REVIEW OF THE LOLP CALCULATION STATEMENT AND AN UPDATE TO THE VALUE OF LOST LOAD REVIEW

MEETING NAME	Imbalance Settlement Group

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Purpose of paper	Decision
Classification	Public

Summary The BSC Panel delegated the responsibility to maintain and periodically review the Loss of Load Probability (LoLP) Calculation Statement to the Imbalance Settlement Group (ISG) in May 2018. Following discussions with National Grid Electricity System Operator (NG ESO), it is apparent that the current Statement does not clearly explain the Dynamic LoLP calculation that National Grid have implemented. This paper highlights errors in the current LoLP Calculation Statement, and also provides an update on Reserve Scarcity Price (RSVP) analysis given the dynamic LoLP was implemented over a year ago. ELEXON is requesting feedback from the ISG on the current methodology to determine the focus of a thorough review.

1. Background

1.1 The implementation of Approved Modification P305 'Electricity Balancing Significant Code Review Developments' on 5 November 2015 led to a number of changes in System Prices calculations. These changes included 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 RSVP is defined under BSC Section T, 3.13 as: $\mathbf{RSVP_j = LoLP_j * VoLL}$

1.3 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 Electricity System Operator (ESO), for each Settlement Period, and is a value between 0 and 1.

1.4 Since 1 November 2019, the LoLP has been calculated using the dynamic methodology; prior to this the static methodology was used. Both the static and dynamic LoLP methodologies are set out in the Loss of Load Probability Calculation Statement (see Attachment A). The current version of this statement (v2.0) was published on the 29 March 2019.

1.5 BSC Section T, 1.6A.7 states, "The Panel shall not delegate its power to determine changes to the Loss of Load Probability Calculation Statement (subject to the approval of the Authority) but it may delegate its responsibility to maintain and review the Loss of Load Probability Calculation Statement."

1.6 At BSC Panel Meeting 278, the BSC Panel agreed to delegate responsibility to the ISG to maintain and periodically review the LoLP Calculation Statement, and to report to the Panel from time to time.

2. Analysis undertaken by NG ESO on LoLP

2.1 In January 2018, NG ESO 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.

2.2 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.

2.3 In May 2019, ELEXON contacted the NG ESO to request updated LoLP analysis. NG ESO 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.

3. Feedback from April 2018 ISG meeting

3.1 At the ISG meeting in April 2018 (ISG204), ELEXON summarised NG ESO's analysis and confirmed it monitored the LoLP parameter in the monthly SPAR. ISG members did not believe further analysis into the change from static to dynamic LoLP was required at this time, but expressed interest in an annual update.

3.2 ELEXON also requested ISG's views on delegating authority for maintaining and periodically reviewing the LoLP Calculation Statement methodology. ISG Members supported ELEXON's proposal to seek the Panel's approval to delegate this to the ISG, and noted the current Loss of Load Probability Calculation Statement (at the time v1.0) had not been reviewed since the implementation of Modification P305 in November 2015.

4. Case for conducting a review of the LoLP Calculation Statement

4.1 BSC Section T, 1.6A.3 states: "The Panel shall review the Loss of Load Probability Calculation Statement:

(a) from time to time; and/or

(b) subject to paragraph 1.6A.4, where it considers necessary in order to give full and timely effect to any relevant Approved Modification by the Implementation Date for that Approved Modification,

and shall make such revisions to the Loss of Load Probability Calculation Statement as may be determined by it and approved by the Authority following such review".

4.2 At BSC Panel Meeting 278 in May 2018, ELEXON suggested reviewing the LoLP Calculation Statement in detail as it had never been reviewed since it was implemented. This remains the case, as no detailed review of the LoLP Calculation Statement has taken place since. The scope of any review should be agreed by the ISG, and will require support from the NG ESO as well as consultation(s) with industry.

4.3 This paper seeks to determine whether the LoLP calculation statement accurately reflects the processes undertaken by NG ESO in calculating the dynamic LoLP. These findings may result in a more wide-ranging review of whether the current LoLP Calculation Statement methodology is still fit for purpose.

5. Assessment of Methodology Statement

5.1 An initial appraisal of the LoLP Methodology Statement identified several opportunities for improving the document. These broadly categorise into:

- areas where the text does not correctly describe how NG ESO perform their calculations;
- internal inconsistencies within the document;
- lack of clarity in the document; and
- areas in which it may be possible to improve the methodology itself.

