ELEXON

Continuous Acceptance Duration Limit (CADL) Review

Imbalance Settlement Group

Date of meeting	**1 December 2020**	Paper number	**ISG236/03**
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Classification	**Public**	Document version	**v1.0**

Summary

The Continuous Acceptance Duration Limit (CADL) is a pricing parameter used to identify short duration Bid-Offer Acceptances (BOAs). These are likely to be associated with system balancing actions, and may be repriced in the Imbalance Price calculation.

The CADL was 15 minutes since its introduction in 2001 until it changed to 10 minutes effective from 1 April 2019.

This review covers the period 1 August 2018 to 31 July 2020, using analysis provided by National Grid Electricity System Operator (NGESO). Considering the volume of Fast Reserve correctly flagged, and the volume of Non-Fast Reserve incorrectly flagged, by the current 10-minute CADL and comparing these to what would otherwise be the case, it is our view that the analysis suggests that the current 10-minute CADL remains suitable.

The Imbalance Settlement Group (ISG) is invited to note the analysis and agree that Elexon will conduct the next scheduled review in two years' time.

1. Background

1.1 The Continuous Acceptance Duration Limit (CADL) flags Bid-Offer Acceptances (BOAs) with a duration of 10 minutes or less, as these actions tend to be associated with system balancing actions. The Replacement Price may then reprice these CADL flagged actions during the Imbalance Price calculation. Introduced in 2001, the CADL had not changed from the initial 15 minute duration until 1 April 2019, following the 2018 CADL Review, when it changed to 10 minutes.

1.2 The Balancing and Settlement Code (BSC), Section T 1.9 states that:

> 1.9.1 For the purposes of the Code, the "Continuous Acceptance Duration Limit" (CADL) shall be 15 minutes or such other amount (in minutes) determined by the Panel and approved by the Authority.
>
> 1.9.2 The Panel may revise such amount from time to time subject to the approval of the Authority.
>
> 1.9.3 In revising the amount of the Continuous Acceptance Duration Limit from time to time, the Panel shall consult with Parties and consider the views expressed in the course of such consultation prior to making its determination (and shall provide a detailed summary of such views to the Authority)

1.3 Modification P217 'Revised Tagging Process and Calculation of Cash Out Prices', implemented in November 2009, altered the operation of CADL in the Imbalance Price calculation. Prior to November 2009, tagged CADL actions were excluded from the Imbalance Price calculation. Since November 2009, CADL actions are flagged and may be repriced using the Replacement Price.

1.4 NGESO's analysis splits all BOAs into two groups; actions from specific Fast Reserve plants, and actions from all other plants (Non-Fast Reserve). Details of the number and volume of Fast Reserve and Non-Fast Reserve flagged BOAs, are covered for the period from 1 August 2018 to 31 July 2020 (referred to as the analysis period).

1.5 As the minimum BOA size required in the definition of Fast Reserve was reduced to 25MW from 50MW on 25 March 2019, NGESO have provided their analysis covering the two year period in two reports. The first report covers 1 August 2018 to 24 March 2019, and second report covers 25 March 2019 to 31 July 2020 (see Attachments A and B).

2. National Grid Electricity System Operator analysis of CADL (2018 – 2020)

2.1 When reviewing the CADL, Elexon request NGESO provide detailed analysis of energy and system balancing actions for the previous two years.

2.2 Their methodology defines plants that offer Fast Reserve actions as those which match, individually or as a group, the following minimum criteria:

a) Initial ramp rate is greater than or equal to 25 MW/min; and

b) BOA size is greater than or equal to 50MW valid up to 24 March 2019, 25MW thereafter; and

c) Start point is greater than or equal to the unit's Stable Export Limit (SEL), unless it is a hydro or open cycle gas turbine (OCGT) station.

2.3 The NGESO provided analysis on the volume flagged by CADL in the Energy Imbalance Price calculation, defining if it was considered as either Fast BOA volume or Non-Fast BOA volumes. During the first review period, five hydro power stations accounted for 94.8% of Fast Reserve BOAs, with 12 gas power stations and a coal station accounting for the remaining 5.2%. Over the second review period, five hydro power stations accounted for 78.9% of Fast Reserve BOA, and the remaining 21.1% was delivered by 16 Gas power stations, two diesel stations, and a battery station.

