This document is an excerpt from the current *MAPP POLICIES AND PROCEDURES FOR TRANSMISSION OPERATIONS: Appendix F: MAPP Regional AFC/ATC/ASTFC Calculation and Request Evaluation Process.* The complete *MAPP POLICIES AND PROCEDURES FOR TRANSMISSION OPERATIONS* can be located in the "Business Practices" section of this web page http://toinfo.oasis.mapp.org/oasisinfo/.

This excerpt describes the MAPP AFC/ATC Calculation methodology.

12   MAPP AFC Calculation

12.1   Non-Recallable AFC Computation for a Pre-contingent MAPP Transmission Service Provider Flowgate

The following equation describes the computation of Non-recallable Available Flowgate Capability (NAFC) for each Pre-contingent Constrained Flowgate for each time period.

$$NAFC_i^t = TFC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - \left(MF_i^t\right)_n - NRES_i^t$$

Where,

$NAFC_i^t$ = Non - recallable (firm) AFC on interface i at time t

TFC_i^t = Total Flowgate Capability on interface i at time t

CBM_i^t = Capacity Benefit Margin value used for NAFC calculation on interface i at time t

TRM_i^t = Transmission Reliability Margin on interface i at time t

$NETC_i^t$ = Non - recallable Existing Transmission Commitments on interface i at time t

$\left(MF_i^t\right)_n$ = Market Flow for RTO n on interface i at time t

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface i at time t

$NRES_i^t$ is calculated by summing all transmission reservation r, at each time t, on each interface i as follows

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|PTDF_i^t\right|_r \le \text{Flowgate Threshold}$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{NAFC} \text{if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|PTDF_i^t\right|_r > \text{Flowgate Threshold}$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

The $\left(d_i^{firm}\right)_{NAFC}$ value is the directionality coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts.

12.1.1   Reciprocally Coordination Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Status Impact Category has its own factor**

The $FirmFGNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Status Impact Category has its own factor**

Where,

$$\left(\Delta P_i^t\right)_r = \left(PTDF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

$$\left(PTDF_i^t\right)_r = \text{Power Transfer Distribution Factor of the transmission reservation } r,$$
$$\text{at time } t \text{ on interface } i$$

$$\left(CAP^t\right)_r = \text{Megawatt capacity of the transmission reservation } r, \text{ at time } t$$

$$CNRES_i^t = \text{Committed (Confirmed) Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

$$ANRES_i^t = \text{Accepted, Counteroffer, and Rebid Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

$$SNRES_i^t = \text{Study Non - recallable (firm) reservation impacts on interface } i \text{ at time } t$$

$$ROFRNRES_i^t = \text{Right of First Refusal Impacts (Rollover Rights) Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

And,

The formula to use is configured on a per flowgate basis.

12.2 Recallable AFC Computation for a Pre-contingent MAPP Transmission Service Provider Flowgate

For each Flowgate, six AFC values are calculated for the evaluation of Recallable service in order to determine the AFC within each service priority group. The following equations describe the computation of these Recallable Available Transfer Capability (RAFC) values for each Flowgate for each time period for each service priority.

Recallable Planning Horizon AFC Computation for a Pre-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right)$$
$$- RETC_i^t - NRES_i^t - \left(MF_i^t\right)_n - NETC_i^t - RRES6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RRES5_i^t$$
$$\vdots$$
$$RAFCN_i^t = RAFC[N+1]_i^t - RRESN_i^t$$

Where,

$$RAFC_{N_i^t} = \text{Recallable (firm) AFC on interface } i \text{ at time } t \text{ for TLR priority } N$$

$$TFC_i^t = \text{Total Flowgate Capability on interface } i \text{ at time } t$$

$$CBM_i^t = \text{Capacity Benefit Margin value used for RATC calculation on}$$
$$\text{interface } i \text{ at time } t$$

$$CBMCOEF_i^t = \text{Capacity Benefit Margin Coefficient on interface } i \text{ at time } t$$

$$TRM_i^t = \text{Transmission Reliability Margin on interface } i \text{ at time } t$$

$$TRMCOEF_i^t = \text{Transmission Reliability Margin Coefficient on interface } i \text{ at time } t$$

$$RETC_i^t = \text{Recallable Existing Transmission Committments on interface } i \text{ at time } t$$

$$NETC_i^t = \text{Non - Recallable Existing Transmission Committments on interface } i \text{ at time } t$$

$$\left(MF_i^t\right)_n = \text{Market Flow for RTO } n$$
$$\text{on interface } i \text{ at time } t$$

$$NRES_i^t = \text{Non - recallable (firm) transmission reservation impacts}$$
$$\text{on interface } i \text{ at time } t$$

$$RRES_{N_i^t} = \text{Recallable (Non - firm) transmission reservation impacts}$$
$$\text{on interface } i \text{ at time } t \text{ for TLR priority } N$$

