

# Regulation Market Issues

RMDSTF

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Monitoring Analytics

# Current Design

- **Incorrectly defined marginal benefit factor function (MBF/MRTS)**
  - Current MBF does not maintain defined RegA/RegD proportions
- **Incorrectly applying the MBF/MRTS in the optimization**
  - Incorrectly calculating effective MW contribution of RegD
- **The current optimization engine does not provide the optimal mix of resources when considering resources with dual offers.**

# Current Design

- **MBF/MRTS not consistently used in pricing and settlement**
- **Assumes MBF/MRTS in price but not settlement**
- **Mileage ratio instead of MBF/MRTS**
  - **The mileage ratio used in settlement does not provide a measure of relative work provided and results in the incorrect payment of RegD.**
  - **Price spikes and “infinite” mileage ratio issues.**

# Effect of Current Design

- **LOC used in clearing and in setting price is not correctly determined**
  - **LOC based on lower of energy or price offer, rather than actual operative energy offer, causes LOC to be incorrect.**
  - **Actual energy offer should be used to determine LOC.**
  - **LOC based on desired amount of MW output at LMP relative to regulation set point can exceed the physical limitations of the unit's ability to ramp.**

# Effect of Current Design

- **Clearing price used in settlements should reflect the within hour actual performance score of the marginal resource, not the historic score.**
  - **Current construct results in clearing price  $\leftrightarrow$  marginal resource offer**

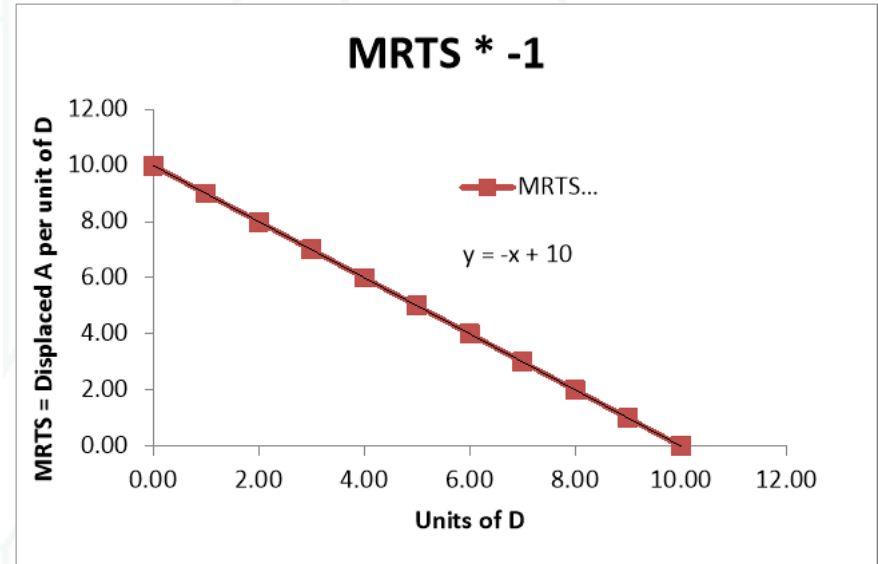
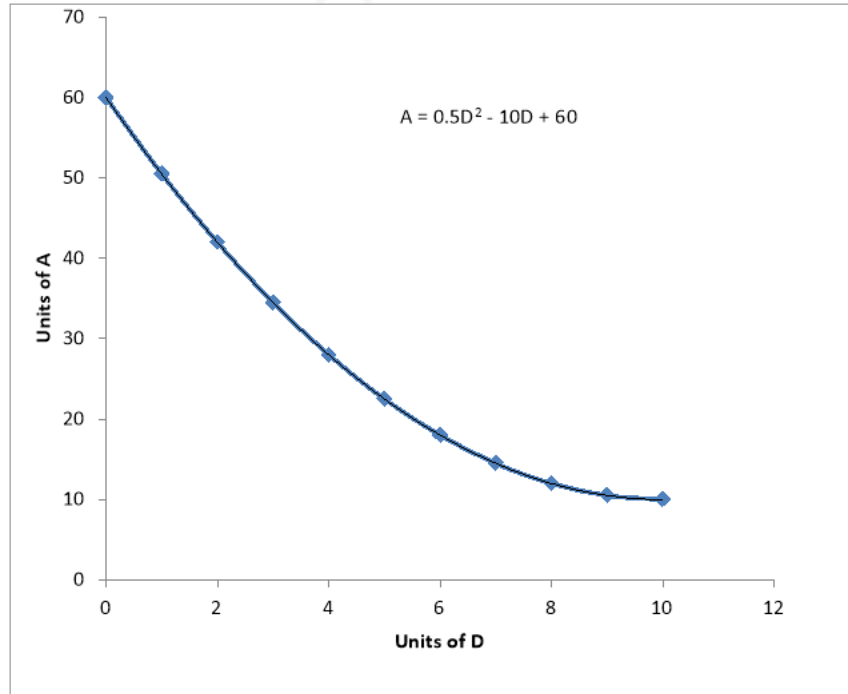
# Effect of Current Design

