

# FTR Auction Credit Examples

Market Simulation  
April 2019



- All Bid and Held positions must be supported by collateral (cash or LC)
- Unsecured credit is not available for FTR Participation

- Monthly Path-Specific Credit Requirements calculate credit based on:
  - Historical Values calculated as the monthly weighted average Day-Ahead congestion prices of the past three calendar years (50%-30%-20%)
  - Adjusted Historical Values
    - When transmission congestion decreases due to certain transmission upgrades
    - The transmission upgrades to be modeled for this purpose shall only include those upgrades that, individually, or together, have 10% or more impact on the transmission congestion on an individual constraint or constraints with congestion of \$5 million or more affecting a common congestion path.
  - Separate Historical Values for on-peak, off-peak and 24-hour FTRs

- All values are calculated on a monthly/FTR basis
- Separate Historical and Adjusted Historical Values for on-peak, off-peak, and 24-hour FTRs
- Each historical and adjusted value has a discount factor applied
  - Discount by 10% when calculating credit requirements for FTR paths with positive expected value
  - Add 10% when calculating credit requirements for FTR paths with negative expected value

- For each FTR, calculate:
  - Cleared Price minus (the Historical Value times the discount factor)
  - Cleared Price minus (the Adjusted Historical Value times the discount factor)
- Take the maximum of those two values
  - Multiply Sell trade types by negative one

- After each Path-Specific Credit Requirement is determined, sum all FTRs within that month
  - For cleared FTRs, negative credit requirements will net with positive credit requirements within a month
  - For bid FTRs, negative credit requirements do not net with positive credit requirements within a month

- Additional Credit Requirements for Undiversified Portfolios
  - Flow Undiversified=the FTR Portfolio is net counterflow. This means that the total value of the portfolio is negative based on FTR auction clearing prices.
  - The FTR portfolio is the cumulative position for all current and future FTRs cleared in previous auctions and FTRs cleared in any current preliminary auction.
  - For customer accounts that are FTR Flow Undiversified in a month, the FTR Credit Requirement will be increased by an amount equal to three times the absolute value of the FTR Portfolio Auction Value in that month, including the tentatively cleared solution.




- The 10¢ /MWh Minimum is calculated as
  - The MW of the FTR times the number of class hours in that month multiplied by 10¢
    - For cleared positions, “Sell” FTR MWh are subtracted from the portfolio total; prior to clearing, the MWh for “Sell” FTR MWh will not be included in the portfolio total.
  - Sum over the entire month to determine the monthly per-MWh Minimum
- If the monthly path-specific requirement plus any applicable increase related to the portfolio diversification results in a value that is less than the monthly per-MWh Minimum, the credit requirement for the month will be set equal to the monthly per-MWh minimum value



A green arrow pointing to the right, containing the text "Subtract ARR Credits in Account".

Subtract ARR  
Credits in  
Account

A yellow arrow pointing to the right, containing the text "Sum All Positive Monthly Subtotals".

Sum All  
Positive  
Monthly  
Subtotals

- Any applicable ARR Credits are then subtracted from the monthly credit requirements
  - Negative ARR Credits may result in a credit requirement
- All positive monthly subtotals are then summed to determine the credit requirement for the portfolio

- To calculate the Mark-to-Auction Value
  - Use the most recently available cleared auction price applicable to the FTR minus the original transaction price of the FTR, multiplied by the transacted quantity.
  - Sum over all the months remaining in the applicable FTR period and for all cleared FTRs and bilateral trades in the customer account.
- If the resultant value is negative, then add the absolute value to the result from summing all positive months.

- PJM may issue Intra-Auction Collateral Calls based on tentatively cleared auctions
  - Diversification and Mark-to-Auction checks are performed using auction prices from the tentatively cleared auctions
  - PJM issues a collateral call for additional credit as required
  - Participants bids are removed from auction if the collateral call is not satisfied by 4:00 pm the next business day

