NEM SETTLEMENT UNDER ZERO AND NEGATIVE REGIONAL DEMAND CONDITIONS

ISSUES PAPER

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SUMMARY

As the national electricity market (NEM) transforms, challenges continue to emerge. One of these is the impact of minimum demand conditions on market and system operations, with increasing distributed energy resources installed at 'load' connection points.

AEMO has identified that its settlement systems as currently configured will not operate to settle the NEM if there is zero or negative regional demand in a trading interval.

The National Electricity Rules (NER) require AEMO to allocate all or a portion of some non-energy costs to Market Customers, based on their share of energy at connection points in a given trading interval, or set of defined trading intervals. The cost recovery formulas in the NER use aggregate regional demand in the relevant trading interval(s) as the denominator for the allocation of these costs, and each Market Customer's share is based on the sum of the net metered energy amount for all its classified loads in the region for the same time period.

The NER and AEMO's settlement systems were not designed for a power system of two-way flows at significant scale, and did not envisage a scenario in which there may be no 'customer energy' from which to recover non-energy costs that are allocated to energy users. Mathematically, if aggregate regional demand is zero or a negative number, AEMO's settlement system will not be able to calculate the relevant non-energy cost recoveries. This will cause the entire automated settlement run to fail, as energy and reallocation transactions are part of the same integrated process for settlement purposes. Not only would the NEM not be settled, but there would be no information available to determine prudential requirements.

AEMO's current analysis suggests minimum demand could occur in South Australia from spring 2021[1]. The introduction of five-minute settlement from 1 October 2021 increases the likelihood of multiple trading intervals being affected by zero or negative regional demand.

In this paper, AEMO explains the issue and the market system changes that must be implemented prior to September 2021 to ensure the NEM can be settled if a zero or negative total regional demand occurs in a trading interval. The paper identifies options to substitute regional demand, for stakeholders to provide feedback on. Because any solution to settle the NEM will result in AEMO being non-compliant with the NER, AEMO intends to pursue a rule change with the AEMC to address the non-compliance associated with this temporary solution.

AEMO notes that the Integrating Energy Storage Systems in the NEM rule change proposal, currently under consultation by the AEMC, identifies the issues associated with recovering non-energy costs based on net energy flows. It proposes that for bi-directional facilities these amounts would be calculated using both produced and consumed energy flows. This may also provide a long-term path to address the challenges of allocating non-energy costs to market loads in low or negative demand conditions.

However, as system changes must be in place within nine months to ensure NEM settlements can continue, AEMO has considered how this can be achieved without eliminating any longer term options. This requires minimising the impact of these changes on market participants, at the lowest feasible cost and least risk to existing market change projects. Given that change windows are limited, stakeholders are invited to submit written feedback on the options or provide alternative suggestions to address the identified issue **by 5pm (AEST) 15 December 2020**.

[1] AEMO, Technical Report, Minimum operational demand thresholds in South Australia - May 2020.

CONTENTS

1. STAKEHOLDER CONSULTATION PROCESS

AEMO's indicative timeline for this consultation is outlined below.

Deliverable	Indicative date
Issues Paper published	26 November 2020
Stakeholder meeting	30 November 2020
Submissions due on Issues Paper	15 December 2020
AEMO notifies NEM Settlement Managers of market system option for implementation	By mid-Jan 2021
AEMO submits rule change to AEMC to address short-term non-compliance	By end of Jan 2021

2. BACKGROUND

2.1 NER requirements

Under Chapter 3 of the NER, one of AEMO's key responsibilities is to settle NEM transactions for traded energy and market ancillary services, and to make and recover payments for certain non-market services or regulated compensation amounts for specified events.

For market settlement, and to calculate and non-energy cost recovery amounts (e.g. most ancillary service payments, compensation for directions and market suspension), AEMO uses net metering data ('N' datastreams) for each connection point assigned to a market participant in that trading interval. The net metering data provides an energy value for settlement, fees and recovery calculations for all market participants.

AEMO has been using net metering data for settlements since NEM start, reflected in the NER by the term adjusted gross energy (AGE) [2]. This represents the net flow of electricity at the participant's connection points in the relevant category for recovery (either load or generation). Where a connection point both consumes and sends out energy, the AGE is calculated on the net energy either supplied to the network (expressed as a positive quantity) or consumed at the connection point (a negative quantity), over the whole trading interval.

The NER require AEMO to allocate non-energy costs to market participants based on the classification of their connection points as load, generation, or small generation. Market Customer allocations are based on the AGE where the net flow is in the traditional direction for a load, i.e. away from the transmission network, as a share of the aggregate total regional demand in a trading interval or other specified period. Table 1 shows the types of non-energy costs to be recovered (in whole or part) from Market Customers based on their AGE.

