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Collaboration on Energy and Environmental Markets

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Submission to AEMC Draft Rule Determination Unlocking CER Benefits

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11 April 2024

Benn Barr

Chief Executive

Australian Energy Market Commission (AEMC)

Lodged electronically,

Collaboration on Energy and Environmental Markets

Dear Benn Barr,

Re: Draft rule determination for unlocking consumer energy resource (CER) benefits rule change

The Collaboration on Energy and Environmental Markets (CEEM) welcomes the opportunity to make a submission in response to the Australian Energy Market Commission (AEMC)'s draft rule determination for unlocking consumer energy resources (CER) benefits rule change.

About us

The UNSW Collaboration on Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from a range of faculties, working alongside a number of Australian and international partners. CEEM's research focuses on the challenges and opportunities of clean energy transition within market-oriented electricity industries. Effective and efficient renewable energy integration is key to achieving such energy transition and CEEM researchers have been exploring the opportunities and challenges of market design and policy frameworks for renewable generation for the past two decades. More details of this work can be found at the Collaboration website. We welcome comments, suggestions, questions, and corrections on this submission, and all our work in this area.

Please feel free to contact Baran Yildiz (baran.yildiz@unsw.edu.au) regarding this submission or for other CEEM matters.

Our approach to this submission

We have included some evidence-based information from our ongoing RACE for 2030 project SolarShift, with the intention to inform this rule determination process for unlocking consumer energy resources (CER) benefits. We focused our attention on two key points for this submission which may or may not be directly related with the questions posed within the Draft rule determination submission document:

1) Wholesale arbitrage benefits of electric water heating system control & scheduling
2) Completeness of smart meter data after collecting and reviewing around 20,000 household smart meters

List of authors

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Collaboration on Energy and Environmental Markets
UNSW Sydney

CEEM UNSW’s Submission to Draft Rule Determination for Unlocking Consumer Energy Resource (CER) Benefits Rule Change

Part 1: Wholesale arbitrage benefits of electric water heating system control & scheduling

This section presents information on the potential wholesale arbitrage benefits of coordination and control of electric water heating systems through smart meters. This information is presented to inform policy makers and regulators in ensuring equitable tariff design for fair distribution of benefits across different stakeholders.

Wholesale market prices are cheaper during the day due to increased rooftop solar generation. Thus, retailers and aggregators can have financial benefits by shifting night-time water heating (traditionally known as controlled load 1, CL1) into day-time heating. Figure 1 below provides a daily example where ~35% of daily hot water demand is shifted to day-time where wholesale market prices are cheaper. The hot water demand is shown across different control groups in different colours against the wholesale prices in $/MWh (RRP)

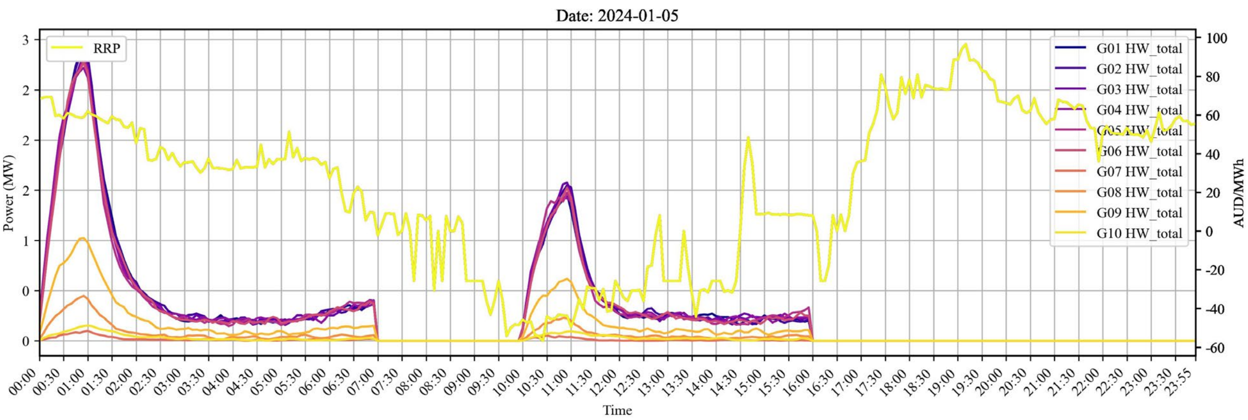

Figure 1 Example night-time vs. day time water heating for different hot water control groups accompanied by wholesale market prices (RRP)

