Analysis of Midwest ISO Congestion Rent Shortfalls

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AGENDA

- Context

- Quantification of Congestion Rent Shortfalls by Cause

- Near-Term Strategies to Reduce Shortfalls

CONTEXT

Midwest ISO asked for support in:

- Identifying and quantifying root causes of congestion rent shortfalls in the day-ahead market.

- Formulating near-term improvements in auction or day-ahead market models or processes to reduce these shortfalls.
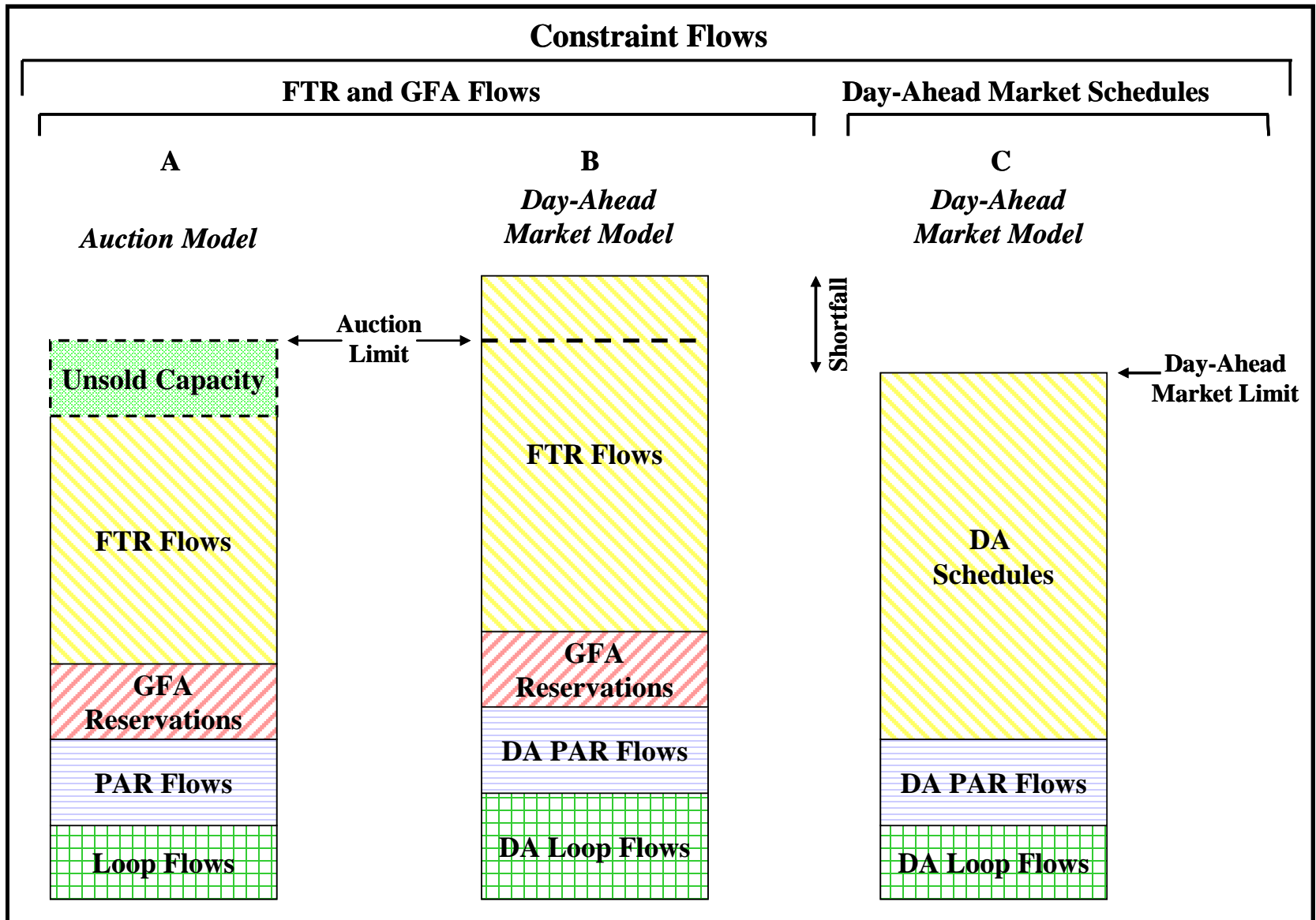
CONTEXT

Identification of potential sources of congestion rent shortfalls was based on the theoretical properties of financial transmission rights, experience in analyzing NYISO congestion rent shortfalls, and discussions with Midwest ISO staff regarding FTR auction and day-ahead market software and processes.

