Responses to Common Questions  
About LMP and FTRs, Flowgate Rights and LMP/Flowgate Hybrids  

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A nation-wide dialogue/debate has been occurring about the merits of locational marginal pricing (LMP) and associated financial transmission rights (FTRs) versus the merits of flowgate rights systems. In some regions, the dialogue has resulted in efforts to create hybrid market designs. In these hybrid designs, the system operators for a Regional Transmission Organization (RTO) would coordinate a bid-based real-time balancing system in which spot energy and transmission are priced using LMP. Energy bought and sold in the RTO’s spot market would be settled at the LMP at each point, while bilateral schedules would be charged for congestion based on the difference between the LMP at the point of delivery and the LMP at the point of receipt. In a hybrid system, the RTO would also administer a system of flowgate rights (FGRs) in the forward market time frame to allow market participants to acquire financial hedges against the LMP-based congestion charges. This paper responds to common questions that are being asked about LMP/FTR systems, FGR systems and possible hybrid proposals.

1. **To what extent is a centralized dispatch required to implement any of these approaches?**

Every approach requires some degree of centralized dispatch. No matter what the market design, the system operators in each control area must maintain system balance in real time and must have some mechanism to manage congestion in real time to keep flows within all applicable security constraints. A centralized dispatch is a principal and necessary means by which system operators meet these requirements and maintain reliability. FERC’s Order 2000 requires that these essential functions be performed using market mechanisms. Under Order 2000, every RTO must provide a real-time balancing market and ensure that all market participants have non-discriminatory access to that market. Every RTO must also provide market-based methods to manage congestion.

All of the approaches described here would allow market participants to submit voluntary bids to the RTO’s system operators. The RTO would use these bids to arrange a security-constrained economic dispatch -- a dispatch that both balances the system and redispitches to relieve congestion at the lowest cost, given the participants’ bids and the constraints that were actually binding in the dispatch. The RTO must then “price” the dispatch in order to compensate those who provided energy to the dispatch and charge those who acquired/used energy from the dispatch.

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1 This paper was prepared by Laura Manz of PSE&G and John Chandley of LECG for the benefit of the NERC Congestion Management Working Group, in conjunction with their evaluation of system redispatch approaches to congestion management.

2 This paper complements a paper prepared in 1997, “Responses to Common Objections about LMP,” prepared by the Supporting Companies and filed at FERC in conjunction with their LMP-based proposals to create the PJM ISO. The 1997 paper was previously distributed to the Congestion Management Working Group.
In an LMP-based system, the RTO uses the bids to clear the market for each dispatch interval. The resulting market-clearing prices reflect the marginal cost of serving an increment of load at each location, given the bids submitted by participants, the actual dispatch and the constraints that had to be honored in the actual dispatch. The LMP prices are thus consistent with the actual dispatch and actual grid conditions.

2. Does the requirement for a centralized dispatch eliminate the market’s ability to engage in bilateral transactions outside the spot market?

No. Every LMP-based system fully accommodates bilateral schedules, and indeed, most trading in LMP-based systems occurs through one or more bilateral mechanisms. In LMP-based systems, bilateral transactions are charged for congestion based on the marginal cost of system usage. The marginal usage cost is equal to the difference between the LMP prices at point of delivery and receipt. This means that a party would pay the same for congestion whether it scheduled a bilateral transaction from point A to point B or whether it sold energy in the RTO spot market at point A and bought the energy from the spot market at point B, receiving and paying LMP prices for this energy. The congestion charge is also equal to the marginal cost of redispetching the system (given the bids, the dispatch and the constraints) to accommodate each transaction. Each bilateral schedule thus pays the congestion charges applicable to its impact on the system, no more and no less. (It is this feature that allows LMP-based systems to provide a “congestion-buy-through” for traders whose transactions create loop flows through an LMP-based system. The RTO can simply charge for the marginal costs of redispetch and accommodate the flows without requiring curtailment under TLR.) If the flows of a given schedule do not contribute to congestion in any way, then the LMP-based prices at its points of receipt and delivery will be the same, so there will be no congestion charge.

3. Do “pure” flowgate systems avoid the need for centralized dispatch?

No. It is not clear what a “pure” flowgate system means. Every control area must use a centralized dispatch to maintain system balance and manage congestion in real time. The fact that transmission rights defined as FGRs are allocated and traded in the forward time period does not eliminate the need for these essential real-time functions. Hence, the fundamental market design questions are the same as they are for an LMP-based system:

(1) Will the control area operators allow market participants to submit voluntary bids to participate in this dispatch?

