



NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

Princeton Forestall Village, 116-390 Village Boulevard, Princeton, New Jersey 08540-5731

Recommendations for the Wholesale Electric Industry of North America:

Inadvertent Interchange

Draft 5d

May 10, 2002

**A White Paper Prepared by the
Joint Inadvertent Interchange Task Force**

**For Consideration by the:
Resources Subcommittee
Market Interface Committee
Compliance Committee**



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Carl A. Monroe
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Joint Inadvertent Interchange Task Force (JIITF) White Paper, Recommendations for the Wholesale Electric Industry of North America: *Inadvertent Interchange*, Draft 5d

Dear Carl:

The Joint Inadvertent Interchange Task Force has almost completed its assignments, and would now like to present its conclusions and recommendations to the Resources Subcommittee and Operating Committee.

The JIITF has formalized its Conclusions to the Operating Committee as follows:

JIITF Recommendation for Action

The JIITF broke down the current NERC definition of Inadvertent Interchange into three “Unscheduled Energy” components: a Frequency Component; a Line Loading Component; and an Energy Component. The Task Force recommends the Frequency Component and the Line Loading Components be addressed in NERC Organization Standards. The JIITF believes the Energy Component is actually a business practice and should be handled by some other organization.

The JIITF composed the following statements addressing each of the three unscheduled energy components and the future of the JIITF:

Frequency Component: The frequency component of unscheduled energy interacts with the “Balancing Resources and Demand” SAR. The JIITF will contribute its White Paper, “Recommendations for the Wholesale Electric Industry of North America: *Inadvertent Interchange*” to the Resources Subcommittee. The Resources Subcommittee can then provide the white paper as a reference document to aid the SAR drafting team and future standard drafting team efforts.

Line Loading Component: The Transmission Loading Component of unscheduled energy interacts with the “Monitor and Assess Short-term Transmission Reliability – Operate Within Limits” SAR. The JIITF believes any congestion management standard developed under this SAR must apply to both scheduled and unscheduled energy into or out of Balancing Authorities. The JIITF will convey this belief to the Requestor of this SAR.

Energy Component: The settlement of the “energy component” of unscheduled energy is considered a business practice and should be addressed by an organization developing business practice standards.

“Allow for reasonable variations in generation control” and “Encourage minimizing imbalances due to poor control”

The JIITF believes properly addressing the “Frequency Component” of unscheduled energy the “Balancing Resources and Demand” SAR will incorporate allowances for reasonable variations in

generation control and encourage minimizing imbalances due to poor control. This depends, of course, on proper treatment of the Energy and Line Loading components in their respective processes.

JIITF Future: The JIITF has addressed the issues and concerns of the OC regarding Inadvertent Interchange. The future of the JIITF is at the pleasure of the OC (i.e. disband, assign additional Inadvertent Interchange issues and concerns, etc.). The recommendation of the JIITF is to disband. The members of the JIITF are from the Resources Subcommittee, the Market Interface Practices Subcommittee, the Compliance Subcommittee and the Electric Energy Industry. These individuals are available to participate, on an individual basis, in the development of the NERC Organizational Standards. The Task Force membership is listed in Attachment A.

The JIITF concepts were presented to the Operating Committee, the Market Interface Committee and the Planning Committee at their March 19–21, 2002 meetings. Based on the Committees' responses as well as industry comments, the JIITF re-evaluated the JIITF concepts in determining the above conclusion statements. The JIITF will not spend time reworking the White Paper, since it will remain in "Draft" form and be used as a reference document. (See Frequency Component Conclusion, above.)

The JIITF White Paper, Draft 5c, dated March 7, 2002, will remain intact as it was on that date.

However, this letter will be inserted in front of the Executive Summary, creating Draft 5d, dated April 18, 2002.

Conclusion

Given the changed environment for standards development, the JIITF recommends each of the three elements of "Unscheduled Energy" be addressed by other groups within the new process. The JIITF

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reiterates its position that comprehensive treatment of the issue must include addressing all three components: Frequency, Line Loading, and Energy. The JIITF offers its draft white-paper, as a reference document, to the Resources Subcommittee for consideration in the SAR development process.

Sincerely,

Paul Spicer

Paul Spicer

Chairman, Joint Inadvertent Interchange Task Force

PS:TJV:mjh

cc: Joint Inadvertent Interchange Task Force
Resources Subcommittee
Market Interface Practices Subcommittee
Compliance Subcommittee

Attachment A

Joint Inadvertent Interchange Task Force Membership		
Name	Representation	Company
Paul Spicer, JIITF Chairman	Resources Subcommittee	Wisconsin Public Service
Carl Monroe	Resources Subcommittee	South West Power Pool
Mike Potishnak	Resources Subcommittee	ISO New England
Terry Bilke	Resources Subcommittee	MISO
Don Badley	Resources Subcommittee	WSCC
Tony Jankowski	Market Interface Practices Subcommittee (MIPS)	Wisconsin Electric Power
Jon Puckett	MIPS	Duke Energy North America
Dean Ulch	MIPS	Southern Company Services
Shirley Buckmier	MIPS	BPA
Peg Appadini	MIPS	Central Illinois Light Co.
Chris Jones	MIPS	Reliant Energy HL&P
Gary Rudder	Compliance Subcommittee	Tennessee Valley Authority
Joe Wilson	Compliance Subcommittee	PJM
Howard Illian	Electrical Industry Participant	Energy Mark Inc.
Warren McReynolds	Electrical Industry Participant	WSCC
Robert Blohm	Electrical Industry Participant	Economist
Tom Vandervort	JIITF Facilitator	NERC

Inadvertent Interchange
Joint Inadvertent Interchange Task Force
Executive Summary

The Joint Inadvertent Interchange Task Force (JIITF) is a joint effort of the OC Resources Subcommittee, MIC Market Interface Practices Subcommittee, the Compliance Subcommittee and commercial power industry experts to address and develop recommendations for Inadvertent Interchange Operating Standards.

