Intertie Optimization FAQs and Implementation Principles

Q1. At a high level, what is intertie optimization and how does it work?

A1. Intertie optimization is the process of efficiently utilizing any interregional transmission capability between neighboring RTOs/ISOs that remains unused after all bilateral trades have been arranged. Intertie optimization (also referred to as "tie optimization") was first proposed by ISO-NE and NYISO in 2011 as follows:

> The core concept of Tie Optimization is for the ISOs to optimize their external transmission links in the same way, or as closely as possible [to how] the ISOs optimize transmission internally. … The concept that underlies Tie Optimization is not new. It is the same bid-based, security-constrained least cost dispatch logic that underlies the wholesale energy market administered by each ISO. This competitive market design applies to all internal nodes and internal transmission facilities today. Tie Optimization simply extends this standard market design to cover the … transmission facilities that interconnect the two ISOs. Operationally, Tie Optimization coordinates real-time energy dispatch across both ISOs' control areas through the exchange of load and offer data for every [dispatch interval].[1]

Intertie optimization is discussed more fully in the whitepaper "The Need for Intertie Optimization: Reducing Customer Costs, Improving Grid Resilience, and Encourage Interregional Transmission" (October 2023).

Q2. What are the expected benefits of intertie optimization?

A2. As ISO-NE and NYISO have explained in 2011, applying intertie optimization across the interregional seams between neighboring markets "achieves the lowest possible production cost and efficiently uses the existing transmission infrastructure."

Intertie optimization achieves these production costs savings and associated customer benefits by avoiding the inefficiencies encountered under the existing interregional scheduling processes. As is well documented, these intertie scheduling processes leave interregional transmission underutilized and inefficiently used today. Intertie optimization thus avoids two well documented inefficiencies: (1) when interties are under-utilized, energy flows in the right direction but at insufficient amounts that do not fully utilize the tie and maximize delivery of lower-cost generation; and (2) when energy flows in the wrong direction, from the higher-priced region to the lower-priced region, displacing more-efficient region-internal generation with less-efficient external generation.

For example, price differences across the MISO-PJM seam exceeded $10/MWh during 3,182 hours; yet during 1,570 (49%) of these hours, market flows were inconsistent with those price differences, exporting power from the higher-priced market to the lower-priced market.[2] Similarly, optimal

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[1] See NYISO, ISO New England, Inter-Regional Interchange Scheduling (IRIS) Analysis and Options (January 5, 2011) at iv.

[2] Monitoring Analytics, 2022 State of the Market Report for PJM (March 9, 2023) at Table 9-27.

levels of real-time transactions between ISO-NE and NYISO have been achieved during only 11% of all trading periods in 2022, down from 23% in 2018.[3] Intertie optimization will avoid these inefficiencies.

Q3. What is the position of the Market Monitors on intertie optimization?

A3. As summarized in the Intertie Optimization Whitepaper, market monitors have long stressed the inefficiency of the existing seams-management approaches. Potomac Economics (the Independent Market Monitor for NYISO, ISO New England, and MISO) first pointed out the need for more efficient management for energy transactions across regional seams in 2003,[4] with similar conclusions reached by other independent market monitors and internal market monitoring units at the time. Yet, despite efforts to improve seams management over the last decade through "coordinated transactions scheduling" (CTS), the recent market monitoring reports demonstrate that CTS has not been effective. For example, in 2023, the PJM IMM has repeated yet again the recommendation it has made every year since 2014:

> The MMU recommends that PJM explore an interchange optimization solution with its neighboring balancing authorities that would remove the need for market participants to schedule physical transactions across seams. Such a solution would include an optimized, but limited, joint dispatch approach that uses supply curves and treats seams between balancing authorities as constraints, similar to other constraints within an LMP market.[5]

Similarly, Potomac Economics continues to recommend that market operators address these seam-related inefficiencies—suggesting clearing of "transactions every five minutes through [the Unit Dispatch System] based on the most recent five-minute prices in the neighboring RTO area."[6]

Q4. Is there any precedent for the use of intertie optimization that demonstrates its value?

