NYISO Congestion Reduction Proposal

Draft: April 29, 2003

Background

NYISO Staff has been working with Market Participants (MPs) to address issues related to shortfalls incurred in the settlement process for TCCs. Shortfalls currently occur in the settlement of congestion rents in the Day-Ahead Market (DAM) and as well as in the settlement of monthly TCC reconfiguration auctions. A further description of these issues is provided in Appendix A [to be completed].

Based on directions from the NYISO Board and drawing on discussions of the Congestion Reduction Task Force (CRTF), the primary objectives of the NYISO's work at this time are: 1) to implement a methodology to assign congestion rent shortfalls in the DAM to the party responsible for the shortfall, 2) to determine, if possible, a methodology for reducing the level of total DAM congestion shortfalls and 3) to implement a methodology to address anomalies in the allocation of monthly reconfiguration auction revenues in situations in which a major transmission outage reduces the transmission capacity available in the monthly auction. Additional objectives also have been discussed, such as: 1) to implement a methodology to correctly allocate real-time congestion rent shortfalls, 2) to align the allocation of congestion rent surpluses with that of congestion rent shortfalls, and 3) to align the allocation processes used in the capability period auctions, the monthly auctions, and the DAM settlements.

The NYISO and MPs have found it challenging to address all of these objectives simultaneously to reach a comprehensive solution to the congestion shortfall issue. There has been a growing consensus that the highest priority objectives should be addressed as soon as possible.[1] At the same time, analyses conducted by the NYISO Staff and LECG indicate the strong likelihood that the majority of the congestion rent shortfalls experienced in the DAM are caused by transmission outages. For instance, Appendix B [to be completed] contains the results of preliminary analyses of the causes of the DAM congestion rent shortfall of approximately $4.3 million incurred on January 3, 2003.

For these reasons, the following proposal focuses on the assignment of congestion rent shortfalls to Transmission Owners (TOs) whose facilities are modeled as out-of-service in the DAM or in a TCC reconfiguration auction. Following the lead of the earlier National Grid (Grid) Proposal, the NYISO Staff believes that this is the important first step towards meeting the objectives described above. . In many respects the NYISO proposal addresses the same issues as Grid's, so that any limitations in the scope of the NYISO proposal should be no greater than that of the Grid proposal previously approved by the Management Committee. However, in several areas,

[1] This consensus is demonstrated by the February 20, 2003 vole by the Management Committee to approve the Congestion Reduction Proposal presented by National Grid (National Grid Proposal).

more notably the allocation of residual auction revenues, the NYISO proposal addresses issues left unfinished in the development of the earlier proposal.

The NYISO also proposes to continue to work with MPs to design a methodology for reducing the overall level of congestion rent shortfalls in the DAM. This is an element of the NYISO proposal, just as it was part of the Grid proposal. It may be the best course, in the end, for the design of a system for reducing the transmission capacity sold in the auction to build on the congestion rent shortfall allocation methodology contained in this proposal, because a reduction in the system transmission capacity offered for sale as TCCs cannot, on its own, equitably resolve the congestion shortfall issue. To reduce total DAM congestion shortfalls, the NYISO and MPs will need to agree on a methodology for reducing the system transmission capacity offered for sale in the TCC auctions. The concern with using this methodology as the primary solution to solving the congestion rent shortfall issue is that it would fund the shortfall arising from the outage of a specific TO's facility using the excess congestion rents collected by selling fewer TCCs in the auction. A cost shifting issue arises because the funding for the shortfall comes at the expense of those TOs that received less revenue from the TCC auction. Thus, a methodology for reducing the transmission capacity sold in the auction may be more workable in combination with other procedures, such as those in this proposal, that can limit the extent of this cost shifting. In addition, the design of a methodology for reducing the overall level of congestion rent shortfalls will be clarified by information on the extent to which the net shortfall costs can be reduced, in the first instance, through direct assignment of costs to facilities that are out of service.

Overview of NYISO Proposal

NYISO Staff and LECG have developed an integrated approach to addressing the elements of the congestion shortfall issue that arise from changes in the transmission facilities modeled as in-service versus out-of-service in TCC capability period auctions, monthly TCC reconfiguration auctions and the DAM. The NYISO proposal consists of five related elements:

1. A method, called the "Make Whole Approach," for determining charges that will be made to the TOs for the shortfall costs attributable to transmission facility outages in the DAM, TCC reconfiguration auctions, or TCC capability period auctions.

2. Application of the Make Whole Approach to determine the revenue that will be paid to the TOs for the increase in congestion rent collections attributable to transmission facilities placed back in-service in the DAM or the TCC reconfiguration auctions.

3. A new flow-based method for allocating residual auction revenues to the TOs; this will be a replacement for the Interface Megawatt-Mile Method (IMWM). The method also will allocate the revenues and costs to the TOs stemming from application of the Make Whole Approach to specific transmission facilities out of service or returning to service in TCC auctions, following the procedures developed for (1) and (2).

4. A modified method for allocating the residual congestion rents from the DAM settlements to the TOs; this will be an adjustment to today's practice of using percentage allocation factors that are equal to each TO's share of the IMWM allocation from the previous capability period auction. In the context of the DAM settlements, the residual congestion rents will be calculated net of adjustments for the direct allocation of shortfalls and revenues to specific transmission facilities out of service or returning to service. The expectation is that the direct allocation of congestion rent shortfall costs to facilities that are out-of-service will greatly reduce the large negative magnitude of the DAM residuals, relative to levels that have been seen in the past.