This paper addresses Inadvertent Interchange as it relates to interconnection reliability. The JIITF realizes Inadvertent is the result of good and poor control practices, built-in accounting anomalies, and is a necessary result of Interconnected operation in a synchronous multi-Balancing Authority network. The proposed solutions attempt to appropriately hold accountable those Balancing Authorities exhibiting poor control practices and recognize those exhibiting good control practices.

Transmission Control aspects of reliability are discussed and remain to be addressed locally, while Interconnection frequency aspects of reliability are addressed specifically. Inadvertent, the difference between a Balancing Authority's scheduled and actual hourly Net Interchange, is defined in Policy 1.

The proposed JIITF solution to the OC charge is three-fold: 1) A transmission use component of existing Inadvertent Interchange is recommended to be included in any congestion management standard developed to be consistent with local transmission market designs; 2) A frequency control component of existing Inadvertent Interchange is recommended to be a stand-alone standard, treated as an obligatory reliability service; and 3) An energy component of existing inadvertent Interchange is recommended to be a stand-alone standard, treated as a commodity. The markets will value Inadvertent energy pay-back and influence settlement practices.

The Reliability Principles, Market Interface Principles, and the JIITF Inadvertent Interchange Principles are found in Attachment 1. The JIITF used these principles for guidance to follow and as defining parameters to stay within in order to meet the requirements of the NERC Standards Authorization Process Manual.

Recommendations for the Wholesale Electric Industry of North America:
Inadvertent Interchange

While a Balancing Authority's hourly Inadvertent Interchange is desired to average to zero, it is unrealistic to expect it to be zero at all points in time. The JIITF identified five major causes of Inadvertent Interchange: 1) Scheduling Error, 2) Meter Error, 3) Unintentional Control Error, 4) Ramping Representation Error and 5) Intentional Control Adjustment. An expanded list is found in Attachment 2.

The JIITF proposed "Transmission Loading/Obligatory Reliability Service Local Standard" is discussed in Attachment 3.

The JIITF proposed "Frequency Control/Obligatory Reliability Service Operating Standard" is found in Attachment 4.

The JIITF proposed "Inadvertent Interchange Operating Standard" is found in Attachment 5.

An option to control (in the short run) existing Inadvertent Interchange accumulation using "100 times L60" is found in Attachment 6

The impact of the Proposed JIITF Solutions on Time Error Correction is found in Attachment 7.

Data Validation and Dispute Resolution process for the Inadvertent Interchange Operating Standard is summarized in Attachment 8.

Operating Committee Action

The Operating Committee approved the following Control Area Criteria Task Force (CACTF) recommendation:

The Resources Subcommittee, along with the Compliance Subcommittee, and a Subcommittee to be named by the MIC, develop Control Area (and Balancing Authority) Inadvertent Interchange Operating Standards including market incentives and penalties that provide for the following two requirements:

- Allow for reasonable variations in generation control, and
- Encourage minimizing imbalances due to poor control.

Commercial Advantages

The emergence of regional power markets in recent years has created new challenges for the operation of the interconnected power system not anticipated in current NERC Policies and Standards. The CACTF identified a practice in the NERC Operating Policies that appears to afford a Balancing Authority's affiliated generators and marketers a commercial advantage over their independent counterparts. This practice is the use of Inadvertent Interchange by Balancing Authorities vs. Energy Imbalance compensation by non-control areas.

Inadvertent Interchange versus Energy Imbalance

The commercial advantage a "traditional" Balancing Authority with affiliated generation has over an independent generator is the method for settling energy imbalances. Specifically, the Balancing Authority satisfies NERC inadvertent rules by repaying with in-kind energy (On- or Off-Peak) at its discretion, while an independent generator (non-Control Area) repays imbalance in accordance with the host Balancing Authority's contract; possibly at market prices.

Inadvertent interchange is the difference between a Balancing Authority's Net Actual Interchange and Net Scheduled Interchange each hour. It includes moment-to-moment control action to continuously support frequency and adjust its real-time generation-to-load balance (Net Actual interchange) with its intent to import/export energy to meet its contractual obligations (Net Scheduled Interchange). The resulting "Inadvertent Interchange" at the end of the hour is owed to or from other Balancing Authorities in the Interconnection. NERC Operating Policies (Policy 1, "Generation Control and Performance") require that Balancing Authorities settle within the Interconnection for this imbalance; generally, with energy or, if permitted by the Interconnection, in financial terms. While NERC requires that Balancing Authorities meet specific Control Performance Standards, there are no requirements on how much Inadvertent Interchange can be accumulated, when it must be settled, or how that settlement must be priced.

