely more an more on electricity. Increasingly, they are investing in solar systems, batteries, EVs, and other energy management solutions.

Nothing controversial here, but the ISP then states

[4] Courses and resources needs to be provided by TAFEs, adult education institutions and even local libraries.

[5] Comments made by politicians that the root cause of specific blackouts in SA were caused by the renewable energy transition were not helpful.

> Virtual power plants(VPPs) are starting to aggregate those assets into larger systems, trading energy between them and the grid, and maximising the system benefits that these resources can provide.

System benefits are not necessarily aligned with consumer benefits when discussing CER. It can be argued that the maximum benefit for consumers are achieved by not participating in orchastrated CER and where users can decide themselves how to use their energy resources. (See "Tensions")

If customers have access to network notices and signals (including wholesale pricing), and the wholesale market (both import and export), they can automate their energy management in line with their own energy goals.

The consumer energy resources which are then listed, along with their expected growth.

- Solar generation continues to rise
- Residential and commercial batteries
- EV ownership is also expected to surge

The section goes on

> Any growth in CER reduces the need for utility-scale solutions,

(which is true, but)

> especially if the assets can be coordinated or 'orchestrated' to complement and support the grid most efficiently.

(is the statement being challenged)

In all of the above resource types, price signalling can be used to indicate to customers what they should be doing with their energy resources to support the grid without additional orchestration.

> An increasing proportion of rooftop solar, EVs, household and community batteries an even household hot water and pool pumps are expected to have the 'smarts' to help man age the import and export of electricity to the distribution grid.

. . . and help consumers control their energy use. (Note: The simplest 'smarts' in these devices would allow control for of the device, without the device having to know what other devices are also also on the same local network.)

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9.3 Further analysis in parparation for the final 2024 ISP

In the list of further items for analysis:

- Sensitivity analysis to understand the impact of passive CER rather than orchestrated CER,

It would be worth considering "active CER" here as well (as defined above in Section 3.4.

5 Other Comments

5.1 AEMC - Review into Consumer Energy Resources Technical Standards

[AEM23a]

This report discusses in detail the standards and regulation that require to be changed to support orchestrated CER in the NEM.

> Individual consumers in the nastional electricity market (NEM) continue to install and connect record amounts of new consumer energy resources (CER) tot he power grid. CER covers a range of low and zero emissions devices such as rooftop solar panels, battery energy storage systems, electric vehicles (EVs) and actively controlled appliances such as pool pumps. With this transition to a more decentralised power grid, the technical standards for how CER devices interact with the broader power grid is increasingly important for the NEM's security and reliability.

A counter argument can be made that provided the power import/export through the consumers connection point (Smart Meter) meets network requirements, then CER only adds to the stability, security and reliability of the power grid.

5.2 ESB Report - Consumer Energy Resources and the Transformation of the NEM

While preparing this submission, the Enewrgy Security Board released its report "Consumer Energy Resources and the Transformation of the NEM - Critical priorities to support transformation: a call to action".

In this report, the ESB identifies that a framework with suitable standards need to be developed to support the orchestration of CER for working effectively with the NEM.

The ESB report refers to the AEMO ISP document as a source supporting their evaluation and proposals.

If customers are able to monitor and control their energy resources behind the meter, and were able to participate in the NEM (import and export) based on network notices and signals (including pricing), then, in this instance:

- the complexity of a VPP and managed CER would not be required; and
- renewable transition speed would increase, due to the simpler system requirements.

There will still be instances where network controlled CER, and VPP infrastructure is useful and required, and will include multisite solar generation (eg. grocery store chains).

6 Conclusion

The 2024 ISP Draft has the primary statement:

> Renewable energy connected by transmission, firmed with storage and backed by gas-fired generation is the lowest cost way to supply electricity to homes and businesses throughout Australia's transition to a net zero economy.

which could be better written as:

> Renewable energy connected by transmission, firmed with storage, backed by gas-fired generation **and supported by notices and signals,** is the lowest cost way to distribute electricity to homes and businesses throughout Australia's transition to a net zero economy.

with the aim of making the following a true statement:

> **Renewable energy connected by transmission, firmed with storage and supported by notices and signals, is the lowest cost way that electricity is distributed to homes and businesses throughout Australia's zero economy.**

To achieve this, consumers need to be supported in their participation in the renewable energy transition by: by

- Improving network communication with actionable notices and signals; and
- Providing standardised and robust visibility of consumer energy use at the meter.

6.1 Comments and Questions?

The author is happy to receive comments and questions about this submission. He can be contacted at mailto:paul@mawsonlakes.org.

7 Appendix: Example Survey Questions for Owners of CER

The following are some example questions that should be put to Consumer Energy Resources(CER) owners, to determine what are the needs to consumers who have or want to invest in CER.

Question 1: What is the reason that you have, or intent to invested in CER?

Question 2: Are you currently able to derive the maximum benefit possible from your CER?

Question 3: What is reducing the effectiveness of the CER for your use?

Question 4: Is there anything else you need in order to increase the benefits you receive from your CER investment?

8 Appendix: Technology Examples

8.1 Amber Electric

Website: https://www.amber.com.au

Amber Electric is an energy retailer that passes though real-time wholesale electricity prices. At the time of writing they apply averaging to the NEMs 5 minute pricing data to 30 minute periods. This is based on the way that the wholesale energy market operates[fA24].

8.2 The Netherlands Smart Meter P1 Consumer Port

A review of the Netherlands experience with their Smart Meter roll-out can be found in [AP19].

