PJM Regulation Study Update

August 30, 2016

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Agenda

- Regulation Requirement
  - Preliminary Results
- MRTS Curves
  - Process flow to show how MRTS curves are developed
  - Examples MRTS curves
  - Summary of different MRTS curves based on different RegD energy storage sizes

Regulation Requirement

RMISTF

August 30, 2016

Regulation Requirement

- Current Regulation Requirement:
  - On-Peak (0500-2359) – 700MW Effective
  - Off-Peak (0000-0459) – 525MW Effective
  - 15,925 MWh daily for regulation

- Proposed Regulation Requirement:
  - Seasonal Requirements (Fall, Winter, Spring, Summer)
  - Ramp/Non-Ramp periods defined based on historical evaluation and engineering study
  - Ramp hours will procure more MW compared to Non-Ramp hours

Preliminary Requirement Level:

- **Ramp Hours = 800MW Effective**
  - Preliminary, investigating potentially separate requirements for morning and evening ramps
- **Non-Ramp Hours = 600MW Effective**

Determination of Requirement Level:

- Evidence additional regulation is needed during ramping hour
- Frequency Bias decrease of 14.27% in 2016 adds to lower CPS and higher BAAL minutes
  - Frequency Bias change from -1555MW/0.1Hz to -1333MW/0.1Hz
- Requirements will be re-evaluated quarterly after new signal implementation
- Requirement increase in line with frequency bias change
  - Ramp Hours = 700*1.1427% = 800MW Effective
  - Non-Ramp Hours = 525*1.1427% = 600MW Effective

Seasonal Definition

- Fall (Preliminary)
  - Months: September 1 – November 30
  - Ramp hours: HE6 – HE8, HE18 – HE24
  - Daily Procurement: 16,400 MWh

- Winter (Preliminary)
  - Months: December 1 – February 29
  - Ramp hours: HE6 – HE9, HE18 – HE24
  - Daily Procurement: 16,600 MWh

Seasonal Definition

- Spring (Preliminary)
  - Months: March 1 – May 31
  - Ramp hours: HE6 – HE8, HE18 – HE24
  - Daily Procurement: 16,400 MWh

- Summer (Preliminary)
  - Months: June 1 – August 31
  - Ramp hours: HE6 – HE14, HE19 – HE24
  - Daily Procurement: 17,400 MWh

MRTS Curves

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MRTS Process Flow

MRTS Process Flow

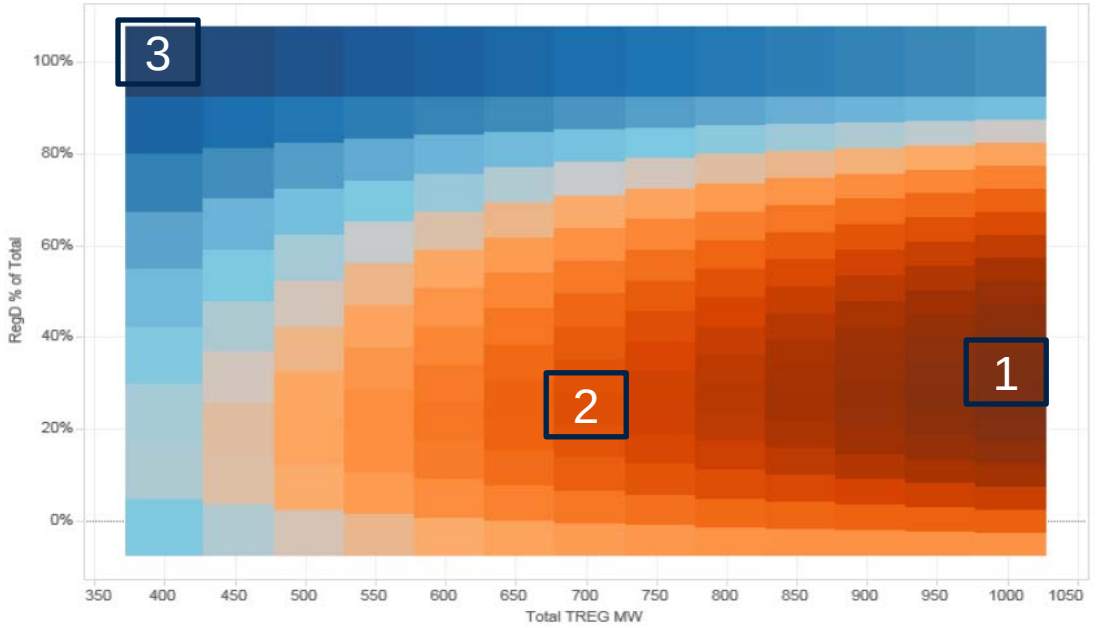
- The engineering relationship is defined between RegA and RegD resources by evaluating how well various mixes of RegA and RegD control ACE

How to read the relationship map:
(example data only)

