Luminant

Draft for Discussion Purposes

Annual CRR Auction Proposed NPRR Discussion Points

May 25, 2011

Key Objective of NPRR Proposal is to Allow All Market Participants to Better Manage Congestion Risk

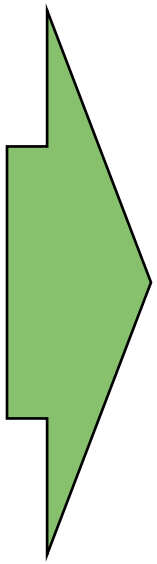
Objectives

1) **Increase number of opportunities to hedge risk**

2) **Increase market liquidity and price transparency in an orderly fashion**

3) **Appropriately size collateral requirements associated with hedging congestion risk**

4) **Limit the likelihood that a CRR position already taken by a market participant prompts the party to stand in the way of future low / no cost transmission solutions**



How Achieved….

- **Implement rolling auctions**
  - Will provide a number of opportunities to hedge risk for any given period
  - Provides multiple price signals
  - Incremental capacity for each delivery period released in each auction - ensures grid is not oversold in forward periods

- **Use market signals vs. historical data to calculate collateral requirements**
  - Appropriately sizing collateral requirements to account for credit risk should enable a more active market

Increasing the number of opportunities available to hedge congestion risk for any given period will not only provide a more liquid congestion market, but also provide market based signals from which to calculate collateral requirements

Three Key Elements to Proposed NPRR

1. **Implement rolling auction no later than 3/31/12, however conduct a one-time annual auction in November with some modifications to the current protocol**

2. **Once rolling auction is implemented there will be no change to the way the delivery month and prompt month are currently collateralized**

3. **Forward months will be collateralized based on mark to market exposure plus initial margin adder**

Given the System and Time Constraints for Implementation of a Rolling Auction, a Modified Annual Auction Is Proposed

The following modifications are proposed to the currently planned annual auction:

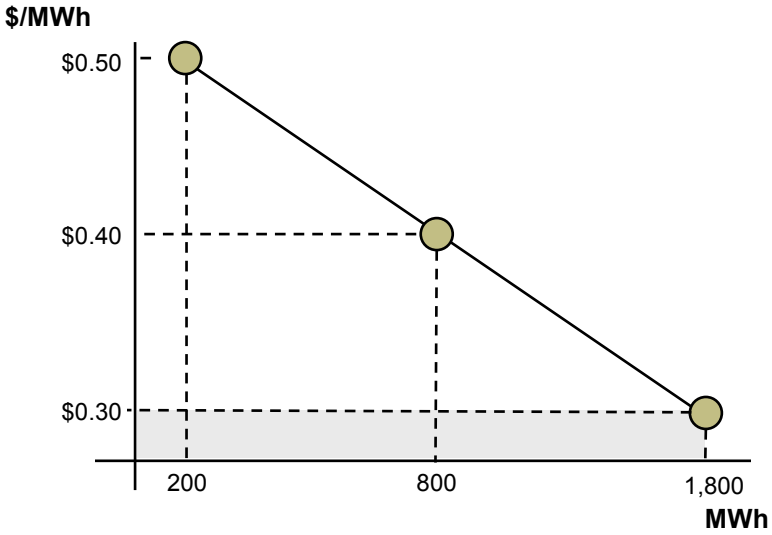
- **Modify pre-auction collateral requirements such that maximum exposure is collateralized, not the sum of all bids (methodology would carry forward to rolling auction)**
  - Would likely represent a relatively large decrease in pre-auction collateral requirements for those market participants who submit auction requirements based on a bid curve (see next slide for an example)

- **Eliminate second year of auction and reduce capacity auctioned in year one from 55% each month to 20%**
  - Would ensure that a meaningful amount of capacity would still be available for rolling auction while allowing for forward market hedging
  - Would be consistent with objective of ensuring that no significant forward positions are taken by any one market participant

