To: NEPOOL Budget & Finance Subcommittee

From: ISO-NE Enterprise Risk Management

Date: March 14, 2018

Subject: PFP-FA Instructional Memo

Executive Summary

On June 1, 2018, a fundamental design change to the Forward Capacity Market (FCM), known as Pay For Performance (PFP) will become effective. PFP alters the risk profile for Capacity Supply Obligations (CSOs); thus the Financial Assurance (FA) methodology must change as well. Because of the lag between the acceptance of the PFP design and the implementation, as well as two recent minor design changes, market participants have requested a consolidated version of how the FA requirements will be affected.

This memo will serve as a guide to the FA impacts of PFP and how to calculate the new FA requirement. The ISO also developed a basic FCM Delivery FA Model (Excel file) designed to help participants approximate their Delivery FA requirements. The model may need to be modified by the end user to accommodate unique scenarios.

Background

Filed in 2014 and becoming effective on June 1, 2018, the PFP FCM structure is intended to better align generators' incentives with the FCM's goals of having reliable capacity for the region.

The PFP market design breaks monthly capacity payments into two independent revenue streams: capacity base payments and capacity performance payments. The capacity base payment is made to any resource having a CSO. The capacity performance payment is linked to a resource's actual performance during capacity scarcity conditions. If a resource delivers more capacity than its share of the system's requirements during a capacity scarcity condition, it will get a positive capacity performance payment; if it delivers less capacity than its share, it will receive a negative capacity performance payment. Positive and negative capacity performance payments are calculated based on the capacity performance payment rate, which is specified in the Tariff.

Effect on Financial Assurance

PFP will change the way the ISO assesses FA for the FCM. The PFP design introduces the possibility that resources with CSOs will have obligations (owe money) to the market in the case of underperformance. Since all obligations must be collateralized through the posting of financial assurance under the ISO Financial Assurance Policy (FAP), beginning on June 1, 2018, a Market Participant with a CSO will be required to add "FCM Delivery FA" to its total Financial Assurance requirements.

FCM Delivery FA is constructed to cover three types of risk: (1) payment of obligations already incurred in a past delivery month; (2) exposure to payment obligations arising from negative capacity performance payments in the current delivery month; and (3) the potential that losses may continue to accrue against a

defaulted CSO up to the annual stop-loss in any Capacity Commitment Period prior to a Market Participant being able to close the position and that the defaulted position is sold at a loss.

FCM Delivery FA Calculation

The monthly FCM Delivery FA requirement is calculated using the formula below. Note that the formula and explanations below reflect changes filed on March 1, 2018[1] and expected to be effective on June 1, 2018.

[1] DFAMW x PE x MAX [(ABR – CWAP), 0.1] x SF x DF - MCC

DFAMW (delivery financial assurance MW) is the summation of CSOs of each resource in the participant's portfolio excluding resources that have reached their annual stop-loss[2] (SLF) and excluding the Energy Efficiency designated portion of demand resources when the obligation month is September, October, November, February, March, April, or May. If the calculated DFAMW is less than zero, then DFAMW is set equal to zero.

PE (**potential exposure)** is a monthly value calculated for the Designated FCM Participant's portfolio as the difference between the Capacity Supply Obligation weighted average Forward Capacity Auction Starting Price and the Capacity Supply Obligation weighted average capacity price for the portfolio, excluding the Capacity Supply Obligation of any resource that has reached the annual stop-loss as described in Section III.13.7.3.2 of Market Rule 1 and, during February through May and September through November, excluding the Capacity Supply Obligation associated with any Energy Efficiency measures. The Forward Capacity Auction Starting Price shall correspond to that used in the Forward Capacity Auction corresponding to the instant Capacity Commitment Period and the capacity prices shall correspond to those used in the calculation of the Capacity Base Payment for each Capacity Supply Obligation in the delivery month.