The $TRMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES_{N_i^t}$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|PTDF_i^t\right|_r \leq \textit{Flowgate Threshold}$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{RAFC} \quad \text{if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|PTDF_i^t\right|_r > \textit{Flowgate Threshold}$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

The $FirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor**

And,

$$RRESN_i^t = \underbrace{CRRESN_i^t}_{Committed} + \underbrace{ARRESN_i^t}_{Accepted} + \underbrace{SRRESN_i^t}_{Study}$$

$$CRRESN_i^t = (CRRESN_i^t)_1 + (CRRESN_i^t)_2$$

Where,

$$(CRRES_{N_i^t})_1 = \sum_r (\Delta P_i^t)_r \quad \text{if } (\Delta P_i^t)_r > 0 \text{ or } |PTDF_i^t|_r \leq \textit{Flowgate Threshold}$$

$$(CRRES_{N_i^t})_2 = \sum_r (\Delta P_i^t)_r \times (d_i^{nonfirm})_{RAFC} \quad \text{if } (\Delta P_i^t)_r < 0 \text{ and } |PTDF_i^t|_r > \textit{Flowgate Threshold}$$

The summation of the recallable impacts is for all reservations with TLR priority level N.

The $(d_i^{firm})_{\text{RAFC}}$ and $(d_i^{nonfirm})_{\text{RAFC}}$ values are the directionality coefficients (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable and/or recallable counter-flow impacts.

Or for a Reciprocally Coordinated Flowgate

Reciprocally Coordinated Flowgate

$$CRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$+ \sum_r (\Delta P_i^t)_r * NonFirmFGNegativeFactor_{RAFC} \text{ where } (\Delta P_i^t)_r < 0$$

$$ARRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$SRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

The $NonFirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor.**

The $NonFirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Status Impact Category has its own factor.**

Recallable Operating Horizon AFC Computation for a Pre-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - (CBM_i^t \times CBMCOEF_i^t) - (TRM_i^t \times TRMCOEF_i^t)$$
$$- FETC_i^t - NSCH_i^t - (NMF_i^t)_n - RSCH6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RSCH5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RSCHN_i^t$$

Where,

$$RAFC_{N_i}^{t} = \text{Recallable (firm) AFC on interface } i \text{ at time } t \text{ for LLR priority } N$$

$$TFC_i^{t} = \text{Total Flowgate Capability on interface } i \text{ at time } t$$

$$CBM_i^{t} = \text{Capacity Benefit Margin value used for RATC calculation on interface } i \text{ at time } t$$

$$CBMCOEF_i^{t} = \text{Capacity Benefit Margin Coefficient on interface } i \text{ at time } t$$

$$TRM_i^{t} = \text{Transmission Reliability Margin on interface } i \text{ at time } t$$

$$TRMCOEF_i^{t} = \text{Transmission Reliability Margin Coefficient on interface } i \text{ at time } t$$

$$FETC_i^{t} = \text{Forecasted Existing Transmission Commitments on interface } i \text{ at time } t$$

$$\left(NMF_i^{t}\right)_n = \text{Non - recallable (firm) Market Flow for RTO } n \text{ on interface } i \text{ at time } t$$

$$NSCH_i^{t} = \text{Total impact of all Non - recallable energy schedules on interface } i \text{ at time } t$$

$$RSCH_{N_i}^{t} = \text{Total impact of all Recallable (Non - firm) energy schedules on interface } i \text{ at time } t \text{ for TLR priority } N$$

And,

$$\underbrace{FETC_i^{t}}_{Forecasted} = \underbrace{NETC_i^{t}}_{Non-recallable} + \underbrace{RETC_i^{t}}_{\text{Re}callable}$$

