

ANNUAL DATA REVIEW: RESERVE SCARCITY PRICE

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Purpose of paper	Information
Classification	Public
Summary	This paper provides an update on the Value of Lost Load (VoLL) and Loss of Load Probability (LoLP) parameters which were introduced by BSC Modification P305. It invites the BSC Panel to note our findings show the LoLP and VoLL changes have not significantly impacted the Reserve Scarcity Price (RSVP) or the Imbalance Price. Comments on the analysis from the Imbalance Settlement Group (ISG) are also included for the Panel's information.

1. Background

- 1.1 The implementation of Approved Modification [P305 'Electricity Balancing Significant Code Review Developments'](#) on 5 November 2015 led to changes in System 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 Electricity Transmission System Operator (NETSO), 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](#) (see Attachment A).
- 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 be 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 used actual data for the period 1 January 2018 to 30 April 2019, and compared the impact of LoLP and VoLL under various scenarios. To isolate the impact of LoLP and VoLL, other variables were kept consistent across scenarios (for example, the same PAR value and dynamic LoLP methodology is used across scenarios when VoLL is varied).
- 1.9 ELEXON will undertake a review of the LoLP Calculation Statement before the end of 2019, as this document has not been reviewed since the implementation of Approved Modification [P305 'Electricity Balancing Significant Code Review Developments'](#) in November 2015. As part of this review, we will revisit the analysis within this paper and include a further six months' worth of data (period will cover up to 31 October 2019).

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2. Summary of Data Review

- 2.1 In the previous review of LoLP, the NETSO provided analysis that compared the static and dynamic LoLP values for a period of six months (June – December 2017). Its analysis showed that the outputs from the dynamic and static LoLP calculations were largely consistent.
- 2.2 Before starting this review, ELEXON contacted the NETSO to request updated LoLP analysis. NETSO viewed the previous analysis as 'a singular piece of analysis to provide comfort to the market', and stated they did not intend to undertake any further analysis.
- 2.3 As such, ELEXON's analysis focused on how changing VoLL would impact the RSVP, which in turn may impact the Imbalance Price (see Appendix 1 for full analysis, covering 1 January 2018 to 30 April 2019). The main findings are summarised below and in Table 1:
- 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 nine days across 12 Settlement Periods, or 0.0002% of Settlement Periods.
 - During the period 1 January 2018 to 31 October 2018, the RSVP was applied to zero balancing actions (VoLL set at £3,000/MWh). Applying the higher £6,000/MWh VoLL value to this period had no impact.
 - During the period 1 November 2018 to 30 April 2019, following the implementation of the phase two changes of Modification P305 (VoLL set at £6,000/MWh), the RSVP was applied to 50 balancing actions, across two days and four Settlement Periods (Settlement Period 34 on 5 November 2018, and Settlement Periods 35, 36 and 37 on 2 January 2019). If the VoLL had remained at £3,000/MWh, the RSVP would have been applied to only 23 balancing actions, across three Settlement Periods on a single day (Settlement Periods 35, 36 and 37 on 2 January 2019).
 - For the period 1 January 2018 to 31 October 2018, the RSVP did not reprice any actions and therefore could not impact the Imbalance Price. For the period 1 November 2018 to 30 April 2019, STOR actions that were included in the PAR for the Imbalance Price were not repriced at the RSVP; any changes in the Imbalance Price were due to RSVP priced STOR actions affecting the pricing stack before PAR tagging.
 - Therefore, between January 2018 and 30 April 2019, no RSVP priced actions were in the PAR, and therefore no RSVP priced actions set the Imbalance Price.**

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

Scenario	P305, Phase One		P305, Phase Two	
Dates	1 Jan – 31 Oct 2018		1 Nov 2018 – 30 April 2019	
PAR	50MWh		1MWh	
LoLP	Static		Dynamic	
VoLL	£3,000/MWh	£6,000MWh	£3,000/MWh	£6,000MWh
Actions Repriced	0	0	23	50
Settlement Periods impacted	0	0	3	4
RSVP Actions in Pricing Stack?	No	No	Yes	Yes
RSVP Actions set Imbalance Price?	No	No	No	No

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- 2.4 The change of the PAR from 50MWh to 1MWh on 1 November 2018 has impacted the likelihood of RSVP priced STOR actions impacting the Imbalance Prices, as less actions are included in the priced volume used in the imbalance calculation. STOR actions assigned the RSVP only contribute to the PAR1 priced volume when the VoLL exceeded £13,000/MWh (see Graph 4 in Appendix 1 for further details).

