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ISP Team, thanks for the draft ISP.

I'm a software engineer working on open source projects with a keen interest in what happens to CER over the next few years.

I am what is soon going to be a typical residential customer, I've got 6kW of rooftop solar, 14kWh of storage and an EV installed for my household use. I'm currently enjoying how cheap they are in terms of ongoing cost.

As highlighted by IEA¹, the current drop in distributed solar PV installations is expected to happen. While the short term benefits of reduced negative spot rates and phase accuracy, its loss represents a loss in future capacity needed to be addressed by investment. Encouraging parallel investment into household storage will ensure the 6c/kWh feed in consumer tariff isn't the deciding factor but rather the saving on peak times of ~30c/kWh.

If I was to assess my current CER resources, the current control by ChargeHQ (a mobile phone app around EV charging) that achieves good savings, lacks a fineness of control, and even within the domestic peak/shoulder/offpeak rates, isn't totally optimal for the grid, or myself.

As highlighted in the ISP, infrastructure cost and development aren't cheap, and I'm keen to ensure the vision of stable, just in time supply is able to serve the needs of future Australians.

I'd like to address the A8.3 Consumer mobilisation, adoption, and orchestration around CER.

Virtual Power Plan as a model

The model under the draft ISP is to move CER through an intermediary Virtual Power Plant (VPP). This is a convenient model from AMEO as a wholesale level entity and, as highlighted, there's a major trust issue that needs to be addressed. The volatility of current retail prices in the upwards only direction at short notice in the recent years has significantly undermined consumer trust of the energy market. This trust aspect needs to be taken seriously, because a VPP poses additional challenges in terms of user trust:

- Compared to a retail energy provider, which assumedly pays/rents poll and lines, the consumer assessment of the value that a VPP delivers to them could be seen as a less

¹ IEA cuts Australia forecast on saturated rooftop solar, 12 January 2024, <https://www.argusmedia.com/en/news/2527072-iea-cuts-australia-forecast-on-saturated-rooftop-solar?amp=1>

tangible value. How valuable are provides is prediction and control over a user's hardware?;

- It could be seen as providing the cost model of AMEO, with a margin added, and not providing much value;
- It's unclear how well a VPP controlling a CER resources, looks after the need of CER equipment (operating with specification, duty cycles etc);
- It's unclear on how the VPP serves the users needs (first?) compared to the needs of themselves, or the needs of the grid.

The "Inquiry into price gouging and unfair pricing practices" by the ACTU February 2024² reports:

Of great concern is price gouging in the electricity sector, a very concentrated industry at all levels. As the regulators themselves have reported there has been routine price gouging from time to time at the generator wholesale level as it sets prices in the price bidding system.

With that in mind, the VPP is being set up as another highly concentrated industry, with low regulation and oversight. This can, as has been the case with existing electricity energy providers, provide a market rich for price gouging.

To boost the VPP trust, I recommend the following, which is largely pulling from consumer practices in the telecommunications/Internet service provider industries:

Recommendation 1:

Mandate a plain english summary of cost/services/benefits which a user can compare.

Recommendation 2:

Mandate a churn scheme, where through an defined and semi automated way, a consumer can change from one provider to another at short notice.

There are undoubtedly more comprehensive recommendations in the ACTU report on how to best provide a good energy market and minimise monopolies in 4.7 -> 4.11 as Energy Sector recommendation along with general recommendations, however none of these are primary AEMO initiatives. A capacity market recommended in 4.7 needs to be considered as the spot pricing volatility of a gamed market cannot be fully considered stable.

While complementing my Home Automation User Involvement below, the principle of the VPP being there as a variable cost provider, and not a controller, is still valid, and there will be users willing to trust providers if a valid market with understandable diverse offering can be made.

² https://www.actu.org.au/wp-content/uploads/2024/02/InquiryIntoPriceGouging_Report_web9-1.pdf

Home Automation

The rising Internet of Things (IoT) and home automation products like Google Home are making the automated control of electronics in the home a mainstream product, and not just in the homes of electronics geeks. Open Source products like Home Assistant³ provide a simple install option for a low hardware cost (\$99) providing feature rich access to home automation. Among the very rich integrations of this are controllers for PV solar, home batteries, EV chargers, lighting and water heaters (along with many other things). Low cost mobile phone applications are also available in a similar realm where most energy devices are able to be remotely (beyond the home network) controlled.