Congestion rent shortfalls can arise if the awarded FTRs are not feasible on the day-ahead market grid or if congestion charges are not collected in the day-ahead market on all transactions creating flows on binding constraints.

Congestion Rent Shortfalls in the Day-Ahead Market

CONTEXT

Congestion rent shortfalls in the day-ahead market can arise from a variety of causes.

- Differences in limits on internal constraints between the FTR auction and the day-ahead market.

- Differences in loopflow reservations on internal constraints between the FTR auction and the day-ahead market.

- Differences in PAR schedules on internal constraints between the FTR auction and the day-ahead market.

- Differences in load zone weights between the FTR auction and the day-ahead market.

- Inconsistent modeling of GFA reservations as obligations and options.

CONTEXT

- Shift factor truncation in the calculation of congestion prices in the day-ahead market.

- Internal constraints not modeled in the FTR auction that were binding in the day-ahead market.

- Differences in network topology between the FTR auction and the day-ahead market (planned and forced outages).

- Differences in network topology between the FTR auction and the day-ahead market (modeling differences).

- Treatment of entitlements on external constraints.

- Miscellaneous other factors.

Sources of Congestion Rent Shortfall

	August	September
Total shortfall in settlement system	$12,833,566	$14,773,451
Internal constraints not enforced	$3,081,000	$2,134,000
Limit differences	$774,000	0^2
Loopflow reservation differences	$6,469,000	$1,256,000^2
PAR schedule differences	$550,000	$78,000^2
Load zone weight differences	Immaterial[1]	Not analyzed
MISO GFA reservation treatment	$840,000	$730,000[3]
Total accounted for	$11,714,000	

[1] Only 22 load zones have been evaluated to date.

[2] On-peak FTRs only.

[3] Does not include 13 MW of a GFA reservation which could not be matched to day-ahead congestion data.

QUANTIFICATION OF CONGESTION RENT SHORTFALLS

Five sources of congestion rent shortfall accounted for a substantial proportion of the total shortfall in the MISO settlement system in the period studied.

- It needs to be kept in mind that the sum of all factors contributing to the congestion rent shortfall may exceed the shortfall in the settlement system as there may otherwise have been a substantial surplus.

- Our initial analysis has focused on quantifying and developing strategies for reducing congestion rent shortfalls attributable to factors other than outages or entitlements on external constraints.

- The development and implementation of strategies to reduce congestion rent shortfalls attributable to outages and entitlements on external constraints is a longer-term process.

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QUANTIFICATION OF CONGESTION RENT SHORTFALLS

Not all unfavorable differences in limits or loopflows on binding constraints result in congestion rent shortfalls.

- Unfavorable changes due to one cause may be offset by favorable changes of another type.

