Attachment 4

Inertia network services

Revised Revenue Proposal 2023-24 to 2027-28

2 December 2022

ElectraNet

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Contents

1. Introduction

Inertia is a critical requirement for a secure power system. A minimum level of inertia, in conjunction with frequency control services, is needed for maintaining the power system frequency within limits, both during normal system operation and after disturbance events. Synchronous generators have historically been the predominant source of inertia in the National Electricity Market (NEM).

Inertia is transferable across interconnectors. With the Heywood interconnector intact, there is sufficient inertia available to South Australia. However, when South Australia is separated from the rest of the NEM inertia must be provided from within the State. The risk of separation will reduce substantially when Project EnergyConnect is expected to be sufficiently operational in mid-2025.

The Rules require that AEMO must periodically determine and publish the inertia requirements for inertia subnetworks, such as the South Australian region.[1] As the Inertia Service Provider in South Australia, ElectraNet must use its reasonable endeavours to provide the level of inertia AEMO determines is necessary by the date it has specified, either itself or by contract.[2]

If AEMO assesses that there is, or is likely to be, an inertia shortfall in South Australia, it must publish and give ElectraNet a notice of that assessment.[3] AEMO did this in August 2020[4] declaring a shortfall equivalent to an amount of Fast Frequency Response (FFR) raise of 115 MW in 2020-21 and 200 MW of FFR raise in 2021-22. This shortfall was then extended in December 2020[5] to 2022-23. This current shortfall is being addressed through inertia service contracts put in place by ElectraNet for 2022-23.

In December 2021[6], AEMO declared a new inertia shortfall equivalent to 360 MW of FFR raise from 1 July 2023 until the expected completion of Project EnergyConnect. This shortfall is the subject of the analysis presented herein.

In its May 2022 update AEMO confirmed that:

> The previously declared inertia shortfalls in South Australia remain, consistent with the original 2021 System Security Reports. This includes a shortfall out to 30 June 2022, and a shortfall from 1 July 2023 until the completion of inter-network testing of Project EnergyConnect, against the secure operating level of inertia in the South Australia region. The shortfall out until completion of Project EnergyConnect is for approximately 28,800 MWs, although it is likely to be more practicable to fill this shortfall with inertia support activities such as fast frequency response (FFR) equivalent to 360 MW[7].

Therefore, given that ElectraNet is the Inertia Service Provider for South Australia, ElectraNet is required, pursuant to clause 5.20.5(a)(1) to provide FFR in the amount of 360MW (or equivalent) until 30 June 2025, by which time Project EnergyConnect is expected to be sufficiently operational to remove this service requirement.

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1 Clause 5.20B.2(a) and (c).

2 Clause 5.20B.4(a).

3 Clause 5.20B.3(c).

4 AEMO, Notice of South Australia Inertia Requirements and Shortfall, 27 August 2020.

5 AEMO, 2020 System Strength and Inertia Report, 17 December 2020.

6 AEMO, 2021 System Security Reports, 17 December 2021.

7 AEMO, Update to 2021 System Security Reports, 11 May 2022, p36.

Accordingly, ElectraNet has engaged extensively with market participants to secure the required inertia network services for 2023-24 and 2024-25 in accordance with AEMO's declaration and the relevant requirements of the Rules.

It is now seeking to put in place the relevant arrangements to fund the provision of these services in accordance with the Rules via a network support payment allowance.

The remainder of this Attachment is structured as follows:

- Chapter 2 describes the relevant regulatory requirements relating to the procurement and funding of inertia network services;
- Chapter 3 addresses the specific requirements of the Rules in relation to the procurement of inertia network services;
- Chapter 4 sets out the approach applied to calculate the likely cost of providing inertia network services; and
- Chapter 5 summarises why our inertia network service costs are prudent and efficient, supporting the approval of the proposed network support payment allowance to fund these services.

Further detailed information on the evaluation of tenders is provided in the Appendix to this document. Due to the commercially sensitive nature of this information, this Appendix is provided on a confidential basis.

2. Applicable Regulatory Requirements

ElectraNet's obligations for the procurement of inertia network services in response to a shortfall declared by AEMO are contained in clause 5.20B.4 of the Rules.

The regulatory requirements for the AER's approval of a network support pass through are contained in clause 6A.7.2 of the Rules.

We discuss each of these elements in turn as relevant to the establishment of a network support payment allowance to fund the provision of these services in the coming regulatory period.