The ACIL Allen 2022 report “Barriers and enablers for rewarding consumers for access to flexible DER and energy use”⁴, shows a great breakdown in the current barriers of existing demographics. Sighted is “Roberts et al (2020) found that the participation in a VPP by households who purchased batteries for largely non-financial reasons was contingent on ‘home energy needs’ being met first.”⁵. Home automation is the level of control that ensures the ‘home energy needs’ being met first occurs. Within this priority of serving home energy needs first there are conditional loads within a household from hot water, dishwashers and EV charging that have a moderate amount of flexibility that can be utilised to be scheduled away from peak demands and scheduled towards over-supply periods.

What has been clear from user engagement in software is that over time the standardisation and rich development has driven the user adoption and ease of use, (taking mobile phone apps as a key innovator in this experience). As such some of the inhibiting factors of the ACIL Allen report will diminish rapidly in the next 3-5 years.

The Home Assistant comes with the ability to install custom modules (of hardware control, or monitoring) and to write fairly basic scripting to automate a user’s home. With the current level of technology there is the ability to maximise (the current fixed time of day) off peak usage. Extending this capability to provide the ability to automate with grid activities is a fairly basic enhancement.

End user hardware of home automation has sufficient processing power to control CER, perform basic predictions, and it does so within the user’s realm of control, putting the user’s energy needs first. It also has access to the user’s usage. The combination of these factors raises the social licence and trust in participation and also the efficiency in implementation from a user’s perspective.

³ <https://www.home-assistant.io>

⁴

<https://www.datocms-assets.com/32572/1658964119-barriers-and-enablers-final-report-v2-352146-1-3-1.pdf>

⁵ Ibid - p.14

Without a managing VPP company, the inherent control of hardware in possession, and trust is significantly greater. Even better, for the user, software is open source meaning it is public, and usable, and modifiable⁶. Even without the programming skill there is an inherent trust in open technologies, or in the least, technologies not controlled by an external entity. Adding to the trust, software is being actively developed by a large user base where it visibly gets bug fixes and improvements every few hours.

Note, permissive open source licensing (Apache 2.0) provides the possibility of any vendor to make a commercial product out of this software, even modified, with very few limitations.

Spinoff projects from this include solar prediction⁷ providing a geographic API of predicted solar available for ease of incorporation into end user predictive energy models using home automation.

To make home automation operate to the benefit of the grid, the first aspect is to drive incentive to benefit the user.

Recommendation 3:

In the same way that VPP achieves its objectives, provide residential users access to weekly forecast electricity costs that have a high accuracy, and provide them a way of ensuring their “user first pattern” load is able to be met through automation.

So with home automation, what would user control look like? The user patterns of behaviour, observed or explicit, can describe the outcomes, but within this, there can be operations that serve, or at least minimise peak demand. For example, “by 8:30am my EV should have at least 80% charge” gives the ability to within a time/cost model, be able to achieve this goal at least expense to the user. The cost model of electricity provisioning is expected to equate to what the grid needs to normalise demand.

Should a user not leave until 9:30am, there can be sufficient logic to continue charging straight from solar, or pulling from the grid at a time when other users are generating solar.

Furthermore, improved AI makes natural speech recognition makes “programming” a set of natural voice commands, to which the application/Home Assistant will pick up and incorporate. The rise in user adoption from simplified interfaces is well known in the software industry.

Even serving a user’s home needs with automation provides, with a market motivation, the ability to reduce usage at high demand with existing algorithms of constraint programming, a more advanced usage is what AMEO uses to manage its grid, but with lower capacity and inputs the problem to solve is simpler.

⁶ <https://github.com/home-assistant/core>

⁷ <https://forecast.solar/>

A user opt-in participation in storage for grid stability would work in a similar way, by taking charge during the day and/or delivering to the grid at times of short supply. The home automation will have sufficient information with provided costs to optimise for this scenario too. This needs to be an option as the user's primary goal is their own energy use rather than taking their personal investment for a VPPs profit margin.

To provide users with the most reliable software in the home automation, the standards that operate elsewhere provides software developers the best opportunity to develop once and have consumer ready software available everywhere (both in AEMO regions and internationally).