- Unsold capacity on a constraint in the auction serves as a buffer against congestion rent shortfalls.
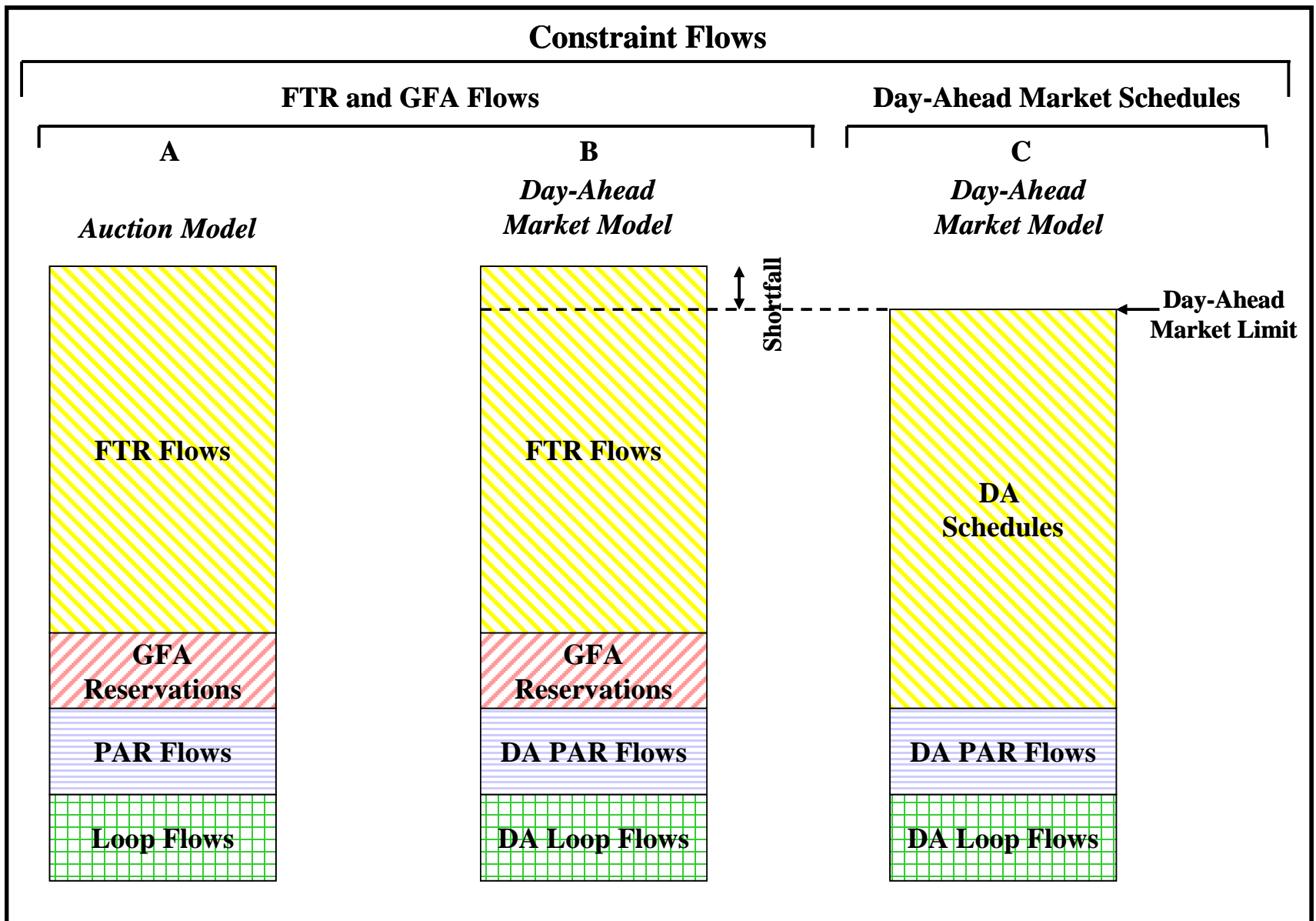
QUANTIFICATION OF CONGESTION RENT SHORTFALLS

The quantification methodology included two steps that excluded adverse system changes that did not produce shortfalls.

- The calculation of shortfalls due to limit reductions due to either deratings or loopflow modeling was based on the difference between auction flows and the day-ahead market limit. This accounts for the effect of unsold capacity.

- All calculated shortfalls were capped on an hour-by-hour, constraint-by-constraint basis by the congestion rent shortfall calculated in the Midwest ISO FTR shortfall tool.

- Because the calculations in the Midwest ISO FTR tool have not yet been completely reconciled with congestion shortfalls in the settlement system, there is still an element of imprecision in these calculations.

Shortfall Impact of Omitted Constraints

Constraint Flows

FTR and GFA Flows

Day-Ahead Market Schedules

A

Auction Model

B
*Day-Ahead
Market Model*

C
*Day-Ahead
Market Model*

Shortfall

Day-Ahead
Market Limit

FTR Flows

FTR Flows

DA
Schedules

GFA
Reservations

GFA
Reservations

PAR Flows

DA PAR Flows

DA PAR Flows

Loop Flows

DA Loop Flows

DA Loop Flows

UNMONITORED CONSTRAINTS

If internal Midwest ISO constraints that were not enforced in the FTR auction are binding in the day-ahead market, it is possible that there will be congestion rent shortfalls in the day-ahead market as the awarded FTRs may not be feasible on some or all of these constraints.

UNMONITORED CONSTRAINTS

The calculated shortfall on unmonitored constraints was derived by identifying constraints that were not monitored in the relevant auction for which a shortfall of $70,000 or more was calculated in the MISO FTR shortfall tool. Unmonitored constraints contributed to shortfalls of over $3 million and $2 million in August and September respectively.

- Because the constraints were not enforced, however, we do not know what the flows actually were in the auction solution, and could not calculate exactly how much shortfall would have been avoided by enforcing the limit in a specific auction.

- It is possible that the flows were below the limit in the auction solution and that enforcing the limit would not have avoided these shortfalls.