Recommendations for the Wholesale Electric Industry of North America:
Inadvertent Interchange

Before market-based energy rates were allowed, reconciliation of Inadvertent Interchange with energy only was considered to be an equitable one-for-one settlement methodology. Cost-based energy prices, allowed at the time, were not volatile. Ten years ago the marketplace did not see energy prices in the \$100+ range. Also, there was a general understanding that Balancing Authorities were on both sides of the inadvertent balance, sometimes long, sometimes short. Today, when energy prices become very high, a Balancing Authority can “lean” on the Interconnection and accrue an inadvertent balance. The respective Balancing Authority can then repay that balance with energy days, months, or years later when energy prices are lower.

Energy imbalance charges. Energy Imbalance Service is the difference between the intended delivery and the actual averaged delivery of energy, by an independent generator, to a load located within a “host” Balancing Authority each hour. The host Balancing Authority must continuously adjust its generation on a moment-to-moment basis to make up the imbalance to meet NERC’s Control Performance Standards obligations. Balancing Authorities’ connection tariffs usually require that this Energy Imbalance be financially settled at market rates.

Comparison Arguments. By definition, Balancing Authorities' Inadvertent Interchange cannot be equally compared to Independent Generators' Energy Imbalance. However, the settlement of the Inadvertent energy component and the Energy Imbalance could be made to be comparable.

Balancing Authorities are required to continuously balance generation against schedules, taking into account generation-to-load ramping, constantly changing demand, generation variation, Interconnection frequency deviations, and NERC Control Performance Standards obligations. Independent generators, on the other hand, usually follow an energy profile that may or may not change hourly. Some independent generators sell load-following or control services, that result in fluctuations of their generators’ output.

The Energy Imbalance Service (Schedule 4 in the *pro forma* Tariff) meets the objectives by applying penalties and credits for energy imbalance. It allows for a “deviation band” of $\pm 1.5\%$ and sets standards for repayment via energy (within the deviation band) within 30 days. If repayment in energy has not occurred in a “reasonable” time, then repayment is in financial terms, which could be at market rates. This both discourages large imbalances and compensates the host Balancing Authority for providing the energy to mitigate the imbalance energy.

Creating 3 Inadvertent Interchange Standards, one addressing the transmission component, one addressing the frequency component and one addressing the energy component, will allow the Inadvertent energy to be settled in a manner comparable to settlement of Energy Imbalance. The actual Inadvertent energy settlement methodology will be determined by the markets, in compliance with Market Interface Principles 3 and 4. The JIITF recommends the Inadvertent energy standards (1) contain settlement options that allow the markets to financially settle Inadvertent energy on an hourly basis, thus eliminating the accumulation problem, or (2) implement additional rules that enforce appropriate management of accumulations.

Inadvertent Interchange Balance

Some amount of inadvertent is reasonable and inevitable. A Balancing Authority's Inadvertent accumulation, will increase, decrease or fluctuate, over time. The short-term goal is to keep good CPS scores. Inadvertent energy is a component of AIE whose instantaneously measured equivalent is ACE, which is included in CPS1. Inadvertent is zero when the Net Actual Interchange is equal to the Net Scheduled Interchange each hour. The long-term goal is to appropriately manage Inadvertent accumulation. This goal requires Balancing Authorities incorporate settlement policies within their Interconnection, in a timely manner.

Existing NERC Policy 1F supports the short-term and long-term goals by stating: "Each Control Area [Balancing Authority] shall be active in preventing unintentional Inadvertent Interchange accumulation. Each Balancing Authority shall also be diligent in reducing accumulated inadvertent balances in accordance with Operating Policies." This Policy sets no limits on the amount of Inadvertent that can be accumulated or when it must be paid back. Compensation is only required through payback of the inadvertent energy in MWh. The "settlement" energy may not reflect the market value when the Inadvertent was created by Balancing Authorities' frequency support. The ERCOT Interconnection requires Inadvertent payment in financial terms and the Western Interconnection allows Inadvertent payment in financial terms. The Western Interconnection also has Balancing Authority Inadvertent accumulation limits and allows energy bilateral pay-back transactions without transmission charges.

Addressing the Operating Committee Requirements

The Operating Committee (OC) charged the JIITF with developing Inadvertent Interchange Operating Standards that include market incentives and penalties that provide for the following two requirements:

- Allow for reasonable variations in generation control, and
- Encourage minimizing imbalances due to poor control.

When the Control Area Criteria Task Force made the above recommendation to the OC, it was feasible for a NERC Subcommittee to craft such a standard. Since that time the NERC Board of Trustees implemented The Standards Authorization Process Manual. This manual defines the characteristics of a NERC Organization Standard and establishes the process for development of consensus for approval, revision, reaffirmation, and withdrawal of such standards. All Organizational Standards shall be consistent with all Market Interface Principles.

Two Market Interface Principles limit the JIITF in recommending incentives, penalties, and the Inadvertent Interchange energy component settlement/pay-back methodology. These are: Market Interface Principle 3, *An Organization Standard shall neither mandate nor prohibit any specific market structure*; and Market Interface Principle 4, *An Organization Standard shall not preclude market solutions to achieving compliance with that standard*.

The JIITF also notes that NERC already has Control Performance Standards in place that set the target for frequency and tie-line error to be enforced by NERC. The JIITF cannot apply CPS1 directly in the OC's charge because CPS1 does not measure Inadvertent Interchange. Accordingly JIITF is recommending standards that complement and assist CPS but do not replace or supersede CPS.

The JIITF recommends local standards for Inadvertent transmission use, one standard for Inadvertent frequency control and one standard for the Inadvertent energy component, thus satisfying the two OC criteria.