5.2 There are a number of instances where the text does not accurately describe the current process. For example, the document states that the Static methodology is based on a normal distribution with a mean of 0 and a variance (σ^2) of 700MW. NG ESO actually use a normal distribution with a standard deviation (σ) of 700MW.

5.3 To give an indication of the materiality of this difference, a standard deviation of 700MW would mean that a 100 MW De-Rated Margin would have a RSVP of £1329.61/MWh, based on a VoLL of £3000/MWh, while a standard deviation of square root 700MW (26MW) would have an RSVP of £0.24/MWh.

5.4 Similarly, the document states that "wind and other forms of renewable generation" are excluded from the calculation of Conventional Generation Capacity (GCAP). NG ESO have confirmed that Biomass and Hydro are actually included in the calculation of GCAP, and it is only wind (and potentially in the future other intermittent generation such as solar) that is excluded.

5.5 The document does not provide a significant level of detail for the dynamic LoLP calculation, making it hard for business requirements for the process to be written. For example, the document refers to differences in wind power forecasts used in the calculation of Static and Dynamic LoLP, but it is not clear what these differences are.

5.6 There are a number of simplifying assumptions made in the methodology, such as not taking account of ramp up rates, or not considering the risk of a transmission system fault. In general these assumptions tend to reduce the overall value of the LoLP. Once the methodology is clearly understood and documented, it may be appropriate to consider reviewing these assumptions, as part of a wide ranging review, in order to improve and refine the RSVP methodology.

5.7 ELEXON receives LoLP values from NG ESO to publish on the Balancing Mechanism Reporting Service (BMRS) and use in Settlement calculations. It is noted that while ELEXON can validate that the values published on the BMRS are those provided by the NG ESO, ELEXON does not have sufficient data to validate the actual calculation performed.

5.8 The NG ESO have confirmed that they review the LoLP calculation every year, and that the increase in demand forecast error over the last few years has had no impact on LoLP or RVSP.

5.9 During BSC Panel Meeting 300, the LoLP figures for 4 March 2020 were discussed. During Settlement Periods 37 and 38 on this day, the System Price was £2,242.31/MWh and £1,708.05/MWh respectively. The prices were set by actions priced at the RSVP. A Panel member commented that the 12:00 forecast of the LoLP values from the previous day were more accurate than the values published for the 12:00 forecast on the day of the spike, which overwrite the previous day values. The 12:00 forecast on the day currently overwrites the 12:00 figures from the previous day on the BMRS. The Panel member requested a change to the BMRS to publish an additional field to show the previous day forecast, rather than the current overwriting process.

6. Value of Lost Load (VoLL) Data Review

6.1 ELEXON's analysis focused on how changing VoLL would impact the RSVP, which in turn would impact the Imbalance Price (see Appendix 1 for full details). 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 385 STOR balancing actions on 12 days across 22 Settlement Periods, or 0.085% 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; the RSVP would still not have been applied to any balancing actions.

6.2 The table below summarises the number of Settlement Periods repriced, across both pre and post 1 November 2018 scenarios, between 1 January 2018 and 9 March 2020:

Scenario	P305, Phase One		P305, Phase Two	
Dates	1 Jan 2018 – 31 Oct 2018		1 Nov 2018 – 9 March 2020	
PAR	50MWh		1MWh	
LoLP	Static		Dynamic	
VoLL	£3,000/MWh	£6,000MWh	£3,000/MWh	£6,000MWh
Actions Repriced	0	0	130	211
Settlement Periods impacted	0	0	11	14
RSVP Actions in Pricing Stack?	No	No	Yes	Yes
Number of Settlement Periods where RSVP Actions set Imbalance Price	0	0	2	2

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

- During the period 1 November 2018 to 9 March 2020, following the implementation of the phase two changes of Modification P305 (VoLL set at £6,000/MWh), the RSVP was applied to 211 balancing actions, across 14 Settlement Periods on five dates. If the VoLL had remained at £3,000/MWh, the RSVP would have been applied to only 130 balancing actions, across 11 Settlement Periods on three days.
- Since January 2018 to 9 March 2020, 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 9 March 2020, 48 RSVP priced actions were in the Price Average Reference (PAR) during Settlement Periods 37 and 38 on 4 March 2020, and therefore set the Imbalance Price. Therefore, the Imbalance Price has only been set by the RSVP in two Settlement Periods between 5 November 2015 and 9 March 2020.