# Example Calculations

The following slides provide calculation details using example data

# Sample Data - Historical CLMP and Adjusted CLMP

Historic CLMPs												
NODE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
A	\$5	\$9	\$4	\$10	\$15	\$4	\$3	\$2	\$1	\$3	\$9	\$8
B	\$9	\$7	\$11	\$9	\$5	\$6	\$10	\$2	\$10	\$6	\$11	\$2
C	\$10	\$10	-\$1	\$9	\$13	\$4	\$7	\$5	\$9	\$4	\$11	\$10
D	\$0	\$9	\$5	\$6	\$6	\$10	\$3	\$10	\$7	\$3	\$12	\$8
E	\$13	\$2	\$7	\$10	\$11	\$5	\$7	\$7	\$4	\$10	\$7	\$5
F	\$0	\$6	\$11	\$7	\$1	\$5	\$4	\$2	-\$1	\$10	\$13	\$9
G	\$12	\$5	\$15	\$3	\$1	\$4	\$12	\$5	\$11	\$2	\$14	\$5
H	\$10	\$4	\$7	\$5	\$2	\$8	\$2	\$9	\$11	\$5	-\$1	\$8

*Assume On-Peak, Off-Peak, and 24-HR historical LMPs are the same*

Adjusted CLMPs (Monthly, Annual using "Monthly & Annual" tab and Long term using "Long Term" tab in calculator)												
NODE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
A	-\$5	-\$5	-\$5	\$19	\$17	\$17	\$7	\$6	\$1	\$10	\$11	\$7
B	\$1	\$1	\$1	\$11	\$6	\$7	\$4	\$9	\$9	\$3	\$15	\$13
C	\$10	\$10	\$10	\$3	\$11	\$18	\$3	-\$1	\$8	\$7	\$10	\$10
D	-\$5	-\$5	-\$5	\$1	\$8	\$6	-\$1	\$3	\$9	\$3	\$1	-\$2
E	-\$2	-\$2	-\$2	\$11	\$11	\$7	\$5	\$8	\$1	\$10	\$14	\$11
F	\$2	\$2	\$2	\$20	\$0	\$14	\$6	\$2	\$5	\$6	\$13	\$5
G	-\$1	-\$1	-\$1	\$17	\$4	\$3	-\$5	-\$5	\$0	-\$2	\$7	\$15
H	\$0	\$0	\$0	\$7	\$0	\$15	-\$1	\$2	\$9	\$5	\$10	\$2

*Assume On-Peak, Off-Peak, and 24-HR adjusted LMPs are the same*



# Sample Data - OnPeak/OffPeak/24H Class Hours

Period	ALL			YR1			YR2			YR3			YRALL		
	On-Peak Hours	Off-Peak Hours	24-HR Hours	On-Peak Hours	Off-Peak Hours	24-HR Hours	On-Peak Hours	Off-Peak Hours	24-HR Hours	On-Peak Hours	Off-Peak Hours	24-HR Hours	On-Peak Hours	Off-Peak Hours	24-HR Hours
JUN	336	384	720	320	400	720	352	368	720	352	368	720	1024	1136	2160
JUL	336	408	744	352	392	744	368	376	744	336	408	744	1056	1176	2232
AUG	368	376	744	352	392	744	336	408	744	352	392	744	1040	1192	2232
SEP	304	416	720	320	400	720	336	384	720	336	384	720	992	1168	2160
OCT	368	376	744	368	376	744	352	392	744	336	408	744	1056	1176	2232
NOV	336	385	721	320	401	721	320	401	721	336	385	721	976	1187	2163
DEC	320	424	744	336	408	744	352	392	744	368	376	744	1056	1176	2232
JAN	352	392	744	352	392	744	320	424	744	336	408	744	1008	1224	2232
FEB	320	352	672	320	376	696	320	352	672	320	352	672	960	1080	2040
MAR	336	407	743	352	391	743	368	375	743	368	375	743	1088	1141	2229
APR	352	368	720	352	368	720	352	368	720	336	384	720	1040	1120	2160
MAY	352	392	744	320	424	744	320	424	744	336	408	744	976	1256	2232

ALL	4080	4680	8760
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Q1	1040	1168	2208
Q2	1008	1177	2185
Q3	992	1168	2160
Q4	1040	1167	2207

YR1	4064	4720	8784												
YR2				4096	4664	8760									
YR3							4112	4648	8760						
YRALL													12272	14032	26304

Annual Bids									
Auction Open									
FTR ID	Source	Sink	Period	TradeType	Bid MW	HedgeType	ClassType	Bid Price	FTR Cost
1	A	C	All	Buy	1	Obligation	OnPeak	\$1,500	\$1,500
2	B	D	All	Buy	10	Obligation	OnPeak	-\$800	-\$8,000
3	C	E	All	Buy	1	Obligation	OffPeak	\$5,000	\$5,000
4	A	F	All	Buy	1	Option	OnPeak	\$1,000	\$1,000
5	G	H	All	Sell	1	Obligation	24H	\$4,000	-\$4,000