Changes in Limits and Congestion Rent Shortfalls
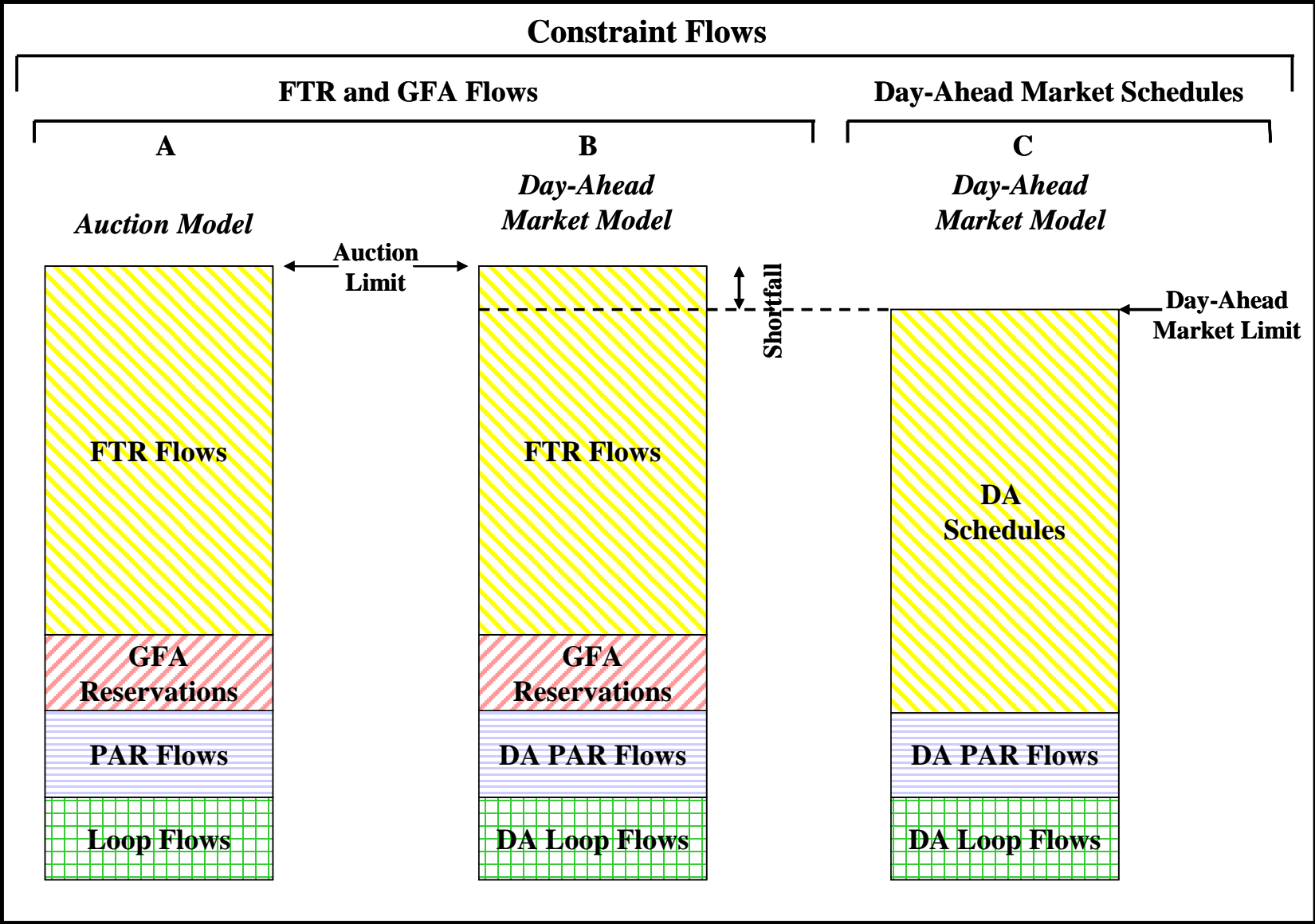
LIMIT DIFFERENCES

Inconsistencies in limits between FTR auction and day-ahead market/real-time operation:

- Awarded FTRs may be infeasible using day-ahead market/real-time limits.

- Limit differences alone will not cause congestion rent shortfalls if the auction flows are less than day-ahead market/real-time limits.

