# Comparison of Tan 45 versus Free Flow Equivalent Anchoring Methods For Establishing Statewide IRM Requirements

This document presents a technical/reliability comparison of the Free Flowing Equivalent and TAN 45 methods and may shed some light on the merits of each approach. A summary of the comparison is presented in Table 1.

In the first place, the term “free-flowing equivalent” is a misnomer. Fig. 1 shows a typical IRM/LCR curve where all points on the curve meet the LOLE = 0.1. At the extreme left portion the curve is asymptotically vertical. At the pure free-flowing point where no transmission limits are assumed to exist, the LCR is theoretically zero and lies on the horizontal axis as indicated on Fig. 1. The so-called “free-flowing equivalent” recognizes this and backs a bit to the right so the point is on the visible curve. This point would be better named the Minimum-Flow Equivalent method because it assumes the maximum amount of generation resources within the constrained areas (very high LCRs), which in turn minimizes the use of transmission into the constrained areas. One could equally think of a point on the other extreme of the curve, the right most point and call such a solution the “Maximum-Flow Equivalent” method because it assumes the minimum amount of generation resources in the constrained areas, which in turn maximizes the use of transmission into the constrained areas. The Tan 45 method balances the use of resources within and outside the constrained areas and therefore also balances the use of the transmission system by the constrained areas. This conclusion is captured as item 2 in Table 1.

IRM/LCR studies have input assumptions relating to such quantities as the availability of generating units and the load forecasted for the study year based on past performance. They represent the best forecasts of what these quantities are expected to be in the upcoming year but as any forecast they are not perfect. The actual availability and load experience in the study year most probably will differ from the forecast, hopefully by not too great a value. At both extremes of the IRM/LCR curve (Fig. 1.) a small change affecting the IRM will have a huge effect on the LCR and vice versa. In contrast, by definition, in the Tan 45 method such uncertainties affect the IRM and LCR by the same magnitude. This conclusion is item 3 in Table 1.

In the final analysis it is important that resources physically do exist corresponding to the adopted minimum requirement. At the extreme points there is a high probability that the required resources would not physically exist in the constrained areas or in the rest-of-state respectively. The TAN 45, by balancing the dependence on resources within and outside the constrained areas has the lowest probability that the required resources would not physically exist. Item 4 of Table 1 makes this point.

The information provided in Fig. 2 is very revealing. These IRM / Zonal LOLE curves were plotted from information provided by the NYISO in their final study for the adoption of the 2006/07 IRM. Fig. 2 shows that at the most extreme left portion of the graph, the locational zones J and K are not the most constrained zones. Zones B (NYSEG) and I (Con Edison outside of NYC) have higher zonal LOLEs and are therefore more constraining than Zones J and K. In essence, Zones B and I have become constrained zones. Zone B is especially troubling since but for modeling considerations the calculations would have resulted in an even higher zonal LOLE[1]. At the FF/E point rest-of-state resources are reduced as much as possible leaving less resources to support Zones B and I. This demonstrates that extreme methods such as the FF/E can lead to lopsided results. Item 5 in Table 1 summarizes this.

Finally, a desirable attribute of an anchoring method to establish minimum requirements is that the impact of load growth throughout the state should not be borne primarily by constrained areas. It is enlightening to examine three load growth scenarios, a) all load growth outside constrained areas; b) all load growth within constrained areas; and c) load growth evenly distributed throughout the state. Since the FF/E seeks to maximize locational capacity, it would seek to add locational capacity in all three scenarios, clearly unfair for scenarios a) and c). Under the TAN 45 method the impact of load growth would be shared among all zones, both within constrained areas and outside constrained areas. This is inherently a more balanced and fair result. In fact, in scenario c), it can be expected that the impact of evenly distributed load growth would be minimized since the requirement is stated in terms of percentage of peak load, automatically leading to higher minimum resource requirements as peak load increases. This attribute is summarized as item 6 of Table 1.