- Calculate Path-Specific Credit Requirement for each FTR for each month
  - Equations are provided in slides 3-5
  - All Historical Values and Adjusted Historical Values will be based on slide 12
  - All class hours will be based on slide 13



# Example FTR Path-Specific Credit Calculation

Calculate  
Monthly  
Path-Specific  
Requirement

$\$1500 * (336/4080) - (1-0.1) * (\$10 - \$5) * 1\text{MW} * 336\text{Hrs}$   
10% discount for volatility

$-\$8000 * 320/4080 - (1+0.1) * (\$7 - \$10) * 10\text{MW} * 320\text{Hrs}$   
10% adder for counterflow bid in which Sink LMP < Source LMP

Monthly Path-Specific Credit Requirements Based on Historical Values

FTR ID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	-\$1,388	-\$179	\$2,159	\$446	\$945	\$124	-\$1,034	-\$821	-\$2,186	-\$179	-\$504	-\$504
2	\$32,605	-\$6,707	\$23,566	\$9,436	-\$4,034	-\$12,755	\$24,013	-\$26,034	\$9,933	\$10,429	-\$3,858	-\$19,698
3	-\$627	\$4,026	-\$2,305	\$70	\$1,229	\$65	\$453	-\$287	\$2,312	-\$1,763	\$2,012	\$2,575
4	\$82	\$82	-\$2,228	\$75	\$90	-\$220	-\$210	\$86	\$78	-\$2,034	-\$1,181	-\$231
5	-\$1,913	-\$1,158	-\$6,887	\$967	\$330	\$2,266	-\$8,524	\$2,339	-\$307	\$1,667	-\$12,209	\$1,669

$(\$1000 * 336/4080 - ((1+0.1) * (\$0 - \$5) * 1\text{MW} * 336\text{Hrs}))$  \$0  
If HedgeType = Option, \$Expected Value is set to zero if Sink LMP < Source LMP

Monthly Path-Specific Credit Requirements Based on Adjusted Historical Values

FTR ID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	-\$4,412	-\$4,412	-\$4,833	\$5,462	\$2,564	-\$179	\$1,526	\$2,840	-\$1,898	\$1,232	\$517	-\$821
2	\$21,517	\$21,517	\$23,566	\$32,844	-\$7,346	\$3,037	\$16,973	\$22,542	-\$627	-\$659	\$53,518	\$57,390
3	\$5,479	\$5,821	\$5,365	-\$2,551	\$402	\$5,070	-\$310	-\$2,756	\$3,086	-\$664	-\$932	\$66
4	-\$2,034	-\$2,034	-\$2,228	-\$199	\$90	\$82	\$78	\$86	-\$1,074	\$82	-\$547	\$86
5	\$319	\$330	\$330	-\$8,249	-\$3,613	\$7,458	\$2,339	\$4,347	\$5,136	\$4,342	\$1,615	-\$10,979

# Example FTR Credit Calculation for Bids

Add  
Individual  
FTR Credit  
Requirement

Auction Open										FTR Requ		
FTR ID	Source	Sink	Period	TradeType	Bid MW	HedgeType	ClassType	Bid Price	FTR Cost			
1	A	C	All	Buy	1	Obligation	OnPeak	\$1,500	\$1,500			
2	B	D	All	Buy	10	Obligation	OnPeak	-\$800	-\$8,000			
3	C	E	All	Buy	1	Obligation	OffPeak	\$5,000	\$5,000			
4	A	F	All	Buy	1	Option	OnPeak	\$1,000	\$1,000			
5	G	H	All	Sell	1	Obligation	24H	\$4,000	-\$4,000			
Monthly Path-Specific Credit Requirement for Open Bids												
FTR ID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	\$0	\$0	\$2,159	\$5,462	\$2,564	\$124	\$1,526	\$2,840	\$0	\$1,232	\$517	\$0
2	\$32,605	\$21,517	\$23,566	\$32,844	\$0	\$3,037	\$24,013	\$22,542	\$9,933	\$10,429	\$53,518	\$57,390
3	\$5,479	\$5,821	\$5,365	\$70	\$1,229	\$5,070	\$453	\$0	\$3,086	\$0	\$2,012	\$2,575
4	\$82	\$82	\$0	\$75	\$90	\$82	\$78	\$86	\$78	\$82	\$0	\$86
5	\$0	\$0	\$0	\$0	\$0	\$2,266	\$0	\$2,339	\$0	\$1,667	\$0	\$0
Monthly	\$38,167	\$27,421	\$31,091	\$38,451	\$3,883	\$10,579	\$26,070	\$27,807	\$13,097	\$13,411	\$56,047	\$60,051

