Suggested Modifications to the Minimum and Mark-to-Market Credit Proposals

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Credit should be proportional to maximum expected loss

- The purpose of credit is to cover losses in case of an adverse outcome
- This loss can be represented by Value at Risk (VaR), which is the greatest possible loss in 95% of outcomes
- Value at Risk is given by $VaR = 1.64 * \sigma_p * \mathrm{V}$ where V is portfolio volume and σ_p is portfolio volatility
- So total credit for a portfolio is influenced by 1) volume of the portfolio and 2) portfolio's volatility

Background: There is no relationship between volatility and portfolio volume

- A tiered approach to minimum credit rates based on portfolio volume suggests that larger portfolios are more "diversified" and have lower risk per MWh than smaller portfolios
- Portfolio volatility is given by $\sigma_p = \sqrt{w^T \Omega w}$

where σ_p is portfolio volatility, Ω is variance-covariance matrix (individual path volatility and inter-path correlation), w is relative weights, and w^T is w transposed

- Since there is no volume factor, the marginal risk per MWh of an FTR portfolio is independent of volume
- **Therefore, larger portfolios should not receive lower minimum credit per MWh based on volume alone**

Examples of larger portfolios having higher expected loss per MWh

Variance-covariance matrix for 5 paths:

Path	Volatility
A	2.4727
B	8.5647
C	11.0657
D	0.1562
E	0.0089

Variance-covariance

6.1140	16.7978	-7.8692	-0.2837	-0.0120
16.7978	73.3537	-41.4122	-1.0781	-0.0529
-7.8692	-41.4122	122.4504	1.2283	0.0745
-0.2837	-1.0781	1.2283	0.0244	0.0010
-0.0120	-0.0529	0.0745	0.0010	0.0001

Example 1: Larger portfolio on few paths vs. small portfolio on more paths

	Volume	
Path	Portfolio 1	Portfolio 2
A	500	10
B	500	10
C	0	10
D	0	10
E	0	10
Portfolio volatility	5.32	2.34
95% VaR:	$8,719.16	$191.77
VaR/MWh:	$8.72	$3.84

Example 2: Larger portfolio on more paths vs. small portfolio on few paths

	Volume	
Path	Portfolio 3	Portfolio 4
A	500	0
B	500	0
C	500	0
D	500	10
E	500	10
Portfolio volatility	2.34	0.08
95% VaR:	$9,588.38	$2.67
VaR/MWh:	$3.84	$0.13

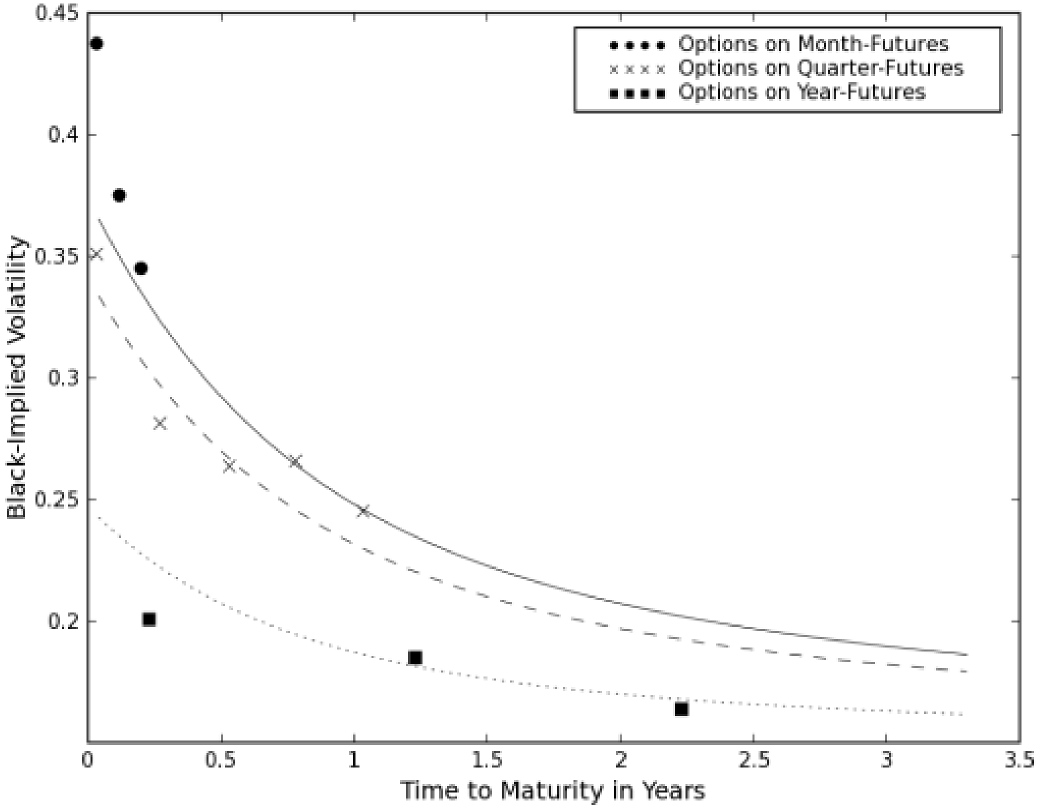
Suggestion: Set minimum credit $/MWh by path based on individual path volatility

