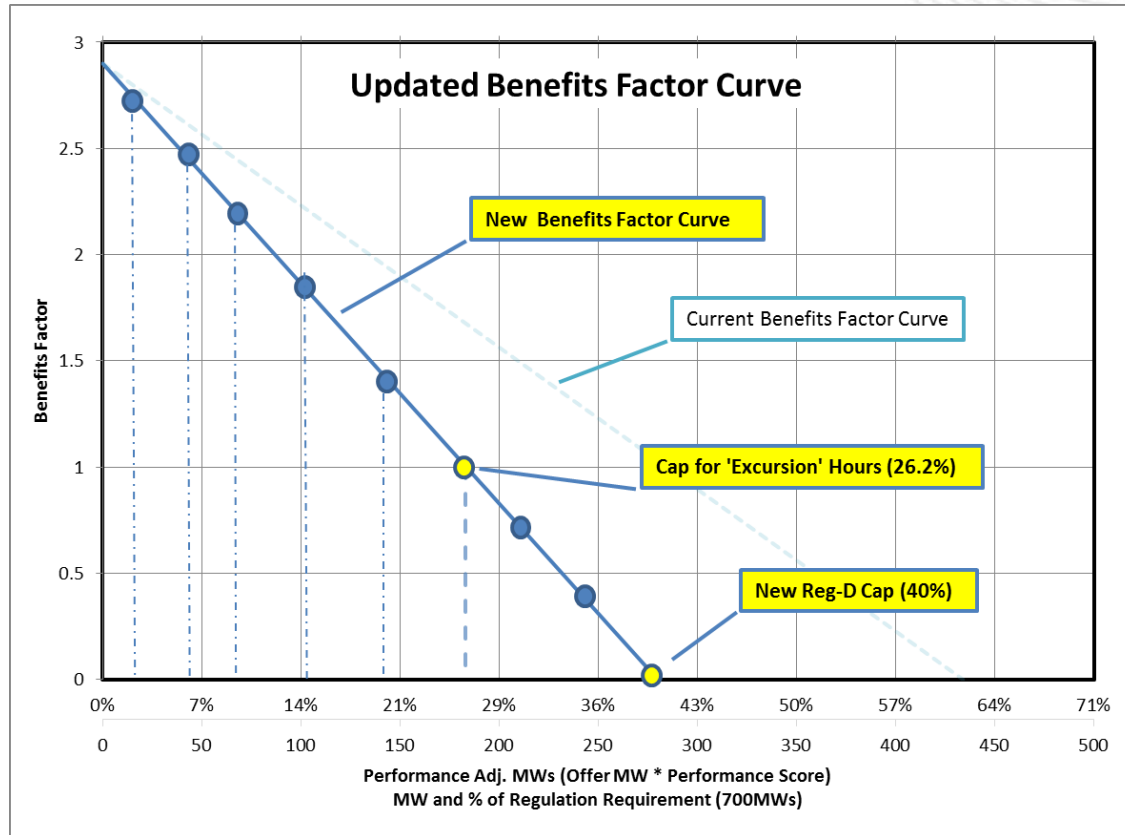


Details of Benefits Factor Calculation

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- The Benefits Factor (BF) models the rate of substitution between traditional RegA and dynamic RegD resources
 - It enables the market to translate a fast moving resource's regulation MW into traditional MW, or effective MW
 - It also adjusts the total cost of a RegD resource to make it attractive to the market clearing engine until the least cost optimum mix of RegD effective MW is reached as a percentage of the regulation effective requirement
- Resource specific BF is calculated for all eligible RegD resources during the regulation market clearing process
- The benefits factor for RegA resource is 1

Updated Benefits Factor Curve



- Market and Operation analysis on a sample set of regulation hours determined an updated Benefits Factor curve to best optimize operations during all system conditions
- The Benefits Factor Curve will be shifted to the left (BF=1 @ 26.2% and BF=0 @ 40%) to allow for optimal system control from Regulation Resources
- Resources with BF < 1 will not be considered for RegD for "Excursion" hours. During these hours the Benefits Factor Curve will be implemented to commit economic RegD resources up to the RegD-RegA neutrality point (BF=1)