The Forecasted ETC value can be based upon the sum of NETC and RETC values submitted by the TSP, or the TSP can rely on the ETC Forecaster to predict the ETC value in the Operating Horizon.

$$(NSCH_i^{t})_1 = \sum_r \left(\Delta P_i^{t}\right)_r$$

$$(RSCH_{N_i}^{t})_2 = \sum_r \left(\Delta P_i^{t}\right)_r$$

Where,

$$\left(\Delta P_i^{t}\right)_r = \left(PTDF_i^{t}\right)_r \times \left(SCH^{t}\right)_r$$

$$\left(PTDF_i^{t}\right)_r = \text{Power Transfer Distribution Factor of the transmission reservation } r, \text{ at time } t \text{ on interface } i$$

$$\left(SCH^{t}\right)_r = \text{Megawatt energy schedule of the transmission reservation } r \text{ or capacity of the priority 2 and hourly priority 6 reservation } r \text{ for which a schedule does not exist, at time } t$$

The $TRMCOEF_i^{t}$ component allows the MAPP TSP to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^{t}$ component allows the MAPP TSP to sell all or a portion of the CBM as recallable transmission service.

12.3 Non-Recallable AFC Computation for a Post-contingent MAPP Transmission Service Provider Flowgate

A Monitored Interface and a Contingency interface pair define each Post-contingent flowgate. Each Monitored Interface and Contingency Interface may be made up of one or more transmission elements.

The following equation describes the computation of Non-recallable Available Flowgate Capability (NAFC) for each Post-contingent Flowgate for each time period.

$$NAFC_i^t = TFC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - \left(NMF_i^t\right)_n - NRES_i^t$$

Where,

$NAFC_i^t$ = Non-recallable (firm) AFC on interface i at time t

TFC_i^t = Total Flowgate Capability on interface i at time t

CBM_i^t = Capacity Benefit Margin value used for NAFC calculation on interface i at time t

TRM_i^t = Transmission Reliability Margin on interface i at time t

$NETC_i^t$ = Non-recallable Existing Transmission Commitments on interface i at time t

$\left(NMF_i^t\right)_n$ = Non-recallable (firm) Market Flow for RTO n on interface i at time t

$NRES_i^t$ = Non-recallable (firm) transmission reservation impacts on interface i at time t

$NRES_i^t$ is calculated by summing all transmission reservation r, at each time t, on each interface i as follows,

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|OTDF_i^t\right|_r \leq Flowgate\ Threshold$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{NAFC} \text{ if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|OTDF_i^t\right|_r > Flowgate\ Threshold$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

The $\left(d_i^{firm}\right)_{NAFC}$ value is the directionality coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable counter-flow impacts.

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

The $FirmFGNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor**

Where,
$$\left(\Delta P_i^t\right)_r = \left(OTDF_i^t\right)_r \times \left(CAP^t\right)_r$$
And,
$$\left(OTDF_i^t\right)_r = \text{Outage Transfer Distribution Factor of the transmission reservation } r,$$
$$\text{at time } t \text{ on interface } i$$

$$\left(CAP^t\right)_r = \text{Megawatt capacity of the transmission reservation } r, \text{ at time } t$$

$$CNRES_i^t = \text{Committed (Confirmed) Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

$$ANRES_i^t = \text{Accepted, Counteroffer, and Rebid Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

$$SNRES_i^t = \text{Study Non - recallable (firm) reservation impacts on interface } i \text{ at time } t$$

$$ROFRNRES_i^t = \text{Right of First Refusal Impacts(Rollover Rights) Non - recallable (firm)}$$
$$\text{reservation impacts on interface } i \text{ at time } t$$

12.4 Recallable AFC Computation for a Post-contingent MAPP Transmission Service Provider Flowgate

For each Flowgate, six AFC values are calculated for the evaluation of Recallable service in order to determine the AFC within each service priority group. The following equations describe the computation of these Recallable Available Flowgate Capability (RAFC) values for each Flowgate for each time period for each service priority.