5. A commitment to work with the MPs to investigate methodologies that could reduce the overall level of congestion rent shortfalls

The Make Whole Approach that the NYISO proposes to use to attribute congestion rent shortfall costs to transmission facilities that are out-of-service in the DAM, in a TCC reconfiguration auction, or in a TCC capability period auction is a modification of the concept introduced by LECG, LLC to the Congestion Reduction Task Force (CRTF) in January 2003. Under this approach, which is described in detail below, a shortfall cost is calculated for each transmission facility outage modeled in the DAM or in a TCC auction, and charged to the TO that owns the facility. Conversely, if a transmission facility is modeled as out-of-service in the monthly reconfiguration auction and is subsequently returned to service in the DAM, then the Make Whole approach will be used to attribute a share of the DAM congestion rent revenue to the facility returning to service. This revenue will be paid directly to the TO that owns the facility. The same procedure will be used to attribute a share of the monthly reconfiguration auction residual revenue to a transmission facility that is modeled as out-of-service in the capability period TCC auction and is subsequently returned to service in the monthly reconfiguration auction.

The new flow-based method will be used to allocate residual auction revenue accruing in the capability period auctions and monthly reconfiguration auctions. The approach differs from the IMWM method primarily in that residual auction revenue is allocated to all facilities on a flow basis, not just to facilities that contribute to the NYISO's closed transmission interfaces. In the TCC reconfiguration and capability period auctions the method also allocates to the TOs, in a separate step, the congestion rent shortfalls and revenues that have been directly assigned using the Make Whole Approach, per items (1) and (2) above. Thus, if a transmission facility is out of service in the auction, the shortfall cost that the TO pays will be allocated to all TOs[2] using the flow-based replacement to IMWM. Conversely, if a transmission facility is returned to service in the reconfiguration auction, the direct allocation of auction revenue that it receives will be charged to the TOs (i.e., reduce their allocation of auction revenue) using the flow-based method.

The monthly residual congestion rent shortfalls or surpluses for the DAM will be allocated using a modification of the current methodology, which is based on each TO's percentage share of the IMWM allocation for the previous capability period. The proposal is to revise the calculation of

[2] This includes the TO bearing the directly assigned shortfall cost because the TCC auction revenue allocated to that TO also is impacted by the transmission facility outage.

the allocation factors to include the imputed value of all outstanding TCCs and Grandfathered ETAs for the month.

The advantages of the NYISO proposal include:

- It improves the allocation of congestion rent shortfall costs arising from transmission facility outages, which are thought to be the major cause of such shortfalls.

- It maintains full funding of TCCs and does not alter the distribution of auction revenues to market participants that release TCCs for sale into the NYISO administered TCC auctions.

- In the DAM and reconfiguration auctions it uses the same method, the Make Whole Approach, to attribute congestion rent shortfall costs to facilities that are out-of-service and congestion rent revenues to facilities that return to service. To maintain equity among TOs and consistency in methodology, the revenue paid to a TO for placing a transmission facility in-service is determined in the same manner as the cost assigned a TO for placing a transmission facility out-of-service.[3] Moreover, the same methodology is used to assign costs for a facility that is out-of-service in a capability period auction, a reconfiguration auction, or in the DAM. Consistent application of the Make Whole method to facilities that are out of service recognizes that the outage of a transmission facility in an auction potentially affects the auction revenues of all TOs, not just the owning party.

- The flow-based method improves the allocation of revenues from the TCC auctions, relative to the IMWM currently in use. The flow-based method includes all transmission facilities in the allocation of TCC auction revenue, eliminating the ad hoc priority that the IMWM gives to facilities crossing the NY closed interfaces. It includes all transmission facilities, even step-up transformers, if these facilities are included in the network model. The flow-based method also eliminates use of a facility's mileage in calculating the auction revenue allocation. Each facility's auction allocation is determined from a calculation of its total flow-based value, which is the product of the nodal price difference across the facility and the auction flow across the facility.

- The Make Whole Approach uses the same methodology to attribute a congestion rent shortfall to any transmission facility outage, without regard to how the facility is related to the NYISO closed interfaces.

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1. Make Whole Approach: Assignment of Cost for Transmission Facilities Placed Out-of-Service

[3] Application of a consistent methodology does not address any issues that may arise from differences in TCC prices between the capability period auction, reconfiguration auctions and the DAM. The approach to these issues requires a determination of whether or not the current situation reflects a competitive equilibrium.

The Make Whole Approach that the NYISO proposes to use to attribute congestion rent shortfall costs to transmission facilities that are out-of-service in the DAM, in a TCC reconfiguration auction or in a TCC capability period auction is a reworking and simplification of concepts introduced by LECG in January 2003.

Day-Ahead Market

A transmission facility outage may cause a DAM congestion rent shortfall in situations in which the set of valid TCCs is not simultaneously feasible on the DAM grid configuration when the transmission facility is modeled as out of service. The following steps describe the method that the NYISO and LECG have developed for calculating the congestion shortfall costs arising from transmission outages in an hour of the DAM:

1. Identify constraints (either pre-contingency or post-contingency) binding in an hour of the DAM. These constraints will have a positive shadow price in the DAM, meaning that there is a congestion cost for flows over these constraints.

2. Calculate flows on each binding constraint for the DAM schedules for the hour. This calculation will be based on the actual grid model (shift factors) for the DAM. In the DAM, a congestion cost is collected for each MW scheduled to flow over a constrained facility.

3. Calculate flows on each binding constraint associated with the set of valid outstanding TCCs. This calculation will use the final set of TCCs (and grandfathered rights) from the last TCC auction. It will be undertaken by applying the actual shift factors for the hourly DAM grid configuration to the net injection (or withdrawal) at each bus calculated from the set of outstanding TCCs. The megawatt flows that result are those that, implicitly, would need to occur in the DAM grid in order to generate sufficient congestion revenue to fully-fund the outstanding TCCs.