3. Feedback from the ISG218

- 3.1 ELEXON presented this analysis to the ISG (ISG218 held on 18 June 2019). ISG committee members provided the following feedback:
- An ISG member noted that the RSVP had only affected the System Price during two Settlement Periods when the VoLL was priced over £13,000/MWh. As such, ISG members questioned the effectiveness of the changes made as part of P305 Stage 2 with regard to the RSVP.
 - An ISG member asked the reason for the lack of impact on System Prices, and whether other processes in the calculation of the Imbalance Price were negating the impact of raising the VoLL. One ISG member said NIV tagging may be responsible for the ineffectiveness, as well as the reduction in PAR.

4. Recommendations

- 4.1 We invite you to:
- a) **NOTE** the findings of the paper;
 - b) **NOTE** there are no significant changes in RSVP as a result of the LoLP and VoLL parameters changing on 1 November 2018;
 - c) **NOTE** that ELEXON will continue to report on LoLP, VoLL and RSVP through the monthly SPAR, with any significant changes highlighted to the ISG and Panel;
 - d) **NOTE** that a review of the LoLP Calculation Statement is due to take place before the end of 2019 (which will include a refresh of this analysis to include data up to 31 October 2019); and
 - e) **COMMENT** on the feedback from the ISG on the effectiveness of the RSVP changes.

Attachments

Attachment A – 'Loss of Load Probability' Calculation Statement

Appendices

Appendix 1 – VoLL Analysis conducted by ELEXON

For more information, please contact:

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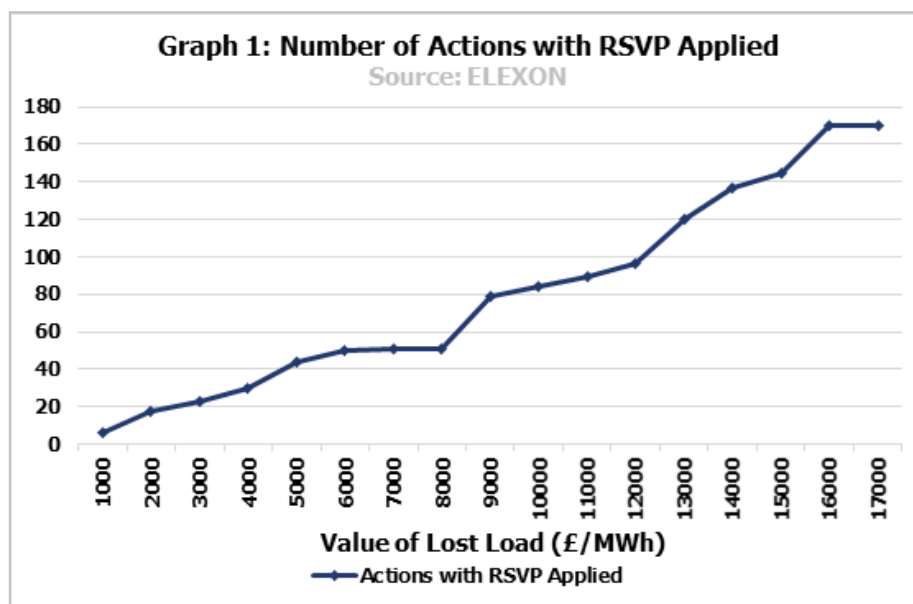
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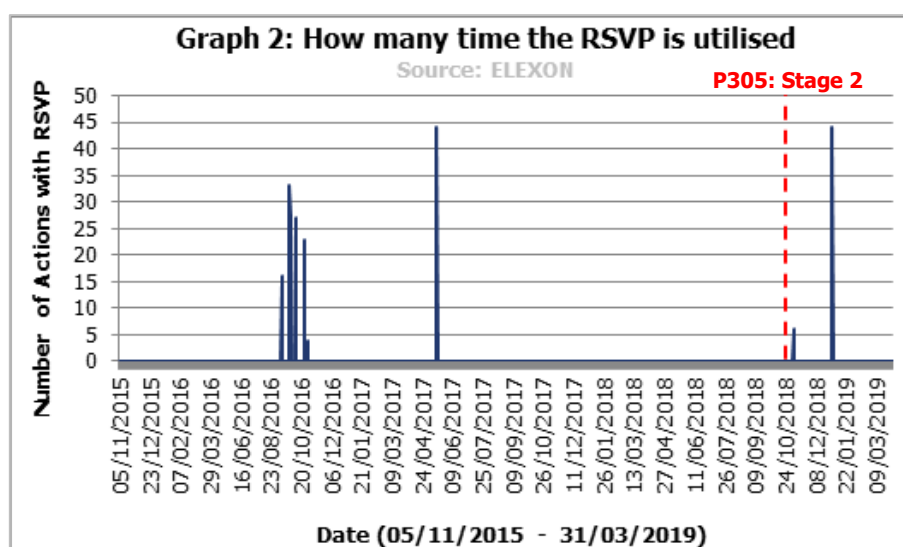
APPENDIX 1 – VOLL ANALYSIS CONDUCTED BY ELEXON