- **The performance score should reflect the ability to productively follow the signal.**
  - **The performance score should penalize the inability to provide full cleared capability MW.**
  - **The performance score should penalize regulation mid-hour dropouts.**

# Effect of Current Design

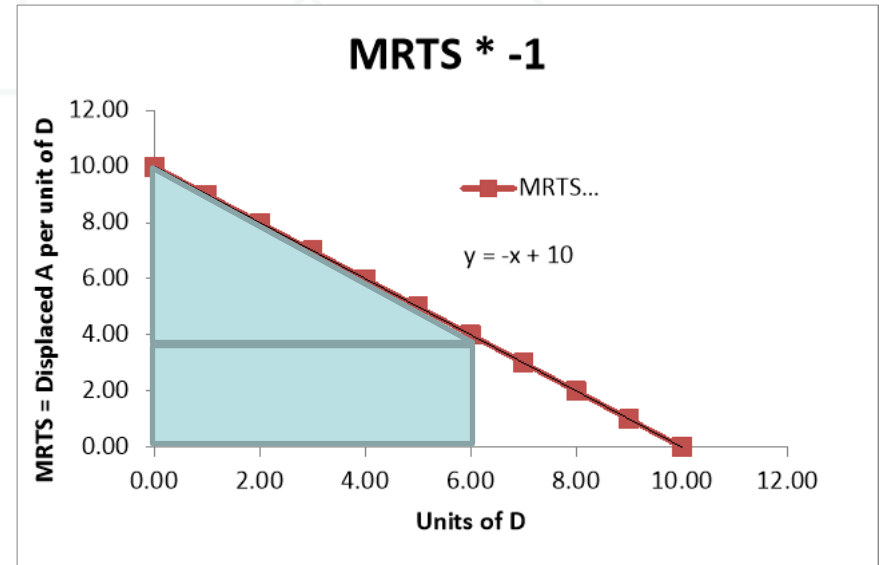
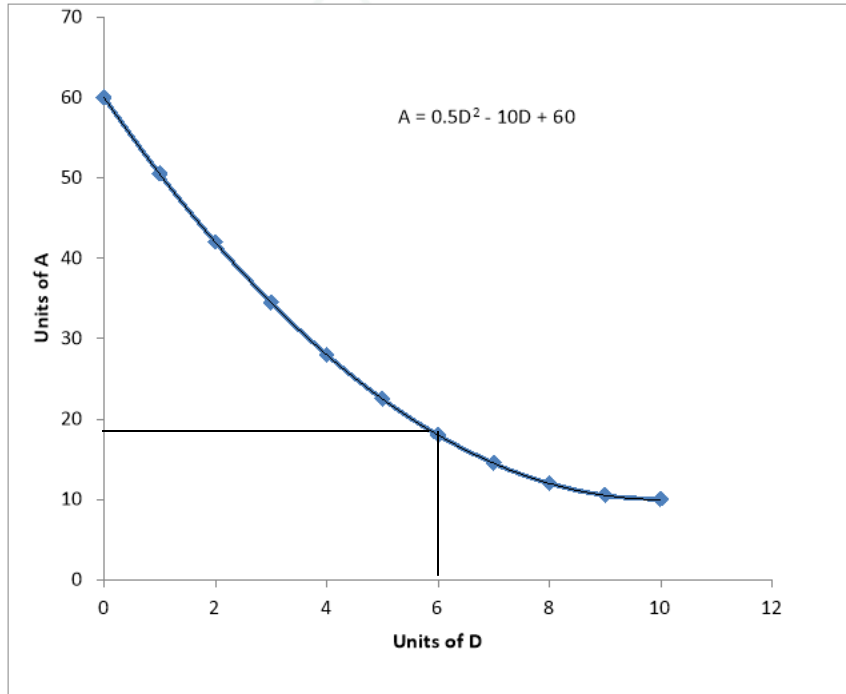
- **Purchasing too much RegD in many hours**
  - **Negatively affecting the provision of regulation and reliability**
  - **Procuring too little RegA**
  - **Incorrect compensation**
  - **Incorrect market incentives**