Allow for reasonable variations in generation control.

The proposed standard addressing frequency control contribution will not preclude a Balancing Authority from experiencing reasonable variations in generation control.

The proposed standard addressing the Inadvertent energy component will not restrict variation in generation control. In fact some Inadvertent is inevitable and expected.

Encourage minimizing imbalances due to poor control.

The proposed standard addressing frequency control contribution will have incentives and penalties that will reward good control and penalize poor control. The incentives and penalties need to be sufficient to promote good performance.

Recommendations for the Wholesale Electric Industry of North America:
Inadvertent Interchange

The proposed standard addressing the Inadvertent energy component will define what Inadvertent energy is, allow alternate methods for settlement/pay-back (i.e. energy in-kind or financial settlement), and state that the energy markets will determine the incentives, penalties and methodologies.

JITF Proposed Inadvertent Solutions

The JITF considered a number of Inadvertent proposals. The Task Force reached a major milestone when it decided by general consensus to separate the reliability components (transmission loading and frequency control) from the commodity component (energy). The results are:

1. The JITF recommends that the conventional Inadvertent Interchange calculation and methodology be separated into: 1) a reliability (transmission loading) component, 2) a reliability (frequency control) component, and 3) an energy component.
 - a. The Transmission Loading component is viewed by the JITF, to be a reliability service. The JITF recommends a Transmission Loading Standard be developed for each region that is consistent with the transmission market design used in that region. In line with other control obligation services, Transmission Loading is recommended by the JITF to be treated as an Interconnected Operations (ancillary) Service. This proposed Transmission Loading service should be addressed, controlled and priced in a manner similar to other ancillary services. See Attachment 3 for a discussion indicating why a general interconnection wide standard cannot be developed at this time.
 - b. The Inadvertent Frequency Control Component is viewed by the JITF to be an obligatory reliability service. The JITF recommends a Frequency Control Contribution Standard. In line with other control obligation services, frequency control is recommended by the JITF to be treated as an Interconnected Operations (ancillary) Service. This proposed frequency control service should be addressed, controlled and priced in a manner similar to other ancillary services. See Attachment 4.
 - i. A “Frequency Control Contribution” (FCC) metric was developed by Howard Illian, a member of the JITF, as a response to the Inadvertent Interchange challenge. The Illian metric is a statistical measurement of frequency response contained within unscheduled energy. Absent a market to determine the FCC unit price, JITF member Robert Blohm proposed a price formula to be monetized by NERC. The JITF recommends the Illian frequency control metric for the obligatory reliability service, priced for now by the Blohm formula. See Attachment 4.
 - c. The Inadvertent energy component is considered a market commodity that has reliability implications. The JITF recommends an Inadvertent Standard that defines Inadvertent, determines the Inadvertent calculation, and allows for alternate Inadvertent settlement mechanisms (i.e. energy in-kind or financial settlement). See Attachment 5.

Recommendations for the Wholesale Electric Industry of North America:
Inadvertent Interchange

- i. In accordance with Market Principles 3 and 4, the markets will determine the Inadvertent energy pay-back/settlement/cash-out (including pricing, penalties and incentives). If necessary the markets will assign a value to the Inadvertent energy component. Market Principles are found in Attachment 1.
2. Existing Inadvertent balances, accumulated under the existing policy, must be eliminated or minimized in a fair manner. One option is to freeze the existing balances when the new Inadvertent Standard is implemented, then eliminate the frozen balances through bilateral schedules over a fixed period of time (e.g. the following 12 months).
 - a. In order to minimize the impact of the “frozen balance” payback recommendation above, the JIITF recommends the Resources Subcommittee target Balancing Authorities with current accumulation of AIE in excess of “100 times L₆₀” and require these Balancing Authorities to develop an Inadvertent management plan to reduce or eliminate this balance. The respective Inadvertent management plans are required to be submitted to the Resources Subcommittee for approval. Definition and justification of the “100 times L₆₀” proposal is included in Attachment 6.
3. The JIITF recommends the proposed standards methodologies and calculations be proven feasible and accurate to a high degree by being subjected to field tests to acquire satisfactory data before wide industry application. This is in accordance with the Organization Standards Process Manual and is important in preparation for future compliance penalties and sanctions.
4. The JIITF recommends all three Standards be based on hourly time periods. Data validation and dispute resolution are essential to ensure successful implementation. If Inadvertent is cashed out through a market process or if there are cash penalties/rewards for extreme hourly values of FCC, an independent clearinghouse that expeditiously “balances the books” for each Interconnection is highly recommended. An expanded discussion on data validation and dispute resolution is in Attachment 8.

These JIITF Proposed Inadvertent Solutions give direction to develop Transmission Loading Contribution, Frequency Control Contribution, and Inadvertent Interchange Standards that meet the requirements of the OC charge.

ATTACHMENT 1

Organization Standard Principles

The Inadvertent Interchange principles, methodologies, and proposed standards must comply with the requirements of the NERC Organization Standards.

Reliability Principles

NERC Organization Standards are based on certain Reliability Principles that define the foundation of reliability for North American bulk electric systems. Each Organization Standard shall enable or support one or more of the following Reliability Principles, thereby ensuring that each standard serves a purpose in support of reliability of the North American bulk electric systems. Each Organization Standard shall also be consistent with all of these Reliability Principles, thereby ensuring that no standard undermines reliability through an unintended consequence.