- BF is calculated for all eligible RegD resources
- The calculation is one of the initial steps in the regulation clearing and pricing
 - Clearing in Ancillary Service Market Optimizer (ASO) an hour ahead
 - Pricing in Locational Pricing Calculator (LPC) in real-time
- The Marginal Benefits Factor is the BF of the last RegD resource cleared to provide regulation service
 - MBF is a value determined after regulation clearing is completed
 - It has no effect in the regulation clearing
 - It is not used in regulation pricing
 - It is not used in the Market Settlement for regulation credit

Step 1: Calculate Performance Adjusted MW

$$Performance\ Adjusted\ MW = RegMW * PS$$

Resource	Offer Type	Signal Type	Reg MW	Performance Score	Performance Adjusted MW
A	Economic	D	50	0.9	45
B	Economic	D	50	0.75	37.5
C	Self-Scheduled	D	50	0.8	40
D	Self-Scheduled	D	50	0.5	25
E	Economic	D	50	0.99	49.5
F	Economic	D	50	0.85	42.5

Step 2: Rank resources in ascending order of the Adjusted Total Cost

$$\text{Adjusted Total Cost (\$)} = \left(\frac{\text{Cap\$} + \text{LOC\$} + \text{Perf\$}}{\text{PS} * \text{BF}} \right)$$

Assume BF = 1 for Benefits Factor Calculation

Resource	Offer Type	Signal Type	Reg MW	Performance Score	Performance Adjusted MW	Total Cost	Adjusted Total Cost
A	Economic	D	50	0.9	45	\$0.00	\$0.00
B	Economic	D	50	0.75	37.5	\$0.00	\$0.00
C	Self-Scheduled	D	50	0.8	40	\$0.00	\$0.00
D	Self-Scheduled	D	50	0.5	25	\$0.00	\$0.00
E	Economic	D	50	0.99	49.5	\$1.00	\$1.01
F	Economic	D	50	0.85	42.5	\$2.00	\$2.35

Step 3: Assign resource specific Benefits Factor

For resources with zero offers and self scheduled, tie breaking logic is implemented *

Benefit Factor tie-breaker logic:

If cost = \$0, rank with performance score (highest to lowest), else use current Adjusted Total Cost equation

$$\text{The Adjusted Total Cost (\$)}_{BF\ calc} = \left(\frac{\text{Cap\$} + \text{LOC\$} + \text{Perf\$}}{PS * BF} \right)$$

Resource	Offer Type	Signal Type	Reg MW	Performance Score	Performance Adjusted MW	Total Cost	Adjusted Total Cost	Benefits Factor
A	Economic	D	50	0.9	45	\$0.00	\$0.00	2.43
C	Self-Scheduled	D	50	0.8	40	\$0.00	\$0.00	2.02
B	Economic	D	50	0.75	37.5	\$0.00	\$0.00	1.63
D	Self-Scheduled	D	50	0.5	25	\$0.00	\$0.00	1.37
E	Economic	D	50	0.99	49.5	\$1.00	\$1.01	0.86
F	Economic	D	50	0.85	42.5	\$2.00	\$2.35	0.42

Resource C is valued more than Resource B because it is better performing, even if their cost is the same