ABR (**average balancing ratio)** is the duration-weighted average of all of the system-wide Capacity Balancing Ratios calculated for each system-wide Capacity Scarcity Condition occurring in the relevant group of months in the three Capacity Commitment Periods immediately preceding the instant Capacity Commitment Period. Three separate groups of months shall be used for this purpose: June through September, December through February, and all other months. Until data exists to calculate this number, the temporary ABR for June through September shall equal 0.90; the temporary ABR for December through February shall equal 0.70; and the temporary ABR for all other months shall equal 0.60. As actual data becomes available for each relevant group of months, calculated values for the relevant group of months will replace the temporary ABR values after the end of each group of months each year until all three years reflect actual data.

CWAP (capacity weighted average performance) is the capacity weighted average performance of the Designated FCM Participant's portfolio and is designed to capture the diversification benefits of multiple-resource portfolios.

The CWAP is calculated assuming that the largest resource in the portfolio is unavailable during the whole period of the scarcity condition and the rest of the resources perform consistent with average historical performance under the past three years of scarcity conditions.

[1] Docket No. ER18-944-000

[2] The annual stop loss flag tracks if the performance payment of a resource has reached its annual stop-loss as defined in the Tariff. If a resource hits its annual stop-loss limit, it is waived from its future financial obligation in the remaining capacity commitment period. Resources which reach their annual stop loss will be designated with a stop-loss flag (SLF = 1).

For each resource in the Designated FCM Participant's portfolio, excluding any resource that has reached the annual stop-loss as described in Section III.13.7.3.2 of Market Rule 1 and, during February through May and September through November, excluding the Capacity Supply Obligation associated with any Energy Efficiency measures, and excluding from the remaining resources the resource having the largest Capacity Supply Obligation in the month, the resource's Capacity Supply Obligation shall be multiplied by the average performance of the resource. The CWAP shall be the sum of all such values, divided by the Designated FCM Participant's DFAMW. If the DFAMW is zero, then the CWAP is set equal to one.

The average performance **(AP)** of a resource is the Actual Capacity Provided during Capacity Scarcity Conditions divided by the product of the resource's Capacity Supply Obligation and the equivalent hours of Capacity Scarcity Conditions in the relevant group of months in the three Capacity Commitment Periods immediately preceding the instant Capacity Commitment Period. Three separate groups of months shall be used for this purpose: June through September, December through February, and all other months. Until data exists to calculate this number, the temporary average performance for gas-fired steam generating resources, combined-cycle combustion turbines and simple-cycle combustion turbines shall equal 0.90; the temporary average performance for coal-fired steam generating resources shall equal 0.85; the temporary average performance for oil-fired steam generating resources shall equal 0.65; the temporary average performance for all other resources shall equal 1.00. As actual data for each resource becomes available for each relevant group of months, calculated values for the relevant group of months will replace the temporary average performance values after the end of each group of months each year until all three years reflect actual data. The applicable temporary average performance value will be used for new and existing resources until actual performance data is available.

The capacity weighted average performance (CWAP) of a portfolio is calculated (1) excluding the resources that have reached their annual stop losses; (2) excluding the portion of resources designated as Energy Efficiency Demand resources if the obligation month is September, October, November, February, March, April, or May; and (3) assuming that the remaining largest asset (m) in the portfolio is not available.

[2] $$\boldsymbol{CWAP = \sum_{i=1}^{n} DFAMW(i) \times \frac{AP(i)}{DFAMW},\ where\ SLF(i) = 0\ and\ i \neq m.}$$

MCC (monthly capacity charge) equals Monthly Capacity Payments incurred in previous months, but not yet billed. The MCC is estimated from the first day of the current delivery month until it is replaced by the actual settled MCC value when settlement is complete. It subsequently will go to zero once the monthly bill is issued (on the first Monday after the tenth day of the month). A positive MCC is a credit which will reduce FCM Delivery FA, while a negative MCC will increase FCM Delivery FA.

SF (scaling factor) incorporates the risk of remaining months in a season. Given the seasonal nature of Capacity Scarcity Conditions, the capacity commitment period is divided into three groups: four summer months, three winter months and five shoulder months. During high risk months (summer and winter), the SF is calculated as the square root of the number of summer or winter months remaining in the seasonal period. For example, the SF will be two (square root of four) in June, and will become one (square root of one) in September. During all the shoulder months, the scaling factor will be one.