2.4 The analysis includes modelling the flagging of actions at various durations of CADL. The aim is to find the most appropriate level of CADL, where the largest numbers of Fast Reserve BOAs are flagged, whilst leaving other actions unflagged. NGESO's analysis is included as Attachment A (2018-19) and Attachment B (2019-2020).

2.5

2.6 **Table** 1, based on the analysis provided by NGESO, shows how the Fast and Non-Fast BOAs Reserve Volumes flagged differ across varying CADL time values for the period 25 March 2019 to 31 July 2020 (note that 1 August 2018 to 24 March 2019 is shown in Attachment A).

2.7

2.8 **Table** 1 shows that at the current 10-minute CADL, 45.0% of CADL flagged actions are Fast Reserve, with 55.0% classed as Non-Fast Reserve. The previous 15-minute CADL if used in the Energy Imbalance Price calculation over the same time period, would have resulted in 38.5% of Fast Reserve and 61.5% of Non-Fast Reserve being flagged.

Table 1: Volume of 'Fast' and 'Non-Fast Reserve' BOAs flagged (duration from 5-20 minutes)

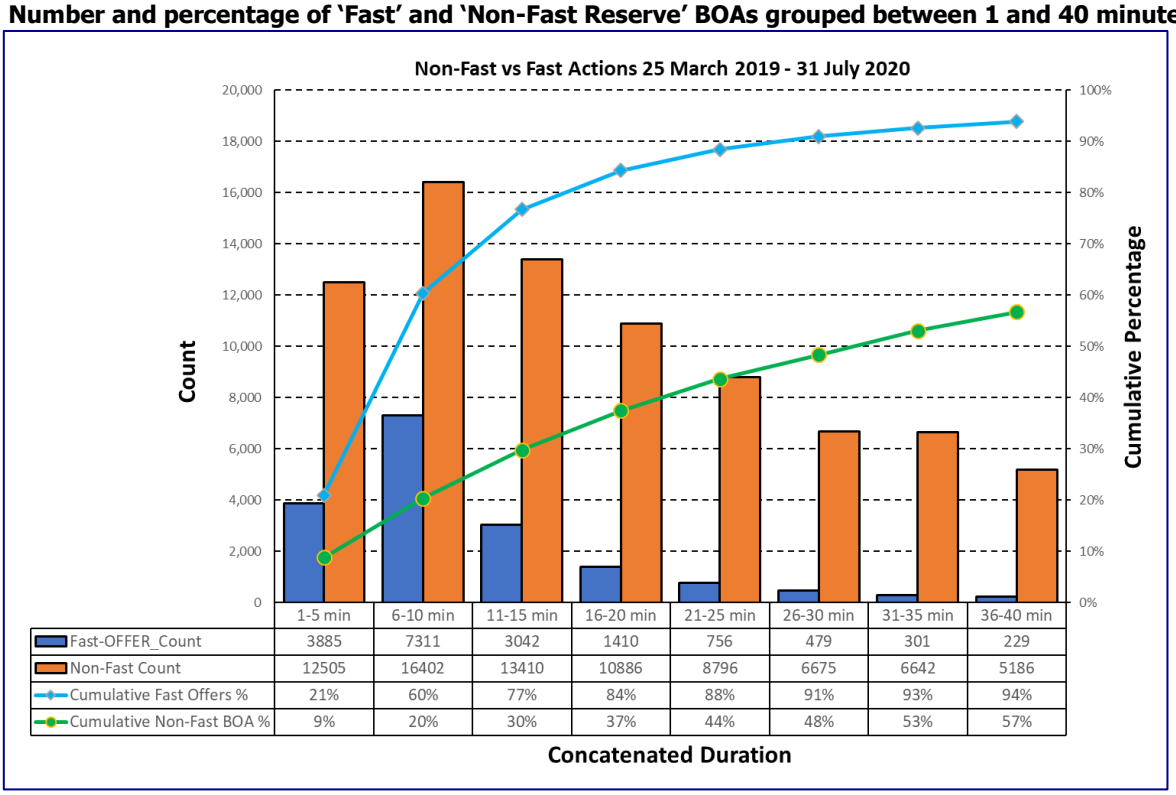
CADL FLAGGED BOAs vs TOTAL BOAs (25 Mar 2019 to 31 Jul 2020)						
Duration (min) (cumulative) (a)	Fast BOAs (MWh) (b)	All BOAs flagged (MWh) (c)	Fast BOAs as % of All BOAs flagged (b)/(c)	All BOAs flagged as % of All BOAs (d)=(e)+(f)	Fast BOAs flagged as % of All BOAs flagged (e)	Non Fast BOAs flagged as % of All BOAs flagged (f)
5	25,074	51,359	48.8%	0.2%	0.1%	0.1%
6	38,996	76,580	50.9%	0.3%	0.1%	0.1%
7	63,711	148,214	43.0%	0.5%	0.2%	0.3%
8	78,453	175,835	44.6%	0.6%	0.3%	0.3%
9	97,367	215,686	45.1%	0.7%	0.3%	0.4%
10	111,361	247,266	45.0%	0.8%	0.4%	0.5%
11	126,890	295,023	43.0%	1.0%	0.4%	0.6%
12	140,583	333,979	42.1%	1.1%	0.5%	0.7%
13	152,792	376,318	40.6%	1.3%	0.5%	0.8%
14	164,348	415,059	39.6%	1.4%	0.6%	0.8%
15	175,134	454,435	38.5%	1.5%	0.6%	0.9%
16	185,249	500,512	37.0%	1.7%	0.6%	1.1%
17	194,645	542,071	35.9%	1.8%	0.7%	1.2%
18	202,626	587,274	34.5%	2.0%	0.7%	1.3%
19	210,862	626,718	33.6%	2.1%	0.7%	1.4%
20	218,604	673,404	32.5%	2.3%	0.7%	1.5%