A4. Yes, the Western energy imbalance markets have been created to optimize transactions within and across transmission seams between multiple Balancing Authority Areas (BAA). As discussed in Section III of the Intertie Optimization Whitepaper, the Western energy imbalance markets have been very successful, generating cost savings that now exceed $4 billion. The implementation of European "market coupling" has similarly created significant cost savings. RTOs in the eastern

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[3] ISO New England Internal Market Monitor, 2022 Annual Markets Report (June 5, 2023) at 160, Figure 5-6. We refer to "optimal" trades as those where the total transmission capability is used in the appropriate (i.e., low-to-high priced) direction.

[4] D. Patton, 2003 State of the Market Report – New York Electricity Markets, Potomac Economics (April 2004) at 98-104.

[5] Monitoring Analytics, 2022 State of the Market Report for PJM (March 9, 2023) at 105.

[6] Potomac Economics, 2021 State of the Market Report for the MISO Electricity Markets (June, 2022) at 89, 120.

interconnection of the U.S. have similarly estimated that the cost savings from intertie optimization would be significant.[7]

Q5. How expensive would it be to implement intertie optimization? Does it involve just a market design plus an algorithm (software) or does it also require steel in the ground?

A5. Intertie optimization would only require an algorithm (software) along with very modest changes to how intertie transactions are already scheduled and financially settled by neighboring system operators using their existing settlement systems. No new physical transmission facilities would be necessary.

As the PJM market monitor notes, the intertie optimization "solution would include an optimized, but limited, joint dispatch approach that uses supply curves and treats seams between balancing authorities as constraints, similar to other constraints within an LMP market."[8]

Q6. To what market time frames would intertie optimization apply?

A6. The optimization should (most urgently) be applied to real-time markets (since interregional transmission utilization is most inefficient in real time and real-time markets are increasingly volatile), but can also be applied to day-ahead markets.

Q7. At what point during regional market operations would intertie optimization be activated?

A7. Intertie optimization would be activated after all bilateral market transactions have been made (and are "locked in").

Q8. What transmission capacity would be used for intertie optimization?

A8. Intertie optimization would use any interregional transmission capacity that remains unused after all bilateral trading has concluded. This includes the ability to schedule intertie market transactions that "counter flow" the schedules resulting from bilateral trades.

Q9. Should intertie optimization frameworks cover both regulated and merchant transmission?

A9. Yes. Because some of the existing and many of the proposed interregional transmission facilities are merchant lines, it is critical that intertie optimization frameworks cover merchant transmission lines. The owners and/or subscribers of merchant lines would make available for intertie optimization (along with regulated transmission) any transmission capacity that remains unused after bilateral trading closes.

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[7] For example, see NYISO, ISO New England, Inter-Regional Interchange Scheduling (IRIS) Analysis and Options (January 5, 2011) at v, II-13, identifying $77 million in production cost savings and $784 million in reduced load expenditures from intertie optimization between New York and New England for the five year study period from 2006 through 2010.

[8] Monitoring Analytics, 2022 State of the Market Report for PJM (March 9, 2023) at 105.

Q10. Would intertie optimization include a "transactions charge" (hurdle rate) that is recovered from the MWh of power transfers scheduled by the optimization?

A10. No. Wheeling or transaction-specific charges would not apply—to avoid creating a hurdle that could prevent transactions that can efficiently utilize the otherwise-unused transmission capacity. However, just as is the case for RTO-internal transactions, congestion charges and marginal loss charges would apply to transactions associated with intertie optimization. (No wheeling revenues would be lost on unused transmission, and on transactions that would not exist in the absence of intertie optimization.)

As noted in the Intertie Optimization Whitepaper, avoiding charges that do not reflect the true marginal cost of transmission is particularly important for scheduling economic transactions on interregional transmission capacity that would otherwise remain unused (such as in real-time, after all bilateral trades have been scheduled). This concept of "hurdle free" transactions (reflecting only congestion and marginal losses) is also central to the design of the RTO/ISO energy markets, the interregional energy imbalance markets in the Western U.S., and European "market coupling" frameworks.

Q11. If intertie optimization is based on hurdle-free transactions, does that mean RTOs/ISOs will have to de-pancake OATT transmission rates between them for all transactions?

