ELEXON

Annual Review of the Value of Lost Load (VoLL) and Loss of Load Probability (LoLP)

Imbalance Settlement Group

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Summary

In 2018, Elexon agreed to give an annual update on the VoLL parameter following analysis provided to the Imbalance Settlement Group (ISG). Note that following the second phase of BSC Modification P305 going live on 1 November 2018, both the LoLP and the VoLL parameter methodologies changed. This paper looks at the impacts of these parameter changes, using data from the implementation date of BSC Modification P305 (5 November 2015) to 31 March 2022, and invites the ISG to note our findings.

1. Background

1.1 The implementation of Approved Modification P305 'Electricity Balancing Significant Code Review Developments' on 5 November 2015 led to changes in Imbalance Price calculations, including the ability to re-price Short Term Operating Reserve (STOR) actions using a Reserve Scarcity Price (RSVP). The RSVP is calculated by multiplying two parameters: Value of Lost Load (VoLL) and Loss of Load Probability (LoLP).

1.2 The second phase of BSC Modification P305 was implemented on 1 November 2018. This reduced the Price Average Reference (PAR) from 50MWh to 1MWh, increased the VoLL, and changed the methodology used to calculate the LoLP.

1.3 The Value of Lost Load (VoLL) is an assessment of the value that electricity consumers attribute to the security of supply. Pre 1 November 2018 it was £3,000/MWh; post 1 November 2018, it rose to £6,000/MWh.

1.4 The LoLP is a defined parameter in the Balancing and Settlement Code (BSC) under Section T, 1.6A. It is a measure of system reliability calculated by the National Grid Electricity System Operator (NGESO), for each Settlement Period, and is a value between 0 and 1. Pre 1 November 2018 it was calculated using the static methodology; post 1 November 2018, it is calculated using the dynamic methodology. Both LoLP methodologies are set out in the Loss of Load Probability Calculation Statement.

1.5 The RSVP is defined under BSC Section T, 3.13 as: $RSVP_j = LoLP_j * VoLL$.

1.6 Balancing actions taken by STOR providers during a STOR availability Window are STOR Flagged, and assessed against the RSVP. If the Utilisation Price of a STOR flagged action is less than the RSVP, then the action will be repriced at the RSVP.

1.7 In BSC Panel Meeting 278, Elexon recommended that an annual data review is conducted on the use of VoLL, with findings presented first to the Imbalance Settlement Group (ISG) and then to the Panel.

1.8 The analysis undertaken in this review uses actual data for the period 1 Apriil 2021 to 31 March 2022, and compares the impact of VoLL under various scenarios. To isolate the impact of VoLL, all other pricing parameters were kept the same as they would be in the live market at the time.

1.9 In December 2020, NGESO raised Issue 92 'Reserve Scarcity Pricing Review' The Issue Group concluded that the Reserve Scarcity Pricing Review provided an opportunity for NGESO to be proactive on a topic that may negatively impact market participants through creating potentially inaccurate and significant price signals.

1.10 Two IT options were assessed to address the key margin methodology accuracy concerns. These options aimed to include non-BM Fast Reserve in the calculation. However, following a high-level cost studies pricing the options in excess of £1m, the cost estimates far outweighed any benefits of these changes and did not represent good value to the Electricity System Operator (ESO) or external customers.

1.11 As the RSVP was being assessed and analysed as part of Issue 92 during last year's review period, Elexon did not provide a VoLL review in 2021. The VoLL Review in 2022 will look at the review period 1 April 2021 to 31 March 2022 with further analysis where required.

2. Changes to the Annual VoLL Review

2.1 Elexon has provided this year's VoLL review through a webpage with interactive Power BI Graphs instead of a static PDF. By presenting analysis in this way, analysts and readers are able to interact with the visualisations and more easily discover trend.

2.2 Due to the capability of Power BI for analysing larger datasets, this review uses data on all applications of the RSVP since the implementation of P305 (5 November 2015) to the end of this review period (31 March 2022).

2.3 ISG Members will receive a PDF of the review but will also be able to consult a web-based version of the review available to enable interactivity.

3. Summary of Data Review

3.1 In January 2018, the NGESO conducted analysis into the potential impacts of moving from a static to dynamic method for calculating LoLP. Their analysis compared dynamic and static LoLP values for the period 1 June 2017 to 13 December 2017.