8.3 Home Assistant

From Wikipedia

> Home Assistant is free and open-source software for home automation designed to be an Internet of things ecosystem-independent integration platform and central control system for smart home devices, with a focus on local control and privacy.

See: https://www.home-assistant.io/

EMHASS: An Energy Management Plug-In for Home Assistant

See: https://emhass.readthedocs.io/en/latest/

This plug-in allows automated controls to be used to manage a customers energy resources in a consistent way, and is able to accommodate a large number of different equipment providers.

Amber Integration for Home Assistant

See: https://www.home-assistant.io/integrations/amberelectric/

This integration uses the Amber Electric developer API. Home Assistant can interact with the Amber Electric system, allowing data normally visible in the Amber Electric app to be used within Home Assistant.

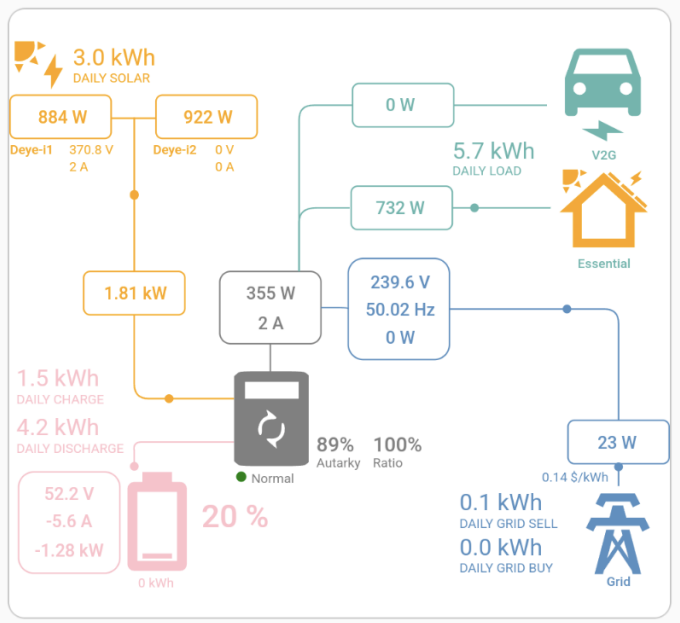

Figure 5: Screen from the EMHASS Energy Management Add-On to Home Assistant

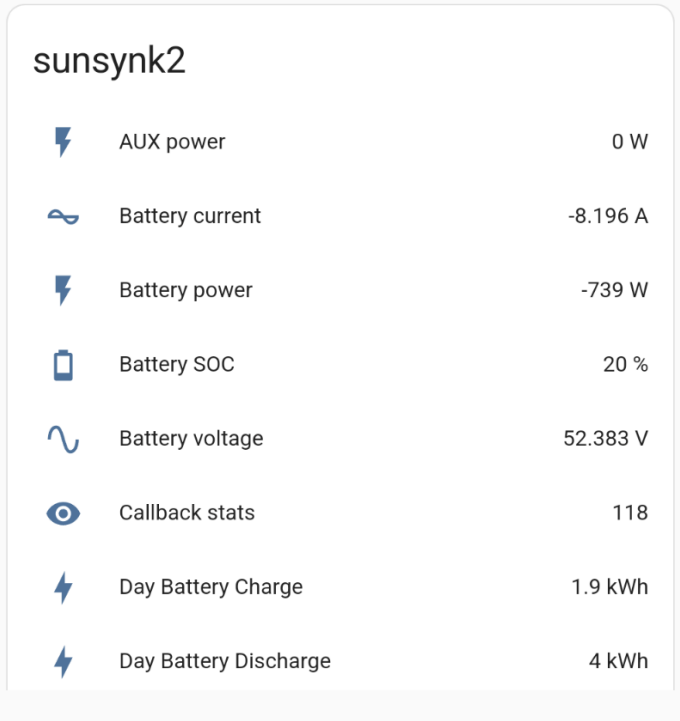

Figure 6: Example of EMHASS Energy Management Parameters

9 Appendix: Acronyms

AEMC Australian Energy Market Commission

AEMO Australian Energy Market Operator

CER Consumer Energy Resources

DNSP Distributed Network Service Provider

ESB Energy Security Board

VPP Virtual Power Plant

ToU Time of Use (Tariff)

References

[AEM23a] AEMC. Review into consumer energy resources technical standards, 2023.

[AEM23b] AEMO. 2024 isp draft, 2023.

[AP19] Pol Van Aubel and Erik Poll. Smart metering in the netherlands: What, how, and why. https://repository.ubn.ru.nl/bitstream/handle/2066/204501/8/204501pub.pdf, 2019.

[fA24] Natalie from Amber. The price in my app is changing more often than every 30 minutes. https://help.amber.com.au/hc/en-us/articles/360044364912-The-price-in-my-app-is-changing-more-often-than-every-30-minutes, 4 Jan 2024.

[Jon24] Tegan Jones. Amber electric charges up with $29 million series c round, eyes global market. https://www.smartcompany.com.au/startupsmart/news/amber-electric-29-million-series-c-raise/, 1 Feb 2024.

[Ned16] Netbeheer Nederland. P1 companion standard, dutch smart meter requirements. https://www.netbeheernederland.nl/_upload/Files/Slimme_meter_15_a727fce1f1.pdf, 2016.

[Par23] Giles Parkinson. Rooftop solar eats up all demand in south australia, world's most renewable grid. https://reneweconomy.com.au/rooftop-solar-eats-up-all-demand-in-south-australia-worlds-most-renewable-grid/, 18 Sep, 2023. Accessed: 15 Feb 2024.