(Recallable Planning Horizon AFC Computation for a Post-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right)$$
$$- RETC_i^t - NRES_i^t - \left(NMF_i^t\right)_n - NETC_i^t - RRES6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RRES5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RRESN_i^t$$

Where,

$RAFCN_i^t$ = Recallable (firm) AFC on interface i at time t for TLR priority N

TFC_i^t = Total Flowgate Capability on interface i at time t

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface i at time t

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface i at time t

TRM_i^t = Transmission Reliability Margin on interface i at time t

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface i at time t

$RETC_i^t$ = Recallable Existing Transmission Committments on interface i at time t

$NETC_i^t$ = Non - Recallable Existing Transmission Committments on interface i at time t

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO n on interface i at time t

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts on interface i at time t

$RRESN_i^t$ = Recallable (Non - firm) transmission reservation impacts on interface i at time t for TLR priority N

The $TRMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES_{N_i}^t$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \left(CNRES_i^t\right)_1 + \left(CNRES_i^t\right)_2$$

Where,

$$\left(CNRES_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0 \text{ or } \left|OTDF_i^t\right|_r \leq Flowgate\ Threshold$$

$$\left(CNRES_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r * \left(d_i^{firm}\right)_{RAFC} \quad \text{if } \left(\Delta P_i^t\right)_r < 0 \text{ and } \left|OTDF_i^t\right|_r > Flowgate\ Threshold$$

and

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r \quad \text{if } \left(\Delta P_i^t\right)_r > 0$$

Reciprocally Coordinated Flowgate

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$
$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmFGNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmFGPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

The $FirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

And

$$RRES_{N_i^t} = \underbrace{CRRES_{N_i^t}}_{Committed} + \underbrace{ARRES_{N_i^t}}_{Accepted} + \underbrace{SRRES_{N_i^t}}_{Study}$$

$$CRRES_{N_i^t} = (CRRES_{N_i^t})_1 + (CRRES_{N_i^t})_2$$

Where,

$$(CRRES_{N_i^t})_1 = \sum_r (\Delta P_i^t)_r \quad \text{if } (\Delta P_i^t)_r > 0 \text{ or } |OTDF_i^t|_r \leq Flowgate\,Threshold$$

$$(CRRES_{N_i^t})_2 = \sum_r (\Delta P_i^t)_r \times (d_i^{nonfirm})_{RAFC} \quad \text{if } (\Delta P_i^t)_r < 0 \text{ and } |OTDF_i^t|_r > Flowgate\,Threshold$$

The summation of the recallable impacts is for all reservations with TLR priority level N.

The $(d_i^{firm})_{RAFC}$ and $(d_i^{nonfirm})_{RAFC}$ values are the directionality coefficients (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable and/or recallable counter-flow impacts.

Or for a Reciprocally Coordinated Flowgate

$$CRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$+ \sum_r (\Delta P_i^t)_r * NonFirmFGNegativeFactor_{RAFC} \text{ where } (\Delta P_i^t)_r < 0$$

$$ARRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

$$SRRES_i^t = \sum_r (\Delta P_i^t)_r * NonFirmFGPositiveFactor_{RAFC} \text{ where } (\Delta P_i^t)_r > 0$$

The $NonFirmFGPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

The $NonFirmFGNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor**

Recallable Operating Horizon ATC Computation for a Post-contingent Constrained Flowgate

$$RAFC6_i^t = TFC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right)$$
$$- FETC_i^t - NSCH_i^t - \left(NMF_i^t\right)_n - RSCH6_i^t$$

$$RAFC5_i^t = RAFC6_i^t - RSCH5_i^t$$

$$\vdots$$

$$RAFCN_i^t = RAFC[N+1]_i^t - RSCHN_i^t$$

Where,

$RAFCN_i^t$ = Recallable (firm) AFC on interface i at time t for LLR priority N

TFC_i^t = Total Flowgate Capability on interface i at time t

CBM_i^t = Capacity Benefit Margin value used for RATC calculation on interface i at time t

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface i at time t

TRM_i^t = Transmission Reliability Margin on interface i at time t

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface i at time t

$FETC_i^t$ = Forecasted Existing Transmission Commitments on interface i at time t

$\left(NMF_i^t\right)_n$ = Non - recallable (firm) Market Flow for RTO n on interface i at time t

$NSCH_i^t$ = Total impact of all Non - recallable energy schedules on interface i at time t