- **A key consideration when evaluating whether to have a one-time annual auction before the rolling auction is that two different methodologies for settlement and collateralization will be in place for the same delivery months**

Current Pre Auction Collateral Requirements Overstate Maximum Credit Exposure

Example: Collateral Requirements of a Single Path (assuming same tenor and product type)



	Bid Volume (MWh)	Bid Price ($/MWh)	Current Collateral Requirement ($)	Collateral Requirement if All Bids Clear at Lowest Bid of $0.30/MWh ($)
Bid 1	200	$0.50	$100	$60
Bid 2	600	$0.40	$240	$180
Bid 3	1,000	$0.30	$300	$300
Total	**1,800**		**$640**	**$540**

- Current protocol requires that pre-auction bids be collateralized at the sum of all bids
  - Equal to $640 in the example
- This methodology will overstate maximum credit exposure when multiple bids are submitted for the same path (assuming same tenor and product type)
- For bids such as these the actual maximum credit exposure would be equal to the sum of all volumes multiplied by the lowest bid price
  - Equal to $540 in the example (shaded area on chart)

The maximum credit exposure under the above bidding scenario is $540, vs. the current protocol requirements of $640

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Current Methodology For Collateralizing Prompt and Delivery Months Will Remain in Place for the Rolling Auction

- **Once rolling auction is implemented there will be no change to the way the delivery month and prompt month are currently collateralized**
  - Prompt month collateralized at full notional value plus $0.75/MWh adder to account for potential risk between invoice price and settlement
  - Once invoice is paid, the delivery month collateral requirements based on risk between invoice price and day ahead settlement

- **The following is proposed for defining "prompt month" and "delivery month"**
  - Prompt Month represents the delivery month that immediately follows the month the auction takes place e.g. January is the prompt month for the auction that takes place in December
  - A forward month will become a prompt month at the time of credit lock minus 5 days e.g. February will become the prompt month 5 days before the credit lock in the January auction
    - *Rationale is that in the event of default, there is still an opportunity to auction CRR volumes at the next auction up until there is an operational limitation (note - 5 days is an estimate)*
  - The prompt month becomes the delivery month as soon as the invoice is paid through to the final day of settlement e.g. when volumes awarded for the January delivery month in the December auction are paid, January becomes the delivery month until the last day of January.
    - *Will result in an overlap of delivery months e.g. February invoice will be paid in January*

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Key Principal of Proposed Methodology is That Forward Months Have Value That Can Be Realized Via Subsequent Auctions

	Description
Fwd Mths Credit Risk	• Willingness of a market participant to fulfill obligation if awarded CRR becomes "out of the money"
Current Collateral Requirements	• Pre-auction requirements of full notional value of sum of all forward month bids/offers ***plus*** a $0.75/MWh adder • Post-auction requirements of full notional value of all forward months based on awarded volumes and cleared prices • Pre-payment of the notional value of all awarded forward volumes ***plus*** future potential exposure based on average weighted historical DAM prices
Considerations	• In the event of market participant default, forward month CRR's still has value as can be re-sold in subsequent auctions • Historical DAM prices are not a good indicator of forward month CRR prices
Proposed Collateral Requirements	• Collateralize for mark to market exposure equal to difference between invoice price and new auction clearing price for that particular CRR instrument if "out of the money" – *CRR account holders will be able to net in the money positions with out of the money positions for both intra month and inter month positions* • In addition an initial margin adder will be applied to all forward volumes and will be equal to – *Risk of price move between auctions* – *Risk of change to grid between auctions (State change)* • Settlement of invoice to occur in month before delivery at the same time auction invoice is paid – *More closely matches up CRR revenues and expenditures*