# Microeconomics: Isoquant and MRTS



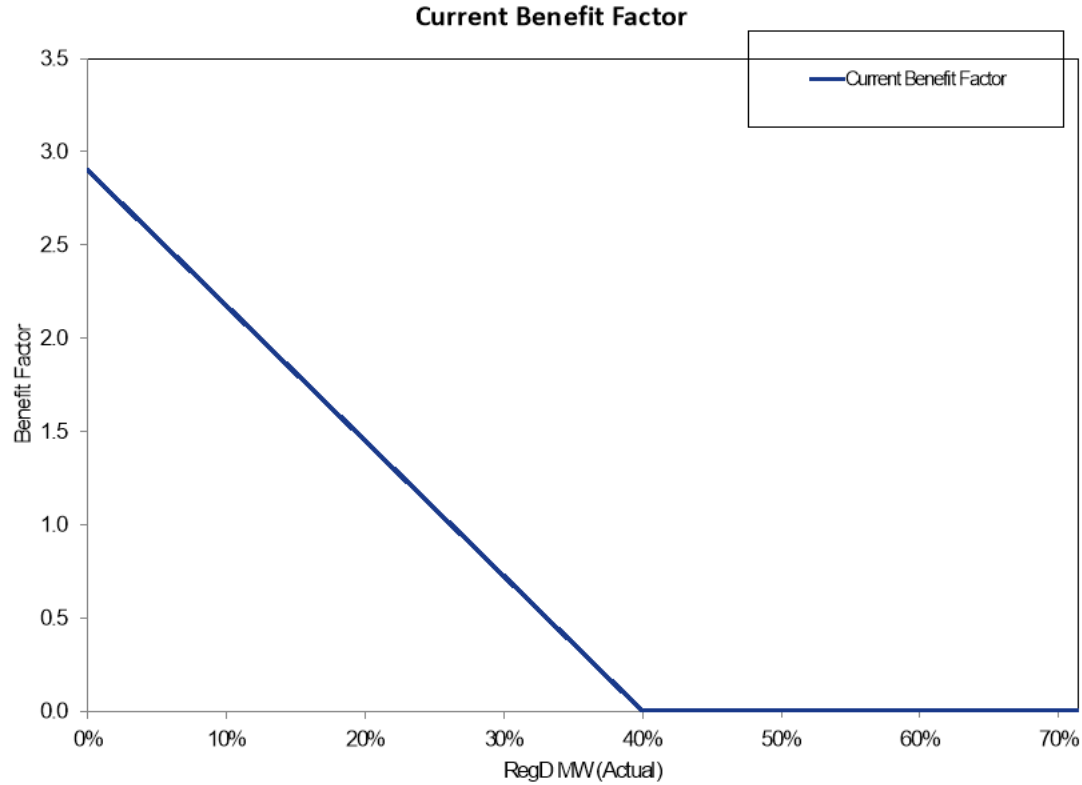


# Microeconomics: Isoquant and MRTS



60 MW A— area @6 MW D = 18 MW A

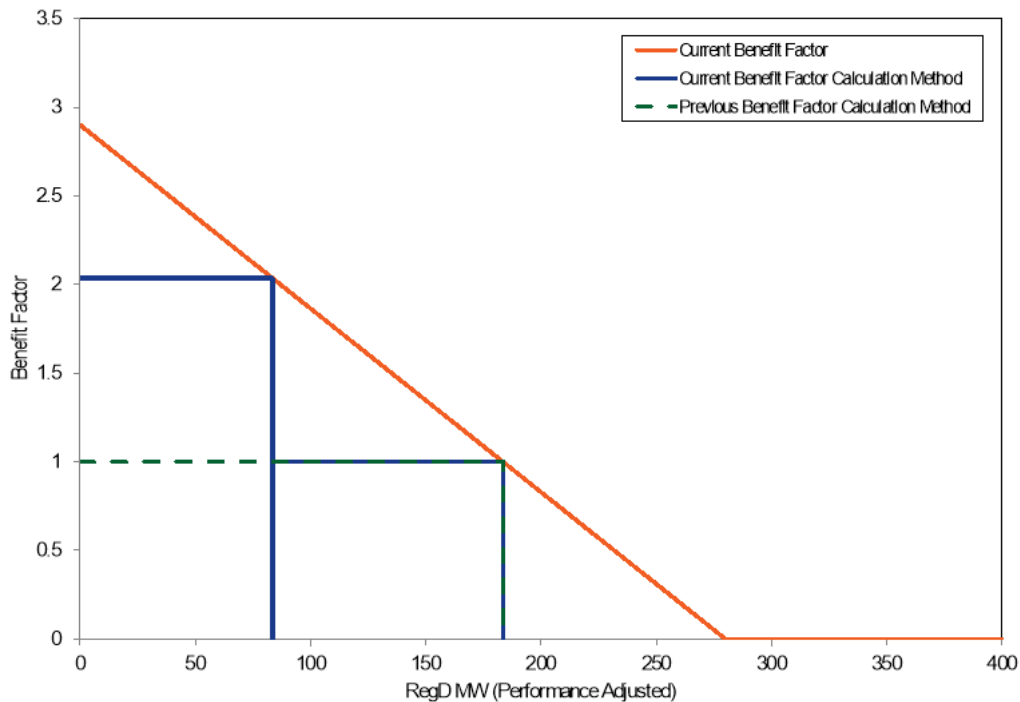
# MBF vs MRTS



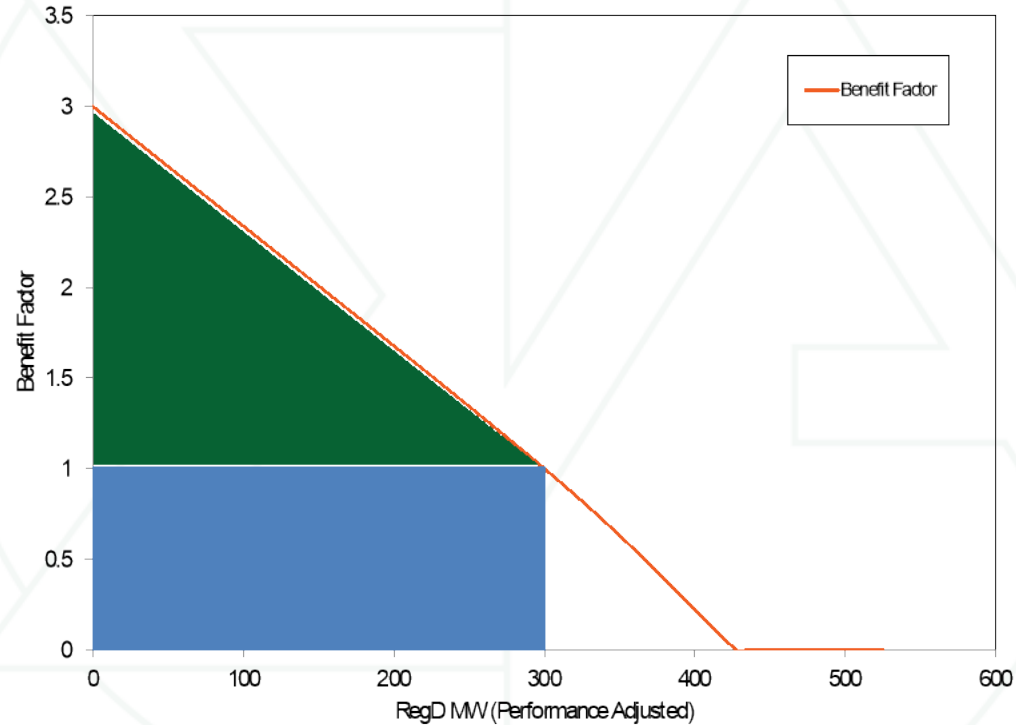
# Incorrect Amount/Proportion of RegD Cleared

RegD Percent of 700 MW	RegD MW (Performance Adjusted)	MBF	Effective MW from RegD MW	Residual A (700 MW Target - Effective MW from RegD)	RegD/ (RegA+RegD)
5%	40	2.54	108.75	691.25	5%
10%	80	2.18	203.00	597.00	12%
15%	120	1.81	282.75	517.25	19%
20%	160	1.45	348.00	452.00	26%
25%	200	1.09	398.75	401.25	33%
30%	240	0.73	435.00	365.00	40%
35%	280	0.36	456.75	343.25	45%
40%	320	0.00	464.00	336.00	49%