3.2 A summary of this analysis was published as an appendix in Issue 29 of the System Price Analysis Report (SPAR) on 25 April 2018. The analysis showed the move from static to dynamic LoLP had a minor impact on the RSVP at Gate Closure.

3.3 Elexon has previously contacted the NGESO to provide further analysis on LoLP. The NGESO stated they did not intend to undertake any further analysis. As Elexon require information from NGESO to review the LoLP our analysis will focus on how changing VoLL would impact the RSVP, which in turn would impact the Imbalance Price (see Appendix 1 for full details).

3.4 In summary, the main findings were:

- Increasing the VoLL in £1,000/MWh increments, from £1,000/MWh to £17,000/MWh, had a consistent effect of increasing the number of STOR actions where the RSVP was applied.
- Since the implementation of Modification P305 on 5 November 2015, the RSVP has been used to reprice balancing actions on 23 days across 44 Settlement Periods, or 0.04% of Settlement Periods.
- During the period 1 April 2021 and 31 March 2022, the RSVP was applied to zero balancing actions with a VoLL set at £3,000/MWh. Applying the higher £6,000/MWh VoLL value to this period resulted in the RSVP being applied to eight balancing actions.
- The table below summarises the number of Settlement Periods repriced with P305 VoLL values of £3,000/MWh and £6,000MWh, between 1 April 2021 and 31 March 2022:

Dates	**1 April 2021 – 31 March 2022**	
PAR	1MWh	
LoLP	Dynamic	
VoLL	£3,000/MWh	£6,000MWh
Actions Repriced	0	8
Settlement Periods impacted	0	3
RSVP Actions set Imbalance Price?	No	No

Table 1: Summary of impact of RSVP on Imbalance Price, by date and scenario

3.5 Since 1 April 2021, STOR balancing energy has been procured on a Day-Ahead basis. This allows STOR providers to price their balancing energy more flexibly and to opt in to the service on a daily basis.

3.6 The changes in STOR balancing actions being accepted during STOR Availability Windows are summarised below by comparing data a year each side of the change.

STOR Service	Long Term	Day Ahead
Dates	1 April 2020 – 31 March 2021	1 April 2021 – 31 March 2022
Count of STOR actions	3,331	7,360
Total Volume of STOR actions	45,228MWh	70,502MWh
Total Cost of STOR actions	£7.0m	£25.1m
Average Price of STOR actions	£152.99/MWh	£356.85/MWh
Number of actions repriced with the RSVP	209	8

Table 2: Changes to the application of the RSVP during to Day Ahead STOR procurement

3.7 During the period 1 April 2021 and 31 March 2022, the RSVP was applied to eight balancing actions. This is a large decrease 1 April 2020 to 31 March 2021 where 209 actions were repriced. The majority of the repriced balancing actions (103) were accepted on 28 December 2020. The utilisation of the RSVP is still limited to singular events with extreme market conditions.

3.8 The Day Ahead STOR has been more expensive using Day Ahead pricing with the average price increasing from £152.99/MWh to £356.85/MWh. The ability to react to market conditions results in the prices representing scarcity on the System, and less likely to be repriced with the RSVP when it is calculated using the live VoLL.

3.9 As the STOR providers can now be more flexible when pricing their STOR balancing energy, the scarcity of the System is better represented in the initial price and the action is less likely to be repriced with the RSVP in the Imbalance Price calculation.

4. Recommendations

4.1 We invite you to:

a) **NOTE** the findings of the Annual Review of the VoLL and LoLP;

b) **NOTE** Elexon will continue to report on VoLL and RSVP through the monthly SPAR, with any significant changes highlighted to the ISG and Panel; and

c) **NOTE** Elexon will review the impact of Day Ahead STOR on the use of the RSVP in the next Annual VoLL Review, once two years of data is available.