A11. No. While depancaking transmission rates would have efficiency benefits for all transactions, OATT-based wheeling charges could still be applied to all bilateral trades (as long as they are allowed by FERC). But no such wheeling charges would be imposed on intertie-optimization-based transactions (i.e., transactions that would not even exist in the absence of intertie optimization.) This is consistent with the approach taken by the Western energy imbalance markets.

Q12. How would transmission customers who are paying for regulated or merchant transmission benefit from intertie optimization if no wheeling charges are applied?

A12. RTO/ISO customers paying for the transmission facilities utilized by intertie optimization would receive (1) all or a portion of the market value of the associated transactions; and (2) additionally benefit from more efficient system dispatch and market prices.

For example, as is already the case in the Western EIM and proposed EDAM, the value of the intertie transactions (i.e., the real-time or day-ahead congestion revenues associated with an intertie's LMP difference) could be allocated to those who make the transmission available for intertie optimization. These congestion (i.e., transfer-related) revenues could be split 50/50 between the neighboring RTOs/ISOs (and their transmission owners) for regulated transmission. If the transmission capacity has been made available by the holders of long-term transmission rights, these congestion revenues should be paid to those who made the rights available.

Q13. Does the payment of congestion revenues to the provider of transmission capacity mean that Financial Transmission Rights (FTRs) or Congestion Revenue Rights (CRRs) need to be issued to the holders of the physical transmission rights?

A13. No. The transmission utilized by intertie optimization is "as available" non-firm transmission. No FTRs/CRRs would be associated with intertie optimization. This is similar to the fact that FTRs/CRRs are not available for real-time market transactions either. Rather, the revenues associated with congestion charges (reflecting the congestion-related LMP difference across the interties) imposed on intertie-optimization transactions could be allocated to the entities who make the transmission available for intertie optimization.

Q14. Is exempting transactions associated with intertie optimization from wheeling charges consistent with open access principles?

A14. Yes. The approach is consistent with how organized wholesale power markets and energy-imbalance markets work. No transmission charges are imposed on individual transactions within RTO/ISO markets and no transmission charges are imposed on any transactions associated with Western energy imbalance markets either. Intertie optimization is utilizing on a non-firm basis only transmission that otherwise would remain unused. Transmission providers already have the discretion to "discount" non-firm transmission based on market conditions. Similarly, allocating congestion revenues to those who made the transmission available, while not imposing wheeling charges, reflects the discounted non-firm nature of this transmission and better reflects market conditions and the marginal value of the available (but otherwise unused) transmission capability.

Q15. Does intertie optimization require that RTOs/ISOs take on a financial position through market transactions?

A15. No. Interregional market transaction through intertie optimization do not change the role RTOs/ISOs already have in their regional markets.

As NYISO and ISO-NE have pointed out in their 2011 report, the RTOs/ISOs do not directly participate in the markets and do not buy or sell power. They simply continue to act as independent settlement administrators for the payments to and from market participants. All energy flows between regions scheduled through intertie optimization are priced at the LMPs, just like to market-internal transactions. This also facilitates market transparency and correctly prices congestion.

Q16. Does intertie optimization require that neighboring regions are integrated into a single security-constrained economic dispatch (SCED) optimization?

A16. No. While the "single-SCED approach" is being used by the Western energy imbalance markets, more disaggregated intertie optimization frameworks are available as well. These frameworks partition the optimization problem into subproblems and coordinate their solutions by exchanging necessary market information. This type of coordination will drive each RTO/ISO's dispatch

towards the optimal solution for the interregional dispatch problem, thus (iteratively) achieving overall economic efficiency.

For example, ISO-NE staff developed and successfully tested through large-scale simulations a "marginal equivalence" approach to intertie optimization under which neighboring system operators exchange every 5 minutes information on marginal generation costs and relevant transmission constraints so that the information can be incorporated into the other RTO/ISO's real-time dispatch. This approach could be applied between two RTO/ISO regions or between RTOs/ISOs and non-market regions. (See Zhao, Litvinov, and Zheng, "A Marginal Equivalent Decomposition Method and Its Application to Multi-Area Optimal Power Flow Problems," IEEE Transactions on Power Systems, Volume 29, Issue 1 (2014)).