Table 1 Non-energy costs recovered from Market Customers under the NER

Payment type	Cost recovery based on aggregate regional demand	NER clause
Market ancillary services		
FCAS – contingency lower	Trading interval	3.15.6A(g)
FCAS – regulation	Trading interval	3.15.6A(i)(2)
Non-market ancillary services		
Network support control ancillary services (NSCAS)	Trading interval	3.15.6A(c8),(c9)
System restart ancillary services (SRAS)	Trading interval	3.15.6A(e)
Interventions		
Compensation for direction – energy, FCAS or other services	Trading interval(s) when direction in effect	3.15.8(b),(f),(g)
Reliability and Emergency Reserve Trader (RERT) payments	Split between:	3.15.9(e)

[2] For load, also referred to as 'customer energy' in clause 3.15.6A and 3.15.8.

Payment type	Cost recovery based on aggregate regional demand	NER clause
Affected participant compensation for RERT	• RERT usage charges and compensation payments – trading intervals when RERT was used. • RERT availability/other charges – billing week when paid.	
Compensation - market suspension – energy and FCAS	Trading interval(s) within a market suspension pricing period	3.15.8A(b),(f)
Other events		
Administered price cap or floor price compensation	Trading intervals in the eligibility period for compensation claims under clause 3.14.6	3.15.10(b)

2.2 Changes in operational demand

AEMO has used operational demand to analyse zero or negative demand because it best reflects the consumed energy from the grid within a NEM region. In the NEM, the likelihood of zero or negative demand increases as more energy generation capability is installed at customer connection points, in particular distributed photovoltaic (DPV) generating systems. While there are already high amounts of DPV across the NEM, South Australia has recorded the lowest minimum demand of all NEM regions, and AEMO's modelling shows it will likely be the first region where a zero or negative demand occurs.

On 11 October 2020, South Australia recorded a new low operational demand of 300MW, equivalent to 150MWh of consumed energy in a trading interval, which is 158MW lower than the minimum recorded in 2019[3]. Based on the latest data from the Clean Energy Regulator[4], approximately 1,600MW of DPV had been installed in South Australia by September 2020, which is an increase of approximately 350MW on the installed capacity 12 months earlier.

Minimum demand in South Australia typically occurs when the underlying demand is low and DPV generation is high, such as during the middle of the day on weekends or public holidays with clear skies and mild temperatures. If these conditions are replicated on a weekend or a public holiday, AEMO estimates that total regional demand could be less than zero in a trading interval by spring 2021.[5]

AEMO's 2020 Electricity Statement of Opportunities (ESOO) identified that South Australia is likely to experience periods of negative demand in 2024. However, the record low South Australian operational demand in October 2020 is already lower than the POE90[6] minimum for the ESOO's Central Scenario, indicating that the High DER Central Downside scenario better reflects what occurred. Given this, AEMO has explored further sensitivities that consider the current uptake of DPV, which is higher than the values used in the ESOO scenarios. These sensitivities indicate that zero or negative operational demand could occur in South Australia from September 2021.

2.3 AEMC consultation on Integrating energy storage systems in the NEM rule change

In August 2020, the Australian Energy Market Commission (AEMC) commenced consultation on AEMO's Integrating Energy Storage Systems into the NEM rule change proposal (ESS proposal), submitted in August 2019. The ESS proposal provides for non-energy costs to be recovered from the proposed new Bi-

[3] AEMO, Operational management of low demand in South Australia – 22 October 2020
[4] CER, Postcode data for small-scale installations – November 2020
[5] AEMO, Technical Report, Minimum operational demand thresholds in South Australia - May 2020.
[6] 90% probability of exceedance

directional Resource Provider category and Market Small Generation Aggregators based on both their consumed and sent out energy (as appropriate) where they contribute to the need for, or benefit from the provision of, the associated services.

AEMO's ESS proposal foreshadowed the need to consider whether a similar approach should also be adopted to recover these amounts from Market Customers and Market Generators, as the current approach fails to capture true production or consumption. AEMO noted that the ability to recover non-energy costs based on the gross energy flow in each direction would be facilitated by the provision of separate metering datastreams ('E' and 'B'), which will be required after the introduction of global settlement. This is scheduled to commence from May 2022.

The AEMC is considering appropriate future non-energy cost recovery arrangements and AEMO will continue to engage with the AEMC on the issues raised in this paper and ESS proposal, to explore opportunities to address them more comprehensively in the longer term.