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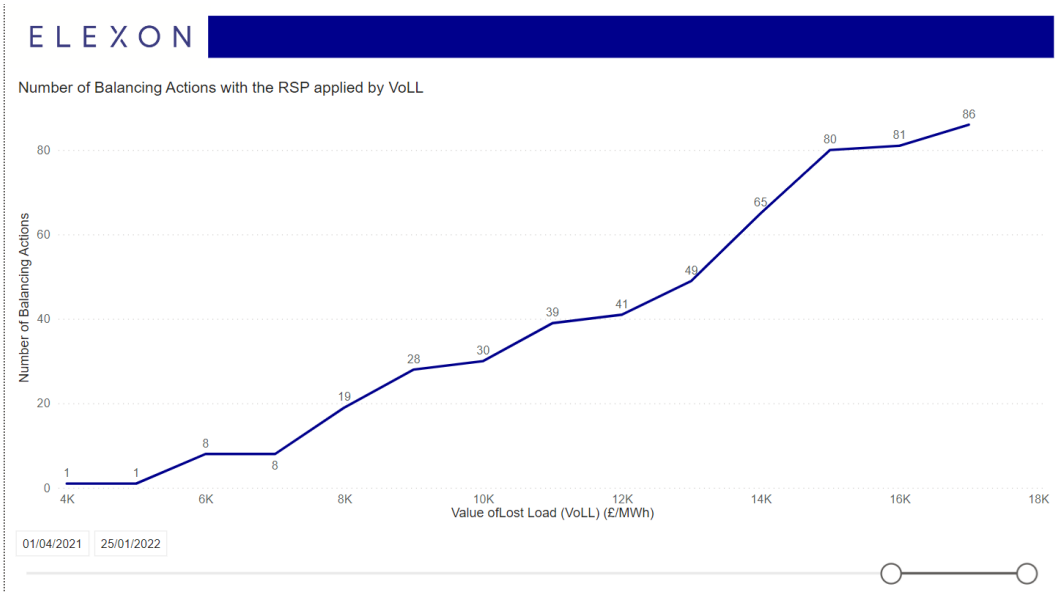
Appendix 1: VoLL Analysis

How does changing the VoLL impact the repricing of STOR actions in the Imbalance Price calculation?

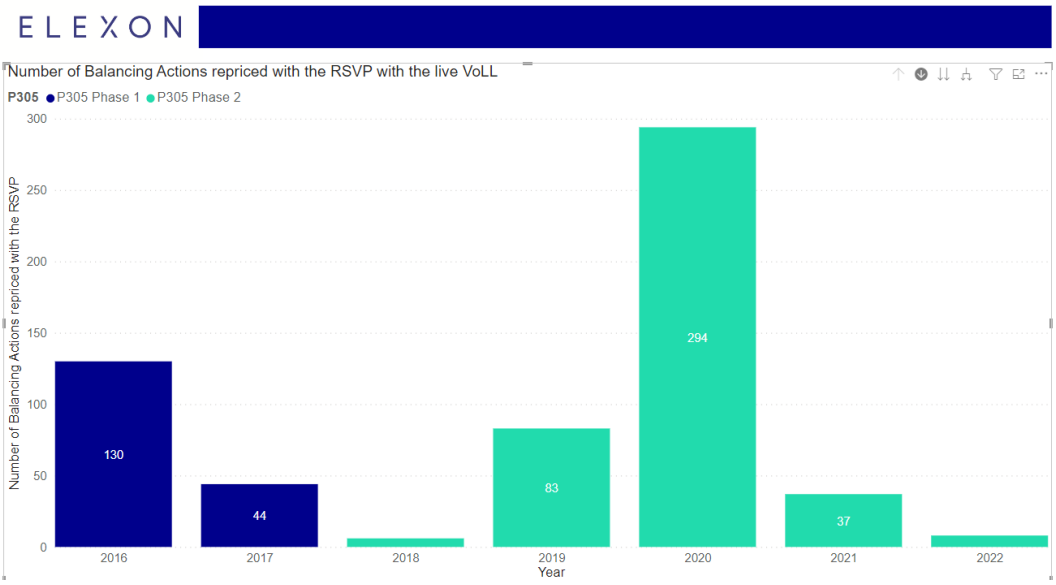
To show the impact of changing the VoLL, Elexon has analysed the number of times the RSVP is applied to STOR balancing actions. The live Imbalance Price calculations were re-run using VoLL values between £1,000/MWh and £17,000/MWh (in £1,000/MWh increments), for STOR balancing actions within the review period 1 April 2021 and 30 April 2022; our findings are shown in the graph below. Readers can look at longer time periods using the Settlement Date slider at the bottom of the graph.