1. Best Control with 1000MW of total regulation and ~30% RegD

2. Good Control with 700MW of total regulation and ~25% RegD

3. Worst Control with 400MW of total regulation and ~100% RegD

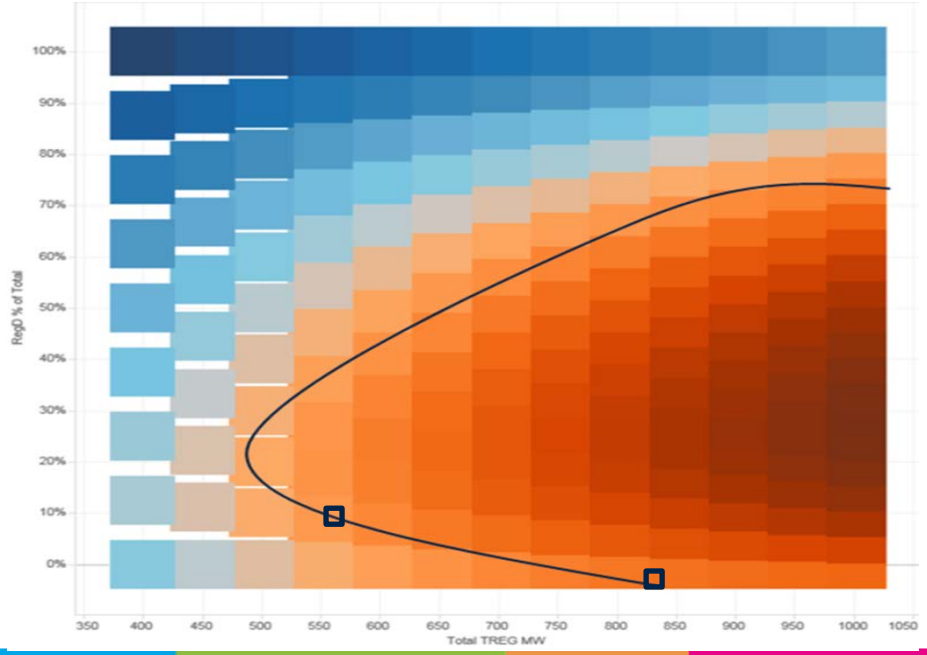


MRTS Process Flow

- Isoquants are developed on this graph based on a fixed level of ACE control (black line below) while varying the amount of total regulation and % of RegD

How to read the isoquant:
(example data only)

- Example: 825MW and 0%RegD is the same control as 575MW and 10% RegD

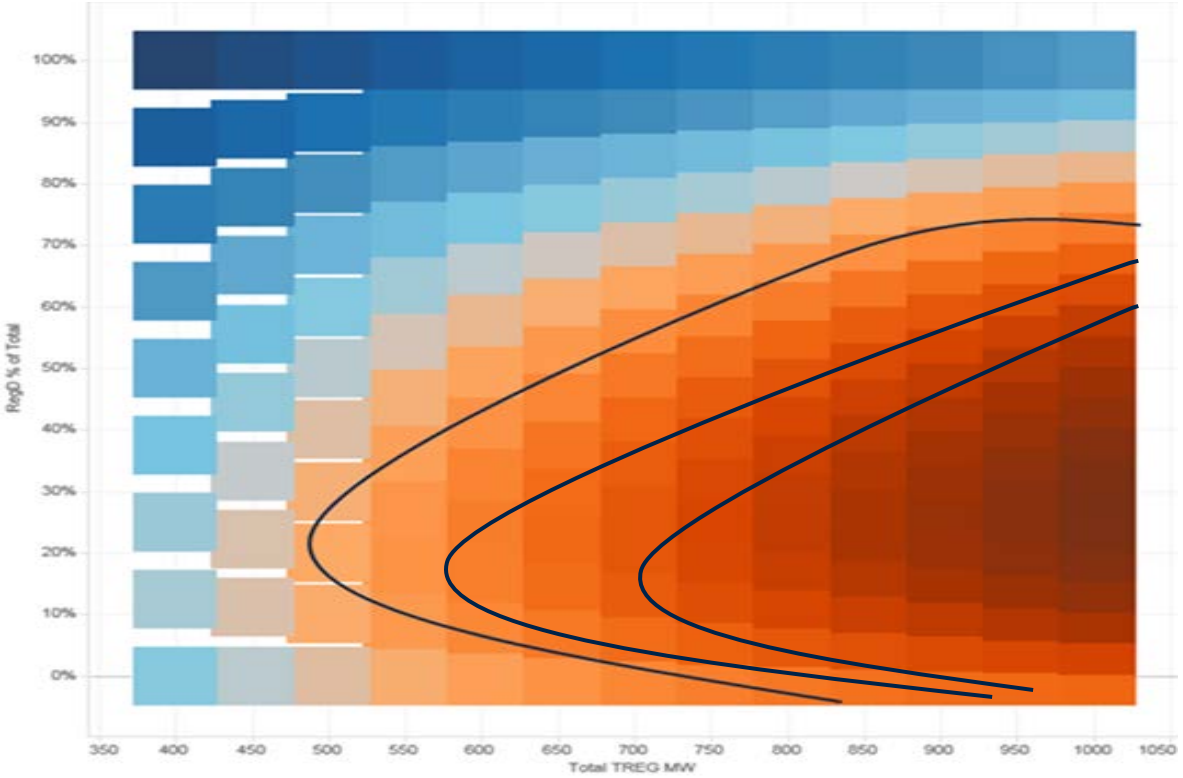


MRTS Process Flow

- Different Isoquants can be drawn within the engineering simulation results
  - Isoquant to be used for MRTS development will be in line with the defined requirement and desired ACE control

(example data only)

- If requirement is 800 effective MW, the Isoquant would start at 800MW of RegA only



MRTS Process Flow

- Control value at 800MW of RegA only will be used as the control base
- All RegA-RegD 'MW pairs' matching this control are then selected

(example data only)

- See boxed values in the plot to the right
  - Data interpolation used between points for more accurate results