To show the impact of changing the VoLL, ELEXON 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 between 1 January 2018 and 30 April 2019; our findings are shown in Graph 1.



STOR Flagged actions are repriced when the RSVP is greater than the Utilisation Price. With the VoLL set at current levels (£6,000/MWh), the RSVP repriced 6 STOR actions on 5 November 2018 and 44 STOR Flagged actions on 2 January 2019. These are the only two days where the RSVP was used since the last review.

Graph 2 shows that no STOR actions were repriced at the RSVP from 1 January 2018 to 31 October 2018. This result was consistent with all VoLL scenarios with no STOR actions being repriced at the maximum VoLL of £17,000/MWh. All repriced actions occurred after the P305 parameter changes on 1 November 2018, and are based on a PAR of 1MWh and a dynamic LoLP value.



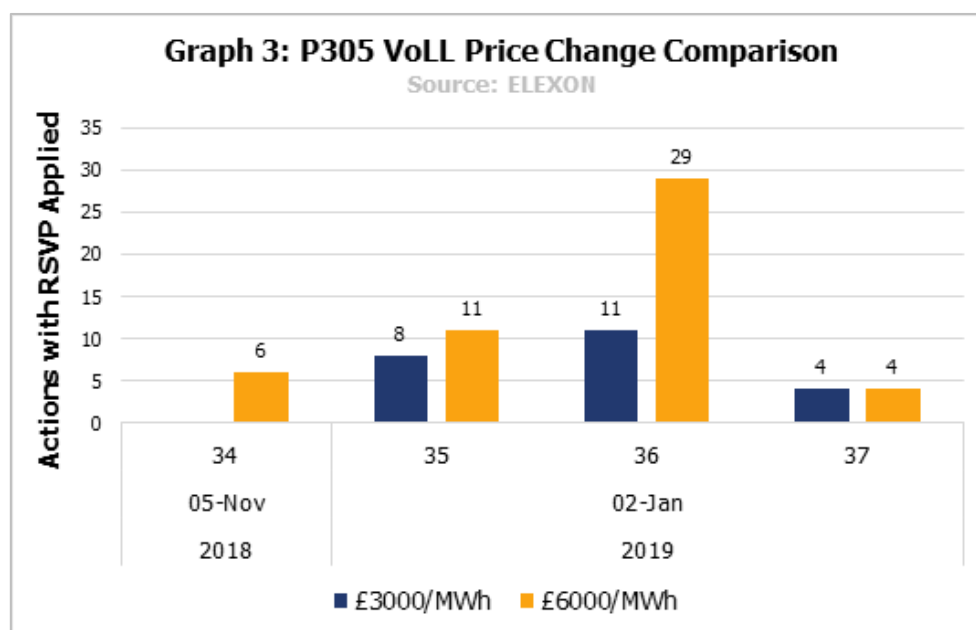
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From 5 November 2015 to 30 April 2019, the RSVP has been used to reprice 224 actions, across 12 Settlement Periods, on nine days. The utilisation of the RSVP is still limited to singular events with extreme market conditions. There were only two Settlement Periods since 5 November 2015 when RSVP priced actions have been included in the PAR volume; Settlement Period 39 on 9 October 2016 and Settlement Period 35 on 17 May 2017.