4. Subtract (3) from (2) to determine whether the MWs scheduled to flow over each constrained facility is less than those calculated for the set of outstanding TCCs; if so, there is a congestion rent shortfall associated with this constraint.

5. Calculate the shortfall cost for each constraint by multiplying the MW amount of the overload by the shadow price of the constraint.

The sum of the shortfall costs calculated in this way for all binding constraints comes close to replicating the total[4] congestion rent shortfall calculated for many hours.

The specific calculation is best described through equations. The congestion shortfall cost assigned to a binding constraint for any hour of the DAM is expressed as follows:

[4] Some difference is total shortfall has been found due to s differences in PAR schedules between SCUC for the hour and the PAR schedule produced in the most recent TCC auction. LECG and NYISO Staff are pursuing this difference.

(1) $$DOC_{a,h} = \sum_{a \in B} SP_{a,h} * \left(F_{a,J,h} - F_{a,I,h}\right),$$ where

$DOC_{a,h}$	=	the congestion shortfall cost assigned to binding constraint *a* in hour *h* of the DAM,
B	=	the set of binding constraints in hour *h* of the DAM,
$SP_{a,h}$	=	the shadow price of binding constraint *a* in hour *h* of the DAM,
$F_{a,J,h}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *J* on the network in hour *h* of the DAM,
J	=	the set of injections and withdrawals resulting from the prior monthly TCC auction,
$F_{a,I,h}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *I* on the network in hour *h* of the DAM,
I	=	the set of injections and withdrawals in the DAM forward schedules.

$$F_{a,J,h} = \sum_{c \in J} \left(GS_{a,c,h} * MW_{c,J}\right),$$ where

$GS_{a,c,h}$	=	the SCUC gen-shift factor in hour *h* for binding constraint *a* for an injection or withdrawal at bus *c*,
$MW_{c,J}$	=	the megawatt value representing the net injection or withdrawal at bus *c* summed from the set of injections and withdrawals *J* (for TCCs).

$$MW_{c,J} = \sum_{i=c} TCC_{i,w,J} - \sum_{w=c} TCC_{i,w,J},$$ where

$TCC_{i,w,J}$	=	megawatts of TCC from injection bus i to withdrawal bus w from the monthly auction,

$$F_{a,I,h} = \sum_{c \in I} \left(GS_{a,c,h} * MW_{c,I,h}\right),$$ where

$GS_{a,c,h}$	=	the SCUC gen-shift factor in hour *h* for binding constraint *a* for an injection or withdrawal at point *c*,
$MW_{c,I,h}$	=	the megawatt value representing the net injection or withdrawal at point *c* summed from the set of injections and withdrawals *I* (for SCUC schedules) in hour *h* of the DAM.

$$MW_{c,I,h} = \sum_{i=c} E_{i,I} - \sum_{w=c} E_{w,I},$$ where

$E_{i,,I}$	=	megawatt injection scheduled in the DAM at point *i*,
$E_{w,I}$	=	megawatt withdrawal scheduled in the DAM at point *w*.

Once the congestion rent shortfall cost has been calculated for each binding constraint, it will be allocated to the TOs with transmission facilities out of service in hour, h, of the DAM. The NYISO Operations Staff (OPS) will determine *a priori* a table showing the binding constraints

that will appear in the DAM when each particular transmission outage occurs. This will be used to establish a mapping from the facility outages in the hour to the constraints for which a congestion rent shortfall cost has been calculated in the hour.

- If none of the constraints associated with a transmission outage are binding in the hour, no congestion rent shortfall cost will be directly charged to the TO in connection with the facility outage for the hour.

- A TO will be charged the congestion rent shortfall for each constraint for which it is the sole transmission owner with one or more facilities out of service that map to that constraint in the hour. For a single transmission outage, a TO may be charged for the congestion rent shortfall on more than one constraint.

- If one or more TOs each have a transmission facility out of service that maps to the same constraint, they will share the congestion rent shortfall cost for that constraint for the hour. According to OPS, this situation occurs infrequently, in instances in which a transmission facility is forced out-of-service and a scheduled transmission outage cannot be postponed. At these times, powerflow and contingency analysis will be required to determine the effect of each outage, individually, on the flows over the binding constraint. The congestion shortfall cost for the constraint will be allocated to the TOs in proportion to the overloads that each outage causes on a stand-alone basis.

The cost assigned to each TO will be determined as follows:

$$CO_{a,t,h} = V_{t,l} / \sum_{y \in Y} V_{s,y} * DOC_{a,h}$$, where

$CO_{a,t,h}$	=	the congestion shortfall cost assigned to TO *t* for binding constraint *a* in hour *h* of the DAM,
$V_{t,l}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *l* out-of-service owned by TO *t*,
$V_{s,y}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *y* out-of-service owned by TO *s*,
Y	=	the set of all transmission facilities out-of-service that effect binding constraint *a*.

Monthly TCC Reconfiguration Auction

The "Make Whole" approach also will be applied to determine the shortfall cost to be assigned to the TO of a transmission facility that is removed from the network model used for a monthly reconfiguration auction. The approach is analogous to that used for the DAM.

1. Run the monthly TCC auction as per current procedures with the transmission facility out-of-service. Determine TCC awards, market-clearing prices and binding constraints.

2. Calculate flows on each binding constraint for the TCCs in the monthly auction solution. This calculation will be based on the network model (shift factors) for the monthly auction.

3. Calculate flows on each binding constraint associated with the set of TCCs from the prior capability period auction. This calculation will apply the shift factors for the monthly network configuration to the net injection (or withdrawal) at each bus calculated from the set of capability period TCCs (and grandfathered rights).