- The previous example also demonstrated that individual path volatility has a significant impact on portfolio risk

Volatility bucket	Credit rate ($/MWh)
x < 0.50	$0.01
0.50 < x < 5	$0.10
x > 5	$0.25

- This is easily implemented on a path-by-path basis, similarly to the reference price calculation, by taking the standard deviation of the average monthly MCC spreads
- Alternatively, downside deviation could be used in place of standard deviation to quantify the adverse risk without penalizing positive jumps

Background: Volatility is not constant in time



- The volatility of MCPs for long-term FTRs is low compared to the volatility for prompt month FTRs
- Volatility increases because as the delivery month approaches, more information (e.g. outage and weather forecasts) is available that may cause price fluctuations
- Since volatility is lower for back-month FTRs delivered far in the future, the minimum $/MWh rate should be lower initially and should increase as the delivery month approaches

Chart from http://www.uni-ulm.de/fileadmin/website_uni_ulm/mawi.inst.050/people/kiesel/publications/articleresubmitv1008.pdf

Suggestion: Tier Minimum $/MWh with respect to time to delivery

	Months to term			
	Prompt	2-3mos	4-11mos	12+ mos
Min $/MWh	$0.25	$0.15	$0.05	$0.01

Note: Proposed tiers are placeholder suggestions

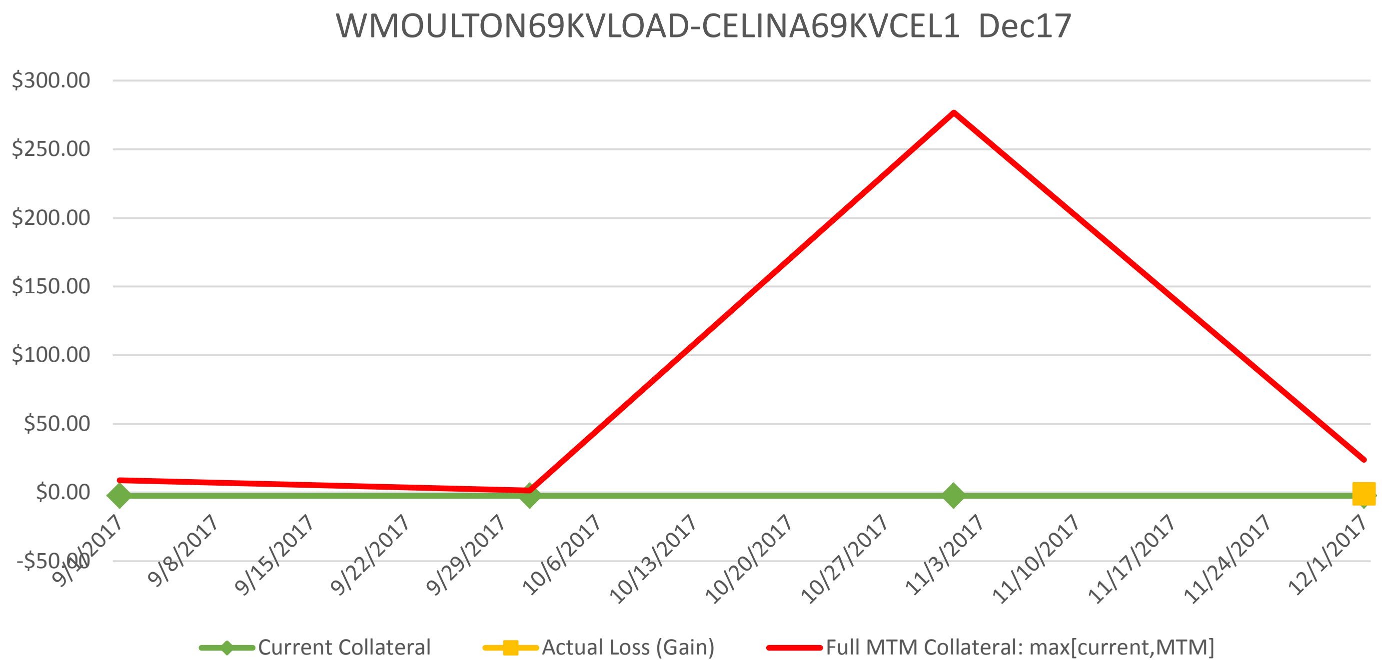
	FTR Term				PY18-19													
	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May19	PY19-20	PY20-21	PY21-22
Auction Mar-18	0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Apr-18		0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
Annual		0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01
May-18			0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01
Jun-18				0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01
LT					0.50	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01

Benefits:

- Allocates credit based on level of risk
- Mechanics for monthly recalculation of minimum credit could be identical to that for yearly reference price update
- Simple to calculate, since portfolio-months are already calculated independently

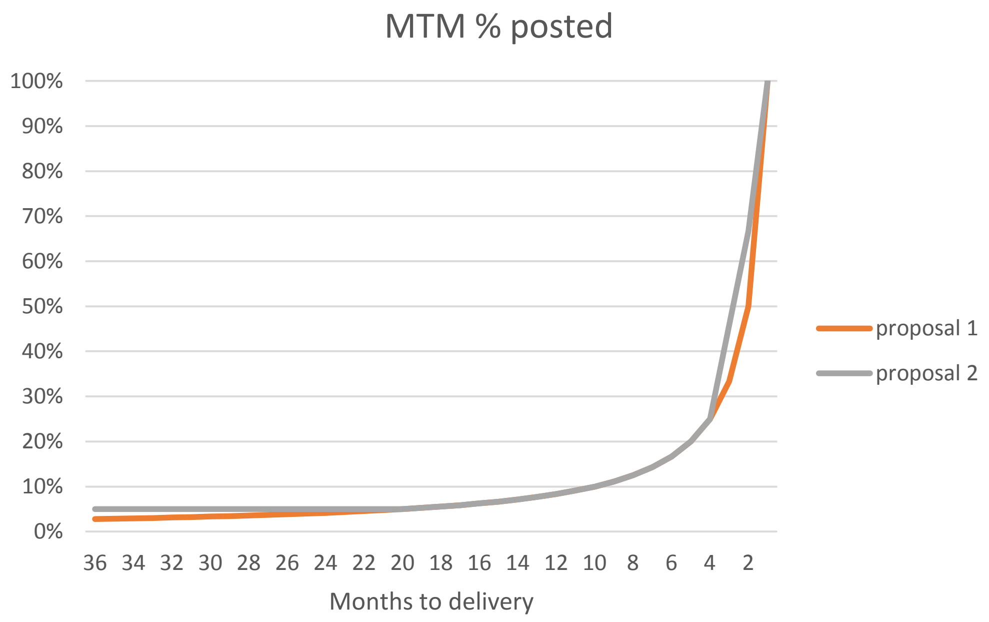
Challenges with the Mark-to-Market concept