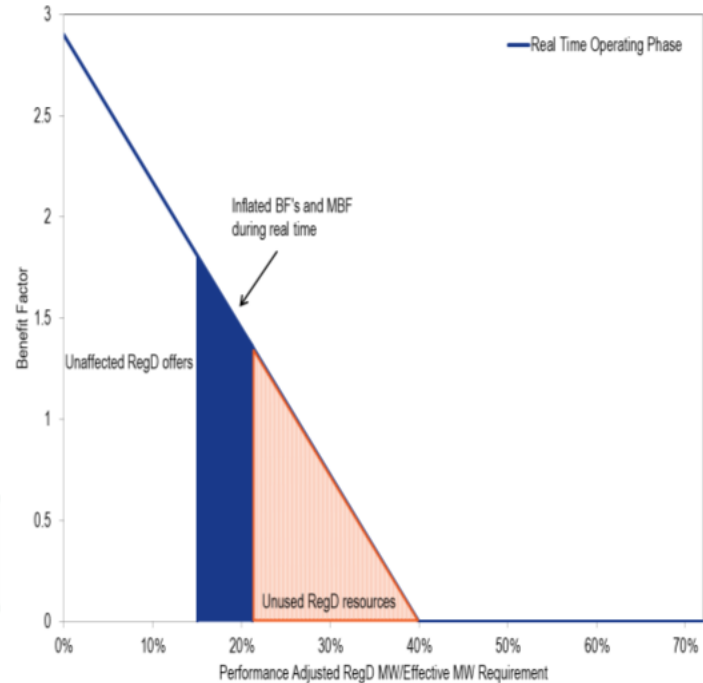
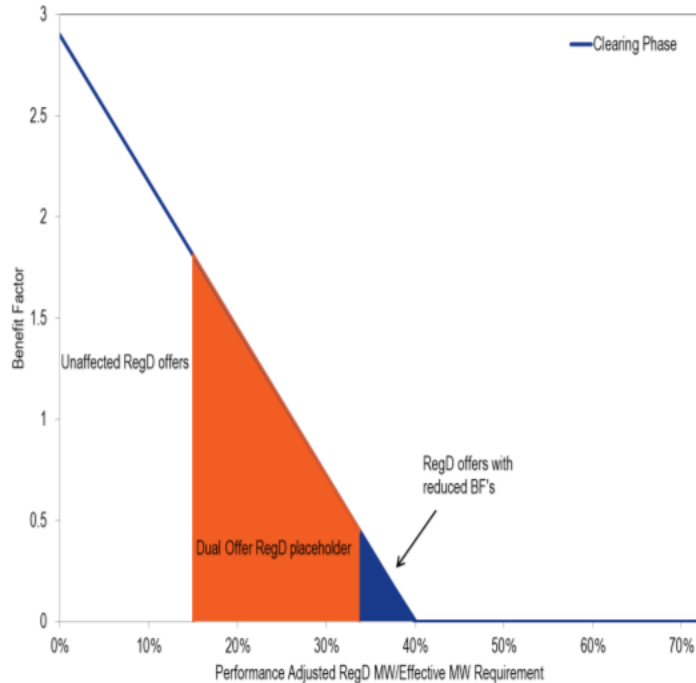
# Example of pre and post December 14, 2015, total effective MW calculations for RegD MW offered at \$0.00 or as self supply



