INADVERTENT INTERCHANGE ENERGY PRICE

Prepared for

The NAESB Inadvertent Interchange Payback Task Force

by

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1. INTRODUCTION

The NAESB Inadvertent Interchange Payback Task Force considered a preliminary proposal for the pricing Inadvertent Interchange Energy during the April 29, 2003 meeting. Before agreeing on the correctness of the pricing methods, the Task Force requested examples of the methods as applied to different conditions. This document presents that proposal in detail and provides example applications of the pricing methods.

2. INADVERTENT INTERCHANGE BI-LATERAL ENERGY PRICE

Some assumptions are required to support the hourly Inadvertent Interchange bi-lateral energy pricing method. These assumptions are as follows.

Assumptions :

1. Each Balancing Authority has a marginal price available.
2. The market in Inadvertent Interchange can be cleared bi-laterally.

Using these assumptions a method of settling Inadvertent Interchange on an hourly basis can be developed. A meeting participant suggested that the following rules can be used to select the price that should be used to settle the bi-lateral transaction.

Settlement Pricing Rules:

1. If the Frequency Error for the hour is positive, the interconnection frequency is above schedule, the lesser of the hourly prices from the bi-lateral parties should be used to price the settlement.
2. If the Frequency Error for the hour is negative, the interconnection frequency is below schedule, the greater of the hourly prices from the bi-lateral parties should be used to price the settlement.

Examples:

The following examples of the application of the pricing method enumerate the possible values of the parameters that affect this method and demonstrate which price is selected. For this example, a two Balancing Authority interconnection is used as shown in Figure 1. The BAs are labeled A and B.

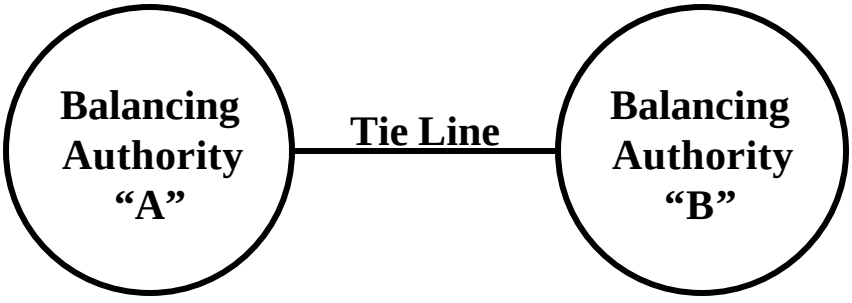

Figure 1. Bi-lateral Settlement Example

Example 1-1: Interconnection Frequency Low, BA "A" 50 MW Inadvertent In, BA "B" 50 MW Inadvertent Out, BA "A" Price = $20 / MWh, BA "B" Price = $25 / MWh.

The Inadvertent Interchange settlement price is the greater of the two prices, $25 / MWh. The inadvertent interchange settlement would be $1,250 from BA "A" to BA "B" (50 MW x $25).

Example 1-2: Interconnection Frequency Low, BA "A" 50 MW Inadvertent In, BA "B" 50 MW Inadvertent Out, BA "A" Price = $25 / MWh, BA "B" Price = $20 / MWh.

The Inadvertent Interchange settlement price is the greater of the two prices, $25 / MWh. The inadvertent interchange settlement would be $1,250 from BA "A" to BA "B" (50 MW x $25).

Example 1-3: Interconnection Frequency Low, BA "A" 50 MW Inadvertent Out, BA "B" 50 MW Inadvertent In, BA "A" Price = $20 / MWh, BA "B" Price = $25 / MWh.

The Inadvertent Interchange settlement price is the greater of the two prices, $25 / MWh. The inadvertent interchange settlement would be $1,250 from BA "B" to BA "A" (50 MW x $25).

Example 1-4: Interconnection Frequency Low, BA "A" 50 MW Inadvertent Out, BA "B" 50 MW Inadvertent In, BA "A" Price = $25 / MWh, BA "B" Price = $20 / MWh.

The Inadvertent Interchange settlement price is the greater of the two prices, $25 / MWh. The inadvertent interchange settlement would be $1,250 from BA "B" to BA "A" (50 MW x $25).

Example 1-5: Interconnection Frequency High, BA "A" 50 MW Inadvertent In, BA "B" 50 MW Inadvertent Out, BA "A" Price = $10 / MWh, BA "B" Price = $5 / MWh.