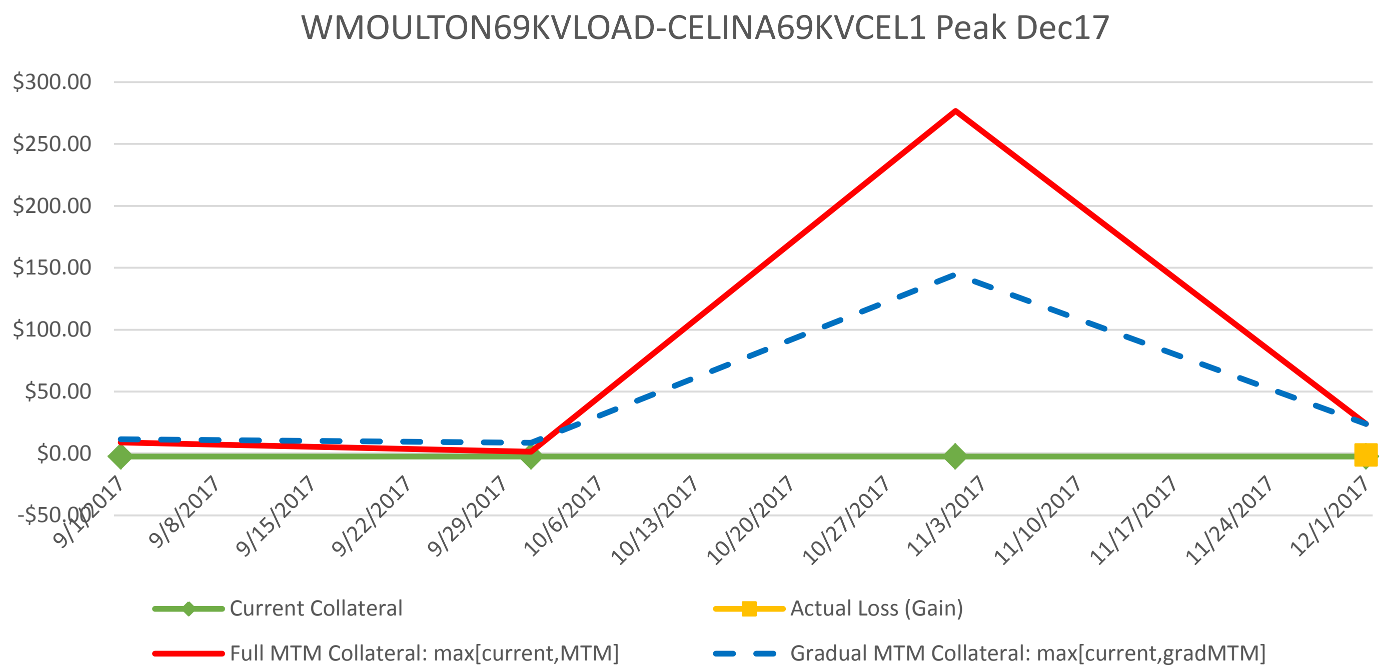
- Auctions are held once a month yielding little visibility into the fair market price and offer infrequent opportunities to correct price swings
- Other markets employing mark-to-market to calculate collateral are continuously traded where price anomalies are traded back to the fair price in a short period of time
- Mark-to-Market will cause regular (potentially large) fluctuations in credit requirement



Suggestion: Apply gradual mark-to-market approach

- Leverages the fact that participants have more information to accurately forecast congestion in the prompt month than in earlier months
- Reduces the $ amount and frequency of collateral calls





Another example