The number of STOR balancing actions with the RSVP applied gradually increases with an increase in VoLL. The Correlation between the number of balancing actions repriced and the price of VoLL had a very strong correlation coefficient of 0.963. The correlation coefficient between the same two variables since 5 November 2015 (P305: Phase 1) was 0.999.

How many STOR actions have been repriced since the RSVP was implemented on 5 November 2015?

From 5 November 2015, the implementation date of Phase 1 of [BSC Modification P305], STOR Flagged actions have repriced when the RSVP is greater than the Utilisation Price. The VoLL was set at £3,000/MWh from 5 November 2015 to 1 November 2018, then rising to £6,000/MWh.



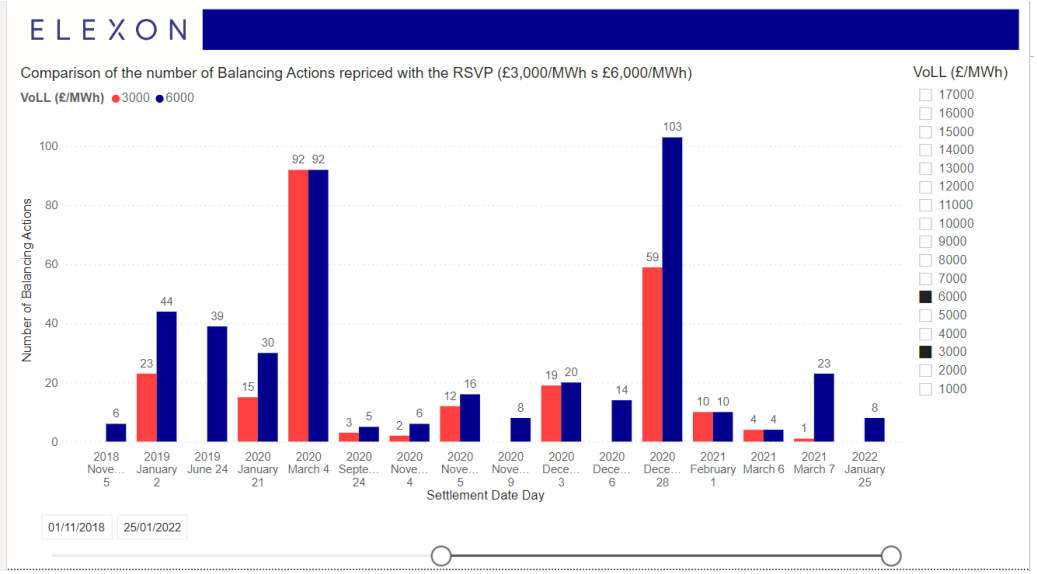
As shown in the graph, after a spike of 294 repriced balancing actions in 2020, the use of the RSVP has dropped in line with the use in 2018 and 2019.

The utilisation of the RSVP is still limited to singular events with extreme market conditions. With the VoLL set at current levels (£6,000/MWh), the RSVP repriced eight STOR actions on 25 January 2022 in the review Period 1 April 2021 to 31 March 2022. Settlement Periods 18, 19 and 20 on 25 January 2022 were the only Settlement Periods in the review period to have the RSVP applied.

How has the increase in VoLL from £3,000/MWh to £6,000/MWh changed the use of the RSVP?