DF (discount factor) is based on the likelihood of a single resource portfolio reaching its monthly stop-loss under different capacity performance payment rates. For the three Capacity Commitment Periods beginning June 1, 2018 and ending May 31, 2021, DF equals 0.75; and thereafter, DF equals 1.0.

Examples

This section shows a number of examples illustrating how to calculate the FCM Delivery FA for a variety of different portfolios in diverse (though not exhaustive) circumstances. These examples are to approximate FCM Delivery FA under certain scenarios and some intermediate calculation steps have been rounded to simplify the illustration. In the case of any discrepancy between the examples below and the ISO New England Inc. Financial Assurance Policy, the Financial Assurance Policy shall govern. Please reach out to the ERM contacts listed if you need assistance or have any questions.

Case 1: Consider a simple one resource portfolio with a CSO in July, 2018 and assume the following key inputs:

DFAMW =100 MW

CWAP = 0 (i.e., the largest and only resource is not available during the scarcity event hours)

ABR = 0.90 for the month

Forward Capacity Auction Starting Price for FCA9 = $17,728/MW-month

Capacity price for the resource = $9,551/MW-month

Potential Exposure (PE) = $17,728 – $9,551 = $8,177/MW

Assuming that there are no capacity performance payments in the previous month, the MCC credit is the CSO MW times the Clearing Price for the prior month.

FCA9 Clearing Price = $9,551/MW-month

MCC = 100 x $9,551

MCC = $955,100

The resource has not reached its annual stop loss limit,

SLF = 0

DF = 0.75

It is the July delivery month (3 months left in summer commitment period).

SF = 1.732

The FA requirement for the month would be the exposure to net penalties, which by formula [1] above equals:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 100 x $8,177 x (MAX(0.90 – 0.0, 0.1)) x 1.732 x 0.75 – $955,100

FA = 100 x $8,177 x 0.9 x 1.732 x 0.75 – $955,100

FA = $873

Once the monthly bill is issued the MCC term goes to zero and the FA requirement for the rest of the month becomes:

FA = $955,973

Case 2: Consider the previous case with the following change: Add an identically sized resource to the portfolio. Assume the capacity price for the second resource is $11,080/MW-month.

For this portfolio, we assume that the largest and historically best performing resource is unavailable. Allowing that the resources are independent in availability, that availability follows a binomial distribution, and that the historical average performance of resource two is 90%, the capacity weighted average performance is calculated by formula [2] as:

CWAP = (0.9 x 100)/200 = 0.45.

PE = $17,728 - (100 x $9,551 + 100 x $11,080)/(100 + 100) = $7,412.5

MCC = 100 x $9,551 + 100 x $11,080 = $2,063,100

In the case of two 100 MW resources, then, the FA requirement would be:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 200 x $7,412.5 x (MAX(0.90 - 0.45, 0.1)) x 1.732 x 0.75 – $2,063,100

FA = 200 x $7,412.5 x 0.45 x 1.732 x 0.75 - $2,063,100

FA = ($1,196,505)

This results in an FA credit.

Once the monthly bill is issued the MCC term goes to zero and the FA requirement becomes:

FA = $866,595

Case 3: Consider the previous case with the following change: Adding one 500 MW resource into the portfolio. Assume a capacity price for the 500 MW resource is $9,551/MW-month.

For this portfolio, given that the 500 MW resource is unavailable, the exposure to penalties is mitigated when both 100 MW resources are available. Assume both 100 MW resources have historical average performance of 90%. The capacity weighted average performance is calculated:

CWAP = (100*0.9 + 100*0.9)/700 = 0.257

PE = $17,728 - (100 x $9,551 + 100 x $11,080 + 500 x $9,551)/(100 + 100 + 500) = $7,958.57

MCC = 100 x $9,551 + 100 x $11,080 + 500 x $9,551 = $6,838,600

In the case of a portfolio consisting of one 500 MW resource and two 100 MW resources, then the FA requirement would be:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 700 x $7,958.57 x (MAX(0.90 - 0.257, 0.1)) x 1.732 x 0.75 - $6,838,600

FA = 700 x $7,958.57 x 0.64286 x 1.732 x 0.75 - $6,838,600

FA = $(2,186,417)

Once the monthly bill is issued, the MCC term goes to zero and the FA requirement becomes:

FA = $4,652,183

Case 4: Consider a case with the same portfolio as in Case 3 but in January (2 months left in winter commitment period) with ABR = 0.7.

