Title	**Report on Flattening Power Factor to RAs**
Version	**1.0**
Date	**12th Oct 2007**

Summary

In line with M30 of T&SC 3.0, the system operators herein propose a value for the Flattening Power Factor, FPF. The introduction of the FPF into the Loss Of Load Probability Table, LOLPT, calculation has the objective of reducing the volatility inherent in the capacity payments mechanism. Choosing an appropriate value for the FPF is a matter of striking an appropriate balance between retaining sufficient volatility to signal the need for availability in times of low margin and avoiding excessive volatility that would render the mechanism highly unpredictable.

A value of 0.35 was proposed in March 2007 by the Regulatory Authorities, RAs, when they published their decision on the LOLP calculation methodology. After carrying out analysis on the effect of different values of FPF on the modified LOLPT calculation, we find that the value of 0.35 is in line with these objectives and we propose this value is used for the FPF in 2008.

While 0.35 is a satisfactory value when using a single FPF, we argue in the Appendix that in order to get most value from the variable and ex-post capacity payments, two FPFs are required – one for each payment.

Introduction

Section M30 of the T&SC 3.0 states that it is the responsibility of the system operator to propose a value for the FPF to the RAs.

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M.30 With respect to the Loss of Load Probability Table, the System Operators shall make a report to the Regulatory Authorities at least four months before the start of the Year proposing a value for the Flattening Power Factor (FPFy) for Year y which shall be in the range $0 < FPFy \leq 1$. The Market Operator shall publish the approved value of this parameter within 5 Working Days of receipt of the Regulatory Authorities' determination or two months prior to the first Capacity Period of the Year, whichever is the later. The System Operators may propose revisions to the value of the Flattening Power Factor (FPFy) during the Year and, subject to the approval of the Regulatory Authorities, the Market Operator shall publish such revised value not less than thirty 30 days prior to the first Capacity Period for which such revised value is to be applied.

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Due to material errors being identified within the algebra of section M.30 of the Trading and Settlement Code, the RAs proposed a modification to correct it. Since the entire LOLPT calculation methodology was subject to modification, the appropriate analyses could not be carried out until this modification was completed.

Now that the modification of the LOLPT calculation is complete, we have carried out analysis of the effect of a number of FPF values on the distribution of the capacity payments and our findings are contained in this report.

Analysis

In the SEM, generators will be paid a capacity payment for their eligible availability in every trading period. Generally, a generator's eligible availability in a trading period is the amount of capacity for which the generator will be rewarded for being available to the system operators for dispatch in that trading period.

The total amount of money to be paid out in capacity payments is fixed on an annual basis. This amount is then further divided into 12 amounts, one for each month of the year. Each monthly amount is divided into three payments for that month – a fixed, a monthly variable and an ex-post payment. These three amounts are spread out over all the trading periods in the month.

The quantity of the monthly fixed amount to be paid out in a trading period in that month is weighted using the demand in that trading period relative to the minimum demand in that month. This payment is independent of the margin.

The quantity of the monthly variable amount to be paid out in a trading period in that month is weighted using a factor, lambda, which is linked to the *forecast* margin in that trading period through the lookup table, LOLPT.

The quantity of the monthly ex-post amount to paid out in a trading period in that month is weighted using a factor, phi, which is a linked to the *actual* margin in that trading period through the lookup table, LOLPT. (See Fig 1.)