2.9 NGESO also plotted the count of Fast and Non-Fast BOAs, and showed these as cumulative percentages by time band (**Graph 1**). Above the previous 15-minute CADL, the cumulative percentage curve, shown on the graph as the blue line, flattens (for Fast BOAs), capturing lower numbers of Fast actions. The cumulative percentage of non-Fast BOAs, shown on the graph as the green line, continues to increase above the 15 minute CADL.

2.10 From **Graph 1**, we can conclude:

- The count of 'Fast Reserve' BOAs peaked at 7,311 in the interval 6 – 10 minutes, with the count of Non-Fast Reserve BOAs peaking at the same interval (16,402).
- With the current CADL of 10 minutes, 60% of Fast BOAs are correctly flagged, and 20% of Non-Fast BOAs are incorrectly flagged.
- Although at 11-15 minutes, the percentage of correctly flagged Fast Reserve BOAs rises to 77%, the percentage of Non-Fast BOAs incorrectly flagged would rise to 30%.
- The 'Fast Reserve' BOAs decreases rapidly when CADL rises above 10 minutes.
- When CADL increases above 10 minutes, a much higher number of 'Non-Fast' actions are flagged, compared with number of 'Fast' actions.

Graph 1: Number and percentage of 'Fast' and 'Non-Fast Reserve' BOAs grouped between 1 and 40 minutes



	1-5 min	6-10 min	11-15 min	16-20 min	21-25 min	26-30 min	31-35 min	36-40 min
Fast-OFFER_Count	3885	7311	3042	1410	756	479	301	229
Non-Fast Count	12505	16402	13410	10886	8796	6675	6642	5186
Cumulative Fast Offers %	21%	60%	77%	84%	88%	91%	93%	94%
Cumulative Non-Fast BOA %	9%	20%	30%	37%	44%	48%	53%	57%

3. Elexon analysis of CADL

3.1 Our analysis shows that CADL flagging occurs in 18.3% of all Settlement Periods with an average of 0.63% of balancing volume per Settlement Period being CADL flagged. Given the importance of CADL impact on imbalance pricing, Elexon undertook further analysis of the CADL. This analysis is shown in Appendix 1, and used data for the period 1 August 2018 to 31 July 2020. Our main findings were:

- The percentage of CADL flagged actions, as a proportion of total actions, has consistently been higher for Buy actions with an average of 0.79% versus 0.48% for Sell actions over the review period (see **Graph 2** in the appendix). It peaked in January 2019 with 2.81% of Buy actions and 1.38% of Sell actions being CADL flagged.
- The percentage of CADL flagged actions have fallen for both Buy and Sell actions from respectively 1.56% and 0.87% (for Aug 2018 to Mar 2019) to 0.50% and 0.32% (for Apr 2019 to Jul 2020) on average (**Graph 3**). In total, the percentage of all CADL flagged actions decreased from 1.2% to 0.41% in second period versus the first one.
- When comparing the Cumulative Fast and Non-Fast Reserve actions by duration, the volume of Non-Fast BOAs flagged actions exceeds the volume of Fast BOAs flagged actions once CADL increases above 12 minutes for 1 August 2018 to 24 March 2019 (**Graph 4**) and above 6 minutes for 25 March 2019 to 31 July 2020 (**Graph 5**). For the second period while the difference is not considerable above a CADL duration of 6 minutes, the growth rate for both Fast and Non-Fast Reserve actions are almost equal up to 10 minutes where the Non-Fast Reserve actions starts to grow at a higher rate.
- We have also looked at the volume of BOAs that would have flagged for a CADL duration of 5 to 20 minutes and showed the differences between the flagged volumes in this review and those of the 2018 review in **Graph 6**. The volume of both flagged Fast and Non-Fast Reserve BOAs has increased from the review in 2018. While reducing CADL from 15 to 10 minutes could be expected to decrease the flagged actions, the increase seen in the volume of CADL flagged actions could be due to the change made in the minimum BOA size required by the definition of Fast Reserve (from 50MW to

25MW). The volume of Non-Fast Reserve BOAs increases considerably for CADL durations above 10 minutes. **Graph 6** also shows that the current 10-minute CADL has incorrectly flagged 13,949MWh less volume of Non-Fast BOAs than a 15-minute CADL would have.

4. The impact of CADL on TERRE and MARI products

4.1 Balancing Volumes from Trans European Replacement Reserve Exchange (TERRE) activations were introduced into the Imbalance Price calculation as part of BSC Modification P344. TERRE is activated to serve a balancing need in a 15 minute block. Balancing volumes associated with TERRE activations are entered into the Imbalance Price calculation as aggregated volumes: Volume of GB Need Met and Replacement Reserve Aggregated Unpriced System Actions. These volumes do not have a duration associated with them and are therefore not affected by CADL Flagging. There have been no balancing volumes from TERRE in the GB market so far.

4.2 Project MARI (Manually Activated Reserve Initiative) will introduce a platform for the exchange of balancing energy from manually activated frequency restoration reserves (mFRR) by July 2022. BSC Modification P407 has been raised to introduce these arrangements into the GB market. How balancing volumes from MARI will be incorporated into the Imbalance Price Calculation, and whether the action duration will form part of the input has yet to be determined by the modification workgroup.

5. Next step

5.1 Our analysis suggests that no change in the value of CADL is needed. Hence, we have not recommended a consultation to the industry. We invite you to provide comments on the analysis included in this paper and make a recommendation to the BSC Panel for its December 2020 meeting.

6. Recommendations

6.1 We invite you to:

a) **NOTE** the analysis presented in this paper;

b) **RECOMMEND** to the BSC Panel that no change is made to the CADL; and

c) **AGREE** that Elexon conduct the next scheduled review in two years' time.