In this case the FA requirement would be:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 700 x $7,958.57 x (MAX(0.7-0.257, 0.1)) x 1.414 x 0.75 - $6,838,600

FA = 700 x $7,958.57 x 0.44286 x 1.414 x 0.75 - $6,838,600

FA = $(4,222,180)

Once the monthly bill is issued, the MCC term goes to zero and the FA requirement becomes:

FA = $2,616,420

Case 5: Now consider the same portfolio from Case 3 in the December obligation month. Assume the largest resource has already reached its annual stop-loss limit and that the portfolio has a net penalty resulting in a charge for the previous month: MCC = $(1,000,000).

CWAP = (0.9x100)/200 = 0.45

PE = $17,728 - (100 x $9,551 + 100 x $11,080)/(100+100) = $7,412.5

ABR = 0.7

The FA requirement for the month would equal:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 200 x $7,412.5 x (MAX(0.7 - 0.45, 0.1)) x 1.732 x 0.75 – (-$1,000,000)

FA = 200 x $7,412.5 x 0.25 x 1.732 x 0.75 + $1,000,000

FA = $1,481,442

Once the monthly bill is issued, the MCC term goes to zero and the FA requirement becomes:

FA = $481,442

Case 6: Now consider the portfolio from Case 2 but now the second resource is subject to a multi-year Capacity Commitment Period election made in a Forward Capacity Auction prior to FCA 9. According to Market Rule III.13.7.3.1, the potential exposure of the second resource is zero. The Forward Capacity Auction starting price used to calculate potential exposure for the second resource shall equal to the capacity clearing price of the same resource.

CWAP = (0.9x100)/200 = 0.45

PE = (100 x $17,728 + 100 x $11,080)/(100 + 100) - (100 x $9,551 + 100 x $11,080)/(100 + 100) = $4,088.50

The FA requirement would be:

FA = DFAMW x PE x (MAX(ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 200 x $4,088.5 x (MAX(0.90 - 0.45, 0.1)) x 1.732 x 0.75 - $2,063,100

FA = 200 x $4,088.5 x 0.45 x 1.732 x 0.75 - $2,063,100

FA = $(1,585,113)

Once the MCC goes to zero the FA requirement becomes,

FA = $477,987

Case 7: Now consider a portfolio of 3 demand response resources. Resource A has a CSO of 150 MW, Resource B is an energy efficiency resource with a CSO of 100 MW and Resource C is a mixed type resource which is partially energy efficiency type with a CSO of 50 MW. Assume all three have a capacity price of $9,551 /MW-month.

If the obligation month were September, October, November, February, March, April, or May, the EE resources would be excluded and the mixed resource would be reduced by the exempt MW amount. Say the CSO for the EE portion of Resource C was 5 MW and the obligation month is September.

DFAMW = 150 + 0 + (50-5)

DFAMW = 195

CWAP = (1 x 0 + 1 x 0 + 1 x 45)/195 = 0.231

PE = $17,728 – $9,551 = $8,177

MCC = $9,551 x 300 = $2,865,300

The FA requirement would be:

FA = DFAMW x PE x (MAX (ABR – CWAP, 0.1)) x SF x DF - MCC

FA = 195 x $8,177 x 0.66923 x 1 x .75 - $2,865,300

FA = $(2,064,976)

FA = $800,324 once MCC goes to zero.

If the obligation month were June, July, August, December, or January the EE resources would be included. For example in July:

DFAMW = 150 + 100 + 50 = 300

CWAP = (1 x 0 + 1 x 100 + 1 x 50)/300 = 0.5

The FA requirement would be:

FA = 300 x $8,177 x 0.4 x 1.732 x .75 – $2,865,300

FA = $(1,590,669) or $1,274,631 once the MCC goes to zero.