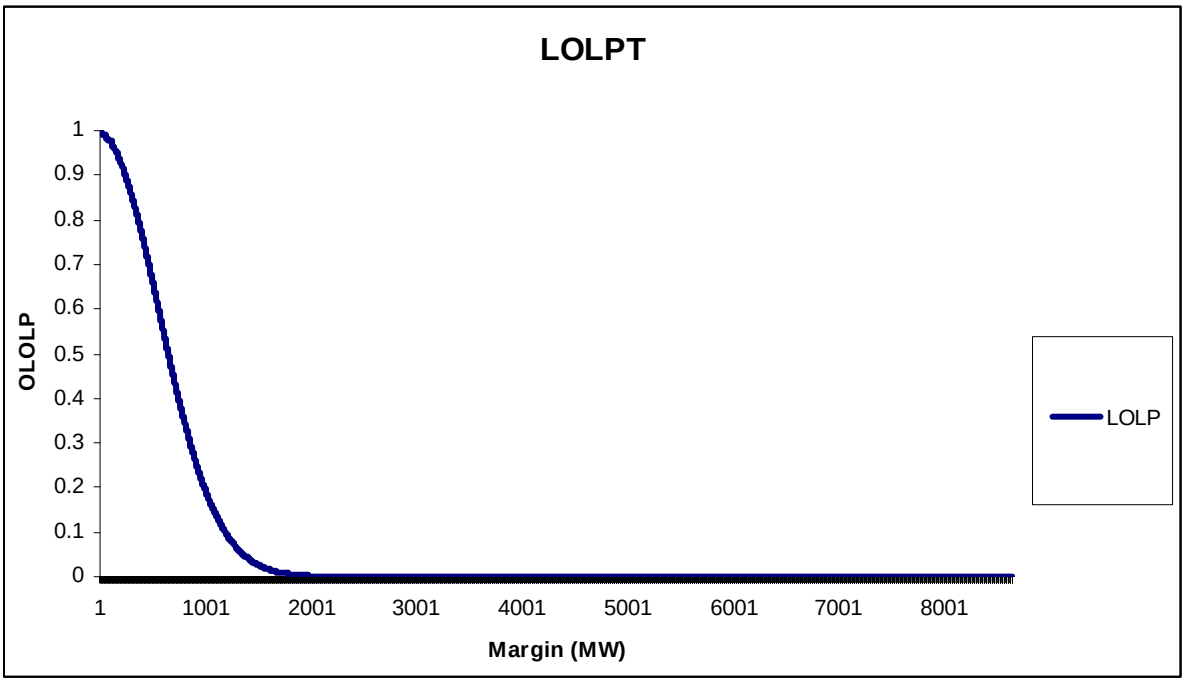

Fig. 1 The LOLPT lookup table

The LOLPT table that links lambda and phi to the margin is based on a calculation of the probability that the amount of available generation will be less than the demand. It considers that all generators are available but have independent probabilities that they will become unavailable at a particular moment. These probabilities are convolved to produce the LOLPT.

However, it was found that both lambda and phi were particularly sensitive to small changes in the margin due to the steep gradient of the LOLPT. Thus, a FPF was proposed to reduce the volatility of the variable and ex-post weighting factors from trading period to trading period. (See Fig 2)