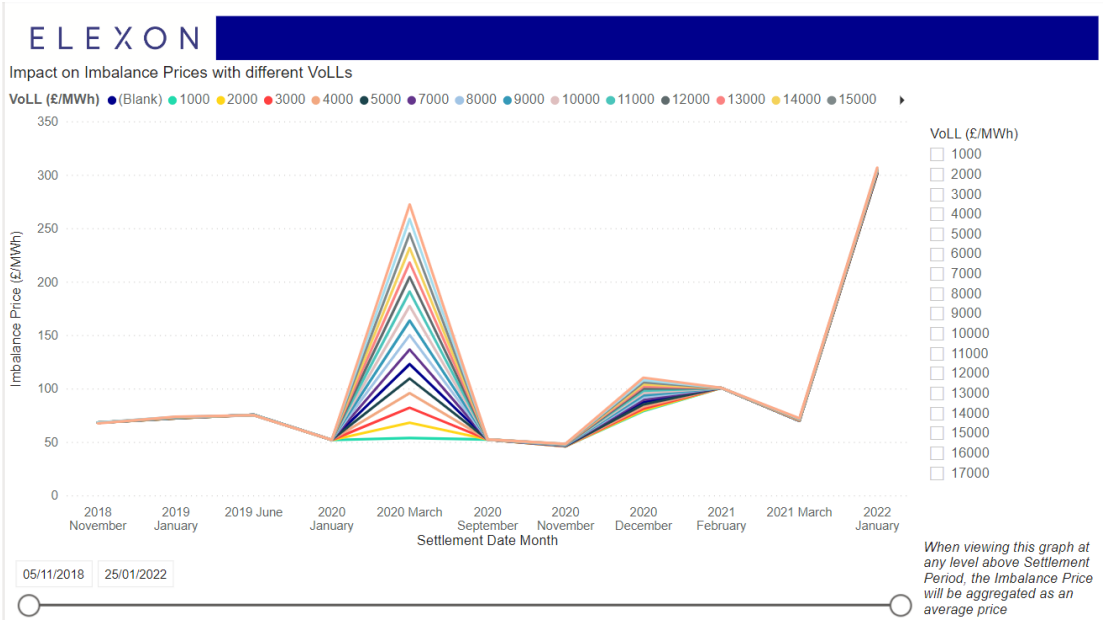
The change in VoLL and LoLP from 1 November 2018 has less of an impact on when the RSVP is used, but a significant impact on the amount of STOR balancing actions that are repriced.

If VoLL had remained at £3,000/MWh post 1 November 2018, there would have been 240 balancing actions with the RSVP assigned over 25 Settlement Periods. With a VoLL of £6,000/MWh from 1 November 2018, 428 balancing actions over 336 Settlement Periods have been repriced with the RSVP. Daily totals of balancing actions that have been repriced since 1 November 2018, with the two VoLL values, are displayed in the graph below.



How has the RSVP and VoLL affected the Imbalance Price?

Since the implementation of Phase 2 of BSC Modification of P305 on 1 November 2018, the Imbalance Price has been set by a STOR action repriced with the RSVP during seven Settlement Periods.



The graph above shows how changing the VoLL in £1,000/MWh increments would have affected the Imbalance Price since 1 November 2018 in Settlement Periods where the RSVP was used.

There were only two Settlement Periods on 4 March 2020 and three Settlement Periods on 28 December 2020 when the RSVP set the Imbalance Price. In these Settlement Periods, changing the VoLL in £1,000 increments would cause a change in Imbalance Price by an amount dependent on the LoLP value in these Settlement Periods. By selecting the 'Drill Down' tool in the top right of the visualisation above, you can see the exact Imbalance Price for each of these Settlement Periods for each VoLL.

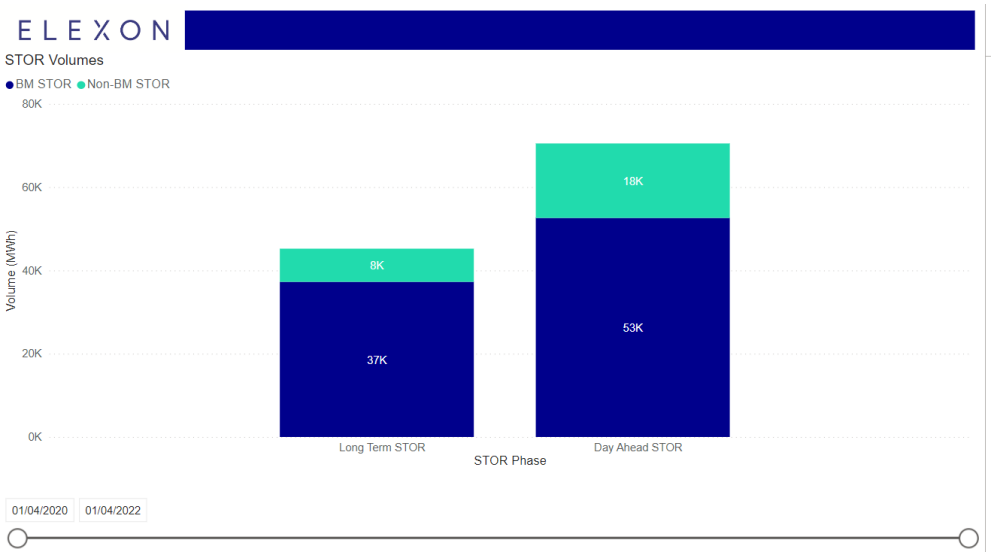
Settlement Period 37 on 28 December was not set by the RSVP in the live market with a VoLL of £6,000/MWh. However, from a VoLL of £7,000/MWh upwards, the RSVP would have set the Imbalance Price in this Settlement Period.