- For each FTR, take the max results between historical and adjusted CLMP
  - Sell FTRs are then multiplied by -1
- Bid credit requirements only sum positive requirements within a month

# Example FTR Credit Calculation for Cleared Positions

Add  
Individual  
FTR Credit  
Requirement

Auction Cleared										FTR Cost Requirement		
FTR ID	Source	Sink	Period	TradeType	Cleared MW	HedgeType	ClassType	Cleared Price	FTR Cost			
1	A	C	All	Buy	1	Obligation	OnPeak	\$1,500	\$1,500			
2	B	D	All	Buy	10	Obligation	OnPeak	-\$800	-\$8,000			
3	C	E	All	Buy	1	Obligation	OffPeak	\$5,000	\$5,000			
4	A	F	All	Buy	1	Option	OnPeak	\$1,000	\$1,000			
5	G	H	All	Sell	1	Obligation	24H	\$4,000	-\$4,000			
Monthly Path-Specific Credit Requirement for Cleared FTRs												
FTR ID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	-\$1,388	-\$179	\$2,159	\$5,462	\$2,564	\$124	\$1,526	\$2,840	-\$1,898	\$1,232	\$517	-\$504
2	\$32,605	\$21,517	\$23,566	\$32,844	-\$4,034	\$3,037	\$24,013	\$22,542	\$9,933	\$10,429	\$53,518	\$57,390
3	\$5,479	\$5,821	\$5,365	\$70	\$1,229	\$5,070	\$453	-\$287	\$3,086	-\$664	\$2,012	\$2,575
4	\$82	\$82	-\$2,228	\$75	\$90	\$82	\$78	\$86	\$78	\$82	-\$547	\$86
5	-\$1,913	-\$1,158	-\$6,887	-\$8,249	-\$3,613	\$2,266	-\$8,524	\$2,339	-\$307	\$1,667	-\$12,209	-\$10,979
Monthly	\$34,865	\$26,084	\$21,976	\$30,202	-\$3,764	\$10,579	\$17,546	\$27,520	\$10,892	\$12,747	\$43,291	\$48,568

- For each FTR, take the max results between historical and adjusted LMP
  - Sell FTRs are then multiplied by -1
- Cleared credit requirements sum both positive and negative requirements within a month

- Additional Credit Requirements for Undiversified Portfolios
  - For portfolios that are FTR Flow Undiversified in a month, the FTR Credit Requirement will be increased by an amount equal to three times the absolute value of the FTR Portfolio Auction Value in that month, including the tentative cleared solution.
  - Monthly Undiversified Adder values are available by Account in FTR Center on the Credit→Detail Screen under the “Undiversified” Credit Type filter. These values are updated in FTR Center after each auction is cleared and the auction results are released.
  - The Monthly Undiversified value is added to monthly path-specific totals

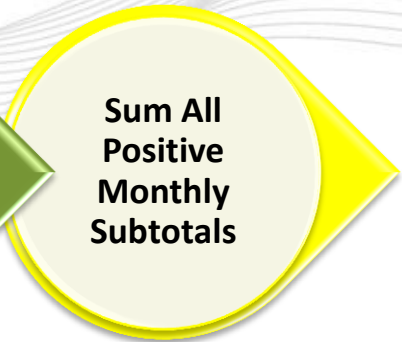


- If the monthly Path-Specific Credit Requirement with undiversified adder is less than the monthly per-MWh Minimum, the credit requirement for the month will be set equal to the monthly per-MWh minimum value (per-MWh for