Example – Timeline of Collateral Requirements

					Jan	Feb	Mar	Apr → Mth 12
December	Pre-Auction Activities	Credit Lock Collateral	Bid Volume	MWh	1,000	800	500	-
			Bid Price	$/MWh	$ 3.50	$ 3.50	$ 3.50	$ -
			Collateral Adder	$/MWh	$ 0.75	$ 0.50	$ 0.50	
			Total Collateral	**$**	**4,250**	**400**	**250**	**-**
	Auction		***Clearing Price***	***$/MWh***	***$ 3.00***	***$ 3.00***	***$ 3.00***	***$ 3.00***
	Post Auction Collateral	Awarded CRR Collateral	Awarded Volume	MWh	1,000	800	500	-
			Awarded Price	$/MWh	$ 3.00	$ 3.00	$ 3.00	$ -
			Collateral Adder	$/MWh	$ 0.70	$ 0.50	$ 0.50	
			Total Collateral	**$**	**$ 3,700**	**400**	**250**	**-**
	Settlement		**Invoice Payment**	**$**	**$ 3,000**	**$ -**	**$ -**	**$ -**
	Intra Auction Collateral		Awarded Volume	MWh	1,000	800	500	
			Collateral Adder	$/MWh	$ 0.70	$ 0.50	$ 0.50	
			Total Collateral	**$**	**700**	**400**	**250**	**-**
January	Pre-Auction Activities	Dec Collateral Requirements	DAM Risk Collateral	$	$ 350	$ -	$ -	$ -
			Prompt Mth Collateral	$	$ -	$ 3,000	$ -	$ -
			Fwd Mth Collateral	$	$ -	$ -	$ 250	$ -
			Total Collateral		**$ 350**	**$ 3,000**	**$ 250**	**$ -**
		Jan Credit Lock Collateral	Bid Volume	MWh	-	200	100	50
			Bid Price	$/MWh	$ -	$ 3.00	$ 3.00	$ 3.00
			Collateral Adder	$/MWh	$ -	$ 0.75	$ 0.50	$ 0.50
			Total Collateral	**$**	**-**	**750**	**50**	**25**
			Total Collateral	**$**	**$ 350**	**$ 3,750**	**$ 300**	**$ 25**
	Auction		***Clearing Price***	***$/MWh***		***$ 2.75***	***$ 2.75***	***$ 2.75***
	Post Auction Collateral	Dec Collateral Requirements	Notional Collateral	$		$ 2,960	$ -	$ -
			Fwd Collateral	$			$ 250	$ -
			MtM Exposure	$		$ -	$ 125	$ -
			Total	$		**$ 2,960**	**$ 375**	**$ -**
		Jan - Awarded CRR Collateral	Awarded Volume	MWh		200	100	50
			Awarded Price	$/MWh		$ 2.75	$ 2.75	$ 2.75
			Collateral Adder	$/MWh		$ 0.70	$ 0.50	$ 0.50
			Total	**$**		**690**	**325**	**163**
			Total Collateral	**$**		**3,650**	**700**	**163**
	Settlement		Dec Activity Invoice	$		$ 2,400	$ -	$ -
			Jan Activity Invoice	$		$ 550	$ -	$ -
			Total	**$**		**$ 2,950**	**$ -**	**$ -**
	Intra Auction Collateral		Awarded Volume	MWh		1,000	900	550
			Collateral Adder	$/MWh		$ 0.70	$ 0.50	$ 0.50
			Total Collateral	**$**		**$ 700**	**$ 450**	**$ 275**

$ 0.70	Weighted DAM Risk Adder
$ 0.75	Pre-Auction Prompt Mth Adder
$ 0.50	Fwd Mth Adder

- Prompt month fully collateralized at bid price plus prompt mth adder as no further opportunity to run auction
- Forward adder ("Initial Margin") used to collateralize forward month bids

- Prompt month fully collateralized at awarded price plus adder to reflect DAM market settlement risk
- Continue to post Initial Margin for forward months to mitigate risk of intra-month price change

- Settlement of prompt month only

- In period between auctions continue to post collateral in prompt month to reflect DAM settlement risk – volume starts rolling off in delivery month
- Forward months continue to be collateralized at Initial Margin adder

