

## Appendix B: Review of international experience

1. We have looked at other jurisdictions to inform our options for a potential standby ancillary service and options to incentivise demand response.

### ERCOT (Electricity Reliability Council of Texas) contingency and emergency event services

2. ERCOT's out-of-market interventions to provide standby reserves have increased costs to consumers both directly (through the procurement of the services) and indirectly (through an increase in energy prices due to inducing artificial scarcity).
3. Since 2007, ERCOT has procured the Emergency Response Service (ERS) to decrease the likelihood of system-wide load shedding. This out-of-market service is open to both qualified loads and generators and is procured four times a year. Participants are required to provide an agreed-upon quantity of megawatts within 10 to 30 minutes to help prevent or alleviate an actual or anticipated Energy Emergency Alert (EEA) event.
4. During Winter Storm Uri in February 2021, the majority of the ERS fleet was deployed and exhausted within 12 hours of deployment. The overall ERS fleet generally met or exceeded the aggregate obligation for the duration of the event, although ERS loads generally over-performed while ERS generators generally under-performed.<sup>1</sup>
5. After the event, two key changes were implemented. Firstly, ERCOT can deploy ERS sooner rather than holding back service until the organisation has called an EEA when Physical Responsive Capability falls below 3,000MW and is not expected to rise above that threshold within 30 minutes. This scenario occurred on July 13, 2022, and ERCOT deployed as much as 1,011MW of ERS for approximately 3.25 hours.<sup>2</sup>
6. Secondly, the ERS budget was increased from US\$50 million to US\$75 million in 2022 to allow ERCOT the flexibility to procure ERS for longer-duration events with a contract term from individual ERS resources to better address seasonal needs and make other administrative changes to the programme.<sup>3</sup>
7. The ERCOT Contingency Reserve Service (ECRS) was introduced in June 2023 to support grid reliability and mitigate real-time operational issues to keep supply and demand balanced. It was intended to provide additional insurance against the significant blackouts suffered in the Texas electricity system during Winter Storm Uri.

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<sup>1</sup> Potomac Economics. *2021 State of the market report for the ERCOT electricity markets*. May 2022. Available at: <https://www.potomaceconomics.com/wp-content/uploads/2022/05/2021-State-of-the-Market-Report.pdf>

<sup>2</sup> Potomac Economics. *2022 State of the market report for the ERCOT electricity markets*. May 2023. Available at: [https://www.potomaceconomics.com/wp-content/uploads/2023/05/2022-State-of-the-Market-Report\\_Final\\_060623.pdf](https://www.potomaceconomics.com/wp-content/uploads/2023/05/2022-State-of-the-Market-Report_Final_060623.pdf)

<sup>3</sup> The fund has been US\$50 million since 2012 and its average price was lower than the average price paid for both responsive reserves and non-spinning reserves in 2021 (before the price increase).

8. However, the ECRS procurement and deployment criteria have reduced supply and significantly raised demand for the ancillary service. At times of potential shortage, generators are paid to withhold a proportion of their capacity from the wholesale market, and flexibility resources (demand response) are paid to reduce consumption. The scheme is designed to allow up to 50% of the procured reserve to be supplied via demand response.
9. This happened on 20 June 2023, when ECRS was first used and resulted in the market schedules reflecting a shortfall of generation. This shortfall was due to the ECRS capacity being removed from the market. Consequently, wholesale prices leapt to their price ceiling of US\$5000/MWh while generators also received significant payments for the volume that they had withheld and were not generating with.
10. Recent analysis from the Texan Independent Market Monitor shows that the ECRS likely raised the real-time market energy cost by around US\$8 billion since its introduction in June 2023. Additional costs continue to accumulate, notably in early September.<sup>4</sup>

### **Australian Energy Market Commission (AEMC) standby reserve products and demand side participation schemes**

11. Recent additions to the Australian National Electricity Market (NEM) demonstrate the high costs associated with out-of-market schemes and the limited impact on participation of paid demand response schemes. In recent consultation, the AEMC has decided to focus on incremental improvements to develop and publish more information to the market and to focus on a proposal to facilitate the uptake of demand response.