Reliability Principle 1 – Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and prescribed abnormal conditions.

{JITF believes the proposed transmission loading service and Inadvertent Standards support Principle #1.}

Reliability Principle 2 – The frequency and voltage of interconnected bulk electric systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.

{JITF believes the proposed frequency control services supports Principle #2.}

Reliability Principle 3 – Information necessary for the planning and operation of interconnected bulk electric systems shall be made available to those entities responsible for planning and operating the systems reliably.

Reliability Principle 4 – Plans for emergency operation and system restoration of interconnected bulk electric systems shall be developed, coordinated, maintained and implemented.

Reliability Principle 5 – Facilities for communication, monitoring, and control shall be provided, used, and maintained for the reliability of interconnected bulk electric systems.

Reliability Principle 6 – Personnel responsible for planning and operating interconnected bulk electric systems shall be trained, qualified, and have the responsibility and authority to implement actions.

Reliability Principle 7 – The security of the interconnected bulk electric systems shall be assessed, monitored, and maintained on a wide-area basis.

Market Interface Principles

Recognizing that bulk electric system reliability and electricity markets are inseparable and mutually interdependent, all Organization Standards shall be consistent with these Market Interface Principles. Consideration of these Market Interface Principles is intended to assure Organization Standards are written such that they achieve their reliability objective without causing undue restrictions or adverse impacts on competitive electricity markets.

Market Interface Principle 1 – The planning and operation of bulk electric systems shall recognize that reliability is an essential requirement of a robust North American economy.

{The proposed frequency control service realizes that some amount of frequency error is inevitable. However, frequency control is a reliability obligation and whoever uses this service should compensate the entity that supplied it as Inadvertent. The difference between scheduled and actual energy needs to be controlled in order to avoid undesirable reliability degradation.}

Market Interface Principle 2 – An Organization Standard shall not give any market participant an unfair competitive advantage.

{This the heart of the comparability issue. By separating the reliability component (frequency) from the commodity component (energy), the JIITF proposal has leveled the playing field.}

Market Interface Principle 3 – An Organization Standard shall neither mandate nor prohibit any specific market structure.

Recommendations for the Wholesale Electric Industry of North America:
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{The JIITF's goal is to provide the market with a performance measure that has reliability attributes built into it. This principle precludes the JIITF from recommending how the markets will structure the Inadvertent pay-back/settlement/cash-out (including pricing, penalties and incentives).}

Market Interface Principle 4 – An Organization Standard shall not preclude market solutions to achieving compliance with that standard.

{Each market may have unique solutions. This principle precludes the JIITF from recommending market solutions and is similar to Principle 3 (see above).}

Market Interface Principle 5 – An Organization Standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards.

{The JIITF is sensitive to the proposed measures requiring hourly net schedule and actual Interchange values.}

JlITF Inadvertent Interchange Principles

Inadvertent Principle 1 – Inadvertent Interchange across an interconnection always equals zero (the system’s energy is necessarily balanced regardless of frequency control and the overall health of the interconnection).

Inadvertent Principle 2 – Locational price models do not guarantee zero sum financial systems for Inadvertent Payback.

Inadvertent Principle 3 – Inadvertent Interchange is sometimes the symptom of a reliability problem. Inadvertent resulting from “bad” control is the cause and inadvertent resulting from “good” control is the response.”

Inadvertent Principle 4 – Inadvertent Interchange is unavoidable for the reliable operation of an Interconnected system.

Inadvertent Principle 5 – Incorrectly aligned Inadvertent economic incentives create uncertainty and risk. Ultimately, reliability and economic efficiency are compromised.

Inadvertent Principle 6 – Inadvertent as a result of “good” control should receive an incentive. Inadvertent as the result of “bad” control should receive a penalty.

Inadvertent Principle 7 – The Inadvertent methodology must equitably share the benefits of Inadvertent Interchange among all participants, satisfying the comparability requirement.

Inadvertent Principle 8 – Inadvertent Balance should be “bounded” by a limit consistent with economical operation of the system without compromising reliability.

Inadvertent Principle 9 – Inadvertent Interchange Standard must adhere to Reliability and Market Interface Principles.

ATTACHMENT 2

Sources of Inadvertent Interchange

If scheduled energy matches the metered values at the interconnection point, for a given time period, there is no actual Inadvertent Interchange created. The variation of generation to load on a real time basis will cause a certain amount of Inadvertent Interchange. Due to the nature of electricity, a zero Inadvertent Balance for any single entity is a coincidence rather than an expectation. It is economically unrealistic to expect to eliminate Inadvertent Interchange completely. Imbalance, frequency error, frequency control, and inadvertent are inextricably linked. Frequency error is permitted due to a long-standing understanding that the cost of reducing frequency error can exceed the benefit of error reduction.

The JIITF identified five general sources of Inadvertent Interchange, these are:

1. Scheduling Error
 - a. Improper entry of data (time, amount, direction, duration, etc.)
 - b. Improper update in real-time (TLR miscommunication etc.)
2. Meter Error
 - a. Loss of telemetry
 - b. Difference between real-time and MWh integrated values
3. Unintentional Control Error
 - a. Regulation Inadequacy
 - i. Insufficient regulating resources committed
 - ii. Poor control algorithm
 - b. Load volatility and unpredictability
 - c. Generation outages
 - d. Generation deviations
4. Ramping Representation Error
 - a. Practice of using contract Net Interchange Schedules instead of integrated Net Interchange Schedules (the ramping effect)

Recommendations for the Wholesale Electric Industry of North America:
Inadvertent Interchange

5. Intentional Control Adjustment

- a. Bias contribution (including time correction)
- b. Unilateral payback (beyond corrections for primary Inadvertent)

ATTACHMENT 3

JITF Proposal

Transmission Loading/Obligatory Reliability Service Local Standard

Brief Description: Control Methodology to Support Transmission Loading Limits.