The Inadvertent Interchange settlement price is the lesser of the two prices, $5 / MWh. The inadvertent interchange settlement would be $250 from BA "A" to BA "B" (50 MW x $5).

Example 1-6: Interconnection Frequency High, BA "A" 50 MW Inadvertent In, BA "B" 50 MW Inadvertent Out, BA "A" Price = $5 / MWh, BA "B" Price = $10 / MWh.

The Inadvertent Interchange settlement price is the lesser of the two prices, $5 / MWh. The inadvertent interchange settlement would be $250 from BA "A" to BA "B" (50 MW x $5).

Example 1-7: Interconnection Frequency High, BA "A" 50 MW Inadvertent Out, BA "B" 50 MW Inadvertent In, BA "A" Price = $10 / MWh, BA "B" Price = $5 / MWh.

The Inadvertent Interchange settlement price is the lesser of the two prices, $5 / MWh. The inadvertent interchange settlement would be $250 from BA "B" to BA "A" (50 MW x $5).

Example 1-8: Interconnection Frequency High, BA "A" 50 MW Inadvertent Out, BA "B" 50 MW Inadvertent In, BA "A" Price = $5 / MWh, BA "B" Price = $10 / MWh.

The Inadvertent Interchange settlement price is the lesser of the two prices, $5 / MWh. The inadvertent interchange settlement would be $250 from BA "B" to BA "A" (50 MW x $5).

Conclusion:

This method works well for the example cited. However, one BA always represented the remainder of the interconnection. The method fails when the interconnection has more than two BAs. When there are more than two BAs, all inadvertent transactions are between a BA and the interconnection. The interconnection has no obvious price. Therefore, a method must be used that determines the appropriate price having price information on only one side of the transaction. The problem lies with Assumption 2 above.

From the preceding example we can develop another set of rules that will correct for the problem identified using the Bi-lateral Energy Price.

3. INADVERTENT INTERCHANGE UNI-LATERAL ENERGY PRICE

Remove assumption 2 and redevelop a pricing method. The assumption is now as follows.

Assumptions :

1. Each Balancing Authority has a marginal price available.

Using this only this assumption a method of settling Inadvertent Interchange on an hourly basis can be developed. The following rules can be used to select the price that should be used to settle the uni-lateral transaction.

Settlement Pricing Rules:

1. If the Frequency Error for the hour is negative, the interconnection frequency is below schedule (low), the hourly prices of all BAs with Inadvertent Interchange **Out** should be used to price the settlement.
2. If the Frequency Error for the hour is positive, the interconnection frequency is above schedule (high), the hourly prices of all BAs with Inadvertent Interchange **In** should be used to price the settlement.

Examples:

The following examples of the application of the pricing method enumerate the possible values of the parameters that affect this method and demonstrate which prices are selected. For this example, a four Balancing Authority interconnection is used. The BAs are labeled A, B, C and D.

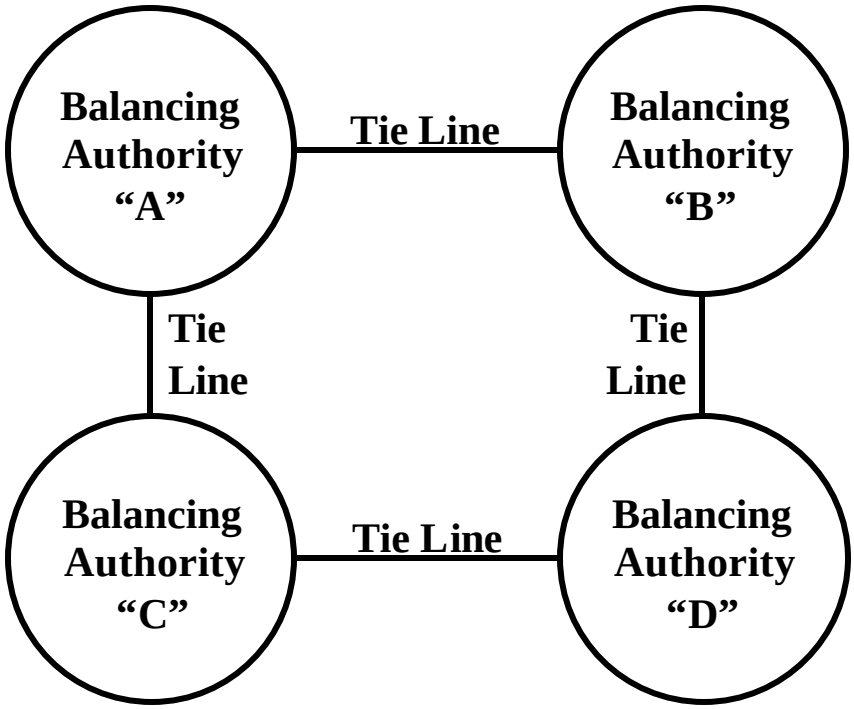

Figure 2. Uni-lateral Settlement Example

Example 2-1:

Interconnection	Frequency Low			
Balancing Authority	**A**	**B**	**C**	**D**
Inadvertent Direction	**In**	**In**	**Out**	**Out**
Inadvertent Amount - MW	**50 MW**	**25 MW**	**40 MW**	**35 MW**
Energy Price	**$15 / MWh**	**$25 / MWh**	**$20 / MWh**	**$30 / MWh**

Since the frequency is low, the settlement prices and quantities for the Inadvertent Interchange would be the prices of the BAs with inadvertent out. The total amount of inadvertent settled would be 40 MW plus 35 MW. The respective prices would be $20 / MWh and $30 / MWh. The total settlement would be for $1,850. BA "A" would pay $1,233, $24.67 / MWh, and BA "B" would pay $617, $24.67 / MWh. BA "C" would collect $800 and BA "D" would collect $1,050.

Example 2-2:

Interconnection	Frequency Low			
Balancing Authority	**A**	**B**	**C**	**D**
Inadvertent Direction	**Out**	**Out**	**In**	**In**
Inadvertent Amount - MW	**50 MW**	**25 MW**	**40 MW**	**35 MW**
Energy Price	**$15 / MWh**	**$25 / MWh**	**$20 / MWh**	**$30 / MWh**

Since the frequency is low, the settlement prices and quantities for the Inadvertent Interchange would be the prices of the BAs with inadvertent out. The total amount of inadvertent settled would be 50 MW plus 25 MW. The respective prices would be $15 / MWh and $25 / MWh. The total settlement would be for $1,375. BA "C" would pay $733, $18.33 / MWh, and BA "D" would pay $642, $18.33 / MWh. BA "A" would collect $750 and BA "B" would collect $625.

Example 2-3:

Interconnection	Frequency High			
Balancing Authority	**A**	**B**	**C**	**D**
Inadvertent Direction	**In**	**In**	**Out**	**Out**
Inadvertent Amount - MW	**50 MW**	**25 MW**	**40 MW**	**35 MW**
Energy Price	**$15 / MWh**	**$25 / MWh**	**$20 / MWh**	**$30 / MWh**

Since the frequency is high, the settlement prices and quantities for the Inadvertent Interchange would be the prices of the BAs with inadvertent in. The total amount of inadvertent settled would be 50 MW plus 25 MW. The respective prices would be $15 / MWh and $25 / MWh. The total settlement would be for $1,375. BA "A" would pay $750 and BA "B" would pay $625. BA "C" would collect $733, $18.33 / MWh, and BA "D" would collect $642, $18.33 / MWh.

Example 2-4:

Interconnection	Frequency High			
Balancing Authority	**A**	**B**	**C**	**D**
Inadvertent Direction	**Out**	**Out**	**In**	**In**
Inadvertent Amount - MW	**50 MW**	**25 MW**	**40 MW**	**35 MW**
Energy Price	**$15 / MWh**	**$25 / MWh**	**$20 / MWh**	**$30 / MWh**

Since the frequency is high, the settlement prices and quantities for the Inadvertent Interchange would be the prices of the BAs with inadvertent in. The total amount of inadvertent settled would be 40 MW plus 35 MW. The respective prices would be $20 / MWh and $30 / MWh. The total settlement would be for $1,850. BA "C" would pay $800 and BA "D" would pay $1050. BA "A" would collect $1,233, $24.67 / MWh, and BA "B" would collect $617, $24.67 / MWh.

Conclusions:

This method works well for the BA controlling to ACE = 0 in that it always uses the price of the BA that helped reduce interconnection frequency error. Therefore, if the energy price alone is sufficient to represent fair compensation for the BA supporting interconnection frequency, then that BA always receives proper compensation.