2.1 Procurement of Inertia Network Services

In response to a notice issued by AEMO to address an inertia shortfall declared in South Australia, ElectraNet as the responsible Inertia Service Provider under clause 5.20B.4 must:

- use reasonable endeavours to make the inertia network services available by the date specified in AEMO's notice;
- make a range and level of inertia network services available to address the inertia shortfall such that the relevant inertia network services when enabled are continuously available, taking into account planned outages and the risk of unplanned outages;
- ensure relevant inertia network services when enabled are qualifying services;
- maintain the availability of those inertia network services until the obligation ceases as specified by AEMO;
- make available the least cost option or combination of options that will satisfy its obligation within the time referred to in AEMO's notice, for so long as the obligation to make the inertia network services available continues;
- prepare and publish relevant information to enable the development of non-network options;
- provide information in its Transmission Annual Planning Report about activities undertaken to satisfy its obligation to make inertia network services available, any inertia support activities undertaken, and any proposed network investment for these purposes; and
- meet relevant information and approval requirements under clauses 5.20B.5 and 5.20B.6.

We provide in this Attachment the relevant information to demonstrate these requirements have been met.

2.2 Network Support Allowance

The Rules allow for the AER to approve a network support payment allowance in a revenue determination that includes the costs of providing inertia network services. They also provide for ElectraNet to recover (or refund) any differences between that network support payment allowance and the actual cost incurred in providing inertia network services via a network support pass through following each regulatory year under clause 6A.7.2.

These arrangements operate as follows:

- only actual service payments incurred will be paid to inertia network service providers by ElectraNet;
- actual service payments incurred will be determined by the number and duration of events requiring the service to be dispatched by AEMO during each year; and
- any surplus or shortfall incurred by ElectraNet will subsequently be refunded to or recovered from customers, respectively.

Therefore, ElectraNet is seeking to put in place a network support payment allowance for the relevant years of the coming regulatory period to fund the provision of these services. In due course, ElectraNet anticipates making network support pass through applications to 'true up' any difference between the amount provided as a network support payment allowance and the actual cost of providing inertia network services in each relevant year.

Among the relevant factors the AER will be required to take into account in assessing ElectraNet's future network support pass through applications is the efficiency of the decisions and actions ElectraNet has made in procuring contracts to provide the inertia network services in question, including whether we failed to take any action that could reasonably be taken to reduce the magnitude of the positive network support event.

It is relevant to consider these matters now in relation to the network support payment allowance against which future 'true ups' will be made. We provide this information in the following sections of this Attachment.

The AER's procedural guideline for preparing network support pass through applications establishes several specific information requirements. Relevant to new network support arrangements to be reviewed by the AER as part of a revenue determination process these include:

- details of the provider(s) of the network support services (including name, relationship to TNSP, nature of services to be provided, length of contract); and
- the consultation processes undertaken by the TNSP and processes undertaken for awarding the contract to the network support provider.

We provide this information in the following sections of this Attachment.

3. Procuring inertia network services for 2023-24 and 2024-25

This section provides the information relevant to the requirements specified in clause 5.20B.4 and 6A.7.2 of the Rules in relation to the procurement and funding of inertia network services.

3.1 Inertia network services procurement

In 2021 we undertook a comprehensive exercise to engage with market participants to secure the services necessary to meet the declared inertia shortfall of 200 MW of FFR in 2022-23 at the lowest cost to electricity customers. That process consisted of two rounds of competitive tenders, with the second round adopting a different proposed price structure to drive a better price outcome for customers.

The AER reviewed these arrangements and determined that the outcomes of the tendering and contract process for the current year are likely to result in efficient market based prices for the required services.[8]

We have conducted an equivalent process in 2022 in response to the inertia shortfall of 360 MW of FFR declared in December 2021. The following outlines this process and outcomes:

- ElectraNet undertook a competitive tender process in September 2022 seeking 360 MW of raise FFR from 1 July 2023.
- This included the relevant technical requirements to be met by qualifying service providers as agreed with AEMO, including the requirements to be met by non-network options;
- ElectraNet sought expressions of interest from the potential FFR providers who had been approached the year before, noting that some expressed their lack of ability to respond. Nine potential suppliers expressed their interest.
- Tenders closed in October 2022.
- Six compliant tenders and one non-compliant tender (seven in total) were received.
- ElectraNet evaluated the six compliant tenders.
- A combination of offers from three providers was found to deliver the lowest cost outcome while meeting the applicable technical specifications to provide the necessary 360 MW of FFR services from 1 July 2023 for the period required by AEMO.