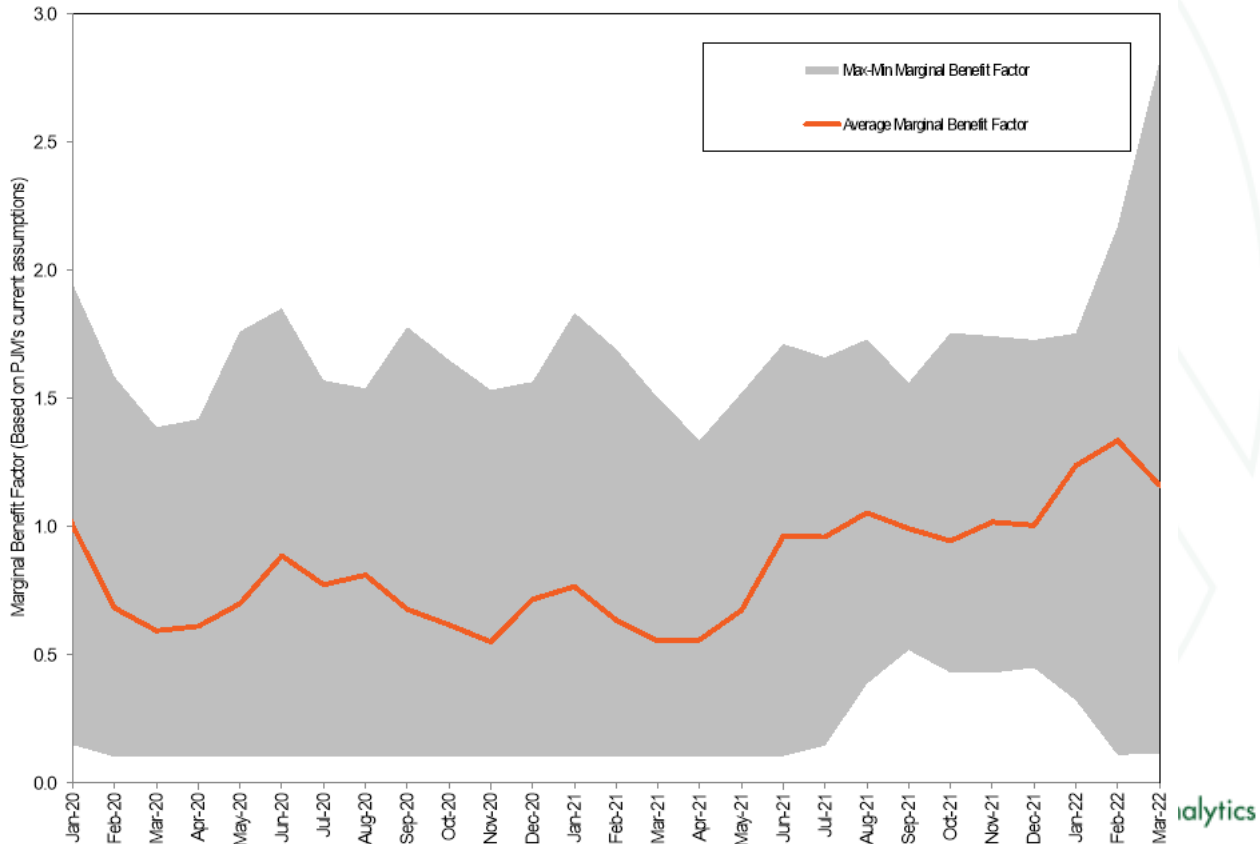
# Illustration of correct method for calculating effective MW



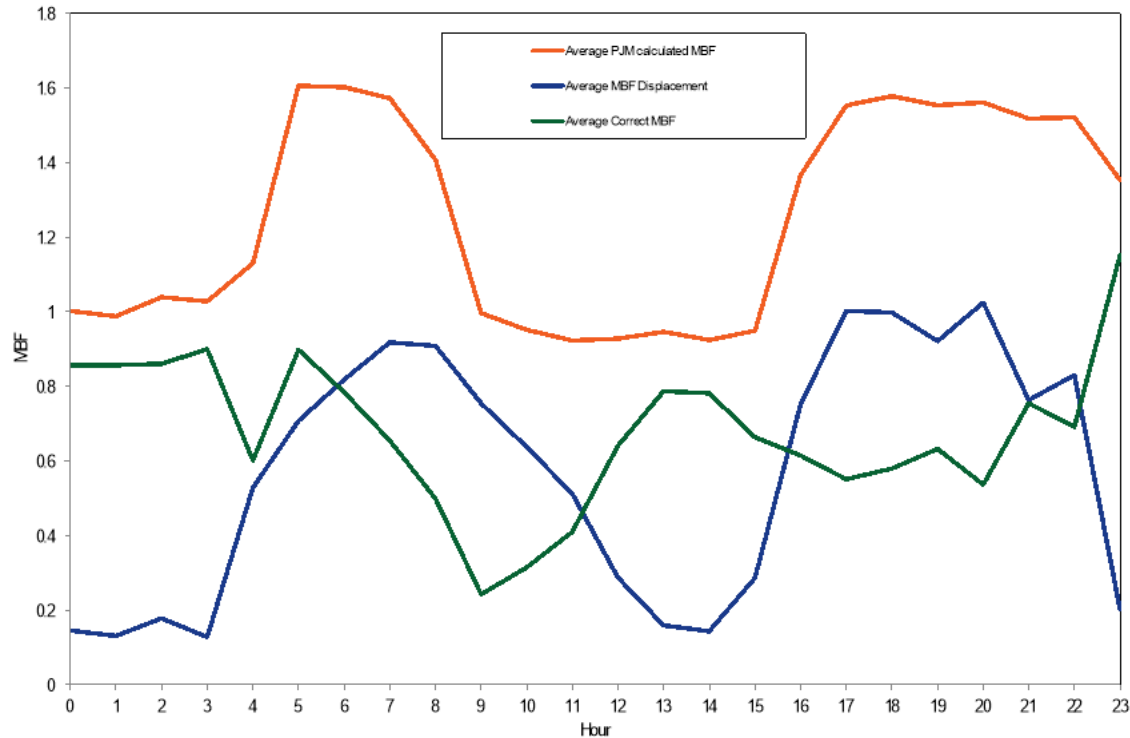
# Clearing phase BF/effective MW reduction, real time BF/effective MW inflation, and exclusion of available RegD resources