Principle to Which Standard Applies: **Reliability Principle 1** – Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and prescribed abnormal conditions.

Entity(s) to Which Proposed or Revised Standard Applies: Entities performing the Transmission Service Provider function.

Purpose of Standard (Should Provide Reliability Basis for the Standard): Regarding Transmission Loading Contribution as an Obligatory Reliability Service reinforces the importance of Transmission Limits to the overall reliability aspects of the Bulk Electric System. It also insures that the Inadvertent settlement mechanism does not become a means to bypass charges and penalties for unscheduled transmission use including use of constrained transmission and TLR bypass.

The differences in market designs and implementation across North America prevent the development of a single Reliability Service to represent the contribution of Inadvertent to Transmission Congestion or Load Management. In an ideal world, the Transmission Loading Contribution of Inadvertent would be one of three observable independent components of the final Value of Inadvertent. The other two are the Frequency Control Contribution and the Market Value of Energy. Some markets have chosen to combine the Transmission Loading Contribution of Inadvertent with the Market Value of Energy, thus preventing the development of a Reliability Service whose Value isn't based on Energy. Other markets have chosen to keep the Transmission Loading Contribution of Inadvertent separate from the Market Value of Energy, allowing the future development of a Reliability Service whose price isn't based on Energy. The Transmission Loading Contribution must be defined in a manner that is compatible with local methods of determining congestion in different transmission and/or energy market designs. Therefore, the Transmission Loading Contribution of Inadvertent must be defined as a local requirement.

ATTACHMENT 4

JITF Proposal

Frequency Control / Obligatory Reliability Service Operating Standard

Brief Description: Control Methodology to Support Interconnected Frequency, 60 Hz

Principle to Which Standard Applies: **Reliability Principle 2** – The frequency and voltage of interconnected bulk electric systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.

Entity(s) to Which Proposed or Revised Standard Applies: Entities performing Balancing Authority functions

Purpose of Standard (Should Provide Reliability Basis for the Standard): The Frequency Control Contribution Standard determines how much compensation Balancing Authorities must receive or pay for Obligatory Reliability Service in the form of Frequency Response that they provided to or extracted from the Interconnection. Supply or use of Frequency Response is contained within a Balancing Authority's Inadvertent.

The Frequency Control Contribution (FCC_{BA}) for each Balancing Authority shall be calculated on the basis of hourly average data as follows:

$$FCC_{BA} = \frac{\text{Sum}(\text{Inadvertent}_{BA} \times \text{Frequency_Error}_{Int})}{\text{Sum}(\text{Frequency_Error}_{Int} \times \text{Frequency_Error}_{Int})} \times \text{Hours_in_Period} \quad (1)$$

where Inadvertent_{BA} : Inadvertent for a Balancing Authority for the hour, in MW.

$\text{Frequency_Error}_{Int}$: Interconnection Frequency Error for the hour, in Hz.

Hours_in_Period : Hours in the settlement period, i.e. a Month.

$\text{Sum}(\)$: Sum of hourly measurements over the period.

The above calculation simply determines (by the "least squares" estimation technique) how much of the hourly frequency error was due to the inadvertent energy incurred by the Balancing Authority and, therefore, how much Frequency Response, as measured with hourly average data, was supplied or demanded with the Inadvertent energy incurred. This "Frequency Response" is a valid measure of how much frequency control service (Frequency Response, Regulation, Reserves, and Load Following) was supplied or used by the Balancing Authority along with the Inadvertent energy.

Recommendations for the Wholesale Electric Industry of North America:
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The payment $FCC\$_{BA}$ that should be exchanged between the Balancing Authorities for the use/provision of frequency control services is then determined by multiplying the result from equation (1) by a settlement price $Price_{Int}$, the Frequency Response Price.

$$FCC\$_{BA} = FCC_{BA} \cdot Price_{Int} \quad (2)$$

where $FCC\$_{BA}$: Frequency Response Settlement for settlement period, e.g. a Month.

$Price_{Int}$: Frequency Response Price, \$ for each MW per Hz.

Until there is a market price, price will be determined as follows:

$$Price_{Int} = m\$_{NERC} \cdot Avg(Frequency_Error_{Int} \cdot Frequency_Error_{Int}) \quad (3)$$

where $m\$_{NERC}$: Monetary Basis--a fixed amount m in dollars--set by NERC.

$Avg()$: = Average hourly measurement over the period.