In evaluating the tenders received we acted, and continue to act, in accordance with our obligations under clause 5.20B.4(c) of the Rules to use reasonable endeavours to secure the required inertia network services in response to the inertia shortfall notice by the date specified by AEMO.

8 AER, Decision: ElectraNet 2022-23 Inertia Shortfall Cost Pass Through, June 2022.

The payment structure in the service contracts comprises:

- fixed fees payable to secure the availability of the service throughout the contracted year;
- variable fees payable when the service is called upon by AEMO in a separation event.

The tender process has resulted in a reduction in the unit price for inertia services of 47% compared with the contracts in place for the current year.

The contracts are being put in place for 2023-24 and 2024-25 in order to maintain the availability of the required inertia network services for the period specified by AEMO.

Appendix A contains further details of the tender evaluation and is provided on a confidential basis.

3.2 Network support pass through requirements

The competitive procurement process undertaken to secure the inertia support services and negotiate the relevant contracts is set out above and in the confidential Appendix attached. This includes details of the providers of the network support services and relevant contractual arrangements.

Details of the pricing arrangements and expected annual costs are set out in the following Chapter.

This fully addresses the information requirements of the AER that apply in establishing an allowance for network support pass through.

The remaining information requirements largely relate to verification of actual amounts incurred, and will be addressed at the time of an annual network support pass through application.

4. Likely cost of providing inertia network services

As discussed above, the network support payment allowance should reflect ElectraNet's likely cost of providing the network support services AEMO has deemed necessary.

The fixed and variable fee structure of the contracts requires an estimate to be made of the likely duration of separation events during the two relevant years to determine the quantity of service expected to be provided and therefore the costs of providing inertia network services.

Therefore, the likely cost of providing these services in 2023-24 and 2024-25 is based on the expected value of the annual duration of separation events as observed in recent data, which are included in Table 1 and Table 2.

Table 1 South Australian separation events

Date	Duration (min)	Credible / Non	Cause	Reference
30/10/1999	10	Unknown	Unknown	AEMO/ ElectraNet report: Update to Renewable Energy Integration in South Australia - February 2016, Table 2
2/12/1999	26	Non-credible	Unknown	
25/05/2003	56	Credible	Unknown	
8/03/2004	43	Non-credible	Unknown	
14/03/2005	22	Non-Credible	Unknown	
16/01/2007	40	Non- Credible	Unknown	
19/10/2011	35	Credible	Malfunction of line protection system.	
13/12/2012	14	Credible	Protection operation during planned switching.	
1/11/2015	35	Credible	Protection setting led to unexpected tripping of South East line 1.	
28/09/2016	150	Non-credible	Major system event.	AEMO report: Black System South Australia 28 September 2016 - March 2017
1/12/2016	89	Credible	Transmission line fault.	AEMO report: FINAL REPORT – South Australia Separation Event, 1 December 2016 - 28 February 2017
25/08/2018	24	Non-credible	Operation of APD Portland tripping scheme.	AEMO report: Final Report – Queensland and South Australia system separation on 25 August 2018 - 10 January 2019
16/11/2019	291	Non-credible	Malfunction of telecommunications equipment caused operation of protection equipment.	AEMO report: Preliminary Report Non-Separation Event South Australia – Victoria on 16 November 2019 - December 2019
31/01/2020	24,480	Non-credible	Collapse of several 500 kV transmission towers in storm event	AEMO report: Preliminary Report Victoria and South Australia Separation Event, 31 January 2020 - April 2020

Date	Duration (min)	Credible / Non	Cause	Reference
12/11/2022	14,400	Non-credible	Collapse of 275 kV transmission tower at Tailem Bend in storm event	AEMO Media release: 13/11/22 - South Australia disconnected from the National Electricity Market

Table 2 shows the same data from Table 1 on an annual basis along with additional columns discussed below.