$RSCHN_i^t$ = Total impact of all Recallable (Non - firm) energy schedules on interface i at time t for TLR priority N

And,

$$\underbrace{FETC_i^t}_{Forecasted} = \underbrace{NETC_i^t}_{Non-recallable} + \underbrace{RETC_i^t}_{Re\,callable}$$

The Forecasted ETC value can be based upon the sum of NETC and RETC values submitted by the TSP, or the TSP can rely on the ETC Forecaster to predict the ETC value in the Operating Horizon.

$$\left(NSCH_i^t\right)_1 = \sum_r \left(\Delta P_i^t\right)_r$$

$$\left(RSCHN_i^t\right)_2 = \sum_r \left(\Delta P_i^t\right)_r$$

Where,

$$\left(\Delta P_i^t\right)_r = \left(OTDF_i^t\right)_r \times \left(SCH^t\right)_r$$

$\left(OTDF_i^t\right)_r$ = Outage Transfer Distribution Factor of the transmission reservation r,

at time t on interface i

$\left(SCH^t\right)_r$ = Megawatt energy schedule of the transmission reservation r or capacity of the priority 2 and

hourly priority 6 reservation r for which a schedule does not exist, at time t

The $TRMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the CBM as recallable transmission service.

12.5 Non-Recallable ATC Computation on a Contract Path

$$NATC_i^t = TTC_i^t - CBM_i^t - TRM_i^t - NETC_i^t - NRES_i^t$$

$NATC_i^t$ = Non - recallable (firm) ATC on contract path i at time t

TTC_i^t = Total Transfer Capability on contract path i at time t

CBM_i^t = Capacity Benefit Margin value used for NATC calculation on

contract path i at time t

TRM_i^t = Transmission Reliability Margin on contract path i at time t

$NETC_i^t$ = Existing Transmission Commitment value used for NATC calculation

on contract path i at time t

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts

on contract path i at time t

$NRES_i^t$ is calculated by summing all transmission reservation r, at each time t, on each contract path i as follows

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmCPNegativeFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{NAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmCPPositiveFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor.**

The $FirmCPNegativeFactor_{NAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the NAFC calculation. **Each Reservation Impact Category has its own factor.**

Where,

$$\left(\Delta P_i^t\right)_r = \left(DF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

$$\left(DF_i^t\right)_r = DF \text{ is the percent impact, } [0,100,\text{-}100\%] \text{ of the transmission reservation } r,$$

$$\text{at time } t \text{ on contract path } i$$

$$\left(CAP^t\right)_r = \text{Megawatt capacity of the transmission reservation } r, \text{ at time } t$$

12.6 Recallable ATC Computation on a Contract Path

For each Contract Path, one ATC is calculated for the evaluation of Recallable service. The following equation describes the computation of these Recallable Available Transfer Capability (RATC) values for each Contract Path for each time period.

Recallable Planning Horizon ATC Computation for a Contract Path

$$RATC6_i^t = TTC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right)$$

$$- RETC_i^t - NRES_i^t - NETC_i^t - RRES6_i^t$$

$$RATC5_i^t = RATC6_i^t - RRES5_i^t$$

$$\vdots$$

$$RATCN_i^t = RATC[N+1]_i^t - RRESN_i^t$$

Where,

$RATC{N_i^t}$ = Recallable (firm) ATC on interface i at time t for TLR priority N

TTC_i^t = Total Contract Path Capability on interface i at time t

CBM_i^t = Capacity Benefit Margin on interface i at time t

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface i at time t

TRM_i^t = Transmission Reliability Margin on interface i at time t

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on interface i at time t

$RETC_i^t$ = Recallable Existing Transmission Committments on interface i at time t

$NETC_i^t$ = Non - Recallable Existing Transmission Committments on interface i at time t

$NRES_i^t$ = Non - recallable (firm) transmission reservation impacts

on interface i at time t

$RRES{N_i^t}$ = Recallable (Non - firm) transmission reservation impacts

on interface i at time t for TLR priority N

The $TRMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the TRM as recallable transmission service.

The $CBMCOEF_i^t$ component allows the MAPP TSP to sell all or a portion of the CBM as recallable transmission service.