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 remained at £3000/MWh from 1 November 2018, there would have been 23 balancing actions with the RSVP assigned. All these would have taken place during on the 2 January 2019.

Graph 3 below shows the distribution of the distribution actions assigned the RSVP over the affected Settlement Periods from 1 January 2018 to 30 April 2019.



Graph 4 shows the greatest change in System Price at different VoLL, along with the total number of Settlement Periods the Imbalance Price would be different to the live scenario. All price differences occurred after the P305 changes made on 1 November 2018; price changes are compared to a live VoLL of £6,000/MWh and a dynamic LoLP.

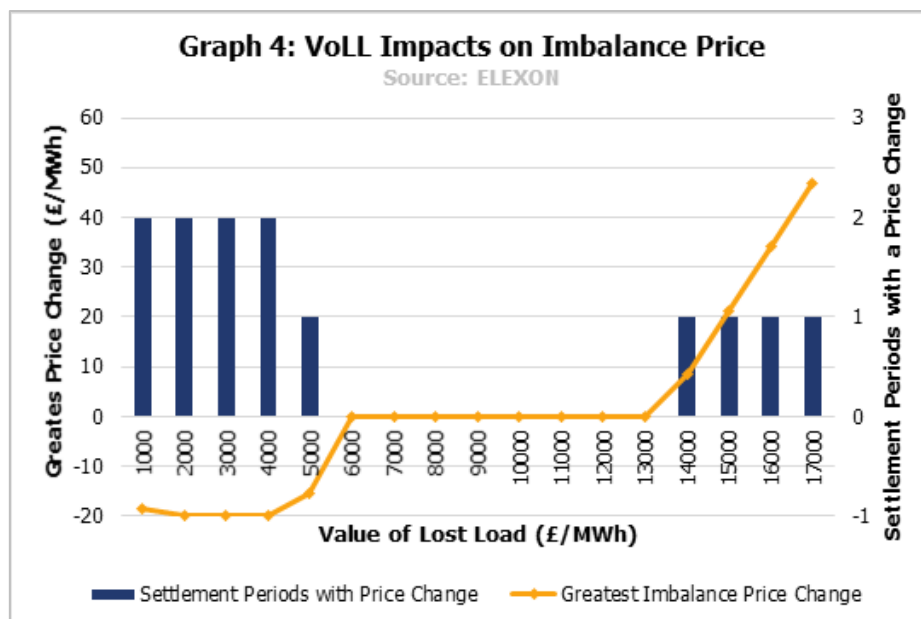
All negative Imbalance Price changes occurred during Settlement Period 36 on 2 January 2019. The negative price change at the VoLL £1,000/MWh was due to STOR actions repriced at the RSVP being arbitrage tagged. This removes some of the STOR actions from the price calculation, affecting the later Net Imbalance Volume (NIV) and PAR tagging.

The negative price changes from the VoLLs £2,000/MWh to £4,000/MWh. Here the RSVP exceeds the Arbitrage tagging price, therefore more STOR actions remain in the price calculation. The PAR volume at these VoLLs is set by the same two STOR actions that have not been repriced at the RSVP.

At a VoLL of £5,000/MWh, the two STOR actions setting the Imbalance Price are priced at the RSVP. The PAR volume is then set by 23 STOR actions all repriced at the RSVP.

When VoLL exceeded £5,000/MWh, the repriced STOR actions became more expensive and were removed due to NIV tagging.

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All positive Imbalance Price changes occurred during Settlement Period 35 on 2 January 2019, where STOR actions set the PAR. These STOR actions were priced at the RSVP from a VoLL of £14,000/MWh; the prices rose linearly from this point.

Given the above analysis, the increase in VoLL to £6,000/MWh on 1 November 2018 has not had a major impact on Imbalance Prices; only two settlement periods had a different Imbalance Price compared to the previous VoLL of £3,000/MWh.

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

The reduction in PAR has had a significant effect on the amount of actions, with the RSVP applied, affecting the final Imbalance Price. STOR actions with the RSVP only contribute to PAR1 when VoLL exceeds £14,000/MWh.