This type of aggregate hot water load control and scheduling is the future of the controlled load for electric water systems that can help network operations by soaking up excess solar generation in the network, balancing supply & demand and reducing voltages and instances of curtailment. We will refer this type of control achieved with smart meters as CL3. In this type of control, in addition to the night-time heating window, water systems are energized during daytime as well. As a result, on average, the number of hours where electricity circuits are energized is higher than traditional night-time controlled load (CL1) window. Therefore, although both control load schemes provide sufficient hot water services for households, the average water temperature is higher in the new controlled load scheme with day-time heating (CL3), resulting in an increase in energy consumption. We estimate this increase to be between 4-10% based on household’s water system size and consumption patterns.

Figure 2 below shows the distribution of annual potential financial savings through wholesale arbitrage by changing from CL1 to CL3 analysed for ~500 households across different states. The plot also incorporates the daily hot water demand and bill increase mentioned above. In this scenario of CL3, around 40-50% of daily water heating is done during the day-time. As seen, retailers and aggregators can have substantial savings per household through shifting some portion of their electric water heating into the middle of the day.

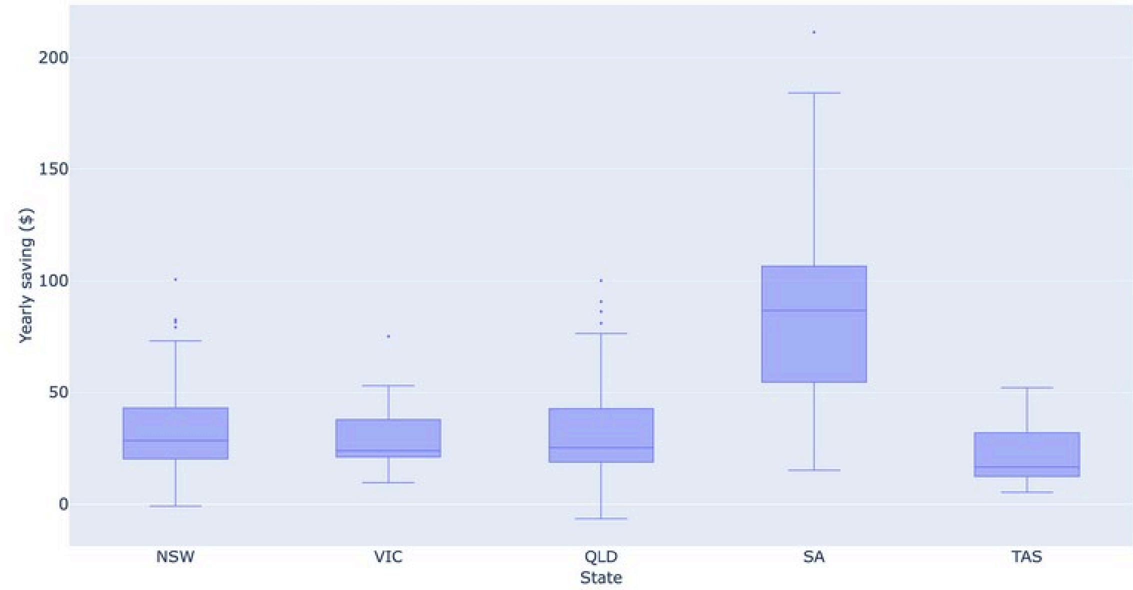

Figure 2 Distribution of yearly financial savings for different households by wholesale arbitrage through changing CL1 to CL3 across different states

