INADVERTENT INTERCHANGE SETTLEMENT DEAD-BAND DISCUSSION

Prepared for

The NAESB Inadvertent Interchange Payback Task Force

by

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1. INTRODUCTION

At the November 3, 2003 NAESB IIPTF Meeting a motion was made to create a dead-band on Inadvertent Interchange. This dead-band would essentially result in all inadvertent falling within a BAs $\mathbf{L_{10}}$ limit to be settled using payback-in-kind and allow inadvertent falling outside the $\mathbf{L_{10}}$ limit to be settled financially. This paper provides technical discussion concerning the reasonableness of setting this specific type of dead-band and the consequences using dead-bands to address this problem in general.

2. QUESTIONS TO ASK

There are a number of questions raised by this motion that should be answered before a final decision is made on the motion itself. These questions include but are not limited to the following:

1. $\mathbf{L_{10}}$ as developed in NERC Policy applies to ACE. The equivalent of ACE when addressing the problem of Inadvertent Interchange settlement is not raw inadvertent but is Area Interchange Error (AIE). Should $\mathbf{L_{10}}$ be applied to Inadvertent Interchange or AIE?
2. The $\mathbf{L_{10}}$ limit applies to a ten minute interval. Inadvertent Interchange is calculated on an hourly basis. How should the $\mathbf{L_{10}}$ limit be applied to Inadvertent Interchange?
3. When ECAR developed their dead-band on inadvertent associated with reliability, they chose to use a dead-band in the frequency domain, not the inadvertent domain. Is a frequency domain based dead-band better for resolving this problem?
4. Many of the discussions over the past months have been directed at developing settlement methods related to the prices associated with inadvertent energy. Is an energy value (price) domain based dead-band better for resolving this problem?
5. One of the issues that must be addressed when considering a dead-band is the effect that the dead-band has on the complexity of the settlement process. Analysis of the complexity of the settlement process with and without a dead-band should provide information on the advisability of setting a dead-band as part of the settlement process. How does setting a dead-band affect the complexity of the settlement process?
6. The most recent work the IIPTF has been to investigate the basis of the Frequency Control Contribution of Inadvertent Interchange. If FCC is an appropriate settlement parameter, should the appropriateness of using a dead-band be determined for energy and FCC independently? Should FCC also have a dead-band?

The remainder of this paper will address the above questions.

3. INADVERTENT INTERCHANGE VS. AIE DOMAIN

Should L_{10} be applied to Inadvertent Interchange or AIE?

The difference between Inadvertent Interchange and Area Interchange Error is the point chosen for zero. Inadvertent Interchange has a zero set based on only scheduled interchange the same basis as that used to calculate the inadvertent. If the dead-band is based on Inadvertent Interchange then the dead-band for a BA with an $\mathbf{L_{10}}$ of 100 MW will be from -100 MWhs to +100 MWhs. Area Interchange Error sets the zero point based on scheduled interchange plus average frequency error times frequency bias. If the average frequency error for an hour is 0.010 Hz and the frequency bias is 2000 MW / Hz for the BA, the AIE dead-band would be from -120 MWhs to +80 MWhs of inadvertent because the frequency bias contribution would move the dead-band 20 MWhs.

$\mathbf{L_{10}}$ was developed to apply to control actions as measured by Area Control Error (ACE). The equivalent of hourly ACE is AIE. Using this logic, the L_{10} limit if applied as a dead-band should be applied to AIE, not raw inadvertent. The current calculation of Inadvertent Interchange guarantees that the sum of the Inadvertent Interchanges for a total interconnection is equal to zero, the same number of MWhs above and below zero. Unfortunately, the AIE zero offset would reduce the probability that there would be a balance between the energy amounts within the dead-band and outside the dead-band because the number of MWhs above and below the zero point would no longer balance.

The moving of the zero point would make it impossible for both the amounts within the dead-band and outside the dead-band to balance at the same time unless the frequency error is zero. Balance outside the dead-band may not be as important as balance within the dead-band because the settlement is financial. If the MWhs inside the dead-band do not balance, it will be impossible to payback all of the MWhs in-kind making the settlement unworkable.

4. APPLYING L_{10} TO HOURLY MEASURES

How should the L_{10} limit be applied to Inadvertent Interchange?

The $\mathbf{L_{10}}$ equation is shown below as equation (1). It is based on the value for $\boldsymbol{\varepsilon_{10}}$ for the interconnection. $\boldsymbol{\varepsilon_{10}}$ is a measure for the 10-minute frequency error for the interconnection.

$$\mathbf{L_{10} = 1.65\varepsilon_{10}\sqrt{(-10B_i)(-10B_S)}} \qquad \mathbf{(1)}$$

Should $\mathbf{L_{60}}$ be used instead of $\mathbf{L_{10}}$ for inadvertent interchange as shown in equation (2) below?

$$\mathbf{L_{60} = 1.65\varepsilon_{60}\sqrt{(-10B_i)(-10B_S)}} \qquad \mathbf{(2)}$$

The current value for $\boldsymbol{\varepsilon_{10}}$ for the Eastern Interconnection is 0.0057 Hz. The equivalent value for $\boldsymbol{\varepsilon_{60}}$ for the Eastern Interconnection is 0.0023 Hz. Therefore, an equivalent $\mathbf{L_{60}}$ would be about 40% of the current value of $\mathbf{L_{10}}$ for a BA.