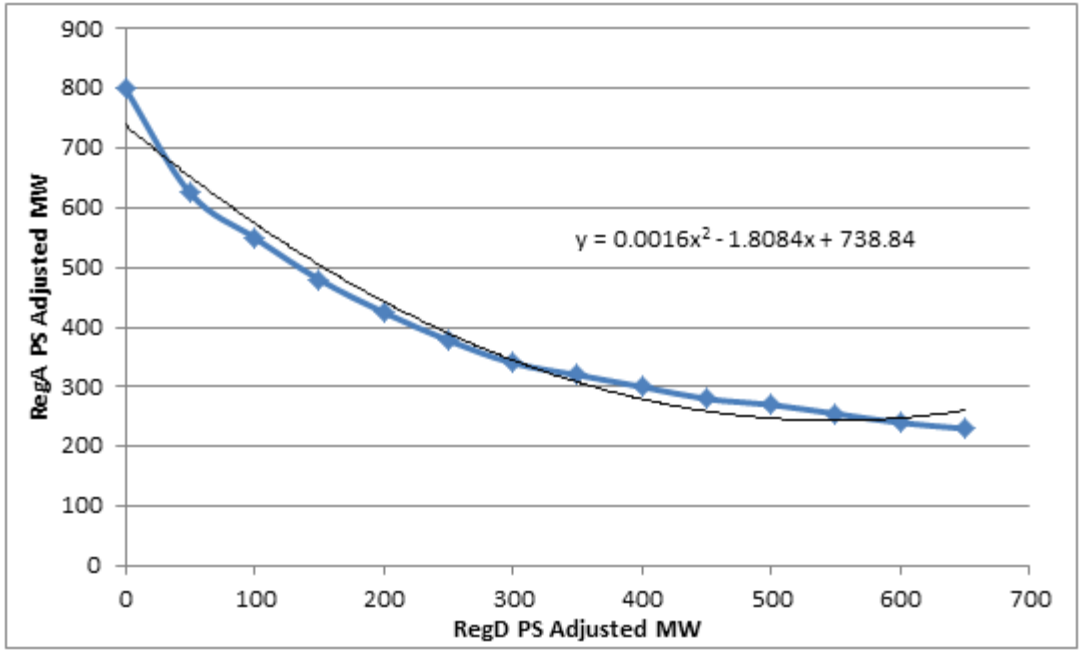
PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									174,367	172,659	168,111	167,888	164,094	161,603	161,519	160,930	159,947	159,293	160,654	159,189	157,830
50								167,541	164,626	160,662	156,535	153,814	152,267	150,132	148,390	146,163	144,179	143,362	141,762	140,259	
100							152,987	149,345	143,896	139,212	136,218	135,452	133,066	130,925	129,160	126,764	124,555	123,703	122,968		
150						140,652	136,558	131,134	127,393	126,240	122,713	119,681	116,126	114,021	112,392	113,113	111,142	109,423			
200					135,332	130,335	125,500	119,326	117,428	114,040	111,217	107,032	103,539	102,589	100,143	99,094	98,235				
250				133,651	126,446	119,945	117,257	112,243	107,741	102,578	98,022	94,073	90,587	87,663	85,230	85,176					
300			131,801	122,671	114,920	111,583	106,004	101,124	94,878	90,055	85,831	82,183	80,084	79,216	77,392						
350		134,830	122,756	113,001	105,316	98,063	93,968	88,532	83,601	81,229	80,273	77,424	73,945	70,705							
400	142,229	125,505	112,860	103,198	96,828	92,933	86,882	81,680	79,098	74,819	70,806	67,126	63,742								
450	133,862	115,953	105,571	97,144	89,891	84,134	79,643	74,833	70,380	67,410	63,813	60,586									
500	126,260	110,686	100,514	90,475	83,407	76,947	71,747	67,115	63,032	59,342	56,075										
550	120,750	104,624	93,039	83,459	75,795	69,518	64,332	59,990	57,267	53,792											
600	113,706	98,083	86,872	77,597	70,314	64,363	59,407	55,236	51,759												
650	109,544	92,537	80,698	71,681	64,647	58,964	54,222	50,445													
700	103,605	87,027	75,473	66,715	59,953	54,531	50,189														
750	98,633	82,389	71,030	62,537	56,039	50,888															
800	**94,506**	78,555	67,411	59,070	52,726																
850	91,109	75,410	64,433	56,219																	
900	88,303	72,885	62,122																		
950	86,024	70,831																			
1000	84,215																				

MRTS Process Flow

- RegA – RegD 'MW pairs' (example data only)

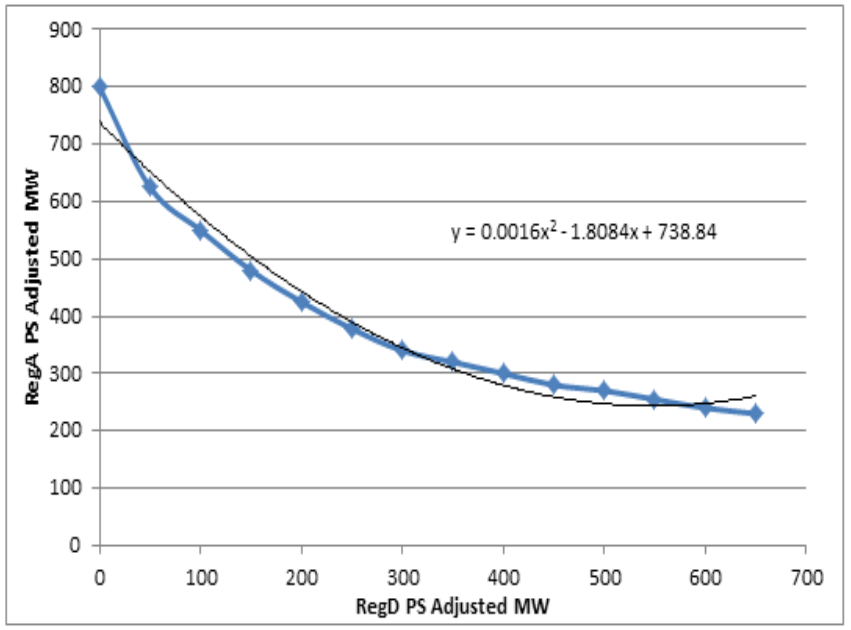
RegA Perf. Adj. MW	RegD Perf. Adj. MW	Total Reg Perf. Adj. MW
800	0	800
625	50	675
550	100	650
480	150	630
425	200	625
378	250	628
340	300	640
320	350	670
300	400	700
280	450	730
270	500	770
255	550	805
240	600	840
230	650	880

- Plot 'MW pairs' to define RegA-RegD solution space (example data only)