6. Subtract (3) from (2) to determine whether the MWs scheduled to flow over each constrained facility in the monthly reconfiguration auction is less than those calculated for the capability period TCCs; if so, there is a shortfall associated with this constraint in the monthly auction.

7. Calculate the shortfall cost for each constraint by multiplying the MW amount of the overload by the shadow price of the constraint in the monthly reconfiguration auction.

The specific calculation is best described through equations. The cost assigned to a binding constraint in a monthly auction is expressed as follows:

(2) $$MOC_a = \sum_{a \in B} SP_a * \left(F_{a,K} - F_{a,J}\right)$$, where

MOC_a	=	the cost assigned to binding constraint *a* in a monthly auction,
B	=	the set of binding constraints from the monthly auction,
SP_a	=	the shadow price of binding constraint *a* in the monthly auction,
$F_{a,K}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *K* on the monthly network configuration,
K	=	the set of injections and withdrawals produced from the prior TCC capability period auction,
$F_{a,J}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *J* on the monthly network configuration,
J	=	the set of injections and withdrawals resulting from the monthly TCC auction.

Once the congestion rent shortfall cost has been calculated for each binding constraint, it will be allocated to the TOs with transmission facilities out of service in the monthly auction. The NYISO Operations Staff (OPS) will determine *a priori* a table showing the binding constraints that will appear when each particular transmission outage occurs. This will be used to establish a mapping from the facility outages in the monthly auction to the constraints for which a congestion rent shortfall cost has been calculated.

- If none of the constraints associated with a transmission outage are binding in the monthly auction, no shortfall cost will be directly charged to the TO in connection with the facility outage in the auction.

- A TO will be charged the shortfall cost for each constraint for which it is the sole transmission owner with one or more facilities out of service that map to that constraint in the auction. For a single transmission outage, a TO may be charged for the congestion rent shortfall on more than one constraint.

- If one or more TOs each have a transmission facility out of service that maps to the same constraint, they will share the auction shortfall cost for that constraint. At these times, powerflow and contingency analysis will be used to determine the effect of each outage, individually, on the flows over the binding constraint. The shortfall cost for the constraint (equation 2) will be allocated to the TOs in proportion to the overloads that each outage causes on a stand-alone basis.

The cost assigned to a TO will be determined as follows:

$$CO_{a,t} = V_{t,l} / \sum_{y \in Y} V_{s,y} * MOC_a$$, where

$CO_{a,t}$	=	the shortfall cost assigned to TO *t* for binding constraint *a* in the monthly auction,
$V_{t,l}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *l* out-of-service owned by TO *t*,
$V_{s,y}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *y* out-of-service owned by TO *s*,
Y	=	the set of all transmission facilities out-of-service that effect binding constraint *a*.

Capability Period TCC Auction

The "Make Whole" approach similarly will be applied to determine the shortfall cost to be assigned to the TO of a transmission facility that is removed from the network model used for a capability period auction. The approach is analogous to that used for the DAM and the monthly auction.

1. Run the capability period TCC auction as per current procedures with the transmission facility out-of-service. Determine TCC awards, market-clearing prices and binding constraints.

2. Calculate flows on each binding constraint for the TCCs in the capability period auction solution. This calculation will be based on the network model (shift factors) for the capability period auction.

3. Run a "but for" capability period auction with the transmission facilities out-of-service in the capability period auction placed back in-service. Determine a set of "but for" TCC awards.

4. Calculate flows on each binding constraint from a power flow for the but for set of TCC awards. This calculation will apply the shift factors for the actual capability period network configuration to the net injection (or withdrawal) at each bus calculated from the set of but for capability period TCCs (and grandfathered rights).

5. Subtract (4) from (2) to determine whether the MWs scheduled to flow over each constrained facility in the capability period auction are less than those calculated for the "but for" capability period TCCs; if so, less revenue has been collected for this constraint in the actual capability period auction than would have been collected in the but for auction.

6. Calculate the shortfall cost for each constraint by multiplying the MW amount difference in flows by the shadow price of the constraint in the capability period auction.

The specific calculation is best described through equations. The cost assigned to a binding constraint in a capability period auction is expressed as follows:

$$COC_a = \sum_{a \in B} SP_a * \left(F_{a,K'} - F_{a,K}\right), \text{ where}$$

COC_a	=	the cost assigned to binding constraint *a* in a capability period auction,
B	=	the set of binding constraints from the capability period auction,
SP_a	=	the shadow price of binding constraint *a* in the capability period auction,
$F_{a,K'}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *K'* on the capability period network configuration,
K'	=	the set of injections and withdrawals produced from the "but for" TCC capability period auction with all lines in service,
$F_{a,K}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *K* on the capability period network configuration,
K	=	the set of injections and withdrawals resulting from the capability period TCC auction.

Once the congestion rent shortfall cost has been calculated for each binding constraint, it will be allocated to the TOs with transmission facilities out of service in the capability period auction. The NYISO Operations Staff (OPS) will determine *a priori* a table showing the binding

constraints that will appear when each particular transmission outage occurs. This will be used to establish a mapping from the facility outages in the capability period auction to the constraints for which a congestion rent shortfall cost has been calculated.

- If none of the constraints associated with a transmission outage are binding in the capability period auction, no shortfall cost will be directly charged to the TO in connection with the facility outage in the auction.

- A TO will be charged the shortfall cost for each constraint for which it is the sole transmission owner with one or more facilities out of service that map to that constraint in the auction. For a single transmission outage, a TO may be charged for the congestion rent shortfall on more than one constraint.