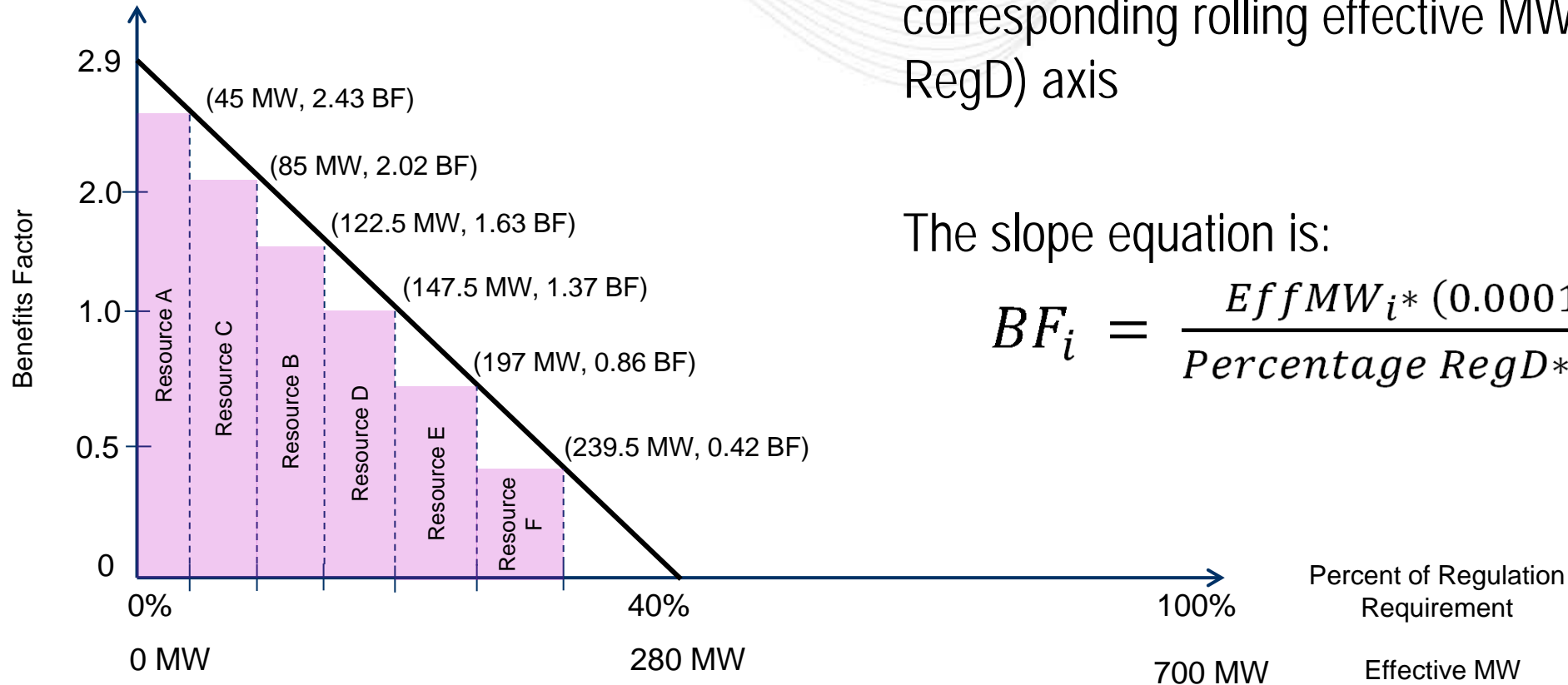
* Pending approval from the MRC

Benefits Factor Calculation Example

The BF is the intersection on the Y (BF) axis of the corresponding rolling effective MW on the X (percentage RegD) axis

The slope equation is:

$$BF_i = \frac{EffMW_i * (0.0001 - 2.9)}{Percentage RegD * RegReq} + 2.9$$



Resource	Offer Type	Signal Type	Reg MW	Performance Score	Performance Adjusted MW	Total Cost	Adjusted Total Cost	Benefits Factor
A	Economic	D	50	0.9	45	\$0.00	\$0.00	2.43
C	Self-Scheduled	D	50	0.8	40	\$0.00	\$0.00	2.02
B	Economic	D	50	0.75	37.5	\$0.00	\$0.00	1.63
D	Self-Scheduled	D	50	0.5	25	\$0.00	\$0.00	1.37
E	Economic	D	50	0.99	49.5	\$1.00	\$1.01	0.86
F	Economic	D	50	0.85	42.5	\$2.00	\$2.35	0.42

During excursion hours, Resource E and Resource F will not clear because they have a Benefits Factor less than 1