It may also be possible that most proportion of daily water heating can be achieved only during solar-window. We will refer this type of control achieved by smart meters as CL4 and Figure 3 presents the distribution of annual potential financial savings through wholesale arbitrage when changing from CL1 to CL4 for the same fleet across different states. In this scenario of CL4, 90-100% of water heating is done during the day-time. It is seen that the savings per household become even more substantial for retailers/aggregators when majority of hot water demand is shifted into day-time

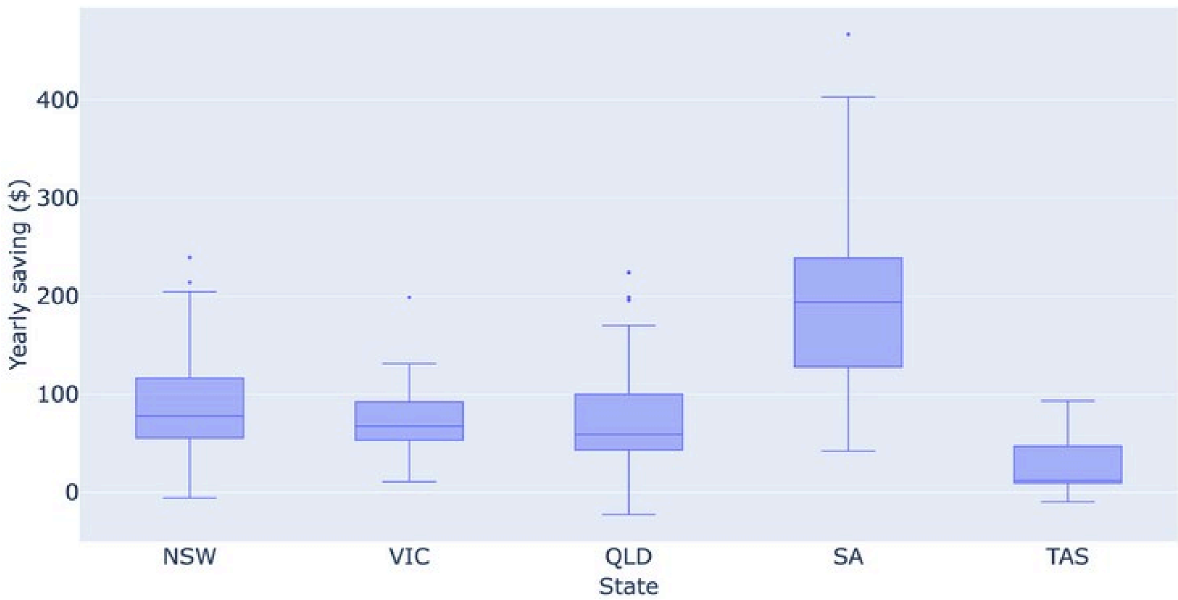

Figure 3 Distribution of yearly financial savings for different households by wholesale arbitrage through changing CL1 to CL4 across different states

According to our retailer market analysis through using EnergyMadeEasy website, there aren't any retailer tariffs that will truly pass some portion of these potential savings on-to customers. We believe it is fair that households should benefit from giving their hot water control away and if some portion of these savings are passed onto households, it will make new controlled load schemes such as CL3 and CL4 more attractive for households. As highlighted in this article, networks are losing their hot water control load fleet, and only through new tariff designs and incentives, we may be able to retain this valuable flexible demand asset for the future. There are a few additional points that we would like to mention, highlighting some of the assumptions and limitations of this analysis:

- This type of new controlled load schemes (i.e. CL3 and CL4) are relatively new and we appreciate it may take some time for retailers/aggregators to come up with new tariffs to pass these benefits onto households.
- There will be increase in costs for retailers/aggregators when controlling the electric water heating systems through smart meters (i.e. CL3 and CL4). These aren't considered in Figure 2 and Figure 3 which will make the retailer/aggregator benefits less than the presented results. These costs include payments to smart metering companies/metering coordinators for relevant smart meter API and interface services as well as increase in data and communication costs. We are working with our project partners on understanding these potential costs for retailers/aggregators and will incorporate them in our future results.
- In most parts of Australia (except VIC) it is expected that smart meter control will be done by retailers/aggregators except for network contingency and emergency events where DNSPs may have control over smart meters. It is likely that the biggest incentive for retailers/aggregators will be the financial saving potential through wholesale arbitrage as discussed above. However, this type of control of smart meters may not always coincide with objectives that supports network operational efficiency. Certain DNSPs may be happy to provide new incentives for retailers/aggregators for them to provide different network services. We will be undertaking further research to understand what these incentives may look like and how likely it may change the smart meter control done by retailers/aggregators.