6.3 The change of the PAR from 50MWh to 1MWh on 1 November 2018 reduced the likelihood of RSVP priced STOR actions affecting the Imbalance Prices, as less actions are included in the priced volume which sets the Imbalance Price.

7. Recommendations

7.1 We invite you to:

a) **NOTE** the annual review of the VoLL;

b) **NOTE** the RSVP set the Imbalance Price in Settlement Periods 37 and 38 on 4 March 2020, but that this is the only occurrence since P305 was implemented in November 2015;

c) **AGREE** for a more in depth review of the LoLP Calculation Statement with NG ESO, to make sure it accurately describes the current LoLP calculation process; and

d) **AGREE** to include any housekeeping changes within the next versions of the LoLP Calculations Statement.

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Attachments

Attachment A – BSC Subsidiary Document: Loss of Load Probability Calculation Statement, Version 2.0 (effective 29 March 2019)

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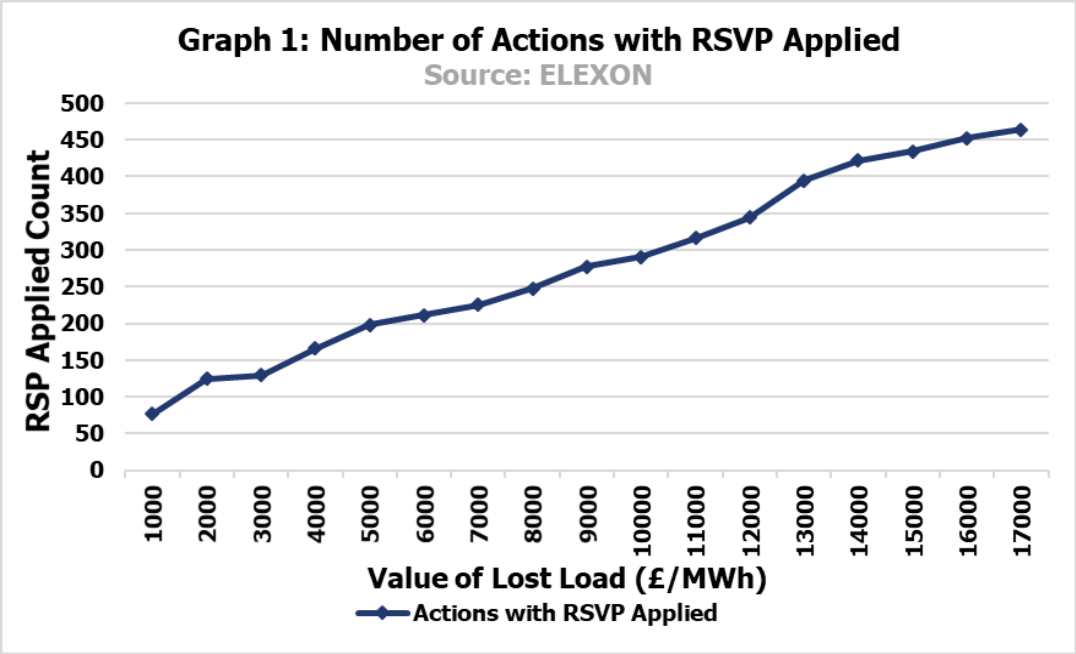
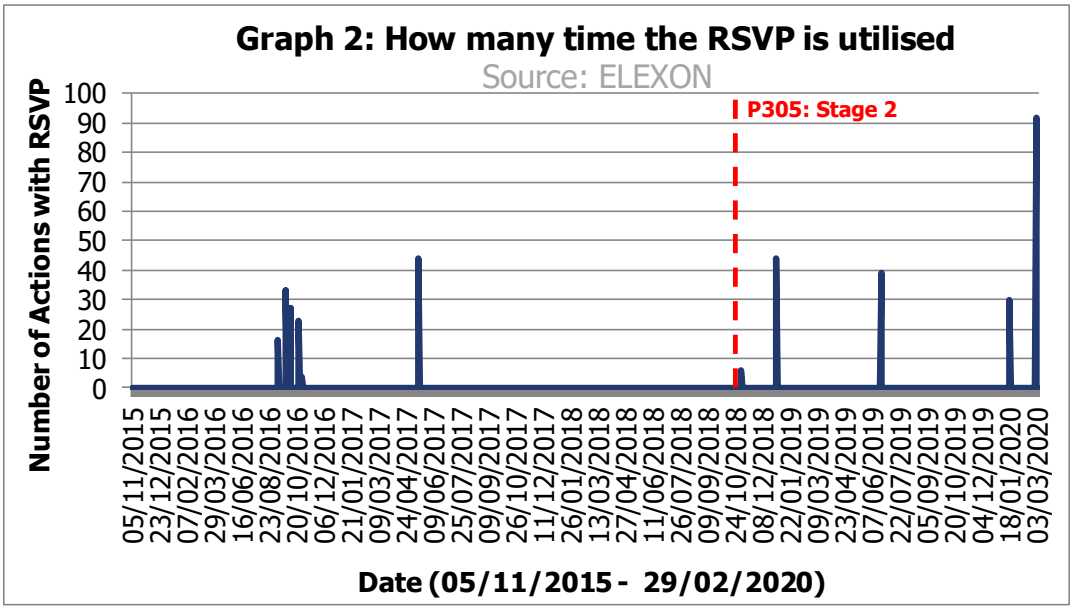
APPENDIX 1 – VOLL ANALYSIS CONDUCTED BY ELEXON