Since $Sum() = Avg() \times Hours_in_Period$ equation (2) reduces to:

$$FCC\$_{BA} = Sum(Inadvertent_{BA} \cdot Frequency_Error_{Int}) \cdot m\$_{NERC} \quad (4)$$

The Monetary Basis will be set by NERC, or other appropriate organization, at a level just sufficient to assure minimum acceptable frequency control until an appropriate market in frequency control services has been established to set the price. The dependence of price on the average square of hourly frequency error experienced over the period reasonably mimics the expected effect that the quality of frequency control provided would have on a market price. As experienced frequency control (measured as the period average "variance" of frequency, or "square" of frequency error) improves, the price is reduced-and, as experienced frequency control

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degrades, the price increases. Using this price formula also has the practical benefit of collapsing the $FCC\$_{BA}$ standard to the extremely simple final equation (4). Once a market in frequency control services is established, a market settlement price will take over from the set $Price_{Int}$ for this service and the formula in effect for $FCC\$_{BA}$ will revert back to equation (2) from equation (4).

ATTACHMENT 5

JITF Proposal

Inadvertent Energy Operating Standard

Brief Description: Inadvertent Energy is the difference in energy between a Balancing Authority's Net Actual and Net Scheduled Interchange and is considered a market commodity. Control is necessary for reliability of the Bulk Electric System.

Principle to Which Standard Applies: **Reliability Principle 1 – Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and prescribed abnormal conditions.**

Entity(s) to Which Proposed or Revised Standard Applies: Entities performing Balancing Authority functions

Purpose of Standard (Should Provide Reliability Basis for the Standard): **This standard requires the Balancing Authorities have Inadvertent Interchange policies.** The energy component of the existing Inadvertent Interchange calculation, if not controlled, can cause imbalances that can lead to degradation of the Interconnection. To avert this negative condition, the Inadvertent energy component must be defined, managed and settled. However, in accordance with Market Principles 3 and 4, the markets will determine the Inadvertent energy pay-back/settlement/cash-out (including pricing, penalties and incentives).

Inadvertent Interchange energy component shall be calculated as follows:

Inadvertent Energy Formula

$$I_i = (NI_A - NI_S)$$

where I_i is Inadvertent Energy of Balancing Authority i

NI_A is Actual Net Interchange

NI_S is Scheduled Net Interchange

Note: The Inadvertent Energy Standard, Attachment #5, including the Inadvertent Energy Formula, is in development and receives constructive criticism after each adjustment. The JITF

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is using this opportunity to incorporate a high degree of accuracy into the Inadvertent Energy Formula and is considering the inclusion of additional Interchange components such as ramping and Scheduled Inadvertent Payback.

ATTACHMENT 6

“100 times L₆₀ Proposal”

Transitional Limit on Inadvertent Accumulations

Transitional Inadvertent accumulation for purposes of this paper means the accumulated Inadvertent balances that are currently on record or will be accumulated during the time it takes the proposed Frequency Control Contribution and Inadvertent Energy Standards to be developed and implemented.

Balancing Authorities currently accumulate on-peak and off-peak inadvertent energy accounts. NERC Policy 1F encourages Balancing Authorities to keep these accounts small. However, there is no limit on the magnitude of the accumulated balances. In the West, a “20xBias” limit has been successfully applied. The JIITF recommends a technically justifiable Inadvertent accumulation limit.

While one of the Balancing Authority’s goals is to maintain a zero ACE on average over a long period of time, the measure of inadvertent accumulation must be annually accumulated AIE. Placing a strict enough limit on annually accumulated AIE prevents perverse pay-back incentives and catches the entities causing long term frequency error soon enough. The JIITF propose a limit that provides for 90% confidence in not holding entities to be excessively accumulating AIE because of a bias in control. The following is a short derivation of the proposed limit.

Consider a hypothetical limiting Balancing Authority that has an ACE distribution that is normal and unbiased, and has historical performance equal to the observed performance of the interconnection as a whole (maximum allowed performance). Any Balancing Authority's long run (annual) accumulation should be no larger than the worst likely accumulation over a year of random drawings made once each hour from the limiting Balancing Authority's ACE distribution.

We have to begin the derivation by dividing a Balancing Authority's unbiased ACE distribution's variance s^2 , or average squared deviation from zero, by the number of hours of the year, to get a measure of the allowed average over a year of hourly AIE. [We don’t divide an unbiased ACE's average deviation from zero which is zero by definition of "unbiased" because the deviations occur in opposite directions and cancel out.] We then take the positive square root ("standard" deviation) of the result to get the measure of the allowed average over a year of hourly AIE:

$$Avg(AIE)_{year} = \sqrt{\frac{s^2}{N_{60-minute_periods_in_year}}} \quad (1)$$

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where \mathbf{s} is the standard deviation of a balancing Authority's unbiased normally distributed ACE.

We call $\mathbf{s}_{allowed}$ the maximum allowed such standard deviation, that of the hypothetical limiting Balancing Authority, with

$$\mathbf{s}_{allowed} = \mathbf{e}_{60} \times \sqrt{B_I \times B_{CA}} \quad \mathbf{3(2)}$$

where \mathbf{e}_{60} is the historical and observed standard deviation of frequency
 (~0.008 Hz for the Eastern Interconnection)

B_{CA} is 10 times the Balancing Authority's bias (MW/.1Hz)

B_I is 10 times the sum of all the Balancing Authorities' biases (MW/.1Hz).

Setting the limit on a Balancing Authority's $Avg(AIE)_{year}$ such that, allowing for statistical bias, there is 90 % confidence that any hour's ACE sample is within or at $1.65 \times \mathbf{s}_{allowed}$, we get

$$Avg(AIE)_{year} \leq 1.65 \times \frac{\mathbf{s}_{allowed}}{\sqrt{N_{60\text{-minute_periods_in_year}}}} \quad \mathbf{(3)}$$

where 1.65 is the statistical conversion factor from a 68.3 % confidence limit (1 standard deviation) to a 90 % confidence limit.