Part 2: Completeness of smart meter data measurements from the field

Smart meters and smart meter data will play a key role in our transition to CER driven, low-emissions energy future. Smart meters can enable remote control (energize, de-energize) of demand-response appliances such as electric water heaters through their dedicated electrical circuit. Cloud communication enables this functionality and therefore, the data send/receive success rates and communication lags have importance. As most households are expected to own a smart meter by 2030, we will have very large energy data from the CER fleet and the quality and completeness of this data will be pivotal in analysing and understanding CER operations from the field.

As part of our ongoing research projects in the flexible demand and electric water heating scheduling & control, we have received smart meter data from two metering coordinators: Company A and Company B. Below we provide some information on the quality and completeness of the smart meter datasets that we have received.

When referring to data, 'market data' includes energy measurements from electric water heating systems that are measured separately on a dedicated electricity circuit and net-energy data from the general supply electricity circuit of the smart meter which includes the difference between household loads and solar generation (i.e., net import or export). 'Power quality data' includes instantaneous measurements of site voltage, active power and reactive power that are measured separately for each phase.

Smart meter data from Company A

Market data includes ~20,000 smart meter measurements between June 2023-April 2024 on a 5-minute time interval. This data includes samples of solar export and general supply household load (net import or export), and samples of controlled electric hot water load. According to our investigation, 99.7% are the actual and accurate data measurements, with the high quality and no data gaps. This level of high consistency and quality of data is promising.

Power quality data includes the instantaneous measurements of voltage, active power, and reactive power on a 5-minute time interval. Power quality data and specific channels are only recorded if they are requested by the metering coordinator customer (i.e. households, retailers, DNSPs etc.). As part of this project, DNSP and retailer have requested power quality data and as a result the dataset includes power quality data from all smart meters. According to our analysis, there are some data gaps for certain households for power quality data however, this is more likely due to data ingestion process during data transfer to UNSW and not related to any smart meter data interface or communication issues with. We are investigating this further.

Smart meter data from Company B

Market and power quality data include measurements from 2629 smart meters between April 2022 – Jan 2023. Figure 4 below shows the completeness of market data measurements in terms of the number of households for two different customer groups (CL and VP) segmented based on their retailers. As seen, there are periods with data-gaps from large number of households. This is expected to be due to potential interface or communication problems from smart meters and/or cloud data platform. Smart meters have the capability to physically store data on device up to a certain date, therefore these missing data may be retrieved. We are investigating on how practical this data retrieval will be and who would be the responsible party for this operation.

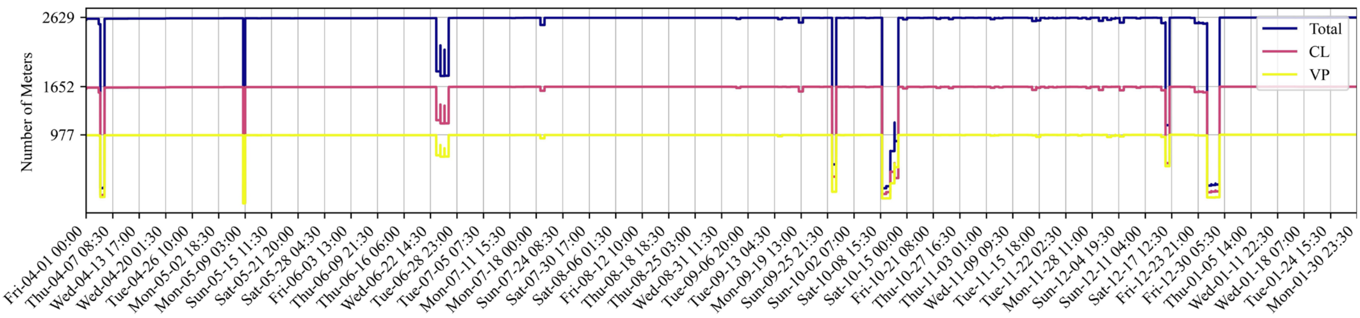

Figure 4 Market data completeness from smart meter Company B between Apr 2022-Jan 2023