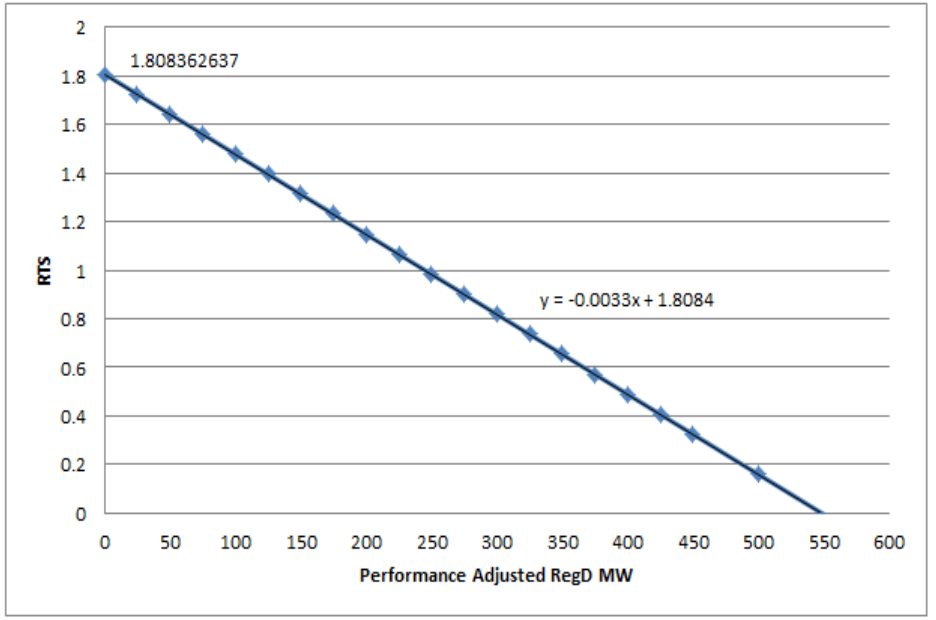


MRTS Process Flow

- By taking the derivative of the RegA - RegD solution curve, the MRTS Curve is defined, which gives the rate of technical substitution (RTS) between RegA and RegD
- (example data only)

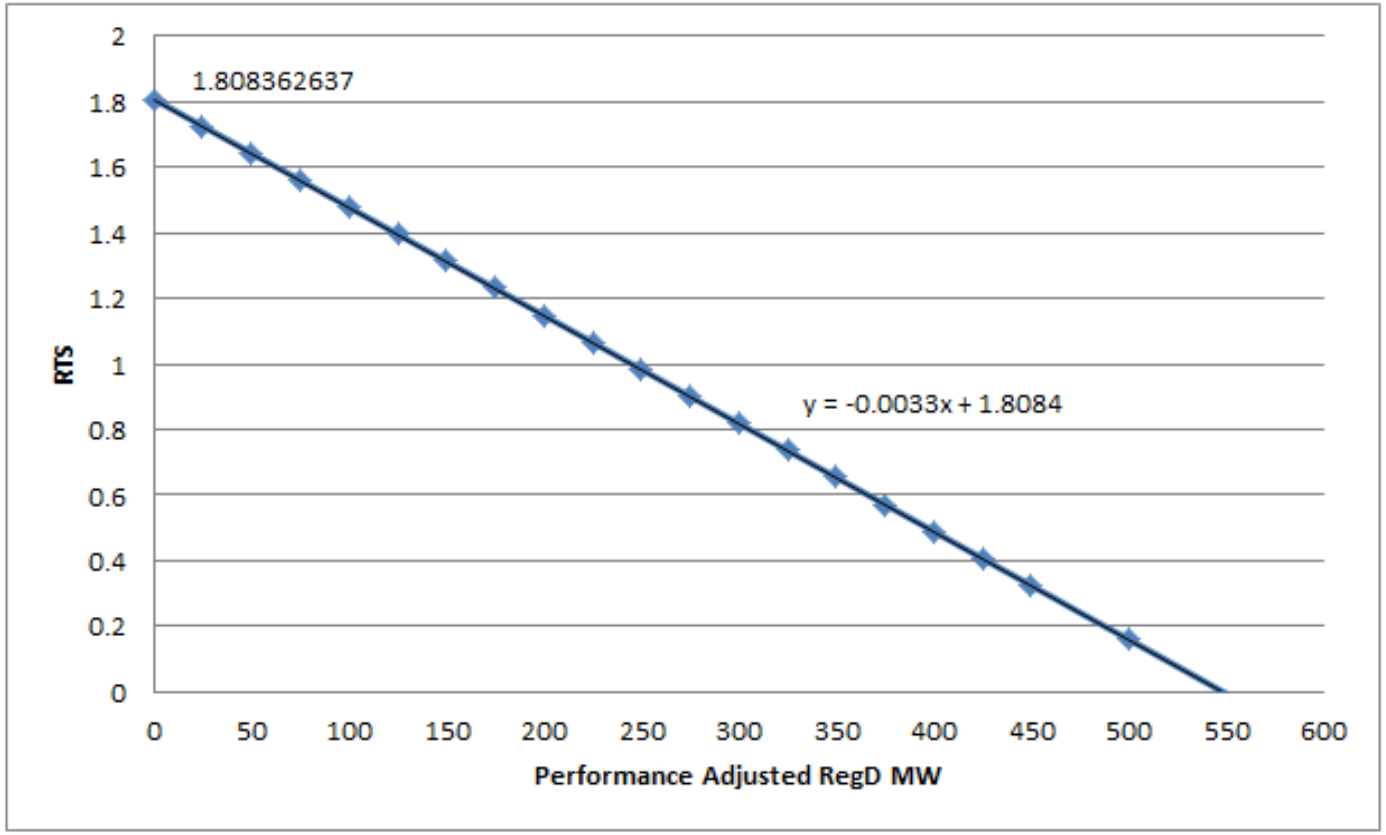


$$\frac{d}{dx}(0.001649 * x^2 - 1.8084 * x + 738.84)$$



MRTS Process Flow

- Use MRTS Curve to clear RegA and RegD resources to least cost solution
- X-axis is RegD performance adjusted MW
- Y-axis is the Rate of Technical Substitution to translate RegD MW to equivalent RegA MW