The computation of $NRES_i^t$ and $RRES{N_i^t}$ is somewhat different from those of Non-recallable ATC computation.

$$NRES_i^t = \underbrace{CNRES_i^t}_{Confirmed} + \underbrace{ANRES_i^t}_{Accepted} + \underbrace{SNRES_i^t}_{Study} + \underbrace{ROFRNRES_i^t}_{Rollover\ Rights}$$

$$CNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * FirmCPNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ANRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$ROFRNRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * FirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $FirmCPPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor.**

The $FirmCPNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 and 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the non-recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor.**

And

$$RRES_{N_i^t} = \underbrace{CRRES_{N_i^t}}_{Committed} + \underbrace{ARRES_{N_i^t}}_{Accepted} + \underbrace{SRRES_{N_i^t}}_{Study}$$

$$CRRES_{N_i^t} = (CRRES_{N_i^t})_1 + (CRRES_{N_i^t})_2$$

Where,

$$CRRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$+ \sum_r \left(\Delta P_i^t\right)_r * NonFirmCPNegativeFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r < 0$$

$$ARRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

$$SRRES_i^t = \sum_r \left(\Delta P_i^t\right)_r * NonFirmCPPositiveFactor_{RAFC} \text{ where } \left(\Delta P_i^t\right)_r > 0$$

The $NonFirmCPPositiveFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable positive impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor.**

The $NonFirmCPNegativeFactor_{RAFC}$ value is a coefficient (between 0.0 - 1.0) for a flowgate. By varying this coefficient the MAPP TSP can choose to include all or none of the recallable counter-flow impacts in the RAFC calculation. **Each Reservation Impact Category has its own factor.**

Where,

$$\left(\Delta P_i^t\right)_r = \left(DF_i^t\right)_r \times \left(CAP^t\right)_r$$

And,

$$\left(DF_i^t\right)_r = \text{DF is the percent impact}, [0, 100, -100\%] \text{ of the transmission reservation } r,$$
at time t on contract path i

$$\left(CAP^t\right)_r = \text{Megawatt capacity of the transmission reservation } r, \text{ at time } t$$

Recallable Operating Horizon ATC Computation for a Contract Path

$$RATC6_i^t = TTC_i^t - \left(CBM_i^t \times CBMCOEF_i^t\right) - \left(TRM_i^t \times TRMCOEF_i^t\right)$$
$$- NETC_i^t - RETC_i^t - NSCH_i^t - RSCH6_i^t$$
$$RATC5_i^t = RATC6_i^t - RSCH5_i^t$$
$$\vdots$$
$$RATCN_i^t = RATC[N+1]_i^t - RSCHN_i^t$$

$RATC_i^t$ = Recallable (firm) ATC on contract path i at time t

TTC_i^t = Total Transfer Capability on contract path i at time t

CBM_i^t = Capacity Benefit Margin value on contract path i at time t

$CBMCOEF_i^t$ = Capacity Benefit Margin Coefficient on interface i at time t

TRM_i^t = Transmission Reliability Margin on contract path i at time t

$TRMCOEF_i^t$ = Transmission Reliability Margin Coefficient on contract path i at time t

$NETC_i^t$ = Non - Recallable Existing Transmission Commitment
value on contract path i at time t

$RETC_i^t$ = Recallable Existing Transmission Commitment
value on contract path i at time t

$NSCH_i^t$ = Total impact of all Non - recallable energy schedules
on icontract path i at time t

$RSCH_i^t$ = Total impact of all Recallable (Non - firm) energy schedules
on contract path i at time t

And,
$$NSCH_i^t = \sum_r \left(\Delta P_i^t\right)_r$$
$$RSCH_i^t = \sum_r \left(\Delta P_i^t\right)_r$$

Where,
$$\left(\Delta P_i^t\right)_r = \left(DF_i^t\right)_r \times \left(SCH^t\right)_r$$

And,
$\left(DF_i^t\right)_r$ = DF is the percent impact, $[0, 100, -100\%]$ of the transmission reservation r,
at time t on contract path i

$\left(SCH^t\right)_r$ = Megawatt energy schedule of the transmission reservation r or capacity of the priority 2 and
hourly priority 6 reservation r for which a schedule does not exist, at time t

The $COEF_i^t$ component allows the MAPP TSP to sell all or a portion of the TRM
and/or CBM as recallable transmission service.