(2) Will the operators allow participants to use the dispatch service for balancing? That is, can they buy and sell energy to balance their transactions or buy/sell energy production or usage that is not contracted?

(3) Will the operators price the dispatch efficiently, using marginal cost? That is, will the imbalance/spot prices reflect market-clearing prices at each location?

(4) Will the operators apply consistent, comparable prices for congestion, whether the transactions are bilateral or spot?
In LMP systems the answers are all “yes.” No matter what form transmission rights take – point-to-point FTRs, or constraint-by-constraint FGRs – the system operators must still answer these questions and do so consistently, in a manner that supports an open, efficient market, as required by Order 2000.

4. Does a flowgate system reduce the need for RTO involvement in the forward markets?

No. The opposite is true. If the RTO administers a flowgate rights system, it must substantially increase its involvement in the forward markets and must in fact become an active participant in the market for FGRs. In order to define which constraints are likely to be “commercially significant,” the RTO must examine both historical flows and constraint data and model expected future market behavior. It must make predictions on expected market use of the grid and the expected value that market participants will place on using the grid in likely constrained conditions. It must define the threshold for “commercially significant” and then designate the constraints that will be “flowgates” for which FGRs will be allocated and auctioned. Because the RTO can easily be wrong in its market predictions, it may inadvertently issue too few or too many FGRs. For example, it may allocate more rights than can be honored (or paid for in the settlements) during any given market period. When it issues too many rights, it will have to buy some of them back, by making direct offers to repurchase these rights in the secondary forward markets. As the grid conditions change, the RTO will be buying and selling FTRs, always seeking to find some hard-to-define balance between the market’s demand for hedges and the feasible supply that the RTO can support without curtailments or subsidies and cost socialization.

It is also possible to define a hybrid system in which the RTO limits itself to the allocation of point-to-point FTRs. While the RTO must limit the allocation (or periodic auction) of FTRs to any set that is “simultaneously feasible,” FTRs do not require the constant market involvement described above. It would then be possible for private commercial entities to purchase FTRs to provide hedges against a privately issued set of FGRs. These FGRs would be defined, allocated and settled by the private commercial entity, which would receive any reward and take any risks from its investments. The RTO would not be required to take or subsidize any of these risks.

5. What is the essential difference between FTRs and FGRs?

The essential difference is how the rights hedge parties against congestion charges. FTRs hedge congestion on a point-to-point basis; FGRs hedge congestion on a constraint-by-constraint basis.

FTRs are defined as point-to-point financial hedges. Their function is to provide a means for market participants to acquire price certainty in advance, given the fact that energy prices and congestion charges will differ by location and will depend on the outcome of the dispatch. Parties can acquire FTRs in advance through allocations and/or bid-based auctions held periodically by the RTO. FTRs can then be traded through various
secondary markets. An FTR entitles the holder to receive in the RTO’s settlements the difference between the LMP at the point of delivery and the LMP at the point of receipt.

In most current Flowgate proposals, FGRs are defined as constraint-by-constraint financial hedges. Like FTRs, their function is to provide a means for market participants to acquire price certainty in advance, given the fact that energy prices and congestion charges will differ by location and will depend on the outcome of the dispatch. Parties can acquire FGRs in advance through allocations and/or bid-based auctions held periodically by the RTO. FGRs can then be traded through various secondary markets. An FGR for a given constraint entitles the holder to receive in settlements an amount based on the shadow price of the constraint.

6. Could settlements under an FTR system and FGR system be equivalent?

Yes, under certain conditions. If every constraint were identified as one for which FGRs were available, and a party acquired all of the FGRs across all of these constraints that would be affected by its point-to-point transaction, in proportion to the actual flows across each constraint, then the settlement for the FGRs could be the same as the settlement for the single point-to-point FTR matching the transaction. Another way to say this is that a point-to-point FTR is equivalent to a complete set of FGRs for every constraint that might be impacted by a transaction between the two points.

This equivalence breaks down, however, if these conditions do not exist. For example, if only some of the constraints are identified, so that the party does not have FGRs for every constraint impacted by the flows from its transaction, then the FGR hedges will only be partial and the settlements will not be the same as they would be for a point-to-point FTR for the same transaction. This equivalence would also not hold if there are any subsidy and cost socialization schemes built into the settlement system. For example, the hybrid proposal recently described by a MISO working group would provide subsidies for FGR holders and socialize the RTO’s costs of managing constraints that are not designated as “commercially significant.”