- The impact of rating differences was distinguished from the effect of loopflow adjustments by focusing on rating differences between the FTR auction and the day-ahead market that were also present in real-time.
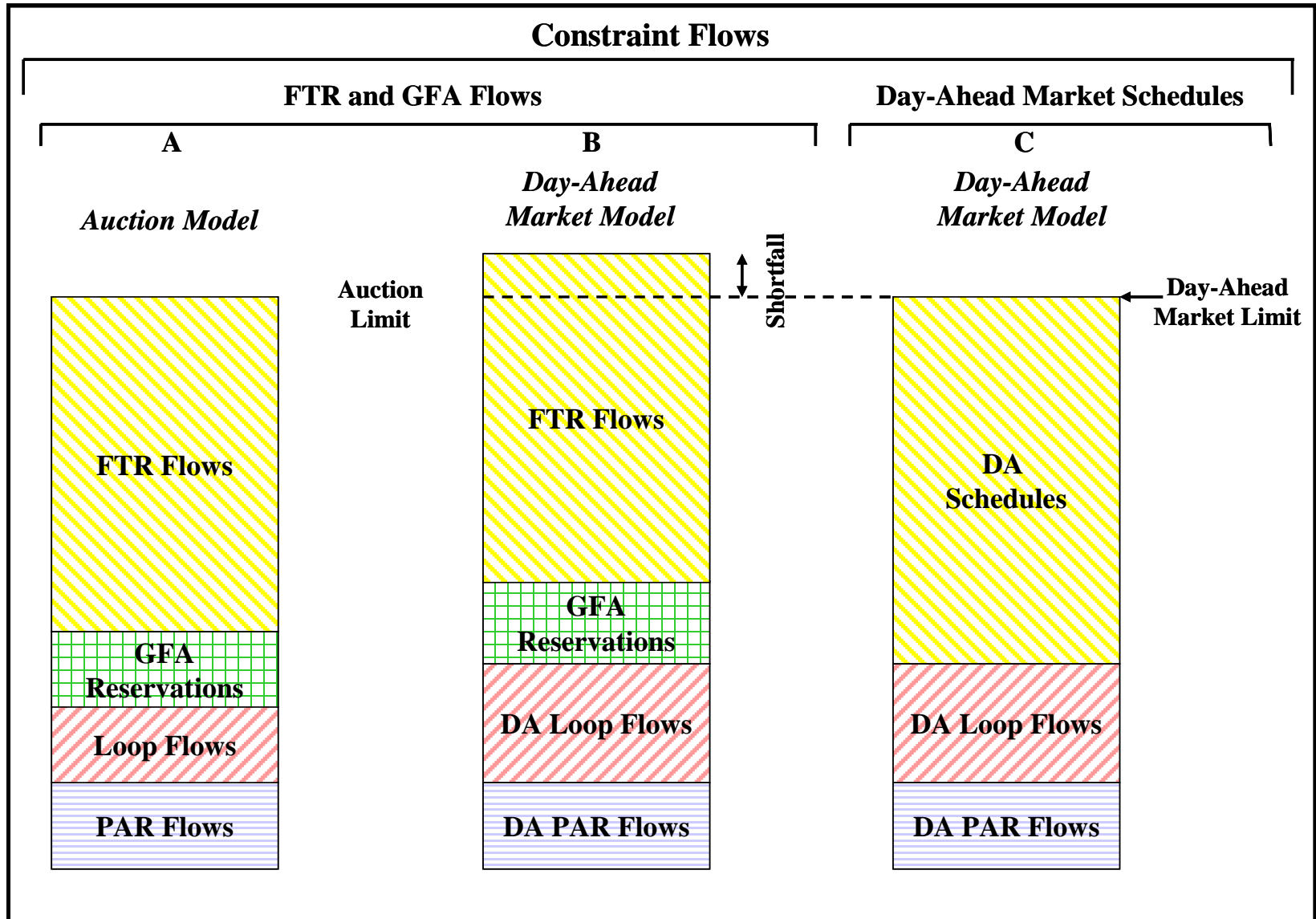
LIMIT DIFFERENCES

Shortfalls were attributed to deratings only to the extent that the limit in the day-ahead market was lower than the flow on the constraint in the auction solution (causing an infeasibility) and if the real-time limit was less than or equal to the day-ahead limit.

- As an example, the real-time limit on one constraint was typically 1,171 MW, in August 2007 compared to the auction limit of 1,195 MW.

- Given the shadow prices of the constraint in August, a 24 MW limit reduction to 1,171 MW would have reduced the shortfall by roughly $888,000.