Figure 5 below provides a more granular example for the completeness of market and voltage data during the period 09-01-2023 and 12-01-2023. In this Figure, depicting market data with a corresponding voltage measurement shows a significant proportion of voltage (power quality) data throughout different intervals of the day is missing. This type of low rate of data completeness and consistency makes data analysis difficult.

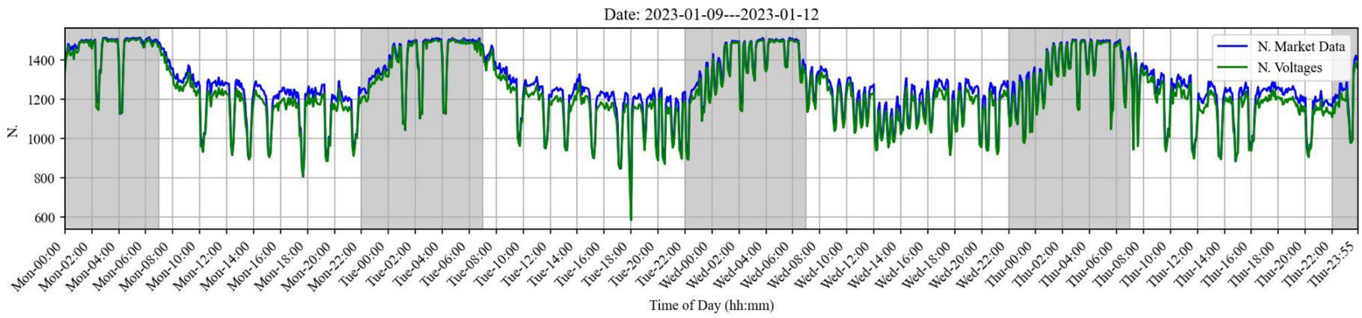

Figure 5 Data completeness for market data and voltages (power quality data)

We summarize a few other points related to the issues with the smart meter data from Company B:

- The sampling rate of market data varies over time and across different households between 30-minute, 15-minute, and 5-minute intervals. Around 33% of meters do not include any data with 5-minute sampling rate.
- Only 57% of smart meters have some power quality data and this data is not complete. The remainder of the meters don't have any power quality data. Power quality data and specific channels are only recorded if they are requested by the metering coordinator customer (i.e. households, retailers, DNSPs etc.). Therefore, it is not expected that all meters record power quality data. However, we are not entirely sure if the discrepancy in this dataset is solely due to customer requests or there are other meter interface/communication problems.
- The sampling rate which is used to record and report data for a certain interval varies among different meters and over time. We have seen different sampling rates such as 1, 2, 3, 5, 7, 8, 9, 10, 15 mins. Having consistent sampling rate is important when analysing and comparing the operations of CER data. We are not sure whether the varying sampling rate is intentional or due to technical issues.

Our conversations with various DNSPs and energy companies indicate that consistency amongst smart meter technology, circuit control capabilities, communication and data format is critical for efficient integration and control of CER. This is especially critical for the interoperability and coordination of different CER and demand response appliances by retailers, aggregators or DNSPs as inconsistencies in smart meters would create operational inefficiencies. We therefore would like to encourage more transparency and communication amongst different metering coordinators and smart meter technology providers for further discussions with the aim to achieve common standards and practices for all different types of smart meters to be installed. This process is critical considering the anticipated large uptake of smart meters by 2030 and trying to modify and fix things after the installations may be much more difficult.