7. Can FTRs and FGRs be either “options” or “obligations”? How do these types of rights differ?

They can be either. In an LMP-based system, the difference between the LMP prices at two points may be either positive or negative. For example, for a transaction from A to B, if the LMP at A is $30 and the LMP at B is $50, the price difference is “positive.” There will be a congestion charge for schedules from A to B of $50 - $30 = $20, reflecting the marginal cost of redispetching to move power from A to B. In this case, an FTR from A to B would be worth $50 - $30 = $20, thus providing a hedge against the congestion charge. If the prices are reversed, such that the LMP at A is $50 and LMP at

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3 Some earlier flowgate rights proposals called FGRs “physical rights,” but more recent proposals all provide a means for pricing the value of FGRs in the RTO’s settlements (so that parties with FGRs can be properly credited for the FGRs they hold) and do not require parties to obtain all the FGRs they need prior to scheduling. These features are characteristic of “financial” rights.
B is $30, then the congestion charge is “negative,” which generally indicates that flows from A to B actually reduce congestion (counterflows) and should be compensated at the difference between the two prices.

If an FTR is defined as an obligation, it is settled in the counterflow case at $30 - $50 = - $20, which means that the party would pay the RTO $20 for its FTR while receiving $20 for its counterflow. Note that the party remains hedged, so that its net congestion charge is zero. If the FTR is defined as an “option,” then the FTR holder receives the credit when the LMP differences are positive but is not required to pay for its FTR when the differences are negative.

Similarly, FGRs can be defined as either “options” or “obligations.” The values of FGRs in the RTO’s settlements can be either positive or negative, depending on the direction of flows relative to the binding constraints and the resulting impact on the shadow prices.

If the goal is to fully and efficiently utilize the grid, schedules that create counterflows that relieve constraints are necessary. This means that parties should be allowed to schedule counterflows, and these counterflows should be compensated, whether the rights are defined as FTRs or FGRs. If scheduled counterflows then allow the RTO to accept additional schedules in the opposite direction, then providing price certainty to all parties may require that the counterflows be obligations, implying a corresponding need for hedges that also function as obligations. Thus, if the goal is to hedge transactions and allow parties to obtain advance certainty with respect to delivered prices, then it can be useful to define rights as obligations, whereas rights defined as options may be more useful in other cases.

In general, the RTO can issue more rights as obligations than it can if all rights are defined as options. The reason is that the obligations allow the RTO to assume that counterflows will either be provided by the rights holder or the holder will pay the RTO for its “negative” right – that is, the marginal cost of redispatch needed to accommodate other transactions. If rights are not defined as obligations, the RTO does not have these assurances and so must limit the number of rights it issues, since it cannot assume either that the counterflows will be provided or that parties with options will pay the marginal cost of redispatch if they choose not to deliver the counterflows. For similar reasons, parties should generally be willing to pay more for options than for obligations. Thus, an obligation FTR or FGR will be discounted in the market relative to an option FTR/FGR to the extent that the market perceives it will have to meet the counterflow or payment obligations.

Ideally, both options and obligations could be offered by the RTO, and the market would sort out the mix of rights it found to be most useful, given the nature of the transactions each participant wished to pursue.

8. What are the trading requirements under FTR and FGR systems?
Assume a proposed transaction schedule from A to B. To be fully hedged against all congestion charges, the scheduling party must obtain the following:

(1) In an FTR system, the party can obtain a single FTR from point A to point B. However, it may also be fully (or partially) hedged by a mix of other FTRs, between other points. Because the FTR is an entitlement to money in the RTO’s settlements, any mix of FTRs that achieves the same amount as the congestion charges for the A to B transaction can provide the necessary hedge. However, since LMP prices, congestion charges and FTR credits are not defined until the dispatch occurs, the party cannot be certain whether any mix of FTRs other than the FTR from A to B provides the exact hedge it needs.

(2) In an FGR system, the party seeking to be fully hedged must obtain that mix of FGRs that matches the distribution of flows from its transaction. In a network, the flows will follow all possible paths in a manner determined by the impedance of each path, and more than one flowgate/constraint may be affected. The flows will be defined by power transfer distribution factors (PTDFs) relative to each flowgate/constraint, and the PTDFs can (and may often) change. Hence the mix of FGRs required for each transaction will change as the PTDFs change and may not be known until near real time.

9. Is it correct that FGRs are easier to trade than LMP-based FTRs?

There is no intrinsic reason for this to be true. A trader needs a single point-to-point FTR to hedge a point-to-point transaction. A trader may need a mix of many different FGRs to hedge the same transaction. There is no logical reason to believe that the trader could more easily acquire all of the FGRs it needed than acquire the single FTR it needed.