This method does not remove the incentive to game the system. The BAs that are causing the interconnection frequency error are encouraged to under-generate when their prices are very high, and are encouraged to over-generate when their prices are very low. Their advantage derives from two conditions.

1. Although they do not set the price, if the price of those supplying the energy is likely to be less than their price under-generating is to their advantage and if their price is lower than the price of those withdrawing energy from the interconnection over-generation is to their advantage. This is shown for BAs "C" and "D" in Example 2-2, and BA "A" in Example 2-4.
2. The averaging of prices necessary to determine settlement will create an advantage for those not helping to reduce frequency error in those cases where the average price used is favorable when compared to their price. This is shown for BA "B" in Example 2-1.

There is a simple method to properly compensate those BAs that perform properly to support interconnection frequency. This simple method does not eliminate the gaming opportunities for other BAs.

4. OTHER CONSIDERATIONS

The analysis provided above helps clarify the issue but it does not provide a solution to the problem of how to price the energy component of Inadvertent Interchange. The following discussions are intended to provide direction for further investigation toward a workable solution.

Market Effects:

Start with a very simple market, and assume the following.

1. There is an interconnection wide market in electric energy.
2. The market is efficient.
3. There are no restricted transactions.
4. There are no frequency errors.
5. There are no transmission losses.

6. There is no transmission congestion.
7. There is no charge for using transmission.

Using the above assumptions, some conclusions can be drawn.

The market price should be the same interconnection wide. If any price differential existed, the market would schedule a transaction from the lower price to the higher price. This transaction would reduce the total cost of energy on the interconnection. This interconnection wide price is similar to System Lambda for a single BA.

The above examples assumed that prices were different between BAs. These price differences must be explained for the examples to represent the total problem.

Transmission Use Charges:

Relax assumption 7 from the above list of assumptions. Reconsidering the relative prices of the BAs leads to a different result. If there is a transmission charge, then any transaction must have a price difference large enough to pay the transmission use charge before it is economic to schedule the transaction between BAs. This allows BAs to have price differences equal to the payment required for the transmission use charge. This difference will always result in a higher price at the supplying end of the transaction and a lower price at the receiving end of the transaction. These price differentials are dependent upon the form of the transmission use charge. This could explain some of the price differences that are observed on the interconnection.

Transmission Congestion Charges:

Relax assumption 6 from the above list of assumptions in addition to assumption 7. The IIPTF has already agreed that the method of managing transmission congestion within ISOs and RTOs is not a subject that should be considered as part of the result of this Task Force. However, the effect of congestion across the seams between ISOs and RTOs and the congestion between BAs that are not part of ISOs and RTOs can affect energy price differences.

The current solutions that are being used within ISOs and RTOs to manage transmission congestion provides a valid method of considering the magnitude of the energy price differences that may occur across seams between BAs, ISOs and RTOs. The LMP methods currently in use in many of the ISO and RTO, designs along with the FERC SMD, explains additional differences between energy prices at different locations on the interconnection.

Transmission Loss Charges:

Relaxation of assumption 5 from the above list can also result in price differences. This consideration is included in most EMSs in use on the interconnection today in the form of real-time loss calculations or B Coefficients that weight relative production losses. ISOs and RTOs also include losses in their calculation of price, although different methods are used in different areas.

Frequency Error Correction Charges:

Most current market designs have left the frequency control and reliability charges for inclusion with the design of the Ancillary Services Market to be completed in the future. Since it is the shared frequency control of the interconnection that causes a significant portion of the Inadvertent Interchange, any Inadvertent Interchange settlement must include consideration of how this market is affected.

Price Effect of Transaction Restrictions:

Finally, there are Non-jurisdictional BAs that are restricted from selling to other BAs on the interconnection. The effect of the price differences that may be created by these restrictions requires consideration.

5. OBSERVATIONS AND RECOMMENDATIONS

Many reasons exist for energy price differences to exist on an interconnection. The design of any settlement system for pricing Inadvertent Interchange must consider all of the reasons for those differences. Design of a system that fails to consider valid reasons for energy prices differences could unintentionally bypass a necessary pricing component and cause unintended market consequences.

The IIPTF should investigate each of the reasons for valid price differences to exist between BAs to insure that Inadvertent Interchange Settlement properly compensates all parties for their contribution to the interconnection. The investigation of these pricing effects should educate the IIPTF on the proper issues and lead in a direction that is beneficial to arrive at a consensus.