### **Standby Reserves**

12. The Australian Energy Market Operator (AEMO) may intervene with directions, instructions, and/or Reliability, Emergency Reserve Trader (RERT) contracts to procure emergency reserve when a shortfall in supply or reserves is forecast.
13. Directions are issued to registered participants (generators and scheduled loads) to operate at a specified output or consumption level and are dispatched through normal market processes. Generators are compensated for responding to the direction.
14. Instructions are sent to Network Service Providers (NSPs) to load-shed customers to maintain the integrity of the power system. These customers are then compensated.
15. Under the RERT framework, AEMO secures contracts for emergency out-of-market reserves from providers, which can be activated (or pre-activated) upon request. These providers are grouped into short-notice, medium-notice, and long-notice providers.

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<sup>4</sup> ERCOT IMM. *IMM Concerns with the AS Methodology and Recommended Improvements*. September 2023, 22. Available at: [Agreement To Change Market Rules \(ercot.com\)](https://ercot.com/Agreement-To-Change-Market-Rules)

16. The AEMC states that ‘interventions in or actions taken out of the market can be costly’ (p. 64).<sup>5</sup> The RERT has only been activated a handful of times since 2021 but the cost per MWh has increased markedly from AU\$10,676.02 per MWh in May 2021<sup>6</sup>, to AU\$ 50,334.32 per MWh in 2023<sup>7</sup>. The total cost associated with the RERT was AU\$0.66 million in 2020/21, AU\$130.6 million in 2021/22, AU\$2.06 million in 2022/23. These costs include the cost of compensating providers for their availability, pre-activation, activation and intervention costs. Consumers bear the full cost of this service through retailer charging.

### Market integrated standby ancillary service

17. In 2020, AEMC consulted on the introduction of an operating reserve market<sup>8</sup> to help respond to unexpected changes in supply and demand. In August 2023 the AEMC proposed not to progress this option<sup>9</sup> because it would not offer any performance improvements relative to the current arrangements while introducing additional costs for the market. A final decision on this proposal is expected on 21 December 2023.
18. AEMC modelling shows that ‘a fleet that evolves to firm renewables with very flexible storage technologies:
- a. will likely be well-placed to manage net demand uncertainty in operational timeframes (five minutes to an hour) so long as participants have sufficient storage to account for such uncertainties
  - b. should be reasonably well-placed to manage net demand needs over the course of a full day, so long as sufficient depth of charge and other resources are available to manage the potential for longer duration events to occur.’<sup>10</sup>
19. The AEMC is instead seeking stakeholder input on two additional incremental improvements:
- a. develop and publish more information to the market and
  - b. procure frequency control ancillary services at a regional level.

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<sup>5</sup> AEMC. *National electricity amendment (operating reserve market directions paper) rule*. August 2023, 3. Available at: [https://www.aemc.gov.au/sites/default/files/2023-08/directions\\_paper\\_2023\\_0.pdf](https://www.aemc.gov.au/sites/default/files/2023-08/directions_paper_2023_0.pdf)

<sup>6</sup> AEMO. *Reliability and Emergency Reserve Trader (RERT) Quarterly Report Q2 2021*. August 2021. Available at: [https://aemo.com.au/-/media/files/electricity/nem/emergency\\_management/rert/2021/rert-quarterly-report-q2-2021.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/2021/rert-quarterly-report-q2-2021.pdf?la=en)

<sup>7</sup> AEMO. *Reliability and Emergency Reserve Trader (RERT) End of Financial Year 2022-23 Report*. August 2023. Available at: [https://aemo.com.au/-/media/files/electricity/nem/emergency\\_management/rert/2023/rert-end-of-financial-year-report-2022-23.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/2023/rert-end-of-financial-year-report-2022-23.pdf?la=en)

<sup>8</sup> AEMO defines ‘operating reserves’ as the capability to respond to large continuing changes in energy requirements, with minimum levels required for the system operator to maintain system security and reliability. Such reserves are currently provided ‘in-market’ informed by the collective decisions of many participants in aggregate. These are not explicitly priced, but implicitly.