- The real-time and day-ahead limits on the same constraint were even lower in September, while the auction limit remained 1,195. However, the flows from the on-peak FTRs purchased were below the real-time and day-ahead limit.

Changes in Loopflow Assumptions and Congestion Rent Shortfalls

LOOPFLOW DIFFERENCES

Inconsistencies between loopflow reservations on internal constraints in the FTR auction and day-ahead market can lead to congestion rent shortfalls.

- Awarded FTRs may be infeasible in combination with the loopflows modeled in the day-ahead market.

- Loopflows are modeled in the day-ahead market in two ways: as source/sink injections and withdrawals, and as limit reductions to reserve capacity for loop flows on specific constraints.

- Limit reductions in the day-ahead market were attributed to loopflow reservations if the limit reduction was not present in real-time.

LOOPFLOW DIFFERENCES

Differences in loopflow reservations between the auction and the day-ahead market accounted for shortfalls of almost $7.2 million during August, roughly $5.6 million of which was on a single constraint

- Given the shadow price of this constraint, an additional 100 MW reservation for loopflows would have reduced the shortfall by $3.7 million during August 2007.

PAR Schedules and Congestion Rent Shortfalls
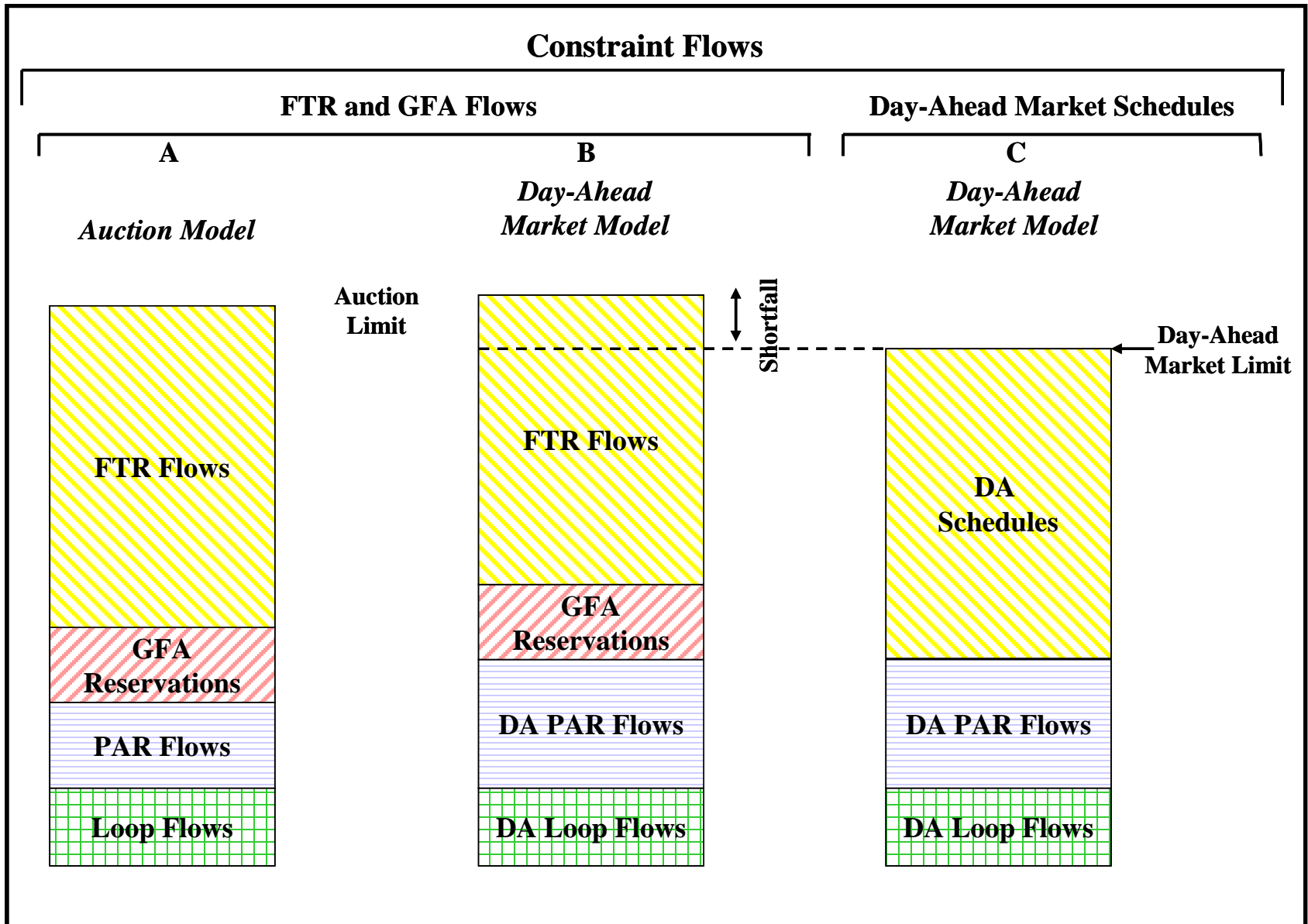
PAR SCHEDULES