- If one or more TOs each have a transmission facility out of service that maps to the same constraint, they will share the auction shortfall cost for that constraint. At these times, powerflow and contingency analysis will be used to determine the effect of each outage, individually, on the flows over the binding constraint. The shortfall cost for the constraint will be allocated to the TOs in proportion to the overloads that each outage causes on a stand-alone basis.

The cost assigned to a TO will be determined as follows:

$$CO_{a,t} = V_{t,l} / \sum_{y \in Y} V_{s,y} * COC_a \quad \text{, where}$$

$CO_{a,t}$	=	the shortfall cost assigned to TO *t* for binding constraint *a* in the capability period auction,
$V_{t,l}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *l* out-of-service owned by TO *t*,
$V_{s,y}$	=	the overload in megawatts on binding constraint *a* from a powerflow analysis with only transmission facility *y* out-of-service owned by TO *s*,
Y	=	the set of all transmission facilities out-of-service that effect binding constraint *a*.

The cost assigned to the TO increases the net auction capability period auction revenue and is allocated to all TOs as revenue based on a methodology to be described in a later section.

2. Make Whole Approach: Assignment of Revenue for Transmission Facilities Placed In-Service

Day-Ahead Market

The Make Whole Approach will also be applied to determine the revenue to be assigned to a TO whose transmission facility is placed in-service in the DAM that was modeled out-of-service in the prior monthly reconfiguration auction.

The approach is analogous to that previously described for transmission out-of-service in the DAM:

1. Identify constraints binding in an hour of the DAM.

2. Calculate flows on each binding constraint for the DAM schedules for the hour. This calculation will be based on the actual network model (shift factors) for the DAM. In the DAM, a congestion cost is collected for each MW scheduled to flow over a constrained facility.

3. Calculate flows on each binding constraint associated with the set of valid outstanding TCCs. This calculation will use the final set of TCCs (and grandfathered rights) from the last monthly TCC auction. It will be undertaken by applying the actual shift factors for the hourly DAM network configuration to the net injection (or withdrawal) at each bus calculated from the set of outstanding TCCs.

4. Subtract (3) from (2) to determine whether the MWs scheduled to flow over each constrained facility are greater than those calculated for the set of outstanding TCCs; if so, there are excess congestion rents associated with this constraint.

5. Calculate the revenue surplus for each constraint by multiplying the MW amount of the additional flows in the DAM by the DAM shadow price of the constraint.

The specific calculation is best described through an equation. The revenue surplus for each constraint is expressed as follows:

$$DS_{a,h} = \sum_{a \in B} SP_{a,h} * \left(F_{a,I,h} - F_{a,J,h}\right), \text{ where}$$

$DS_{a,h}$	=	DAM surplus assigned to binding constraint *a* in hour *h* of the DAM,
$SP_{a,h}$	=	shadow price of binding constraint *a* in hour *h* of the DAM,
B	=	the set of binding constraints in hour *h* of the DAM,
$F_{a,I,h}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *I* on the network in hour *h* of the DAM,
I	=	the set of injections and withdrawals in the DAM forward schedules.
J	=	the set of injections and withdrawals resulting from the last TCC auction, and

$F_{a,J,h}$ = the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *J* on the network in hour *h* of the DAM.

Once the surplus revenue has been calculated for each binding constraint, it will be allocated to the TOs with transmission facilities placed back in service in hour, h, of the DAM. The NYISO Operations Staff (OPS) will determine *a priori* a table showing the binding constraints that will appear in the DAM when each particular transmission outage occurs. This table will be used to establish the constraints that will be relieved by each transmission facility that returns to service in the hour. If one or more TOs each have a transmission facility that returns to service, enabling increased flows on the same constraint, they will share the surplus revenue for that constraint. At these times, powerflow and contingency analysis will be used to determine the effect of each facility that returns to service, individually, on the flows over the binding constraint.

Monthly TCC Reconfiguration Auction

Finally, the "Make Whole" approach will be used to directly assign revenue to a TO for a transmission facility returned to service in a monthly reconfiguration auction that was modeled as out-of-service in the prior capability period auction.

The approach is analogous to that previously described for transmission out of service in the monthly reconfiguration auction:

1. Run the monthly TCC auction as per current procedures with the transmission facility in service. Determine TCC awards, market-clearing prices and binding constraints.

2. Calculate flows on each binding constraint for the TCCs in the monthly auction solution. This calculation will be based on the network model (shift factors) for the monthly auction.

3. Calculate flows on each binding constraint associated with the set of TCCs from the prior capability period auction. This calculation will apply the shift factors for the monthly network configuration to the net injection (or withdrawal) at each bus calculated from the set of capability period TCCs (and grandfathered rights).

4. Subtract (3) from (2) to determine whether the MWs scheduled to flow over each constrained facility in the monthly reconfiguration auction are greater than those calculated for the capability period TCCs; if so, there is a revenue surplus associated with this constraint in the monthly auction.

5. Calculate the revenue surplus for each constraint by multiplying the MW amount of the additional flows in the monthly auction by the shadow price of the constraint in the monthly reconfiguration auction.

The specific calculation is best described through an equation. The revenue surplus for each constraint is expressed as follows:

$$MS_a = \sum_{a \in B} SP_a * \left(F_{a,J} - F_{a,K}\right), \text{ where}$$

MS_a	=	surplus revenue assigned to binding constraint a in a monthly auction,
B	=	the set of binding constraints from the monthly auction,
SP_a	=	the shadow price of binding constraint *a* from the monthly auction,
J	=	the set of injections and withdrawals resulting from the last monthly TCC auction,
$F_{a,J}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *J* on the monthly auction model,
K	=	the set of injections and withdrawals resulting from the last TCC capability period auction, and
$F_{a,K}$	=	the flow on binding constraint *a* produced by imposing the set of injections and withdrawals *K* on the monthly auction model.