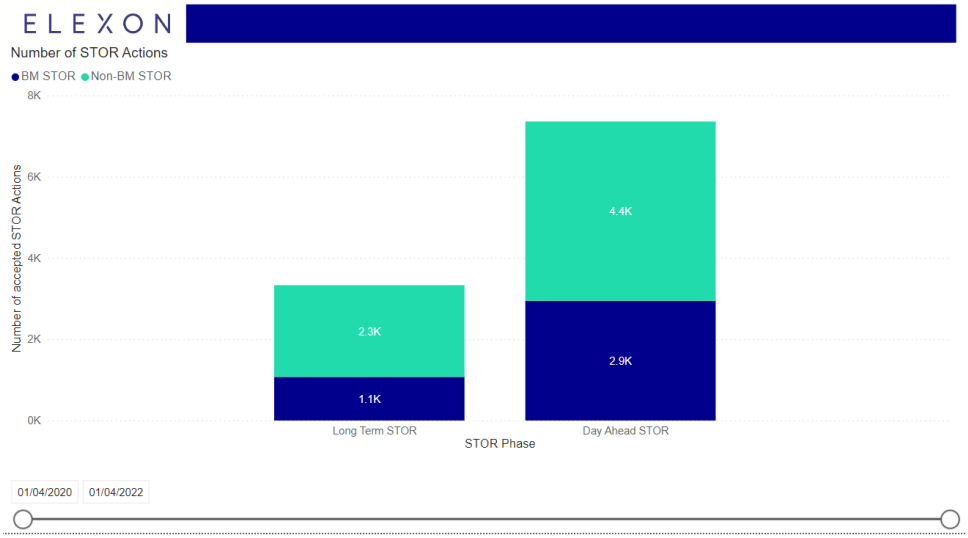
The RSVP has not set the Imbalance Price since the NG ESO began purchasing STOR from the Day Ahead market on 1 April 2021.

The RSVP (and therefore VoLL) is still only used under extreme market conditions. As per National Grid's previous analysis, dynamic LoLP values are largely consistent with static LoLP values and a review at this stage is not necessary.

STOR prices and volume changes

Since 1 April 2021, the NGESO has purchased STOR from the Day Ahead market rather than tendering for season-long durations. To compare the impact this has had on accepted balancing actions, Elexon has looked at a year of STOR actions during STOR Availability Windows from 1 April 2020 to 31 March 2021 (labelled as 'Long Term STOR') and a year of STOR actions from 1 April 2021 to 31 March 2022 (labelled as 'Day Ahead STOR'). The graphs below look at the total volume, average price and total number of actions in the two different categories.





By purchasing on the Day Ahead market, providers of STOR are able to react to market conditions and account for the scarcity on the System. The average BM STOR Price has risen by £214.35/MWh (136%), and the average Non-BM STOR by £180.41/MWh (135%).

The number and volume of STOR actions has also increased between the two comparison periods. There were 1,872 (174%) more BM STOR actions and 2,157 (96%) more Non-BM STOR actions taken in the year of the Day Ahead market than in the Long Term market.

Despite the increase in the number, volume and price of STOR actions taken in STOR Availability Windows, there were only eight STOR actions repriced in a year of the Day Ahead Market. This compares to 209 in a year of the Long Term market.

Elexon's analysis implies Day Ahead STOR has impacted the use of the RSVP. Elexon will continue to report on VoLL and RSVP through the monthly SPAR, with any significant changes highlighted to the ISG and Panel. Elexon will review the impact of Day Ahead STOR on the use of the RSVP in the next Annual VoLL Review, once two years of data is available.