All the analysis presented in this document, as summarized in Table 1 and supported by Figs. 1 and 2, clearly indicate that a moderate middle-of-the–road method such as the TAN 45 method best meets all the desirable technical/reliability attributes of an IRM/LCR anchoring method.

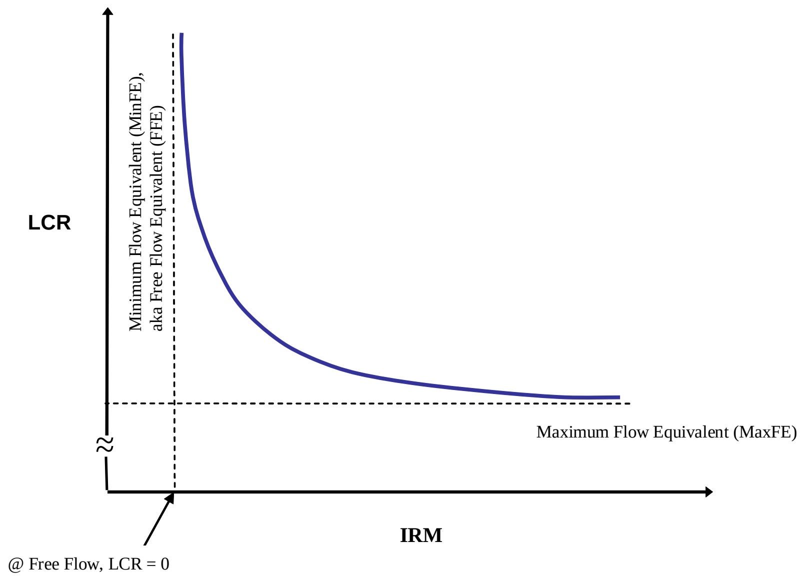
[1] The MARS model used in developing the curves of Fig. 1 actually allowed resources from Zones A and C to flow into Zone B, which cannot physically happen. ICS is examining this issue to develop a solution.

# Table 1. Comparison of Tan 45 versus Free Flow Equivalent Anchoring Methods for Establishing Statewide IRM Requirements

| Item | Technical/Reliability Attributes of an Anchoring Method | Free-Flow Equivalent | Tan 45 |
|---|---|---|---|
| 1 | Meet an LOLE of 0.1 | Yes[2] | Yes[2] |
| 2 | Balanced use of resources within and outside constrained areas (conservative)[3] | No, over-relies on resources within constrained areas | Yes, not biased either way |
| 3 | Stability of IRM/LCRs[3] | Highly unstable at the resulting extreme point by use of the FF/E in that assumption uncertainties that have a small effect on the IRM would have a large effect on the LCRs | Highly stable since the Tan 45 by definition is the point at which uncertainties affect both parameters by the same magnitude |
| 4 | Feasibility of Results | High probability that the resulting LCRs exceed the available locational capacity | Low probability that the resulting LCRs exceed the available locational capacity |
| 5 | At the minimum requirements, zonal LOLEs in constrained zones must be higher than in unconstrained zones[4] | Some zones in rest of state have LOLEs that are higher than in constrained areas but have no locational requirements | Zones in constrained areas have a higher LOLE than in rest of state zones |
| 6 | The impact of load growth throughout the state should not be borne primarily by constrained areas. If the only change from one year to the next is load growth evenly distributed throughout the state, then there should be a minimum impact on the resulting IRM/LCRs. | Since method maximizes use of resources within constrained areas, it tends to account for load growth by requiring more resources in constrained areas. This will happen even when load growth is evenly distributed throughout the state or is exclusively outside the constrained areas. | Since method balances the use of resources within and outside constrained areas, it accounts for load growth by requiring resources within and outside constrained areas. If load growth is evenly distributed throughout the state, the impact on resulting IRM/LCRs is minimized. |

[2] This assuming the resources physically exist, which is addressed in item 4
[3] See Fig. 1
[4] See Fig. 2

# Fig. 1: IRM / LCR Curve



# Fig. 2: Zonal LOLEs vs. IRM