Once the surplus revenue has been calculated for each binding constraint, it will be allocated to the TOs with transmission facilities placed back in the monthly TCC reconfiguration auction. The NYISO Operations Staff (OPS) will determine *a priori* a table showing the binding constraints that will appear when each particular transmission outage occurs. This table will be used to establish the constraints that will be relieved by each transmission facility that returns to service in the auction. If one or more TOs each have a transmission facility that returns to service, enabling increased flows on the same constraint, they will share the surplus revenue for that constraint. At these times, powerflow and contingency analysis will be used to determine the effect of each facility that returns to service, individually, on the flows over the binding constraint in the monthly auction.

The revenue assigned to the TO is removed from the residual revenues paid to the TOs from the monthly auction based on a methodology to be described in a later section.

3. Allocation of Residual Revenues from TCC Auctions

NYISO Staff has developed a method to assign each transmission facility within the NYCA a flow based value determined from the market-clearing prices and MW flows produced by the injections and withdrawals representing the TCCs awarded in an auction. Summing these flow based values over all transmission facilities owned by a TO provides a total flow based value used to determine each TO's share of the residual revenue from the auction. If the award of TCCs affected only TO transmission facilities, then the sum of the TO flow based values would equal the residual revenue from the auction. Because the NYCA transmission system is interconnected with four neighboring systems, MW flows are produced on other transmission facilities not owned by NY TOs. Thus, the revenue allocation will not be equal to the flow-based value for each TO. Instead, the flow based values will be used to develop allocation factors to distribute the residual revenue from an auction.

The results of a TCC auction include the TCCs awarded and their associated market-clearing prices, nodal prices and binding constraints. The TCC auction software produces nodal prices at all nodes in the network. Thus, nodal prices are produced on each end of a transmission facility.

The flow based methodology compares the MW flow on any transmission facility produced from the injections and withdrawals associated with the TCCs awarded in an auction with the MW flow on the transmission facility prior to the auction. The MW flows prior to the auction are those stemming from all unexpired TCCs and grandfathered rights; this is called the Initial Condition. An Initial Condition is determined prior to each auction, for the same network configuration used in the auction. The product of this MW flow difference and the difference in the nodal prices at each end of the transmission facility is the value assigned to the facility. Summing these values over all transmission facilities owned by a TO provides a distribution weighting to assign the TO a proportion of the residual revenue from the auction.

This method is analogous to the process used to unbundled TCC awards at the conclusion of an auction. Remember that a TCC from a point A within zone X to a point B within zone Y can be unbundled into three components. One component is defined from point A to zone X, a second component from zone X to zone Y and a third component from zone Y to point B. The number of TCCs per component is equal to the number of TCCs awarded in the bundled TCC and the sum of the component market-clearing prices equals the market-clearing price of the bundled TCC.

The method developed by NYISO Staff merely unbundles an awarded TCC into all its component parts. Each TCC represented as an injection and withdrawal will produce flows on all transmission facilities in the network. The flow on all transmission facilities leaving point A equals the injection at point A and the flow on all transmission facilities into point B equals the withdrawal at point B. Thus, only the TCC amount awarded is flowing over the parallel paths in the network with each parallel path carrying a portion of the total TCC. Also, as shown above, the sum of the market-clearing prices of the unbundled TCC over a parallel path equals the market-clearing price from A to B. The product of the portion of the TCC flowing over a parallel path and the market–clearing price from A to B summed over all parallel paths equals the product of the TCC amount awarded and the market-clearing price from A to B. Therefore, the sum of the revenue assigned each unbundled component equals the revenue produced from the sale of the TCC. However, since some of the unbundled components are owned by non-NY TOs, the revenue assigned to NY TOs will not equal the revenue produced by the TCC auction.

The allocation of revenue from a TCC auction assigned to a TO is expressed as follows:

$$R_t = \sum_{l \in T} \left(F_l - F_{l,IC}\right) * \left(P_{y,l} - P_{x,l}\right) \quad , \text{ where}$$

R_t	=	the revenue allocated to TO *t* from the TCC auction,
l	=	transmission facility from bus x to bus y owned by TO *t*,
T	=	the set of transmission facilities owned by NY TOs that are modeled in the TCC auction network,
F_l	=	the megawatt flow on transmission facility *l* from the TCC auction,

$F_{l,IC}$	=	the megawatt flow on transmission facility *l* from the Initial Condition of the TCC auction,
$P_{y,l}$	=	the nodal price at bus *y* on transmission facility *l* from the TCC auction, and
$P_{x,l}$	=	the nodal price at bus *x* on transmission facility *l* from the TCC auction.

Note that F_l will likely equal $F_{l,IC}$ in situations in which a transmission element is fully subscribed by grandfathered TCCs.

Allocation of Revenues to TOs from Make Whole Charges Collected for Transmission Facilities Placed Out-of-Service in a Monthly TCC Auction

Monthly TCC auctions conducted with all transmission facilities in-service have produced positive residual revenue for TOs, while auctions conducted with transmission facilities out-of-service have produced negative residual revenue. The Make Whole Approach assigns a cost to each TO whose transmission facility is placed out-of-service in the monthly auction and causes a revenue shortfall on a binding constraint. The TCC residual revenue from the auction should be positive with the addition of the revenue from these Make Whole charges to the TOs.

The problem becomes one of allocating the revenue from these directly assigned costs to the TOs. The proposed allocation is based on the difference in the flow based value determined from the actual monthly auction and from a "but for" case for the monthly auction, which assumes that all lines are in service that were in service in the prior capability period auction. The difference in the flow based value for each TO is used to determine a set of weights to distribute the directly assigned costs of transmission outages.