# Maximum, minimum, and average PJM calculated MBF by month

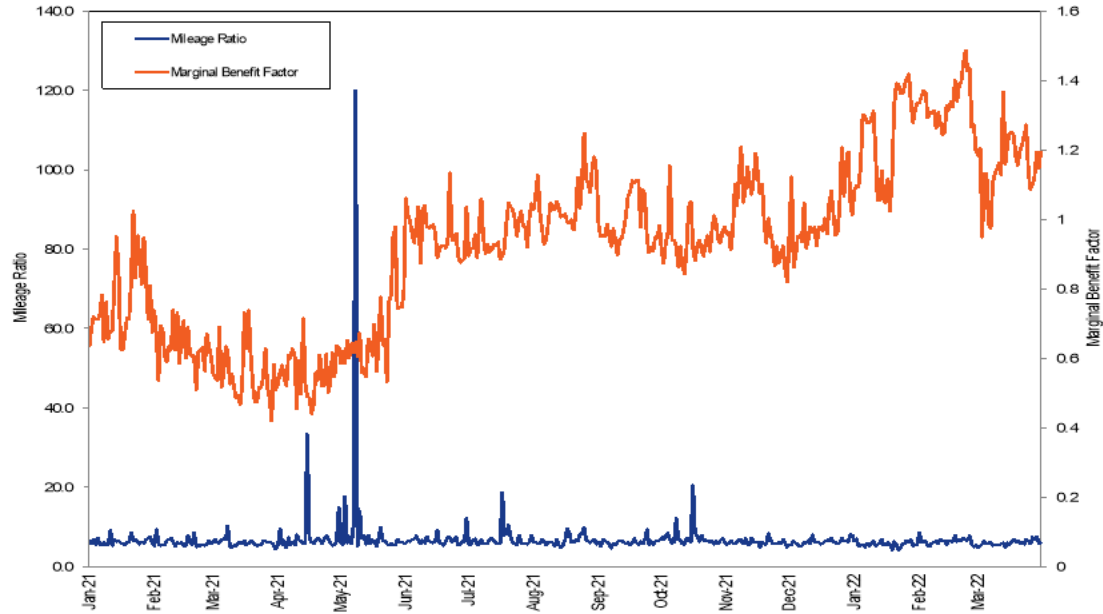


# Effect of PJM's current dual offer clearing method on the average MBF in each hour of the day





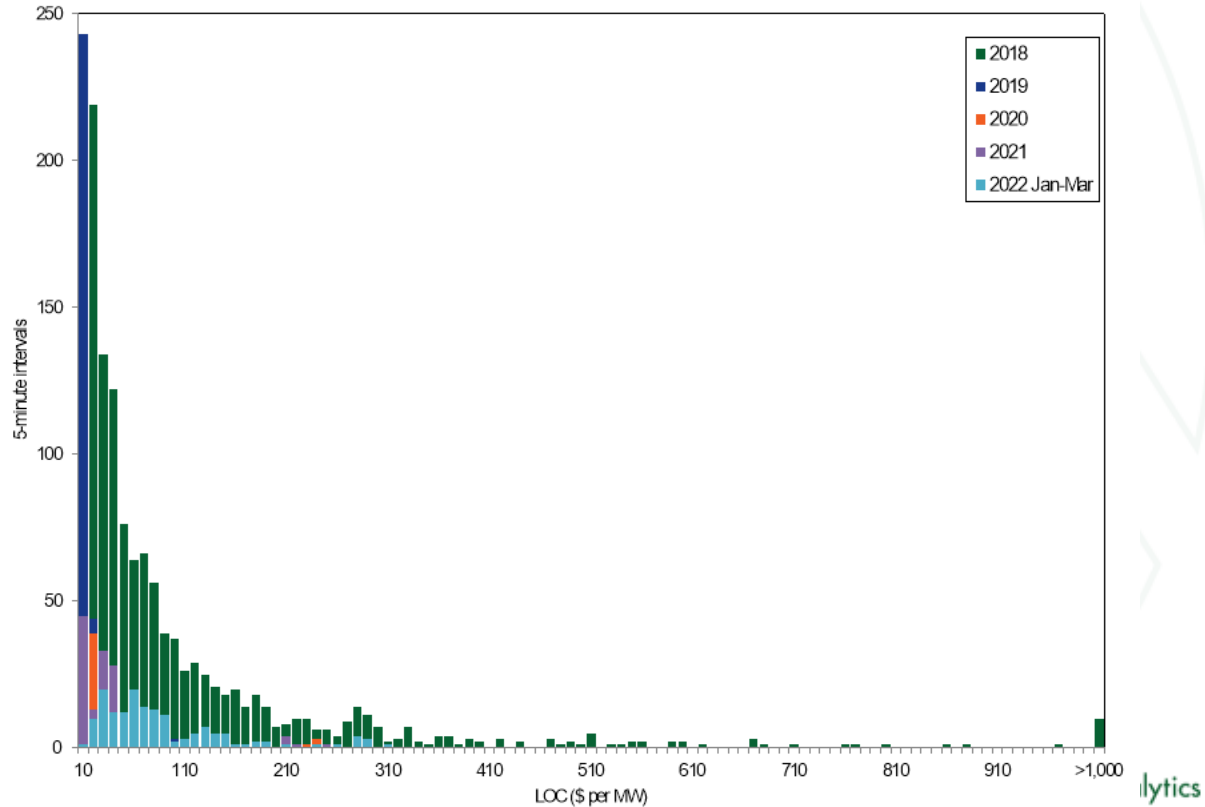
# MBF vs Mileage Rate



# Average monthly price paid per effective MW of RegD and RegA under mileage and MBF based settlement

RegD Settlement Payments						
Year	Month	Marginal Rate of Technical		RegA (\$/Effective MW)	Percent RegD Overpayment (\$/Effective MW)	Total RegD Overpayment (\$)
		Mileage Based RegD (\$/Effective MW)	Substitution Based RegD (\$/Effective MW)			
2021	Jan	\$30.47	\$11.43	\$11.43	166.6%	\$558,397
	Feb	\$88.91	\$19.90	\$19.90	346.7%	\$1,310,279
	Mar	\$61.03	\$17.93	\$17.93	240.4%	\$1,277,850
	Apr	\$65.99	\$16.73	\$16.73	294.3%	\$1,492,094
	May	\$39.55	\$16.42	\$16.42	140.9%	\$1,081,445
	Jun	\$26.57	\$18.40	\$18.40	44.4%	\$457,543
	Jul	\$27.36	\$19.34	\$19.34	41.5%	\$513,073
	Aug	\$38.23	\$31.77	\$31.77	20.4%	\$288,112
	Sep	\$35.63	\$28.59	\$28.59	24.6%	\$410,694
	Oct	\$51.13	\$38.91	\$38.91	31.4%	\$688,515
	Nov	\$63.20	\$52.92	\$52.92	19.4%	\$377,458
	Dec	\$33.94	\$26.85	\$26.85	26.4%	\$399,675
Yearly		\$46.48	\$24.93	\$24.93	86.4%	\$8,855,253
2022	Jan	\$62.73	\$68.59	\$68.59	(8.5%)	(\$1,580,376)
	Feb	\$29.38	\$31.51	\$31.51	(6.8%)	(\$516,687)
	Mar	\$31.86	\$25.56	\$25.56	24.7%	\$281,052
	Yearly	\$41.73	\$42.24	\$42.24	(1.2%)	(\$1,816,012)

# LOC distribution in each five minute interval with a RegD marginal unit and an LOC greater than zero



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