<sup>9</sup> AEMC. *Enhancing reserve information (formerly Operating reserves)*. June 2023. Available at: <https://www.aemc.gov.au/rule-changes/enhancing-reserve-information-formerly-operating-reserves>

<sup>10</sup> AEMC. *National Electricity Amendment (Operating Reserve Market Directions Paper) Rule*. August 2023. Available at: [https://www.aemc.gov.au/sites/default/files/2023-08/directions\\_paper\\_2023\\_0.pdf](https://www.aemc.gov.au/sites/default/files/2023-08/directions_paper_2023_0.pdf)

20. These improvements provide the opportunity to observe the future fleet's response to changes in market signals, before introducing any complex changes.

### **Demand response initiatives**

21. In 2021, AEMO introduced Wholesale Demand Response (WDR). This mechanism provides a payment to demand side participants for responding to a dispatch instruction.<sup>11</sup>
22. The WDR provider receives a payment for the quantity of load they have curtailed relative to a baseline consumption calculated by AEMO at the cleared wholesale price. These payments are charged to the retailer. The WDR provider must also pay a compensation payment to the retailers of the load they have reduced at a regulated tariff rate.
23. To date, only one participant has registered for the WDR, providing up to 65.3MW of demand response at any given time. This compares to a NEM winter 2022 demand peak of 32,553MW.<sup>12</sup>
24. Additionally, in August 2023, AEMC opened consultation on integrating price responsive resources into the electricity market.<sup>13</sup> The proposal would implement a scheme much like the dispatch notification scheme recently implemented in New Zealand.

### **UK demand flexibility service (DFS)**

25. Following the impact of the Russian invasion of Ukraine on European gas supplies, the National Grid electricity system operator (ESO) forecast significant issues meeting winter peak demand in 2022/23. In response, National Grid implemented a paid demand flexibility service (DFS).
26. The service ran from November 2022 to March 2023, with 20 test events and two live events taking place. DFS will continue as an enhanced action for winter 2023/24. This will allow ESO to deliver both test events and, where necessary, live events.
27. Electricity retailers can register as DFS providers to receive a guaranteed minimum payment of GBP3,000/MWh of response per event. It is then up to the retailers to decide how much of the payment to pass on to consumers.
28. Half the tests that ESO will run in 2023/24 will use the guaranteed GBP3,000/MWh payment. The second half will become competitive, subject to the total volumes participating in the service.<sup>14</sup>

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<sup>11</sup> AEMO. *Wholesale Demand Response: High-level Design*. June 2020. Available at: <https://www.aemo.com.au/-/media/files/initiatives/submissions/2020/wdrm/wdrm-high-level-design-june-2020.pdf>

<sup>12</sup> Australian Energy Regulator. *Seasonal peak demand – NEM*. Available at: <https://www.aer.gov.au/wholesale-markets/wholesale-statistics/seasonal-peak-demand-nem>

<sup>13</sup> AEMC. *National electricity amendment (integrating price-responsive resources into the NEM) rule*. August 2023, 3. Available at: <https://www.aemc.gov.au/sites/default/files/2023-08/ERC0352%20-%20Integrating%20price-responsive%20resources%20into%20the%20NEM%20-%20Consultation%20paper.pdf>

<sup>14</sup> ESO. *Demand Flexibility Service (DFS)*. Available at: <https://www.nationalgrideso.com/industry-information/balancing-services/demand-flexibility-service-dfs>

29. The response quantity is assessed against a baseline consumption estimate. This baseline is calculated using an average consumption of a number of working or non-working days over the preceding 60 days. The system operator issues a notice to participants that a response is required, and participants signal to their customers to reduce their demand.
30. While the DFS provided incentive for an urgent and significant response to an unforeseen supply event, New Zealand is not currently facing a supply shortfall or comparable scale or immediacy. The cost of implementing any solution should be lower than the next cheapest generation investment.
31. Ofgem, the energy regulator for Great Britain, is also seeking input on how to best attract domestic energy users to becoming flexible energy consumers able to reap the benefits of a net zero energy system.
32. This scheme was successful and saved over 3,300MWh of electricity during peak times and consumer feedback was positive. The payments to flexibility providers were significant, GBP11.1 million.<sup>15</sup> This could be justified based on expected severe shortfalls in supply, however, the scale of New Zealand's winter supply issues may not justify this cost.