Substituting $(L_{60}/1.65)$ for $\mathbf{s}_{allowed}$, we get

$$Avg(AIE)_{year} \leq \frac{L_{60}}{\sqrt{8760}} \quad \mathbf{(4)}$$

where L_{60} is the maximum allowed biased standard deviation of any Balancing Authority's ACE--a maximum likely to exceed or equal with 90 % confidence any hour's sample of that ACE due to statistical bias,

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We multiply back the right-hand side of equation (4) by the 8760 hours in the year to get the annual energy accumulation limit

$$AIE_{accumulation_limit} = L_{60} \times \sqrt{8760} . \quad (5)$$

Rounding up $\sqrt{8760}(= 93.6)$ to 100 yields the proposed inadvertent accumulation limit, to wit

$AIE_{accumulation} \leq 100 \times L_{60} . \quad (6)$

The “one hundred times L_{60} ” limit on accumulated AIE allows annual accumulations no bigger than 100 times the maximum allowed biased standard deviation of a Balancing Authority's ACE- -a maximum that is set to exceed or equal with 90 % confidence any Balancing Authority's ACE due to statistical bias. This places a technically justified limit on accumulations of inadvertent without creating perverse payback incentives. It allows for reasonable generation and load variation, but not excessive use of inadvertent accounts.

ATTACHMENT 7

Time Error Correction

Time Error Correction

Traditional methods of managing Inadvertent (accumulated Inadvertent accounts and payback-in-kind) demonstrate that Time Error is manageable. Time Error Correction allows the unintentional Inadvertent, in the opposite direction, to be paid back to the Interconnection unilaterally. This unilateral payback of Inadvertent corrects the inadvertent accounts of Balancing Authorities that took or supplied Inadvertent in the opposite direction and corrects Time Error at the same time. Unilateral Time Error Corrections performed interconnection-wide that happen to be in the same direction as the Balancing Authorities' Inadvertent account have the effect of stranding Inadvertent on the interconnection. This condition reduces the effectiveness of the payback process.

Historically, these considerations have not significantly influenced the North American Interconnections with respect to Time Error Correction procedures. Until recently, interconnection-wide, Time Error Corrections have been performed as needed stranding Inadvertent, and little attempt has been made to identify unintentional inadvertent for unilateral payback. The exception to this is the recently implemented time error corrections procedures implemented on the Western Interconnection. The procedures identify “Primary Inadvertent” and implements only “Primary Inadvertent” payback.

Effect of JIITF Recommendations on Time Error Correction

The recommendations of the JIITF will not adversely affect the above Inadvertent payback-in-kind process. It will, however, cause those choosing to perform unilateral Inadvertent payback, to be more sensitive about the effect that the unilateral payback will have on interconnection frequency. Unilateral payback will be more likely to occur when it will help restore frequency to schedule, and less likely to occur when it will contribute to additional frequency error. Both of these effects are likely to improve reliability.

If Inadvertent is settled with a cash out process, the automatic Time Error correction effect of unilateral Inadvertent payback will be eliminated. Reductions in this automatic Time Error correction can easily be compensated for with interconnection wide Time Error Corrections. The interconnection wide Time Error Corrections will have no effect on the settlement of either the Inadvertent or the Frequency Control Contribution since pure Time Error Corrections do not create either Inadvertent or Frequency Error from schedule. Only the failure to provide effective control during the Time Error Correction process will cause additional inadvertent, and that inadvertent will also create associated Transmission Loading Components and Frequency Control Components incurring effective control. Therefore, interconnection Time Error

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Corrections will not affect the energy, Transmission Loading Contribution or Frequency Control Contribution settlement process.

The results of the JIITF proposed solutions are changes that result in Inadvertent Management decisions and Time Error Correction decisions that are independent of each other.

ATTACHMENT 8

Data Validation and Dispute Resolution

Data Validation

The Inadvertent Interchange Operating Standard end-state will depend on due process and ultimately actual experience. The JIITF highly recommends an independent clearinghouse that expeditiously “balances the books” for each Interconnection, especially if Inadvertent energy is cashed out through a market process or if there are severe penalties for extreme hourly values in FCC.

Potential for abuse exists if the books are not balanced with validated data. Without a central clearinghouse, Balancing Authorities can sell energy “off the ties.” In addition, excessive FCC that exposes a Balancing Authority to a penalty in an hour can be “moved” into other hours by editing tie-line data.

Validated data is essential for any standard where money is at stake (either through compliance or financial settlement).

Dispute Resolution

Disputes will be more frequent and more spirited if Inadvertent energy is settled on an hourly basis and/or settlement involves financial transactions. The process must be able to move forward even if one or more parties have disputes.

To expeditiously balance hourly books (each day), on an Interconnection level, the JIITF recommends a streamlined process be developed, approved and implemented. The process includes an independent clearinghouse that, in effect, is a large matrix that accepts Balancing Authorities' actual and scheduled data. The “Interconnection Books” cannot close until all differences are resolved between “partners.” However, when values for either scheduled or actual Interchange are contested, the independent clearinghouse would implement a procedure to balance the Interconnection Books, on an interim basis.

Ultimately, if the “partners” cannot come to an agreement on the contested Inadvertent Interchange, a dispute resolution process would be implemented to determine a final resolution.