per-MWh for bids																		
FTR ID	Source	Sink	Period	TradeType	Bid MW	ClassType	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	A	C	All	Buy	1	OnPeak	33.6	33.6	36.8	30.4	36.8	33.6	32	35.2	32	33.6	35.2	35.2
2	B	D	All	Buy	10	OnPeak	336	336	368	304	368	336	320	352	320	336	352	352
3	C	E	All	Buy	1	OffPeak	38.4	40.8	37.6	41.6	37.6	38.5	42.4	39.2	35.2	40.7	36.8	39.2
4	A	F	All	Buy	1	OnPeak	33.6	33.6	36.8	30.4	36.8	33.6	32	35.2	32	33.6	35.2	35.2
5	G	H	All	Sell	1	24H	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Total							441.6	444	479.2	406.4	479.2	441.7	426.4	461.6	419.2	443.9	459.2	461.6
per-MWh for cleared FTR																		
FTR ID	Source	Sink	Period	TradeType	Cleared MW	ClassType	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1	A	C	All	Buy	1	OnPeak	33.6	33.6	36.8	30.4	36.8	33.6	32	35.2	32	33.6	35.2	35.2
2	B	D	All	Buy	10	OnPeak	336	336	368	304	368	336	320	352	320	336	352	352
3	C	E	All	Buy	1	OffPeak	38.4	40.8	37.6	41.6	37.6	38.5	42.4	39.2	35.2	40.7	36.8	39.2
4	A	F	All	Buy	1	OnPeak	33.6	33.6	36.8	30.4	36.8	33.6	32	35.2	32	33.6	35.2	35.2
5	G	H	All	Sell	1	24H	-72	-74.4	-74.4	-72	-74.4	-72.1	-74.4	-74.4	-67.2	-74.3	-72	-74.4
Monthly Total							369.6	369.6	404.8	334.4	404.8	369.6	352	387.2	352	369.6	387.2	387.2

A green arrow pointing right, containing the text "Subtract ARR Credits in Account".

Subtract ARR  
Credits in  
Account

A yellow arrow pointing right, containing the text "Sum All Positive Monthly Subtotals".

Sum All  
Positive  
Monthly  
Subtotals

- Any applicable ARR Credits are then subtracted from the monthly credit requirements
  - Negative ARR Credits may result in a credit requirement
- All positive monthly subtotals are then summed to determine the credit requirement for the portfolio

- To calculate the Mark-to-Auction Value
  - Use the most recently available cleared auction price applicable to the FTR minus the original transaction price of the FTR, multiplied by the transacted quantity.
  - Sum over all the months remaining in the applicable FTR period and for all cleared FTRs and bilateral trades in the customer account.
- If the resultant value is negative, then add the absolute value to the result from summing all positive months.
- Mark-to-Auction re-evaluation based on tentatively cleared auction prices may result in an intra-auction collateral call



# Bid Credit Requirements for Same-Path FTRs

- Calculates the highest possible credit requirement for bids placed on the same path
- For each set of same-path bids, the credit requirement for each possible outcome is determined and the outcome which produces the highest credit requirement is used to determine the bid credit requirement for the set of same-path bids
- The price which is determined to cause the highest potential credit requirement will be used for all bids at or above price for buy bids and at or below price for sell offers
- All same-path buy bids will be subject to 10¢ per-MWh requirements

## Example of Credit calculation for same characteristic bids

FTRID	SOURCE	SINK	PERIOD	CLASS	HEDGE	TRADE	MW	PRICE
1	A	B	ALL	24H	Obligation	Buy	5	4
2	A	B	ALL	24H	Obligation	Buy	5	2
3	A	B	ALL	24H	Obligation	Buy	150	500
4	A	B	ALL	24H	Obligation	Buy	500	300

### Credit Requirements – Individual

FTRID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Total
1	\$5,189	\$1,516	-\$969	\$5,189	\$6,672	\$4,516	\$24,554	\$10,150	\$7,763	\$2,048	\$4,437	\$7,367	\$79,400
2	\$5,188	\$1,515	-\$970	\$5,188	\$6,671	\$4,515	\$24,553	\$10,149	\$7,762	\$2,047	\$4,436	\$7,366	\$79,391
3	\$161,792	\$51,791	-\$22,758	\$161,792	\$206,469	\$141,596	\$742,930	\$310,815	\$238,601	\$67,750	\$139,220	\$227,338	\$2,450,095
4	\$531,089	\$164,144	-\$84,352	\$531,089	\$679,736	\$463,769	\$2,467,940	\$1,027,556	\$787,667	\$217,340	\$455,849	\$749,300	\$8,075,476

**Total= \$10,684,363**

### Credit Requirements – Same Path

FTRID	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Total
3	\$159,327	\$49,243	-\$25,306	\$159,327	\$203,921	\$139,131	\$740,382	\$308,267	\$236,300	\$65,202	\$136,755	\$224,790	\$2,422,643
4	\$531,089	\$164,144	-\$84,352	\$531,089	\$679,736	\$463,769	\$2,467,940	\$1,027,556	\$787,667	\$217,340	\$455,849	\$749,300	\$8,075,476
1													
2													

**Total= \$10,498,119**

*Highest possible credit requirement is at the \$300 price so this price is used to determine credit requirement for all bids above \$300*