Inconsistencies in PAR schedules on internal constraints between the FTR auction and the day-ahead market can result in congestion rent shortfalls.

- The data used for the analysis portrayed total PAR flows on individual constraints so we could not distinguish between changes in schedules and changes in shift factors attributable to outages.

- In general, one expects PAR optimization in the day-ahead market to produce congestion rent surpluses.

PAR SCHEDULES

Consistent differences in PAR schedules between the FTR auction and the day-ahead market on three constraints caused roughly $550,000 in congestion rent shortfalls during August.

- Given the shadow prices of these constraints, a 10 MW improvement in PAR flow assumptions would have reduced the shortfall by $420,000 in August.

- There was a similar difference in auction and day-ahead market PAR flows on these constraints in September, but the constraint shadow prices in the peak hours were much lower.

GFA RESERVATIONS

Inconsistent treatment of MISO GFA reservations as options and obligations between FTR auction and day-ahead market settlements can lead to congestion rent shortfalls.

- The FTR auction models MISO GFA reservations as *obligations*; hence, they can provide counterflow for the sale of additional FTRs.

- Day-ahead market settlements deduct the value of MISO GFA reservations valued as *options* from day-ahead congestion rents.

- Awarded FTRs may be infeasible with MISO GFA reservations treated as options.

GFA RESERVATIONS

Modeling GFA reservations as obligations in the FTR auction and as options in day-ahead market settlements can lead to congestion rent shortfalls in the day-ahead market that are distinct from the potential for shortfalls in GFA settlements if GFA schedules exceed GFA reservations.

- The $840,000 figures for August and $730,000 for September are the difference between the value of the MISO GFA reservations settled as obligations and options.

- Not all of this difference was necessarily reflected in infeasible FTRs and we have not attempted such a computation.