3. URGENT ISSUE

NER non-energy cost recovery formulas include numerators and denominators based on AGE for relevant trading intervals, calculated using net metering data. As total regional energy for Market Customers reduces, primarily as a result of continued DPV growth, this reduces the amount of these costs that can be recovered from Market Customers. However, the NER formulas cannot work at all when the aggregate AGE of all Market Customers is zero or negative for one or more trading intervals. In a region. AEMO has projected that this could potentially occur in South Australia from September 2021.

The risk of a zero or negative aggregate AGE denominator increases further with the implementation of five-minute settlement from October 2021, as the calculation will use aggregate AGE in intervals from 5-minutes, rather than over at least 30 minutes.

If zero or negative regional demand occurs in a region during a trading interval in which non-energy costs are to be recovered from Market Customers in a billing period, AEMO has no means of recovering those costs. If the recovery amount cannot be allocated, the calculation will fail and AEMO's automated settlement runs will stop working. Because settlement is an integrated process, this will impact settlement of all transactions, including energy and reallocations, as well as prudential assessment processes that rely on settlement runs. While energy and reallocation transactions could be calculated using manual processes, this would introduce delay, error and significant cost. Non-energy transactions, however, could not be completed because the NER provide no basis to determine recovery amounts.

AEMO considers a low cost and low impact solution must be implemented prior to September 2021 because the consequences of AEMO's settlement systems not working will have a significant negative impact on all market participants.

4. PROPOSED SOLUTION

4.1 Short-term solution to be implemented by September 2021

AEMO considers that doing nothing to address the issue is not a reasonable approach, otherwise the settlement systems will not settle the NEM if zero or negative aggregate regional demand occurs in any trading interval.

AEMO proposes to automate NEM settlements system to substitute defined reference AGE values where less than 1 MWh regional consumed energy is recorded in a trading interval or other relevant period used for recovery calculations. Table 2 sets out a number of possible substitution options. The estimated cost for AEMO to implement any of the options is not expected to exceed $100,000[7] if the design can be incorporated in conjunction with other settlement system changes already programmed to commence in December 2021. AEMO currently expects that these could be applied, tested and implemented by September 2021.

Table 2 Options for substitution of AGE

Option	Reference AGE values for substitution	Comments
1 (AEMO's preferred option)	• Market Customer's AGE with its average AGE for all relevant connection points in the region over the previous calendar year • Aggregate regional demand (represented by AAGE) with the sum of the substituted Market Customer average AGEs in the region over the previous calendar year	• AEMO considers this to be the most equitable approach because the cost would be spread over a greater number of market participants and trading intervals, which would be averaged out • The data is more accurate than option 2 because it uses actual historical metering data for the Market Customer's own sites. • If a Market Customer was inactive or not registered in the previous calendar year, then they are exempt from recovery • Consistent methodology with how AEMO calculates Market Generators' fees in the market
2	• Use a rolling 365-day period average energy consumption which is calculated dynamically every time a factor is required	• Data accuracy is a concern because preliminary metering data would be used for some days • If a Market Customer was registered closer to the zero or negative demand event occurring, their number may be distorted • All active Market Customers would share the cost
3	• Use the last interval which has a total region consumption larger than 1MWh	• Disadvantages Market Customers who were more active than usual before the zero or negative demand event occurred • Only the active participants at the time of the non-energy cost recovery event would share the cost
4	• Divide the non-energy cost to be recovered by the number of active Market Customers and recover equally from all	• Disadvantages smaller Market Customers • All active Market Customers would share the cost

AEMO acknowledges that in any given set of circumstances, the need to substitute AGE values to make these calculations work will create winners and losers. As doing nothing is not an option, to some extent this seems inevitable. AEMO currently considers option 1 to be the most equitable of the options but is

[7] The change is limited to FCAS, NMAS and Direction market customer recoveries only considering the likelihood of these three services or interventions being required during a low demand / high DPV generation scenario which may cause zero or negative demand in a region during a trading interval.

keen to hear market participant views. In providing feedback on the options, please keep in mind that this substitution will only change Market Customers' trading amounts in respect of non-energy cost recovery amounts, and then only where the net regional demand is less than 1 MWh for the whole of the relevant recovery calculation period. Energy and reallocation transactions would continue to be settled as normal.

Under each option, while the NEM will be settled if a zero or negative demand trading interval occurs, AEMO would not be calculating non-energy cost recovery in accordance with the NER. Given this, AEMO intends to submit a rule change to address this non-compliance and the selected option to the AEMC by late January 2021.

AEMO would appreciate stakeholders providing feedback to AEMO on the following questions via written submissions or email AEMO.Settlements@aemo.com.au by 5pm 15 December 2020.

Questions

- Do you agree with AEMO's proposed Option 1 short term solution?
- Considering the options identified, are there other options that may be more appropriate? If so, please describe the option and any risks and benefits?