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 between 1 January 2018 and 9 March 2020; 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, 44 STOR actions on 2 January 2019, 39 STOR actions on 24 June 2019, 30 on 21 January 2020 and 92 actions on 4 March 2020. 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, as no STOR actions are 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.

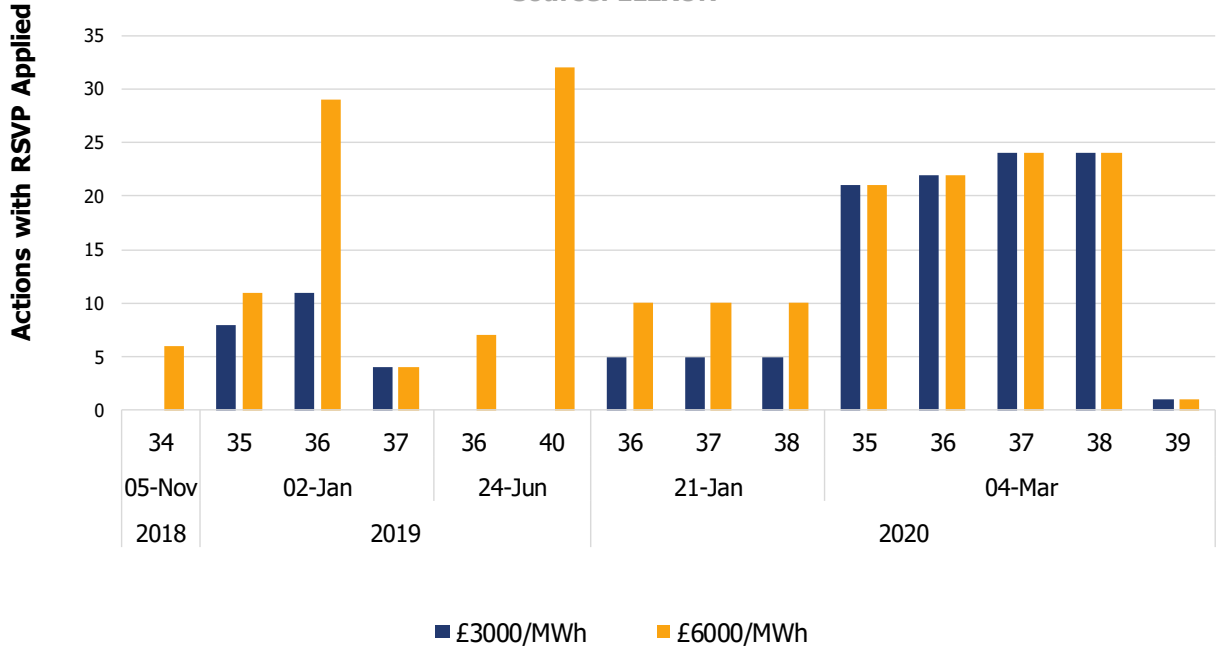
From 5 November 2015 to 9 March 2020, the RSVP has been used to reprice 385 actions, across 22 Settlement Periods, on 12 days. The utilisation of the RSVP is still limitied to singular events with extreme market conditions. When the Price Average Reference (PAR) was 50MWh (from 5 November 2015 to 30 September 2018), there were only two Settlement Periods 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. Since the reduction of PAR to 1MWh on 1 November 2018, there have been **two Settlement Periods when RSVP priced actions have been included in the PAR volume; Settlement Periods 37 and 38 on 4 March 2020**.