FTRs and FGRs are different ways of defining property rights to the same grid, and the capacity of the grid is limited. For any given grid configuration, and any feasible set of flows/transactions, the RTO could issue a set of FTRs or a set of FGRs. Once either set

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4 Note that this assumes that all constraints that could be binding in the dispatch have been designated as flowgates, and that the RTO has made FGRs available for all flowgates. If some constraints have not been designated as flowgates, but those constraints become binding, then there is no means by which parties can acquire a complete hedge. In some flowgate proposals (e.g., the MISO Hybrid), traders that are otherwise fully hedged are excused from having to pay the congestion charges for any non-designated constraints. The RTO is required to provide redispatch to relieve these constraints, and its redispatch costs are socialized in some fashion.

5 Some flowgate proposals solve this problem by freezing the PTDFs for some specified period. (The MISO Hybrid would freeze PTDFs on a monthly basis.) This requires that the RTO define the settlement credit for FGRs based on the PTDFs fixed for that period, whereas the congestion charges are defined by actual grid conditions in real time. If PTDFs in the actual dispatch differ from those that are frozen for the settlement period, this difference can create a need for further socialization of some part of the RTO’s actual redispatch costs. Note that there are two dispatches used to define settlements: one uses hypothetical (frozen) grid assumptions to define FGR credits; the other uses actual grid conditions to define congestion charges. This inconsistency may encourage infeasible schedules and may create opportunities for gaming and other problems.
were issued (e.g., through an auction), there is no logical reason to believe that parties could trade FGRs any more easily than FTRs.

Flowgate rights advocates believe that if there are relatively few commercially significant flowgates, so that only a limited set of FGRs will be required to hedge each transaction, and if PTDFs do not change frequently, so that parties do not have to acquire a different mix of FGRs to match changed flows for the same transaction, then trading should be easy. If either or both of these assumptions is incorrect, then trading may not be as easy as assumed. In a dynamic power system, it seems likely that either or both of these assumptions will not be true. If they are not true, to make trading easier, the RTO would have to designate only a few constraints as flowgates and the RTO’s market rules would have to allow parties to ignore non-flowgate constraints and to ignore changed PTDFs, while requiring the RTO to absorb and socialize the redispatch costs of the actual constraints and PTDFs. Hence, the relative ease of any non-subsidized FGR trading system may depend critically on how many constraints there are, how stable they are over time and how stable the PTDFs are.

10. What factors can affect the liquidity of FTR/FGR trading in secondary markets?

Several factors may affect the liquidity of FTR or FGR trading in similar ways. For example, if an RTO allocates some rights to parties for equity reasons, it matters to rights trading what happens when those rights are not used. If a state is implementing retail choice, and if rights are allocated to those who pay for “network service,” then it matters whether the rights must be surrendered as customers switch between suppliers. In some states with retail choice, incumbent utilities continue to have obligations to serve “default customers.” If the state policy is to subsidize retail choice in any manner or to diminish the ability of the utilities to recover stranded costs if customers switch, then the utilities may have incentives not to surrender the rights they are allocated. States with fixed shopping credits can inadvertently create incentives not to release rights to the market as market prices fluctuate above and below the fixed shopping credit. All of these factors appear to be affecting FTR secondary trading in PJM. Moreover, all of these factors would also adversely impact rights trading if PJM’s rights were FGRs.

11. Does an LMP system require a single control area with centralized dispatch, or could it work in a region with multiple control areas?

It is possible to design an LMP-based market in a region with multiple control areas. However, some degree of regional coordination is essential, and the degree of coordination provided by the RTO will determine how best to achieve efficient congestion management and consistent pricing across the RTO region.

In current LMP-based systems – PJM, New York and ISO-New England (under development) – the ISO is the control area operator for the entire market region. In many parts of the country, RTOs are being formed in regions that will continue for some

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Note that FTRs do not depend on any distinction between commercially significant constraints and other constraints, nor does the full hedging ability of FTRs depend on unchanging PTDFs.
undefined transition period to function with multiple control areas. To achieve an
efficient regional redispatch to relieve congestion and achieve consistent pricing
throughout the RTO region, some coordination of the dispatch and its pricing will be
necessary.

In general, a region can attempt to coordinate the separate dispatches and pricing of each
control area without a central coordinator (the model being developed between PJM,
New York, Ontario and New England). Alternatively, a region can use an RTO to
facilitate this coordination. Different approaches are possible and are the subject of other
papers.7

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7 See, for example, Michael Cadwalader and John Chandley, “Implementing Locational Marginal Pricing
in a Multi-Control Area Environment,” August 28, 2000, prepared for the MISO Hybrid Working Group.