Table 2 Annual duration of South Australian separation events (min)

	All	Pre 2016	Post 2016
1999	36	36	
2000	0	0	
2001	0	0	
2002	0	0	
2003	56	56	
2004	43	43	
2005	22	22	
2006	0	0	
2007	40	40	
2008	0	0	
2009	0	0	
2010	0	0	
2011	35	35	
2012	14	14	
2013	0	0	
2014	0	0	
2015	35	35	
2016*	89		89
2017	0		0
2018	24		24
2019	291		291
2020	24,480		24,480
2021	0		0
2022	10,164		10,164
Annual Average	**1,472**	**17**	**5,007**

* 2016 data excludes the system black event of 28 September. When this event occurred there was no power system to stabilise (i.e. the SA system was lost rather than separated) so the services in question would not have been called upon.

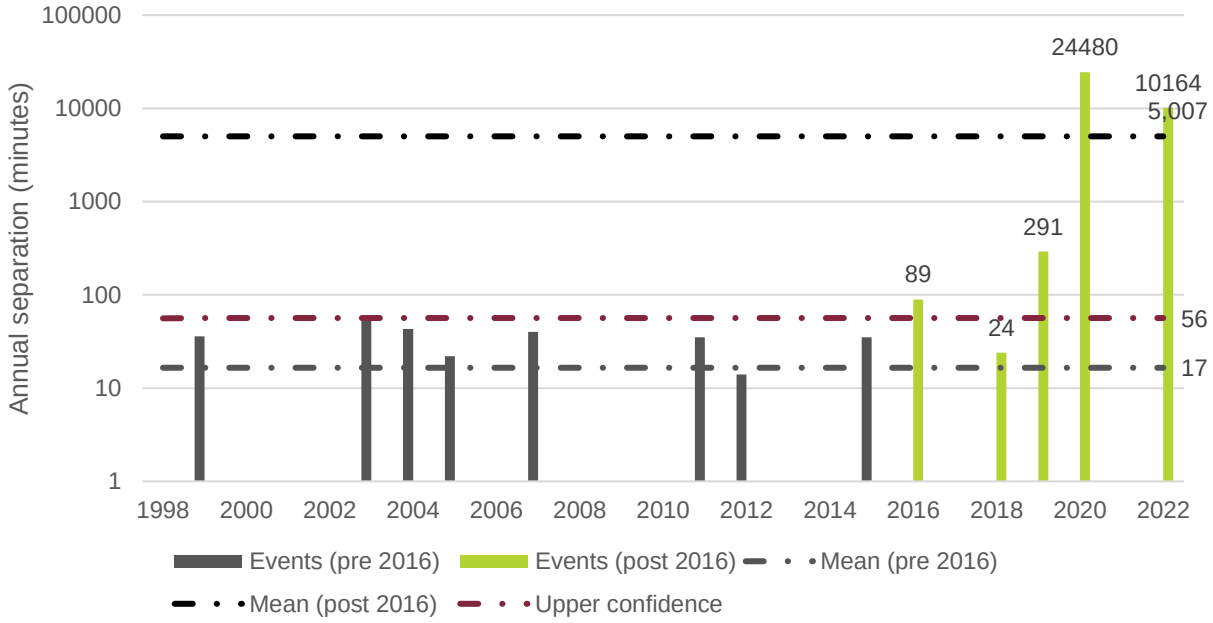
The expected value is a statistical concept referring to the mean outcome of a stochastic process. In this context it provides the best available estimate of the annual duration of separation events taking account of the range of durations that have been observed, including years in which the annual duration was zero. The expected value of the annual duration of separation events can be calculated by taking the mean from the historic data, as shown in Table 1 above and plotted in Figure 1 below.

In calculating the expected value, we note that:

- ElectraNet's likely cost of providing the inertia network services depends on the likely duration of any event that might occur in 2023-24 and 2024-25.
- The likely duration of future separation events is uncertain.
- South Australia has been separated from the rest of the NEM on 15 occasions since market start in December 1998. A summary of these events is provided in Figure 1 below based on the details in Table 1.
- The average duration of those 15 events was 2,365 minutes, or approximately 93.5 hours per event. However:
  - The annual average duration of outages, accounting for years in which no outage occurred, was 1,472 minutes per annum, or approximately 25 hours;
  - The system black event of 2016 should be disregarded because the system never operated as an island, so the services under consideration would not have been required.
- It is clear from Figure 1 that separation events that occurred since the beginning of 2016 lasted longer than events prior to 2016. More specifically:
  - prior to 2016, the longest duration of a separation event was 56 minutes, which is less than the average duration of separation events since 2016.
  - There are no examples in which the duration of a separation event that occurred after the beginning of 2016 is below the mean duration of separation events before 2016 (of 17 minutes).
- These two facts suggest that a systemic change in the expected duration of separation events occurred in 2016. This is consistent with the fact that the South Australian power system has changed fundamentally since the beginning of 2016 with the retirement of Northern Power Station (a major source of inertia) and significant growth in Distributed Energy Resources (DER) from 620 MW to 1,710 MW as of December 2021.
- This systemic difference means that the appropriate data from which to calculate the expected duration of a separation event for 2023-24 and 2024-25 should be informed only by data observed since 2016.
- The average annual duration of outages after 2016 was 5,007 minutes per annum. The difference in the mean before and after 2016 can be shown to be statistically significant.