- Continue to post collateral in delivery month to reflect DAM settlement risk – example assumes 50% of mth rolled off
- Awarded volumes for Feb in Dec auction now become prompt month and are collateralized at notional value plus prompt mth adder
- Mar volumes continue to be collateralized by Initial Margin

- Incremental capacity released for Jan auction - pre-auction bids/offers are collateralized in the same way as in Dec auction

- Prompt mth (Feb) now collateralized at awarded price plus adder to reflect DAM market settlement risk
- New clearing price for Mar means that Mar volumes awarded in Dec are now $0.50/MWh out of the money. Therefore additional collateral is needed for this exposure

- Settlement of Feb awarded volumes in both the Dec, and Jan auctions

- In period between auctions continue to post collateral in prompt month to reflect DAM settlement risk – volume starts rolling off in delivery month
- Forward months continue to be collateralized at Initial Margin adder

Example: Event of Default

Event			
Dec '11 CRR Auction	Awarded Jul '12 CRR Volume	MWh	1,000
	Awarded Jul '12 CRR Price	$/MWh	$ 3.00
	Fwd Mth Initial Margin Adder	$/MWh	$ 0.50
	July '12 CRR Collateral Requirement	$	$ 500
	Expected CRR Revenue to Load	$	$ 3,000
Jan '12 CRR Auction	Awarded Jul '12 CRR Volume	MWh	1,000
	Awarded Jul '12 CRR Price	$/MWh	$ 3.00
	New Auction Clearing Price for Jul '12	$/MWh	$ 2.75
	Jul '12 Mark to Market Exposure	$	$ (250)
	Revised July '12 CRR Collateral Requirement	$	$ 750
	Expected CRR Revenue to Load	$	$ 3,000
Mkt Participant Defaults	Collateral Previously Collected	$	$ 500
	Collateral Exposure	$	$ 250
Jan '12 CRR Auction	Volume Available for re-auction	MWh	1,000
	New Auction Clearing Price for Jul '12	$/MWh	$ 2.60
	Expected CRR Revenue to Load	$	$ 3,000
	Revenue collected from re-auctioned volume	$	$ 2,600
	Collateral collected from defaulting party	$	$ 500
	Uplift cost to ERCOT participants		$ -

- Initial Margin represents both price and state change risk between auction periods
- Represents expected revenue to load from auction for the 1,000 MWh awarded
- New auction clearing price of $2.75/MWh means previously awarded CRR is out of the money, therefore has to post an additional $250 of collateral
- If market participant defaults at this stage, ERCOT would have $500 of collateral with $250 still owed
- Original volumes now available for auction again
- New auction price means that load still needs $400 to be made whole
- Original $500 initial margin collected makes up difference such that no uplift cost to market

To the extent that initial margin adder does not cover price movement between auction, potential uplift risk will exist

Potential Methodology for Calculating Initial Margin

	Description	Considerations
Parallel Shift	• Uses a Z-score, current monthly price, and historical volatility terms structure to estimate potential worst case price movement across all tenors	• Relatively simple to implement • Assumes normal distribution of prices • Not suitable for options • Assumes independence among risk factors
Delta-Normal	• Uses a correlation matrix of risk factors to arrive at a worst case price scenario	• Relatively simple to implement • Assumes normal distribution of prices • Not suitable for options • Allows for relationships between risk factors
Historical Simulations	• Utilizes historical price returns to calculate the risk of a current portfolio	• Relatively simple to implement • Takes into account non normal distributions as well as options • Allows for relationships between risk factors • Historical returns not necessarily indicative of future market conditions
Monte Carlo Based Simulations	• Parameterizes the risk factors of a portfolio in order to simulate price paths in an attempt to estimate the potential worst case price movement of a portfolio	• More statistically robust methodology • Takes into account non normal distributions as well as options • Allows for relationships between risk factors • More complex to implement

While a robust methodology for calculating initial margin is preferred, an interim solution that allows for estimated initial margins may be used in the short-term

Potential Sources for Price Volatility In Order to Calculate Initial Margin (excludes State Change component)