Recommendation 4:

Adopt applicable open international standards like OpenADR 3.0⁸ for the communication of supplier to consumer information. Participate in open standards development at an international level to ensure AEMO expertise and requirements can be standardised as is expected for an energy market leader.

Privacy

The model and predictions of users' residential energy consumption is a model of their behaviour and life. Taken to the extreme their personal movements are inherently part of energy consumption and the energy model is a map to exploiting their personal and property security. To maximise trust and social contract, privacy must be considered.

Recommendation 5:

Participation in a grid operation should not require a user to provide any identification, and only a broad identification of beyond a grid region in which they are residing, to the extent it is necessary to model behaviour in part of a grid.

The logical implication of this is that a user's billing, that has strong identification requirements, is also independent/decoupled from home automation that attempts to minimise this bill for the user's benefit. While a home automation system may couple to a user's power meter as a validation mechanism, however this is entirely out of scope of what a grid operator should see.

Recommendation 6:

The estimated usage from the grid by the user is private data and should not exist beyond home automation hardware in the users control.

To the maximum extent possible, even emergency grid load shed messages should not see a response from the user that some load is being dropped. The behaviour to the grid can be

⁸ <https://www.openadr.org/openadr-3-0>

observed at regional area. Over time with sufficient active participants in a region, AMEO should gain trust in the performance of these sorts of events.

By AEMO or a VPP not actually having control raises the trust, but with automation and a cost model that benefits the user, the benefit to the grid comes naturally from these along with the preservation of a user's privacy and all user hardware serving the user first.

Development

The ecosystem of the Home Assistant project, when the applicable standards are decided, could be benefited by contributions in the form of implementation of these standards.

Recommendation 7:

Develop implementations of OpenADR 3.0 into Home Assistant, if not already there, to provide the basis of consumer cost optimised energy usage.

Recommendation 8:

For Home Assistant, develop, if not already there, port a basic constraint language solver, that can minimise costs of energy consumption with forecast cost data, and a forecast model of user consumption, and a set of user requirements.

Recommendation 9:

For the specific problem of PV, EV, and storage, and home usage, provide a user blueprints⁹, friendly way of achieving a quick installation of Home Assistant, for various solar/battery/EV/provider options. This will get a minimal cost system operational, with easy to recognise options like supporting grid stability. This provides user visible estimates of cost comparisons.

Adoption

The presence of technology alone doesn't drive its adoption. Marketing needs to be performed to ensure a user base is aware of the existence of options that, under their complete control, and privacy, saves them on electricity costs.

Recommendation 10:

Promote home automation as a way to maximise user capital costs for user benefit and to utilise variable costs of the grid to fill personal capacity gaps at the lowest cost.

⁹ https://www.home-assistant.io/docs/automation/using_blueprints/

Gaps in automation can result from high power electrical appliances that lack the ability to be controlled. These typically are water heaters, dishwashers, washing machines and air conditioning. Collaborate to ensure that bluetooth/wifi options exist for these appliances so they can fall within the bounds of control.

Recommendation 11:

Consult with consumer electronics manufacturers to ensure that high load products on the grid can be controlled locally.

The other key is to ensure home automation has the ability to read domestic meter readers with a consistent and secure protocol. This will ensure that non-controlled items can be measured when it fits into the domain of automation prediction.

Recommendation 12:

Ensure Australian domestic meters can be accessed securely as measurement instruments by home automation. This allows non-automated appliance usage to be accounted for by forecasting/measuring a user's local electricity usage.

Summary:

While the VPP concept has the ability to be a significant driver in delivery of grid stability, the erosion of trust in electricity providers by high concentrations of companies performing price gouging will significantly limit their viability. Privacy aspects exposed to VPPs also reduce users' safety.

Home automation technology provides a way for user's hardware to be used for users' benefit, with privacy. Home automation with the accessibility to dynamic pricing can benefit the grid stability at the same time as the user. With clear opt in extra grid stability operations, to absorb excess supply or provide a generation gap, gives users control and trust.

Taking a lead in international standards and donating to open community/commercial software bases to improve user experience will drive the adoption here at a low cost (especially compared to other capital projects).

Thanks for keeping the lights on.

Daniel Black