Appendices

Appendix 1 - Elexon CADL analysis

Attachments

Attachment A – National Grid Electricity System Operator – 2018/19 CADL Review

Attachment B – National Grid Electricity System Operator – 2019/20 CADL Review

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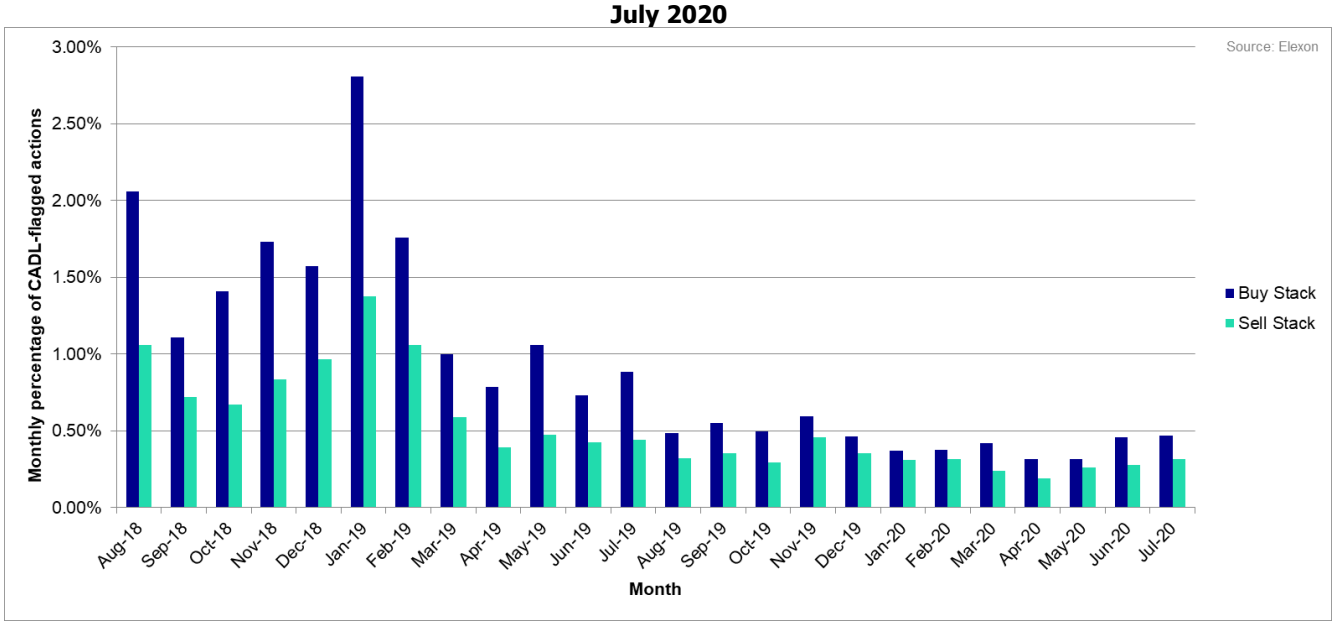
Appendix 1 - Elexon analysis of CADL (1 August 2018 to 31 July 2020)