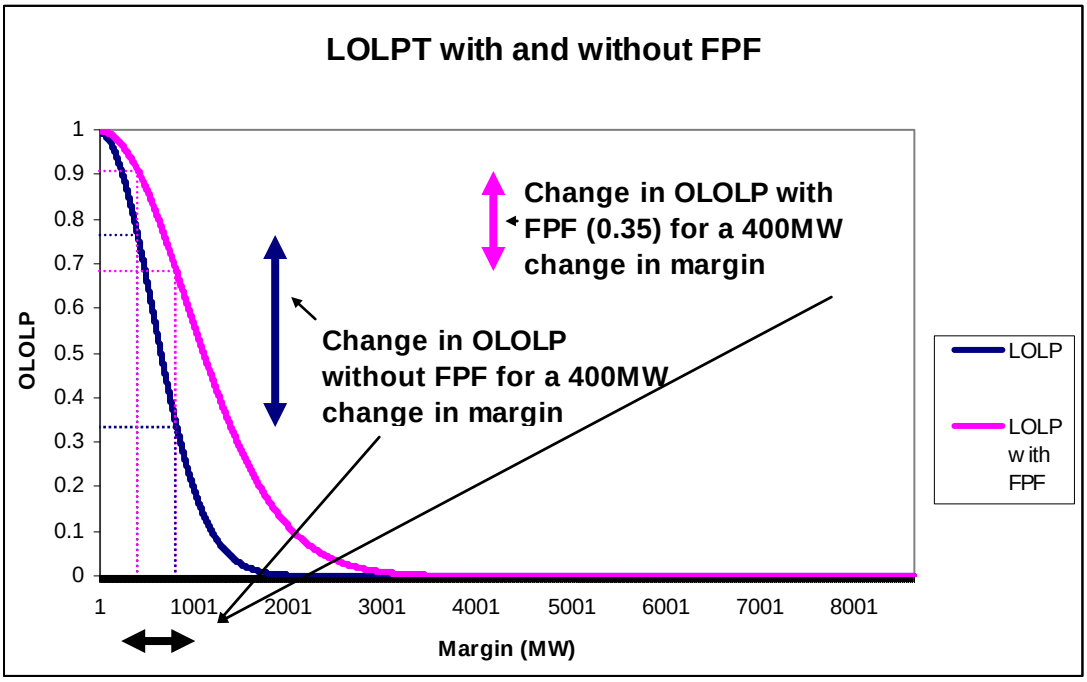

Fig 2. The sensitivity of the Output LOLP from the LOLPT to small changes in margin. The effect of the FPF in reducing this sensitivity is illustrated.

The decision to include the FPF in the capacity payment calculation was outlined in "Single Electricity Market-Loss of Load Probability Curve for Capacity Payment Mechanism-Decisions Paper and Response to Detailed Comments-AIP-SEM-07-65-30th March 2007".

In this document the RAs put forward a figure for the FPF,

> "The desire is to keep some volatility in the payments to signal the need for availability during periods of system stress, but at the same time provide a smooth stream of payments over the course of the month. To achieve this objective, the RA's have decided to implement a PF of 0.35, following simulation studies of the impact that various PFs have on the distribution of payments."

The system operators agree with the objectives outlined above. Furthermore, our analysis has indicated that the FPF applied to the modified LOLPT calculation leads to results similar to those published in the Addendum to the above paper (AIP-SEM-07-41).

Conclusion

From our analysis, we find that the value of 0.35 initially proposed by the RAs in their decision paper is inline with achieving the dual objectives of maintaining sufficient signal and decreasing the volatility.

Appendix

The case for two Flattening Power Factors – one for the Variable Payment and one for the Ex-Post Payment

It is the view of the System Operators that there are very good reasons to consider the use of two FPFs – one for the variable payment and one for the ex-post payment.

Our reasons are as follows:

1. The variable payments are linked to a forecast of the margin through the LOLPT. Implicit in this forecast are large uncertainties due to the limits on the predictability of wind, demand and discrete forced outage events a month in advance.
2. During the month, a generator, as they know with certainty that these payments will occur in these periods, will be likely to focus their availability around these periods.
3. Therefore, a small FPF (flatter LOLPT) is required for the Variable Payment (<0.5). Both the SOs and the generators benefit from a small FPF for the variable payment. It would mitigate against the forecast uncertainty by spreading the payments more evenly whilst retaining the signal linked to the margin.
4. The ex-post payments are linked to the actual margin over the month as measured ex post. The difficulties associated with the forecast uncertainty of the margin in the variable payment are no longer present as the ex post margin is known with a high degree of certainty. The largest payment amounts will go into periods where capacity was required the most.
5. During the month, a generator will be unlikely to focus their availability on periods where there is no guarantee that they will receive that amount as they have to wait until ex post to know with certainty what payments will be made in what periods.
6. Therefore, a large FPF (steeper curve) is required for the Ex-Post Payment (>0.75). Both SOs and generators benefit from a large FPF for the ex-post payment. As the payment is linked to actual margin, much larger value is placed on capacity in periods where the actual margin was low. While there is uncertainty as to when the margin will be low, a more pronounced signal coupled with updated forecasts of the ex post margin will ensure that generators have adequate incentive to respond when they are required.
7. In general, the FPF should be used to scale the LOLPT to reflect the confidence intervals of the margin calculation. When the margin is forecasted a month in advance, the confidence intervals are wide, reflecting the uncertainty of the forecast. The weighting of the variable payment should reflect this uncertainty. On the other hand, the confidence intervals of the ex-post margin are very narrow, reflecting almost certainty. The weighting of ex-post payment should reflect this certainty. In this way, it can be assured that higher value is placed on capacity when the actual margin is lower.
8. Finally, while the FPF has an important role to play in the Capacity Payment Mechanism, of greater importance is the relative difference between the Capacity Payment Ex-Post Sum and the Capacity Payment Variable Sum. It is recognised that in order to give generators some measure of certainty regarding their revenue from the capacity payment, there is a requirement for the Variable Payment. However, in order to reflect that capacity is more valuable to the system operator and indeed consumers at times when the actual margin is low, the Capacity Payment Ex-Post Sum should be greater than the Capacity Payment Variable Sum.