MRTS Process Flow

MRTS Definition for Seasonal and Ramping/Non-Ramping hours

Fall Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									174,367	172,659	168,111	167,888	164,094	161,603	161,519	160,930	159,947	159,293	160,654	159,189	157,830
50								167,541	164,626	160,662	156,535	153,814	152,267	150,132	148,390	146,163	144,179	143,362	141,762	140,259	
100							152,987	149,345	143,896	139,212	136,218	135,452	133,066	130,925	129,160	126,764	124,555	123,703	122,968		
150						140,652	136,558	131,134	127,393	126,240	122,713	119,681	116,126	114,021	112,392	113,113	111,142	109,423			
200					135,332	130,335	125,500	119,326	117,428	114,040	111,217	107,032	103,539	102,589	100,143	99,094	98,235				
250				133,651	126,446	119,945	117,257	112,243	107,741	102,578	98,022	94,073	90,587	87,663	85,230	85,176					
300			131,801	122,671	114,920	111,583	106,004	101,124	94,878	90,055	85,831	82,183	80,084	79,216	77,392						
350		134,830	122,756	113,001	105,316	98,063	93,968	88,532	83,601	81,229	80,273	77,424	73,945	70,705							
400	142,229	125,505	112,860	103,198	96,828	92,933	86,882	81,680	79,098	74,819	70,806	67,126	63,742								
450	133,862	115,953	105,571	97,144	89,891	84,134	79,643	74,833	70,380	67,410	63,813	60,586									
500	126,260	110,686	100,514	90,475	83,407	76,947	71,747	67,115	63,032	59,342	56,075										
550	120,750	104,624	93,039	83,459	75,795	69,518	64,332	59,990	57,267	53,792											
600	113,706	98,083	86,872	77,597	70,314	64,363	59,407	55,236	51,759												
650	109,544	92,537	80,698	71,681	64,647	58,964	54,222	50,445													
700	103,605	87,027	75,473	66,715	59,953	54,531	50,189														
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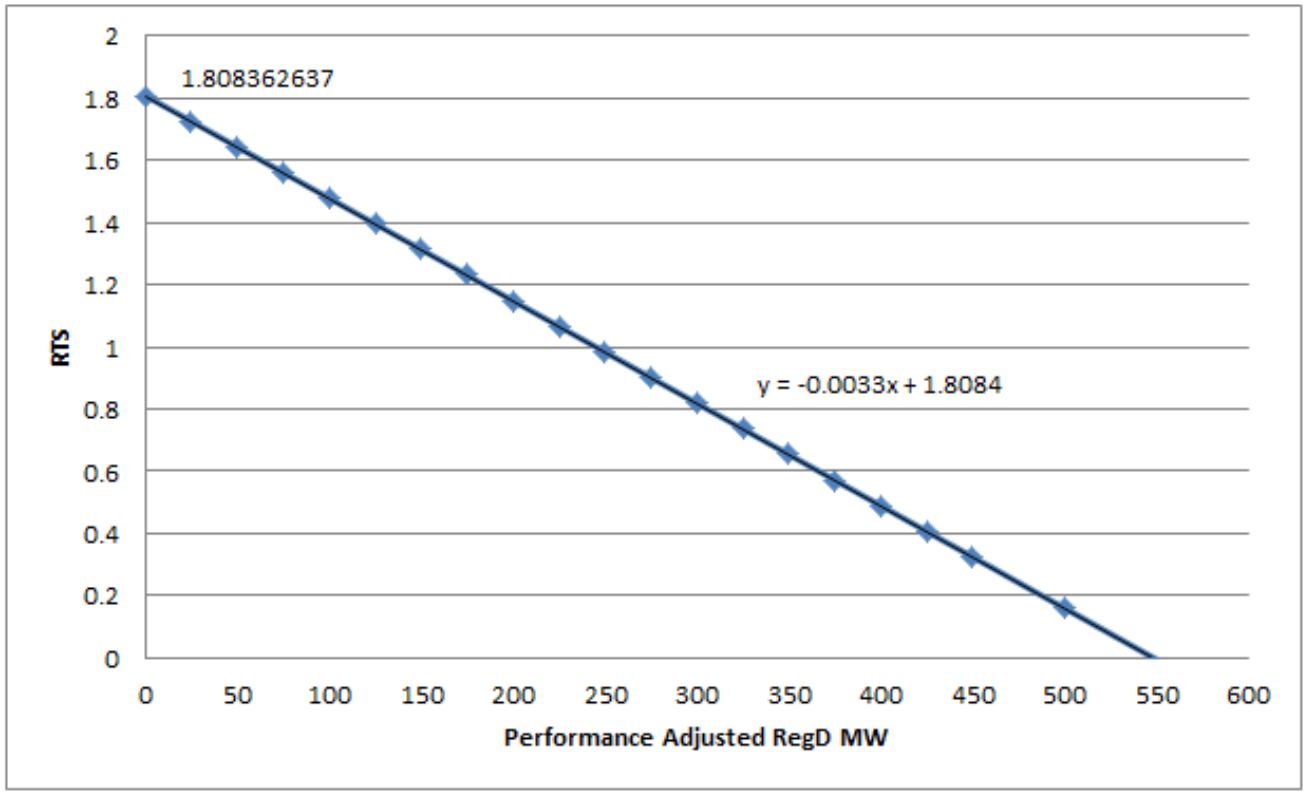
800	**94,506**	78,555	67,411	59,070	52,726																
850	91,109	75,410	64,433	56,219																	
900	88,303	72,885	62,122																		
950	86,024	70,831																			
1000	84,215																				

- 30 minute energy storage modeled
- Effective Requirement for ramping hours = 800MW
- Use control at 800MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Ramping MRTS Definition

Requirement: 800 Effective MW



- 30 minute energy storage modeled
- MRTS = 1
  - 35% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 245 Perf. Adj. MW of RegD
- MRTS = 0
  - 64% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 548 Perf. Adj. MW of RegD