Historic Data

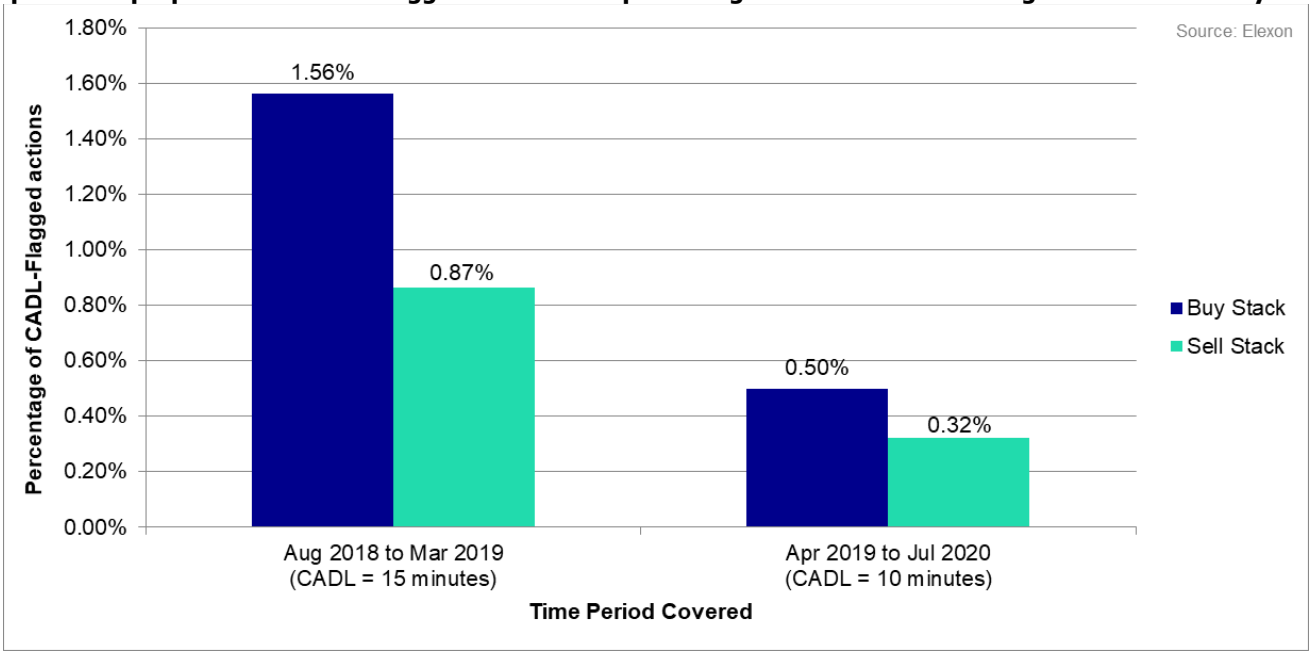
We have looked at the Buy and Sell CADL-Flagged actions as a proportion of all actions (CADL-Flagged, CADL-Unflagged, SO-Flagged, and SO-Unflagged actions) for the period August 2018 to July 2020, in order to gain some appreciation for the amount of CADL-Flagged actions. This is shown in **Graph 2** and summarised in **Graph 3** below:

Graph 2: The monthly proportion of CADL-Flagged actions as a percentage of all actions for 1 August 2018 to 31 July 2020



As can be seen the proportion of both Buy and Sell stacks peaked in Jan 2019 with 2.81% and 1.38% respectively. The proportion stayed relatively constant since August 2019. Between August 2018 and March 2019, when the CADL was 15 minutes, 1.2% of balancing actions were CADL flagged in total. This falls to 0.41% for between April 2019 and July 2020, when the CADL was 10 minutes. The above data are also summarised in **Graph 3**.

Graph 3: The proportion of CADL-Flagged actions as a percentage of all actions for 1 August 2018 to 31 July 2020.



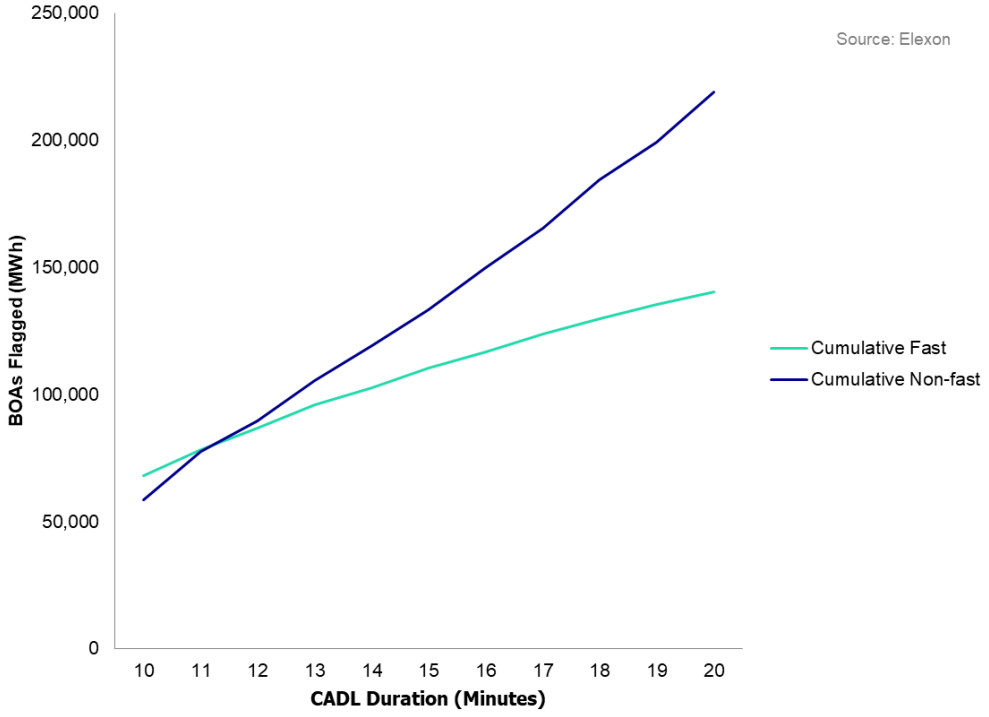
As can be seen the proportion of both Buy and Sell stacks have fallen from an average proportion of respectively 1.56% and 0.50%, to 0.87% and 0.32% when CADL changed from 15 to 10 minutes.