The change in VoLL and LoLP from 1 November 2018 has impacted when the RSVP is used, and how many actions are repriced using the RSVP.

If VoLL remained at £3,000/MWh from 1 November 2018, there would have been 130 balancing actions with the RSVP assigned on three dates over 11 Settlement Periods. From the 1 November 2018, when the VoLL was £6,000/MWh, 211 actions across 14 Settlement Periods on five dates were repriced. **Graph 3** below shows the distribution of the distribution actions assigned the RSVP over the affected Settlement Periods from 1 January 2018 to 9 March 2020.

Graph 3: P305 VoLL Price Change Comparison

Source: ELEXON



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.

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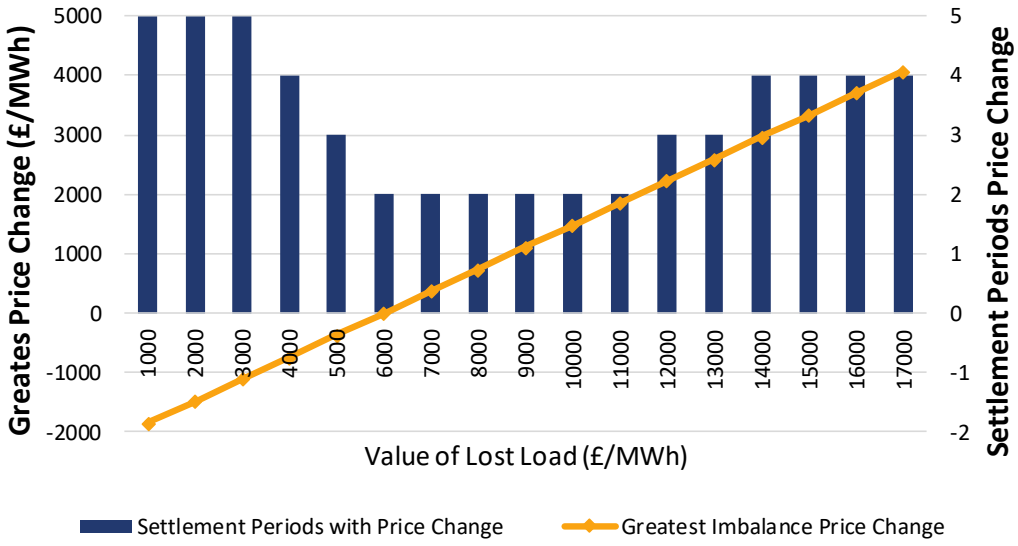
All of the greatest changes in Imbalance Price occurred on 4 March 2020 during Settlement Period 37, where the dynamic LoLP was 0.037. As the RSVP set the Imbalance Price in this Settlement Period, the price changes are in line with the LoLP and change by £370/MWh for each £1000/MWh VoLL increment.

Graph 4: VoLL Impacts on Imbalance Price

Source: ELEXON



Given the above analysis, the increase in VoLL to £6,000/MWh on 1 November 2018 has only had a major impact on Imbalance Prices when the RSVP has been included in the PAR volume and set the Imbalance Price. This only happened during Settlement Periods 37 and 38 on 4 March 2020. If the VoLL were £3,000/MWh for these two Settlement Periods, the Imbalance Price would have been £1111.58/MWh less in Settlement Period 37 and £844.46/MWh less in Settlement Period 38.

	Imbalance Price 4 March 2020	
VoLL	SP37	SP38
£3,000/MWh	1130.72	863.60
£6,000/MWh	2242.31	1708.05
Difference	1111.58	844.46

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 we do not believe a review at this stage is necessary.

The reduction in PAR has had a significant effect on the amount of actions with the RSVP applied affecting the final Imbalance Price.