The flow-based weights will be calculated as follows:

$$W_t = \sum_{l \in T} \left(F_{l,J'} - F_{l,J}\right) * \left(P_{y,l} - P_{x,l}\right), \text{ where}$$

W_t	=	flow based value weighting for TO *t* to be applied in determining its share of the revenue from the directly assigned shortfall cost for the monthly auction,
T	=	the set of transmission facilities owned by NY TOs that are modeled in the TCC auction network,
l	=	transmission facility from bus x to bus y owned by TO *t*,
J'	=	the set of injections and withdrawals produced from a but for rerun of the monthly auction with all transmission facilities in-service that were in-service in the prior capability period auction,
$F_{l,J'}$	=	the flow on transmission facility *l* produced from the set of injections and withdrawals *J'*,
J	=	the set of injections and withdrawals from the monthly auction,
$F_{l,J}$	=	the flow on transmission facility *l* from the monthly auction,
$P_{y,l}$	=	the nodal price at bus *y* on transmission facility *l* from the monthly TCC auction, and

$P_{x,l}$	=	the nodal price at bus *x* on transmission facility *l* from the monthly TCC auction.

The revenue assigned each TO from the directly assigned costs of a transmission facility modeled out-of-service in a monthly auction can be expressed as follows:

$$AR_t = DC * W_t / \sum_{z \in Z} W_z, \text{ where}$$

AR_t	=	revenue assigned a TO *t* from directly assigned Make Whole costs to TOs,
DC	=	the directly assigned cost to all TOs for transmission facilities placed out-of-service in the monthly auction that were not out of service in the capability period auction,
W_t	=	flow based value weighting for TO *t* of the directly assigned costs to the auction,
z	=	TO *z*,
Z	=	the set of all TOs, and
W_z	=	flow based value weighting for TO *z* of the directly assigned costs to the auction.

Note that the TOs with transmission facilities out of service are included in the calculation of AR_t. The total revenue distributed to a TO from a monthly auction when a transmission facility is modeled as out-of-service will be calculated following the monthly auction. It can be expressed as follows:

$$RT_t = R_t + AR_t$$

Allocation of Revenues to TOs from Make Whole Charges Collected for Transmission Facilities Placed Out-of-Service in a Capability Period TCC Auction

The Make Whole Approach assigns a cost to each TO whose transmission facility is placed out-of-service in the capability period auction and causes a revenue shortfall on a binding constraint. The TCC residual revenue from the auction will be increased by the revenue from these Make Whole charges to the TOs.

The problem becomes one of allocating the revenue from these directly assigned costs to the TOs. The proposed allocation is based on the difference in the flow based value determined from the actual capability period auction and from a "but for" case for the capability period auction, which assumes that all lines are in service. The difference in the flow based value for each TO is used to determine a set of weights to distribute the directly assigned costs of transmission outages.

The flow-based weights will be calculated as follows:

$$W_t = \sum_{l \in T} \left(F_{l,K'} - F_{l,K}\right) * \left(P_{y,l} - P_{x,l}\right), \text{ where}$$

W_t	=	flow based value weighting for TO *t* to be applied in determining its share of the revenue from the directly assigned shortfall cost for the capability period auction,
T	=	the set of transmission facilities owned by NY TOs that are modeled in the TCC auction network,
l	=	transmission facility from bus x to bus y owned by TO *t*,
K'	=	the set of injections and withdrawals produced from a but for rerun of the capability period auction with all transmission facilities in-service ,$F_{l,K'}$ = the flow on transmission facility *l* produced from the set of injections and withdrawals *K'*,
K	=	the set of injections and withdrawals from the capability period auction,
$F_{l,K}$	=	the flow on transmission facility *l* from the capability period auction,
$P_{y,l}$	=	the nodal price at bus *y* on transmission facility *l* from the capability period TCC auction, and
$P_{x,l}$	=	the nodal price at bus *x* on transmission facility *l* from the capability period TCC auction.

The revenue assigned each TO from the directly assigned costs of a transmission facility modeled out-of-service in a capability period auction can be expressed as follows:

$$AR_t = DC * W_t / \sum_{z \in Z} W_z, \text{ where}$$

AR_t	=	revenue assigned to TO *t* from directly assigned Make Whole costs to TOs in capability period auction,
DC	=	the directly assigned cost to all TOs for transmission facilities placed out-of-service in the capability period auction, W_t = flow based value weighting for TO *t* of the directly assigned costs to the auction,
z	=	TO *z*,
Z	=	the set of all TOs, and
W_z	=	flow based value weighting for TO *z* of the directly assigned costs to the auction.

Note that the TOs with transmission facilities out of service are included in the calculation of AR_t. The total revenue distributed to a TO from a capability period auction when a transmission facility is modeled as out-of-service will be calculated following the capability period auction It can be expressed as follows:

$$RT_t = R_t + AR_t$$

Allocation of Revenue Reduction to TOs for Make Whole Revenue Paid for Transmission Facilities Placed In-Service in a Monthly TCC Auction

The "Make Whole" approach will pay TOs for transmission facilities returned to service in a monthly reconfiguration auction that were modeled as out-of-service in the prior capability period auction.

The problem becomes one of allocating the funding for these payments to the TOs; they will receive less revenue from the monthly auction because some of the monthly auction revenue will be directly paid to the TO that returns a line to service. The proposed allocation is based on the difference in the flow based value determined from the actual monthly auction and from a "but for" case for the monthly auction, which assumes that the same lines are out of service that were out of service in the prior capability period auction. The difference in the flow based value for each TO is used to determine a set of weights to distribute the directly assigned costs of transmission outages.