Elexon analysis using National Grid data

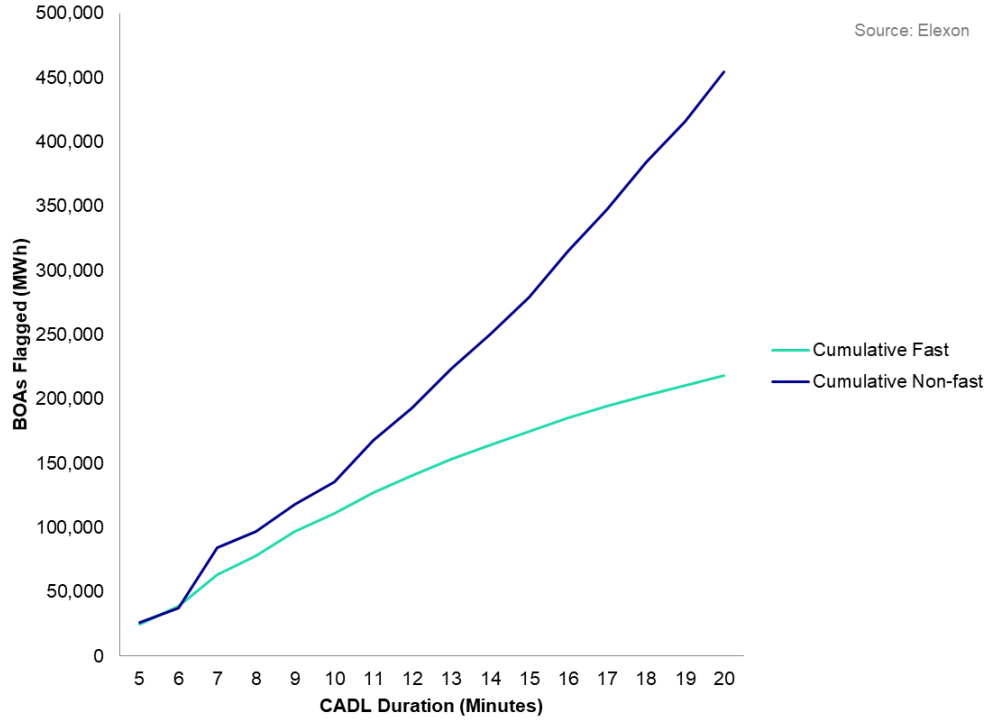
Using the data from

Table 1, a graphical representation of the Cumulative Fast and Non-Fast Reserve actions has been created (**Graph 4**). This shows that once the CADL duration increases above 6 minutes (after 25 Mar 2019), the volume of Non-Fast BOAs flagged is higher than the volume of Fast BOAs flagged. However the difference is still not considerable and the rate of increase between 7 and 10 minutes is almost equal until above 10 minutes where the volume of Non-Fast BOAs increases at a greater rate than that of Fast BOAs thereafter.

Graph 4: Volume of 'Fast' and 'Non-Fast Reserve' BOAs between 10 and 20 minutes duration (1 Aug 2018 – 24 Mar 2019).