### **Singapore demand side management sandbox**

33. Singapore's experiment with demand response and interruptible load shows the importance of getting the settings right. Revenue uncertainty, onerous requirements and harsh penalties can provide high barriers to entry and disincentivise participation.
34. In October 2022, the Energy Market Authority (EMA) announced a new regulatory sandbox to support participation in demand response programmes by streamlining procedures, reducing penalties and providing clearer activation timeframes. The temporary sandbox scheme was launched on 1 January 2023 and will run until 31 December 2024. It comprises two existing programmes: Demand Response Programme and Interruptible Load Programme.
35. The Demand Response (DR) programme was introduced in 2016 to enable eligible business consumers to participate directly in the wholesale market. Under the programme, they can cut their electricity demand voluntarily when wholesale electricity prices are high or when system reliability is low. In exchange, they receive a share in the system-wide benefits.
36. DR providers receive one-third of the savings arising from the reduction in electricity prices as incentive payments. This ensures that most of the benefits are accrued to the broader consumer base, while providing a fair return to DR participants. The incentive payment will be up to S\$4,500/MWh, which is the existing ceiling for wholesale electricity prices.<sup>16</sup>

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<sup>15</sup> ESO. *Demand Flexibility Service Winter 2022/23 review*. August 2023. Available at: <https://www.nationalgrideso.com/document/287006/download>

<sup>16</sup> Energy Market Authority. *Factsheet demand response interruptible load*. Available at: [https://www.ema.gov.sg/content/dam/corporate/our-energy-story/energy-demand/factsheet-demand-response-interruptible-load\\_20221103.pdf](https://www.ema.gov.sg/content/dam/corporate/our-energy-story/energy-demand/factsheet-demand-response-interruptible-load_20221103.pdf)

37. In 2020, the EMA consulted on the DR programme to encourage its uptake.<sup>17</sup> In their consultation they note that ‘participation in the DR programme had been low since its inception, with only 4 instances of dispatch in total (2 dispatches in 2018, 2 dispatches in 2020). Energy DR capacity registered was also only 0.05% of peak load’ (p. 4).
38. At the launch of the sandbox there were three DR providers and four DR facilities in the market. In July the registered capacity of DR facilities increased by around 37%. However, there do not appear to be any new providers participating.
39. Participants in the Interruptible Load (IL) Programme are paid to be on standby to reduce their committed electrical load during conditions of tight power generation supply. Consumers can offer to reduce their electricity consumption through their electricity retailer or a Demand Response Aggregator. This programme was established in 2004 to improve the power system stability during times of supply disruptions.
40. As at 31 December 2022, there was no registered capacity for IL for primary reserve. In 2022, however, there was a slight increase in capacity and frequency use of IL registered capacity for contingency reserves. It appears that no new participants have joined the IL programme since the sandbox trial was established.
41. During the sandbox trial, participants continue to be subjected to the existing compliance thresholds and penalty amounts. If the participant assesses that it should not have been penalised or the penalty amount should have been lower under the sandbox scheme, it can submit the penalty refunds request to the EMA and Energy Market Company. From January to July 2023, they have given back around S\$194,000.<sup>18</sup>

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<sup>17</sup> Energy Market Authority. *Review of the demand response programme in the national electricity market of Singapore consultation paper*. Available at: <https://www.ema.gov.sg/partnerships/consultations/2020/review-of-the-demand-response-programme-in-the-national-electricity-market-of-singapore>

<sup>18</sup> Energy Market Company. *Demand side management sandbox*. Available at: <https://www.home.emcsg.com/about-emc/media-news-announcements/media-news/Demand-Side-Management-Sandbox#:~:text=The%20DSM%20sandbox%20enhances%20the,when%20there%20is%20tight%20supply>.