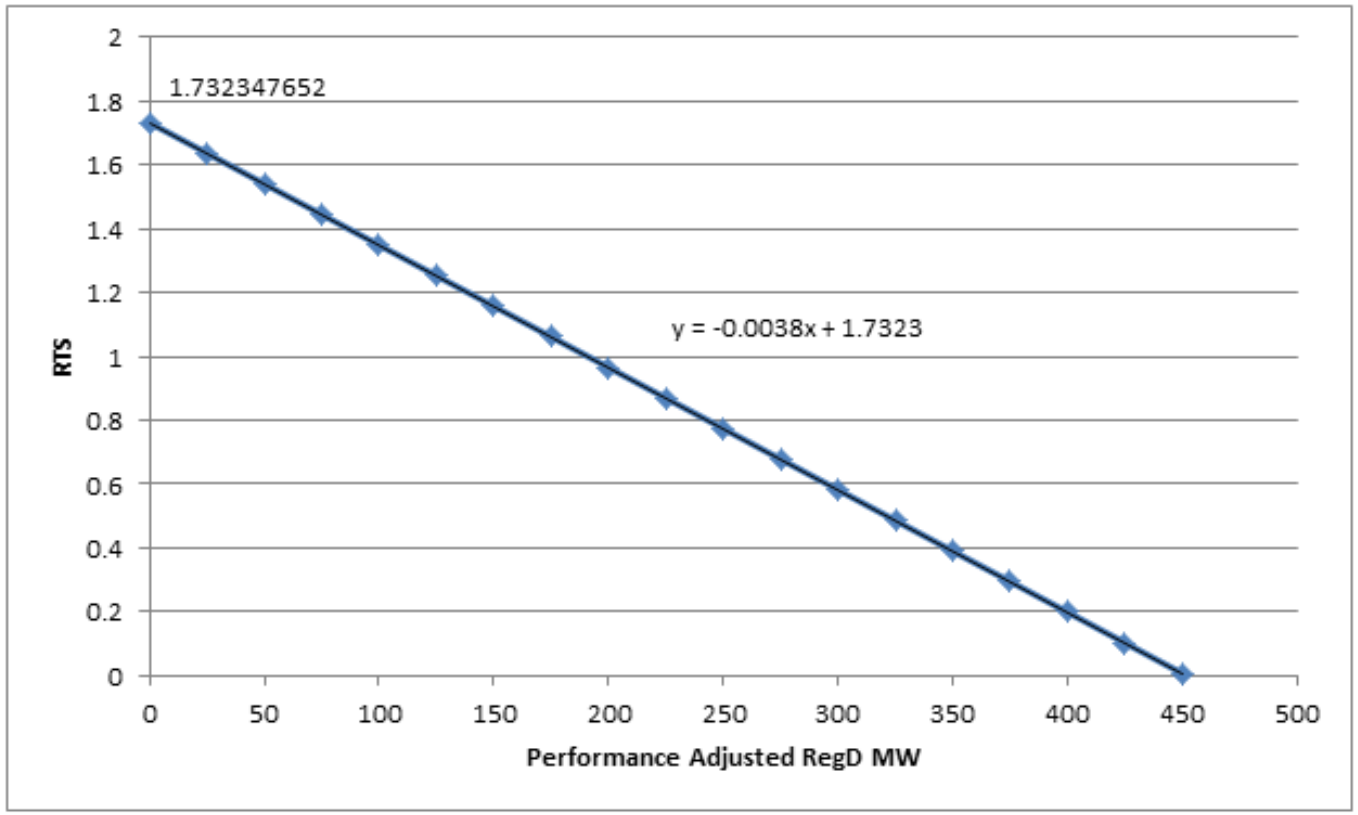
Fall Non-Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									111,291	109,063	106,479	105,031	104,331	102,324	100,414	99,273	97,565	95,810	94,305	93,022	91,788
50								98,349	95,754	92,781	90,311	88,264	87,159	85,481	83,956	83,255	82,690	82,139	80,888	79,676	
100							86,395	83,406	80,276	77,670	75,467	73,614	71,977	**71,276**	69,949	68,797	67,655	66,510	65,365		
150						76,002	71,988	**68,609**	65,727	63,290	61,257	59,468	58,639	57,263	56,841	55,661	54,597	53,577			
200					**69,000**	64,093	60,108	56,916	54,296	51,975	50,742	49,664	47,991	47,422	46,165	44,974	44,005				
250				**65,996**	60,038	55,314	51,603	48,611	46,061	44,694	42,772	41,066	39,547	38,343	37,338	36,424					
300			**65,316**	57,590	51,740	47,265	43,801	41,788	39,448	37,464	35,784	34,433	33,283	32,272	31,422						
350		68,846	58,358	50,851	45,293	41,879	39,318	36,685	34,624	32,986	31,719	30,713	29,780	28,952							
400	78,884	**63,795**	53,624	46,334	41,094	37,920	34,852	32,554	30,881	29,558	28,461	27,544	26,824								
450	73,804	59,146	49,250	42,992	37,966	34,357	31,763	29,803	28,306	27,173	26,284	25,547									
500	69,774	56,322	46,617	39,706	34,974	31,770	29,537	27,883	26,597	25,557	24,780										
550	67,389	53,445	43,871	37,163	32,700	29,702	27,713	26,242	25,094	25,053											
600	**64,960**	51,177	42,576	35,999	31,696	28,810	26,874	25,581	24,636												
650	63,797	50,093	40,763	34,370	30,136	27,391	25,633	24,481													
700	62,247	48,618	39,372	33,078	29,029	26,343	24,670														
750	61,060	47,467	38,289	32,141	28,111	25,576															
800	60,110	46,572	37,495	31,409	27,477																
850	59,356	45,925	36,857	30,836																	
900	58,774	45,417	36,375																		
950	58,333	45,035																			
1000	57,970																				

- 30 minute energy storage modeled
- Effective Requirement for non-ramping hours = 600MW
- Use control at 600MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Non-Ramping MRTS Definition

Requirement: 600 Effective MW



- 30 minute energy storage modeled
- MRTS = 1
  - 36% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 191 Perf. Adj. MW of RegD
- MRTS = 0
  - 68% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 452 Perf. Adj. MW of RegD

Fall Summary Results Ramp

		Controllers Where MRTS = 1				Controllers Where MRTS = 0			
Ramp/ Non-Ramp	**Value**	**Today**	**15 New**	**30 New**	**60 New**	**Today**	**15 New**	**30 New**	**60 New**
Ramp	% Perf. Adj. RegD MW	1%	26%	35%	38%	68%	58%	64%	67%
	Perf. Adj. RegD MW	6	195	245	262	610	525	548	565
	Total Perf. Adj. MW (RegA+RegD)	800	743	702	687	902	907	853	838
	Effective MW Req.	800	800	800	800	800	800	800	800

- Today = MRTS creation using controller in production today
- 15/30/60 New = MRTS creation using the new controller with conditional neutrality and 15, 30, or 60 minute energy storage

Fall Summary Results Non-Ramp

		Controllers Where MRTS = 1				Controllers Where MRTS = 0			
Ramp/ Non-Ramp	**Value**	**Today**	**15 New**	**30 New**	**60 New**	**Today**	**15 New**	**30 New**	**60 New**
Non-Ramp	% Perf. Adj. RegD MW	0%	30%	36%	40%	66%	65%	68%	74%
	Perf. Adj. RegD MW	2	164	191	209	587	456	452	484
	Total Perf. Adj. MW (RegA+RegD)	600	554	531	521	892	700	660	657
	Effective MW Req.	600	600	600	600	600	600	600	600