Figure 1 below shows how the duration of separation events in South Australia has increased markedly since 2016 compared to the earlier period. Figure 1 is shown with a logarithmic scale to prevent the 2020 and 2022 separation events from being off the chart scale.

Figure 1 – South Australia separation events



Based on the data in Figure 1 above, ElectraNet considers that 5,007 minutes per annum, being the annual average duration of separation events since 2016 is the expected value of the annual duration of separation events in 2023-24 and 2024-25.

Therefore, we have estimated the cost impact of making inertia network services available in each of these years on this basis. In doing this, we note that the service AEMO directed us to acquire is capped under the service contracts at four hours (i.e. 240 minutes) per annum.

Considering this cap, our estimate of the likely cost we will incur in providing inertia network services in 2023-24 is $8.15 million. This estimate is calculated based on annual fixed costs of $2.36 million and variable costs of $5.8 million based on contract prices and the likely duration of separation events discussed above. This is the likely cost of providing the services we are required to provide using the least cost combination of options for providing that service.

As noted above, it would also be possible to propose a network support payment allowance to cover the certain cost of providing inertia network services, which is the fixed costs of the relevant contracts. ElectraNet would then 'true up' this amount to the actual cost of providing inertia network services each year through a network support pass through.

ElectraNet discussed these options with its Consumer Advisory Panel, noting that:

- Including only the certain (i.e. fixed) component of costs would minimise the impact on transmission prices in the immediate term, but:
  - would likely increase the variability in future transmission prices as it provides for likely larger 'true up' adjustments;
  - would see customers paying for inertia network services after the service has ceased once Project EnergyConnect is in place due to the lag inherent in the network support pass through process.
- Including the full cost up front would increase the impact on transmission prices in the immediate term but would tend to provide a 'smoother' price path in future and would ensure that services are only paid for in the year that they are used.

The CAP's clear advice, from the perspective of large and small customers, is that price stability is important, and so it is in consumer's best interests for the expected full cost to be included in the network support payment allowance in the first instance.

We have therefore proposed a network support payment allowance that reflects the expected cost of providing the network support services, as calculated above.

5. Conclusion

Sections 3 and 4 of this Attachment have addressed the relevant requirements of clause 5.20B.4 of the Rules in relation to the procurement of inertia network services.

For the purposes of the network support pass through process, which would occur subsequently as set out in Section 2.2, Section 3.2 of this Attachment addresses the requirements of 6A.7.2 and the associated AER guideline that must be satisfied at the present time in establishing a network support payment allowance to fund the inertia network service.

The information presented in Section 3 explains the range of actions we have taken to minimise the costs of inertia network services for the required period of 2023-24 and 2024-25, and make available the least cost combination of options to meet that requirement.

As explained in that section, we conducted a competitive tender process that built on our previous comprehensive procurement process. This resulted in a substantial reduction in unit costs (of 47%) as presented above.

Based on the outcomes of this procurement process, we are putting in place service contracts with the relevant service providers to secure the level of inertia network services for the period required to address the inertia shortfall, and ensure the services when enabled will be continuously available, taking into account planned and unplanned outages.

We have proposed a network support payment allowance that reflects the expected cost of providing the network support services in 2023-24 and 2024-25, based on the calculations set out above. The establishment of a network support payment allowance to meet the expected cost of providing the service, and the subsequent true-up through the annual network support pass through process, will ensure that customers pay no more than the actual costs of making the required inertia network services available in 2023-24 and 2024-25.

ElectraNet has put in place a prudent and efficient inertia service solution in 2023-24 and 2024-25 that will address the shortfall declared by AEMO and support the safe and secure operation of the power system, based on the competitive procurement process we have followed to drive a lowest cost outcome.

ElectraNet