5. DEVELOPING A FREQUENCY DEAD-BAND

Is a frequency domain based dead-band better for resolving this problem?

When ECAR developed a solution to the specific problem of a BA leaning on the interconnection for an extended period of time, they also viewed the problem as a reliability problem, not a financial problem. As a result of defining the problem as a reliability problem, they chose to use a single sided dead-band, considering only low frequency, in the frequency domain. Since the dead-band for Inadvertent Interchange is also justified as related to reliability, should it not also be defined in the frequency domain?

There is a significant advantage gained from the selection of a dead-band in the frequency domain. This advantage derives from the fact that the average frequency error experienced by all BAs on an interconnection in any single hour is the same. Therefore, all BAs would lie within or outside the dead-band in any single hour. Since the Inadvertent Interchange for any single hour for an interconnection

sums to zero. The selection of a frequency dead-band will insure that all Inadvertent Interchange within the dead-band and all Inadvertent Interchange outside the dead-band will remain balanced. This insures that the payback-in-kind methodology used within the dead-band will always be balanced. It does not insure that the payback-in-kind will be feasible with respect to location on the interconnection.

6. DEVELOPING AN ENERGY VALUE (PRICE) DEAD-BAND

Is an energy value (price) domain based dead-band better for resolving this problem?

The goal of this task force is to develop a settlement method for Inadvertent Interchange that would mitigate the financial advantage that the payback-in-kind method can be used to create. This raises the question of whether a dead-band should be based on the value (price) of the Inadvertent Interchange. This selection would insure that financial settlement would only apply to Inadvertent Interchange when the value of the inadvertent is the greatest.

The difficulty with a value (price) dead-band is that the financial advantage that can be gained from the payback-in-kind methodology results from the value (price) difference between the value (price) of the inadvertent when it is created and the value (price) when it is repaid in-kind. Since it is the difference between values (prices) and not the magnitude of the value (price) a dead-band based on energy value (price) fails to help with this problem.

7. PROCESS COMPLEXITY USING A DEAD-BAND

How does setting a dead-band affect the complexity of the settlement process?

One of the goals of designing a settlement process should be to design a process that is as simple as possible. Therefore, the imposition of a dead-band on the settlement process should be investigated with respect to how it affects the complexity of the settlement process. Does the imposition of a dead-band make the settlement process simpler or more complex?

Frequency Domain Dead-band:

The simplest settlement process including a dead-band is a process that uses a dead-band based in the frequency domain. Only a dead-band based in the frequency domain insures that the MWhs within the dead-band remain balanced and the MWhs outside the dead-band also remain balanced. This result in very important for insuring that every participant on the interconnection has a counter party available to settle the inadvertent that they have whether that settlement is in-kind or financial. This insures that the settlement process whether financial or in-kind does not have to deal with providing fair settlement when no counter party for settlement exists. All other dead-band domains fail to insure the existence of a counter party for settlement.

Although the two settlement processes are relatively simple, the imposition of a dead-band requires that both settlement processes be designed and implemented. Therefore, the imposition of a dead-band requires approximately twice the complexity as the implementation of either the financial settlement alone or the payback-in-kind settlement alone.

Energy Domain Dead-band:

If the energy domain is used as the basis for developing a dead-band, there is currently no way to assure that the energy within the dead-band balances and that the energy outside the dead-band also balances. In addition to the complexity of having two settlement processes to manage, both processes will be imbalanced with respect to settlement. This requires that additional methods be developed to manage the settlement when there are no counter parties with which to settle. This complexity is far beyond any complexities managed in either the current in-kind process or a purely financial settlement process. This characteristic of an energy domain dead-band should eliminate it from consideration unless a method can be developed to simply balance the settlements within and outside the dead-band.

8. DEVELOPING AN FCC DEAD-BAND

Should FCC also have a dead-band?

The Frequency Control Contribution is still being investigated by the IIPTF. Therefore, it is premature to discuss the issue in detail. One characteristic is clear. The FCC is balanced because the Inadvertent Interchange upon which it is based is also balanced. Similar dead-band questions should be investigated for the FCC settlement process as for the energy settlement process.

9. OBSERVATIONS AND RECOMMENDATIONS

A number of observations can be made based on the above discussion.

1. Imposition of a dead-band will not simplify the settlement process. It will make it more complex.
2. A value (price) dead-band does not make sense, because the financial advantage that can be gained from inadvertent results from a value (price) difference between to times, the time the inadvertent is created and the time it is repaid.
3. The use of an energy domain based dead-band will result in the most complex settlement of the methods considered, because an energy domain dead-band will not assure that counter parties for settlement exist.
4. Only the use of a frequency domain dead-band deserves further investigation. This is the only dead-band that will assure settlement counter parties in all cases.

These observations result in a single recommendation at this time.

1. The consideration of all dead-bands should be rejected until the settlement process is completely defined. At that time, a frequency domain based dead-band should be investigated to determine its affect on the both the quality and complexity of the settlement process.