- Today = MRTS creation using controller in production today
- 15/30/60 New = MRTS creation using the new controller with conditional neutrality and 15, 30, or 60 minute energy storage

Appendix

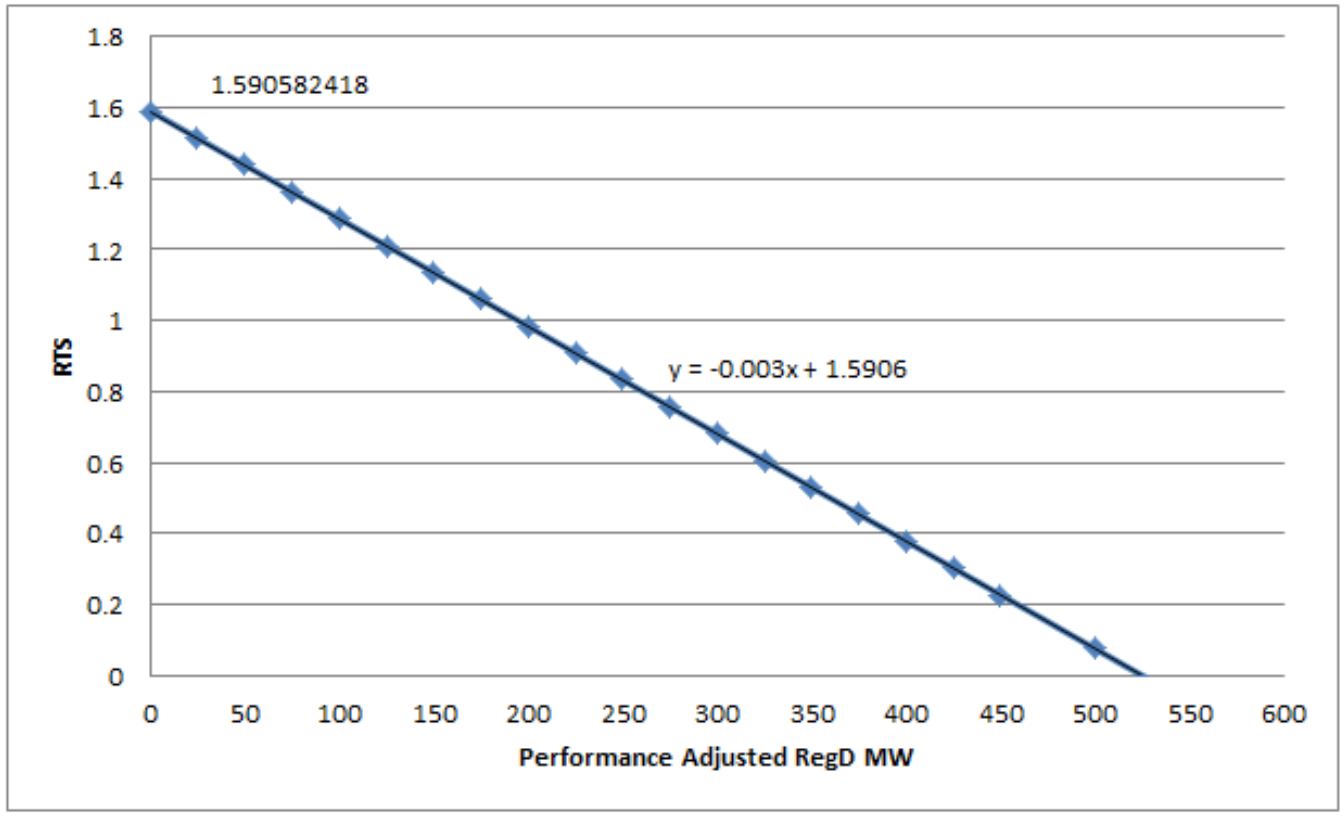
Fall Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									186,645	182,857	180,331	179,866	176,274	174,533	174,596	173,072	171,809	169,762	168,816	167,243	165,880
50								178,259	174,928	171,464	170,080	166,136	164,377	162,927	159,816	156,970	156,958	155,144	152,679	151,429	
100							164,746	162,185	158,438	155,174	151,275	147,662	145,396	142,377	141,422	140,580	138,863	136,394	136,907		
150						152,979	147,350	142,481	138,271	136,240	132,534	133,146	132,028	131,949	130,169	130,304	128,652	127,064			
200					143,405	137,077	134,670	132,028	130,752	127,968	125,366	124,022	121,105	121,335	119,544	116,932	116,331				
250				138,648	133,073	127,957	127,548	124,927	120,943	117,367	115,042	112,061	109,263	108,397	105,792	105,376					
300			136,012	129,024	122,666	119,550	115,564	113,169	108,425	104,995	102,923	100,053	98,200	95,462	92,896						
350		136,612	126,117	118,412	112,371	107,576	103,704	99,462	95,666	92,311	91,375	90,689	88,160	85,815							
400	142,229	127,846	117,367	108,778	104,023	99,537	94,763	91,612	89,957	86,611	83,605	81,027	78,735								
450	133,862	117,924	107,508	101,884	96,272	90,940	87,416	83,478	80,023	77,957	75,208	74,839									
500	126,260	111,493	102,094	94,466	88,849	83,644	79,409	76,729	73,430	70,591	68,097										
550	120,750	105,283	94,986	87,540	81,052	75,980	71,869	68,313	65,287	62,766											
600	113,706	99,360	89,299	81,036	74,726	69,815	65,859	62,624	59,955												
650	109,544	93,530	82,680	74,598	68,432	63,702	59,974	56,912													
700	103,605	87,787	77,084	69,146	63,193	58,617	54,983														
750	98,633	83,047	72,422	64,619	58,744	54,226															
800	**94,506**	79,104	68,564	60,777	55,026																
850	91,109	75,847	65,321	57,589																	
900	88,303	73,181	62,636																		
950	86,024	70,983																			
1000	84,215																				

- 15 minute energy storage modeled
- Effective requirement for ramping hours = 800MW
- Use control at 800MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Ramping MRTS Definition

Requirement: 800 Effective MW



- 15 minute energy storage modeled
- MRTS = 1
  - 26% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 195 Perf. Adj. MW of RegD
- MRTS = 0
  - 58% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 525 Perf. Adj. MW of RegD