The flow-based weights will be calculated as follows:

$$WR_t = \sum_{l \in T} \left(F_{l,J} - F_{l,J'}\right) * \left(P_{y,l} - P_{x,l}\right), \text{ where}$$

WR_t	=	flow based value weighting for TO *t* to be applied in determining its share of the revenue reduction resulting from the directly assigned payments to transmission returned to service in the monthly auction,
T	=	the set of transmission facilities owned by NY TOs that are modeled in the TCC auction network,
l	=	transmission facility from bus x to bus y owned by TO *t*,
J	=	the set of injections and withdrawals from the monthly auction,
$F_{l,J}$	=	the flow on transmission facility *l* from the monthly auction,
J'	=	the set of injections and withdrawals produced from a but for rerun of the monthly auction with all transmission facilities out of service that were out of service in the capability period auction,
$F_{l,J'}$	=	the flow on transmission facility *l* produced from the set of injections and withdrawals *J'*,
$P_{y,l}$	=	the nodal price at bus *y* on transmission facility *l* from the TCC auction, and
$P_{x,l}$	=	the nodal price at bus *x* on transmission facility *l* from the TCC auction.

The revenue reduction assigned each TO for a transmission facility returned to service in a monthly auction can be expressed as follows:

$$RD_t = DR * WR_t / \sum_{z \in Z} WR_z, \text{ where}$$

RD_t	=	revenue reduction assigned to TO *t*,
DR	=	the directly assigned payments to all TOs for transmission facilities place in-service in the monthly auction that were not in-service in the capability period auction,
WR_t	=	flow based value weighting for TO *t* of the revenue reduction applied to the auction,
z	=	TO *z*,
Z	=	the set of all TOs, and
WR_z	=	flow based value weighting for TO *z* of the revenue reduction applied to the auction.

The total revenue distributed to a TO from a monthly auction when a transmission facility is returned to service can be expressed as follows:

$$RT_t = R_t - RD_t$$

4. Allocation of Residual DAM Shortfalls and Surpluses

The fourth element of the NYISO proposal is a modified method for allocating the DAM residual congestion rent shortfall or surplus to the TOs. The modified allocation methodology will be a replacement for today's use of IMWM percentage allocation factors.

As under the current NYISO Tariff, congestion rent surpluses accumulated over the month will be used to reduce the residual congestion rent shortfalls occurring over the same month and the monthly residual will be allocated to the TOs. The change introduced by the current proposal is that the DAM residual congestion rents will additionally include adjustments for the direct allocation of shortfalls and revenues to specific transmission facilities out of service or returning to service. Thus, the revenue the NYISO receives for charging a TO a shortfall cost for a facility that is out of service in the DAM will be added to the DAM residual congestion rents. Similarly, the revenue the NYISO pays to a TO for a facility that is returned to service in the DAM will reduce the DAM residual congestion rents. The expectation is that the direct allocation of congestion rent shortfall costs to facilities that are out-of-service will reduce the large negative magnitude of the DAM residuals, relative to levels that have been seen in the past.

The allocation factors for the monthly shortfall or surplus will be calculated from the imputed revenue that each TO receives for TCCs and Grandfathered ETAs for that month. Each TO's imputed revenue will be the calculated based on: revenue distributions received from TCC auctions for which the TCCs sold remain valid in the present month, revenue received for ETCNL and Residual TCCs, and the imputed value of Grandfathered TCCs and ETAs sold by the TO for which the grandfathered agreement remains valid in the present month. The Grandfathered TCCs and ETAs will be valued at the monthly auction market clearing prices, yielding an approximation of the revenue that each TO would have been paid if it had sold the transmission capacity associated with the TCCs and physical rights in the auction. This is an approximation of the imputed value of the rights that the TO has sold under its grandfathered

contract, and for which it continues to receive contract revenue. Each TO's allocation factor for the monthly residual congestion rent shortfall or surplus will be the ratio of its imputed revenue to the total imputed revenue for all TOs.

The rationale for this method for allocating the DAM congestion rent residuals is that, when viewed from the perspective of allocating a shortfall, it resembles a flat "full funding tax." Under the method, each TO's share of a DAM shortfall will be proportional to the value that it has received from the sale of fully funded TCCs (or non-curtailed grandfathered ETAs). The allocation method can be viewed as a flat tax that supports the revenue the TOs receive from the sale of fully funded TCCs in the auction and from the continuation of grandfathered ETAs. TOs receiving more revenue from the auction pay a higher total tax, because they receive a greater benefit from full funding of TCCs.[5]

5. Reduction in Total DAM Congestion Rent Shortfalls

The NYISO, in consultation with the MPs, will work to develop a methodology to apply an availability adjustment to the TCCs sold in the TCC auctions so as to reduce the level of residual shortfalls in the DAM and in the TCC monthly reconfiguration auctions. The appropriate adjustments will depend on the reduction in the residual shortfall that can be obtained through direct assignment of shortfall costs attributable to transmission outages using the Make Whole Approach. The goal is for the availability adjustment method to be brought back to the BIC for approval and for subsequent implementation in time for the fall 2003 TCC auctions.

As described in the National Grid Proposal, the methods proposed should not have the result of withholding capability that could have been used to support TCC sales in one part of the system in order to generate a surplus in order to offset shortfalls that occur on other parts of the system that are over-subscribed beyond their anticipated capability.

[5] For TCCs sold in the auction, the overall impact of this tax will be the same as that of a flat tax on the congestion rent payments made to TCC holders; it will reduce the TCC auction revenue allocated to the TOs. A tax on congestion rent payments to TCC holders reduces TCC auction revenue because it decreases the amount that parties would bid to buy TCCs.