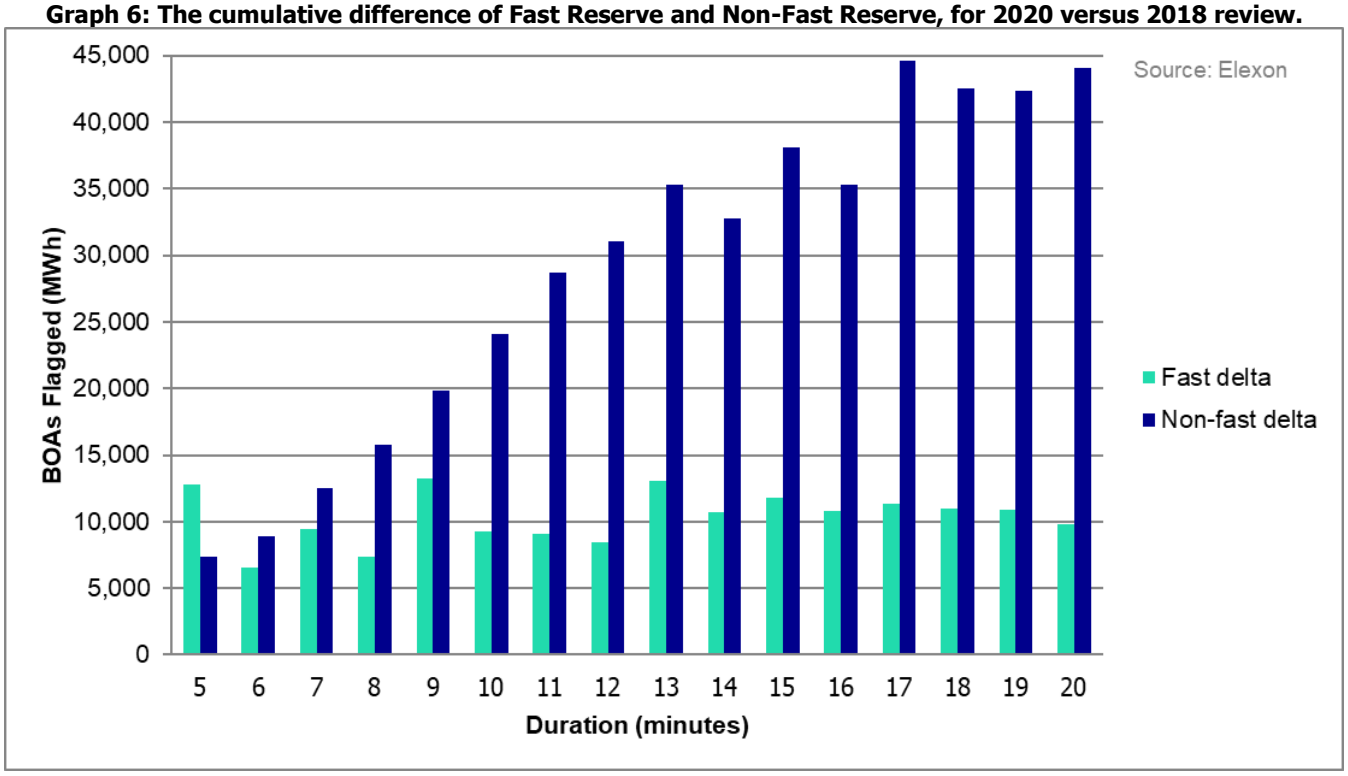


Graph 5: Volume of 'Fast' and 'Non-Fast Reserve' BOAs between 10 and 20 minutes duration (25 Mar 2019 – 31 Jul 2020).



Graph 6 shows the difference between the volume of actions that would have been flagged for CADL duration of 5 to 20 minutes in this review versus the 2018 review (based on data 1 August 2016 – 31 July 2018).

Graph 6: The cumulative difference of Fast Reserve and Non-Fast Reserve, for 2020 versus 2018 review.



This analysis shows that while the flagged volume of both Fast and Non-fast Reserve BOAs has increased from the review in 2018, the volume of Flagged Non-Fast Reserve BOAs has increased rapidly. While current 10 minute CADL has flagged 24,114 MWh more Non-Fast Reserve BOAs in the 2020 review than in the 2018 review period, with the previous 15 minute CADL there would have been more 38,063 MWh Non-Fast Reserve incorrectly flagged. In summary, the change of CADL has incorrectly flagged 13,949MWh less volume on Non-fast over the two-year review period.