Considerations

CRR Auction Price

- Preferred solution but would take a minimum of 3 years before enough data exists in order to calculate a robust initial margin

Forward Prices

- Forward market prices should reflect latest view of forward CRR value
- Forward market only typically trades for Hub and Zone
  - Zone market is still relatively illiquid
- Publicly available information via broker quotes

DAM Prices

- Provides multiple price observations
- Day ahead prices not necessarily representative of forward market

Model Generated Prices

- Use model based scenarios to determine price volatility

Interim solution before sufficient price data exists is likely to involve a combination of various price inputs

APPENDIX

Credit Calculations – Pre Auction Collateralisation

$$CE_{c,a} = [\, CEOBLBID_{o,a} + CEOPTBID_{o,a} + CEOBLOFFER_{o,a} + CEOPTOFFER_{o,a} \,]$$

Where:

$$CEOBLBID_o = [[\, Max[\, 0 , Min[\, P_{bid}, MCEP_{(j,k),c,t,d,z} \,]] + A_{(j,k),t,d}] * QOBLB_{(j,k),o,t,d} \,] + FA_{(j,k),t,d} * QFDOBLB_{(j,k),o,t,d}$$

$$CEOPTBID_o = [Max[\, 0 , Min[\, P_{bid},, MCEP_{(j,k),c,t,d,z} \,]] * QOPTB_{(j,k),o,t,d}] + FA_{(j,k),t,d} * QFDOPTB_{(j,k),o,t,d}$$

$$CEOBLOFFER_o = [-1 * Min[\, 0 , Min[\, P_{offer}, MCEP_{(j,k),c,t,d,z} \,]] * QOBLO_{(j,k),o,t}] + [-1 * FA_{(j,k),t,d} * QFDOBLO_{(j,k),o,t,d} \,]$$

$$CEOPTOFFER_o = [-1 * Min[\, 0 , Min[\, P_{offer}, MCEP_{(j,k),c,t,d,z} \,]] * QOPTO_{(j,k),o,t}] + [-1 * FA_{(j,k),t,d} * QFDOPTO_{(j,k),o,t,d} \,]$$

- **Prompt Month Obligation Bid** (P + A)* Q + **Forward Obligation Bid** A * Q, where P is the maximum of the bid price and a price that derives the max exposure for a given bid curve, similar to the logic being used in DAM
- **Prompt Month Option Bid** P * Q + **Forward Option Bid** A * Q, where P is the maximum of the bid price and a price that derives the max exposure for a given bid curve
- **Prompt Month Obligation Offer** P * Q + **Forward Obligation Offer** A * Q, where P is the absolute of offer price and a price that derives the max exposure for a given offer curve
- **Prompt Month Option Offer** P * Q + **Forward Option Offer** A * Q, where P is the absolute of offer price and a price that derives the max exposure for a given offer curve
- **Please note that A and FA are path specific adders that will mitigate the risk of price movement between auctions**

Credit Calculations – Future Credit Exposure

$$FCE_{o} = FCEOBL_{o} + FCEOPT_{o} + FCRFGR_{o} - Max[0, FDAR_{o}]$$

Where Prompt Month FCE =

$$FMMOBL_{o} = Max[ACPEOBL_{h,(j,k),o,p}, -FMMOBL_{o,p,h,(j,k)}]$$

+

Where Forward Months FCE =

$$INTMOBL_{o} = (INTM_{h,(j,k)} * OBLMW_{o,h,(j,k)}) +$$

$$FMMOBL_{o} = [(ACP_{h,(j,k)} - OBLPR_{(j,k),a}) * OBLMW_{o,h,(j,k)}]$$

- This formula calculates FCE for prompt month as per current protocols to capture the risk of the CRR – DAM price movement; forward months are collateralized by the sum of a path specific initial margin multiplied by awarded quantity and the difference between original awarded CRR ACP and most recent market clearing price, multiplied by awarded quantity
- The latter part of equation captures the MTM movement by specific source sink pairing of a CRR