Changes in Nodal Load Weights and Congestion Rent Shortfalls
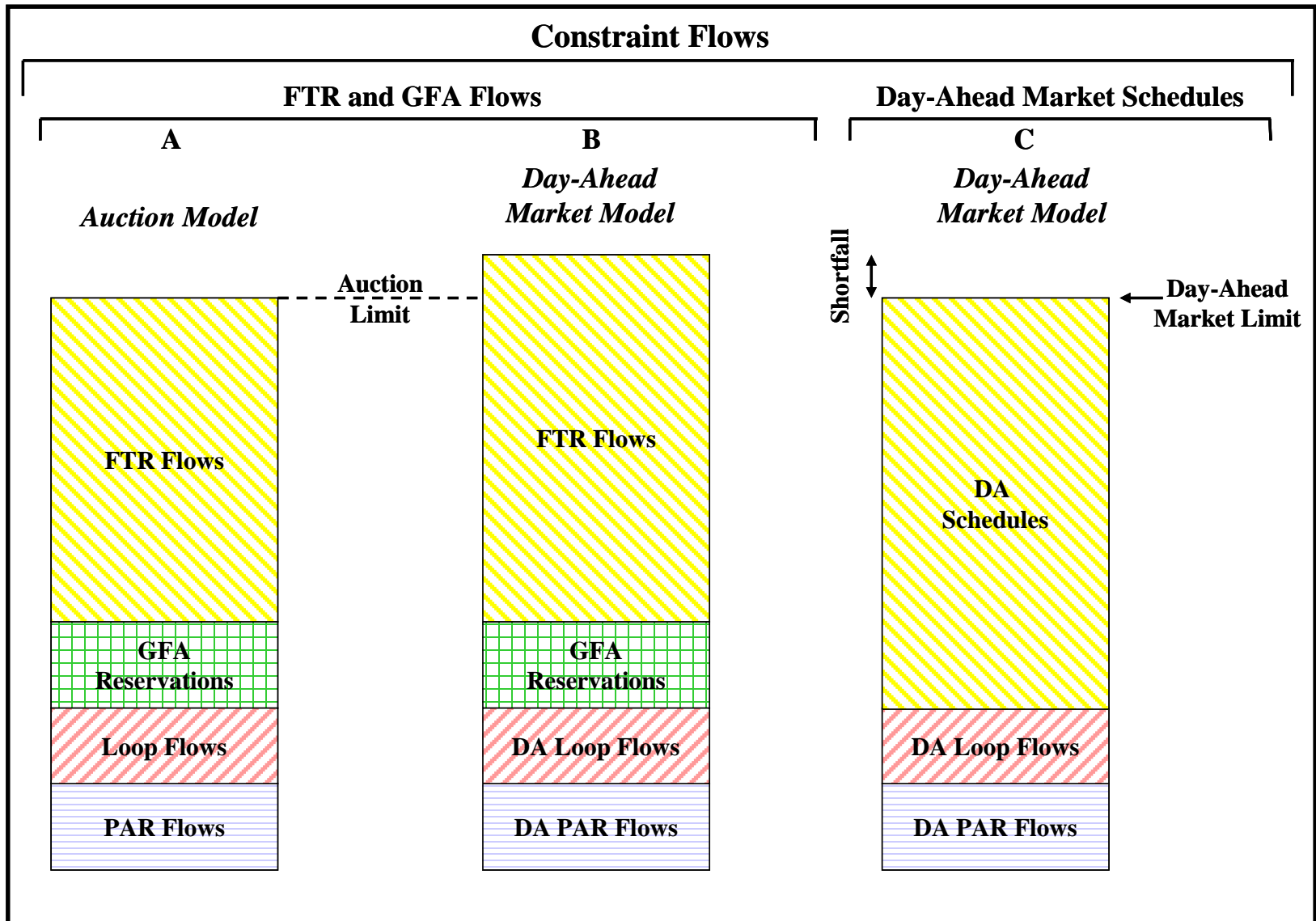
LOAD ZONE WEIGHTS

Differences in the nodal weights used to represent load zones in the FTR auction and the day-ahead market:

- MISO FTRs sourcing or sinking in load zones are based on congestion components calculated using day-ahead market nodal load weights.

- The FTRs awarded in the auction based on auction load zone weights may be infeasible at day-ahead market load weights.

- Variations in nodal load weights do not necessarily cause congestion rent shortfalls. The variations may not affect flows over binding constraints and even if they do, the variations may average to zero over the month.

- It is also possible, however, that the differences in some load zones might consistently give rise to significant shortfalls. It is an empirical question.

LOAD ZONE WEIGHTS

We calculated congestion components for 22 load zones using auction nodal load zone weights and day-ahead market epnode congestion components and compared them to congestion components calculated using day-ahead market load weights.

- In three cases the load zone price calculated using auction weights was $90 to $180 per megawatt per month lower than the load zone price calculated using day-ahead market weights.

- There were not large quantities of FTRs sinking at any of these three load zones, and in one case many more FTRs were sourced at the zone than sunk there, so the load weight difference produced a surplus.

NEAR-TERM STRAGEGIES

There are several areas for short-term steps to reduce congestion rent shortfalls in the day-ahead market.

- Unmonitored internal constraints.

- Limit, loopflow and PAR flow differences.

- Load zone weights.

Congestion rent shortfalls on constraints that were not enforced in the auction may have arisen simply because the auction flows exceeded the limit enforced in the day-ahead market, so simply enforcing the limit would eliminate some of the shortfalls.

- Some of the shortfalls on these constraints may have been a result of outages not modeled in the auction and some may have arisen from limit differences or loopflow differences had the constraint been enforced, so simply enforcing the limit in the auction would not eliminate all shortfalls on these constraints.

Have a goal of enforcing all constraints that have historically had a monthly constraint shadow price in excess of $2,000/MW.

In retrospect, lower assumed PAR counterflows, lower auction limits and larger loopflow reservations on just a few constraints would have substantially reduced congestion rent shortfalls during August and, to a lesser extent, during September.

- A goal should be to review the limits, PAR flows and loopflow assumptions for all constraints with past monthly constraint shadow prices in excess of $2,000 to bring the auction model in closer accord with the day-ahead market.

No serious shortfalls associated with Load Zone Weights have been identified for August 2007.

- It would be desirable to complete this analysis for all constraints to see if there are serious issues for any other load zones.