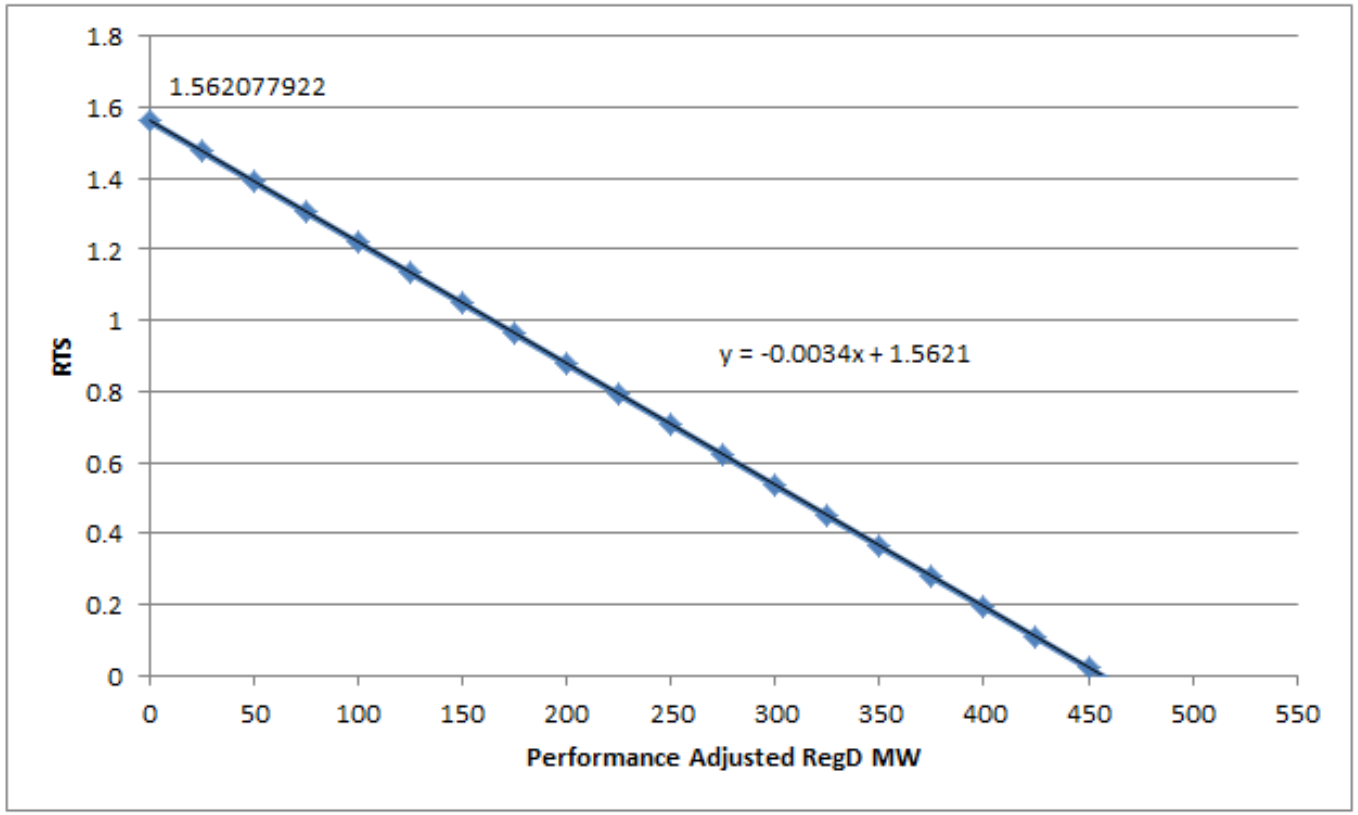
Fall Non-Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									119,504	118,194	115,832	114,289	113,554	111,480	109,519	108,324	106,598	104,928	104,036	102,570	101,207
50								107,082	104,870	102,336	100,750	98,665	97,411	95,599	93,877	92,945	91,432	90,713	89,350	88,062	
100							94,412	92,851	90,219	87,943	85,911	84,007	82,262	**80,752**	79,233	77,796	76,475	75,220	74,065		
150						83,617	80,270	**77,537**	75,117	73,014	71,111	69,457	67,964	66,579	66,039	64,875	63,839	62,856			
200					**75,075**	71,045	67,827	65,225	63,062	61,221	59,517	58,680	57,170	56,691	55,587	54,586	53,637				
250				**70,472**	65,445	61,602	58,559	56,079	54,027	52,177	50,522	49,038	47,742	46,664	45,766	44,910					
300			**68,002**	61,216	56,380	52,729	49,910	47,599	45,624	43,932	42,461	41,255	40,228	39,325	39,309						
350		70,038	60,526	53,871	49,157	46,480	43,805	41,624	39,790	38,292	37,072	36,892	35,984	35,186							
400	78,884	**64,709**	55,366	48,803	44,136	40,729	38,219	36,283	35,602	34,426	33,454	32,528	31,681								
450	73,804	59,879	50,627	44,145	40,427	37,180	34,844	33,202	31,940	30,909	30,069	29,293									
500	69,774	56,907	47,680	41,269	36,820	33,729	31,684	30,235	29,186	28,354	27,668										
550	67,389	53,899	44,753	38,393	34,009	31,107	29,260	28,005	27,102	27,286											
600	**64,960**	51,516	43,247	36,961	32,721	29,967	28,209	27,026	26,209												
650	63,797	50,380	41,316	35,140	31,055	28,424	26,736	25,647													
700	62,247	48,848	39,836	33,765	29,757	27,207	25,587														
750	61,060	47,681	38,684	32,676	28,772	26,289															
800	60,110	46,769	37,789	31,847	27,993																
850	59,356	46,067	37,090	31,171																	
900	58,774	45,526	36,567																		
950	58,333	45,129																			
1000	57,970																				

- 15 minute energy storage modeled
- Effective Requirement for non-ramping hours = 600MW
- Use control at 600MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Non-Ramping MRTS Definition

Requirement: 600 Effective MW



- 15 minute energy storage modeled
- MRTS = 1
  - 30% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 164 Perf. Adj. MW of RegD
- MRTS = 0
  - 65% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 456 Perf. Adj. MW of RegD

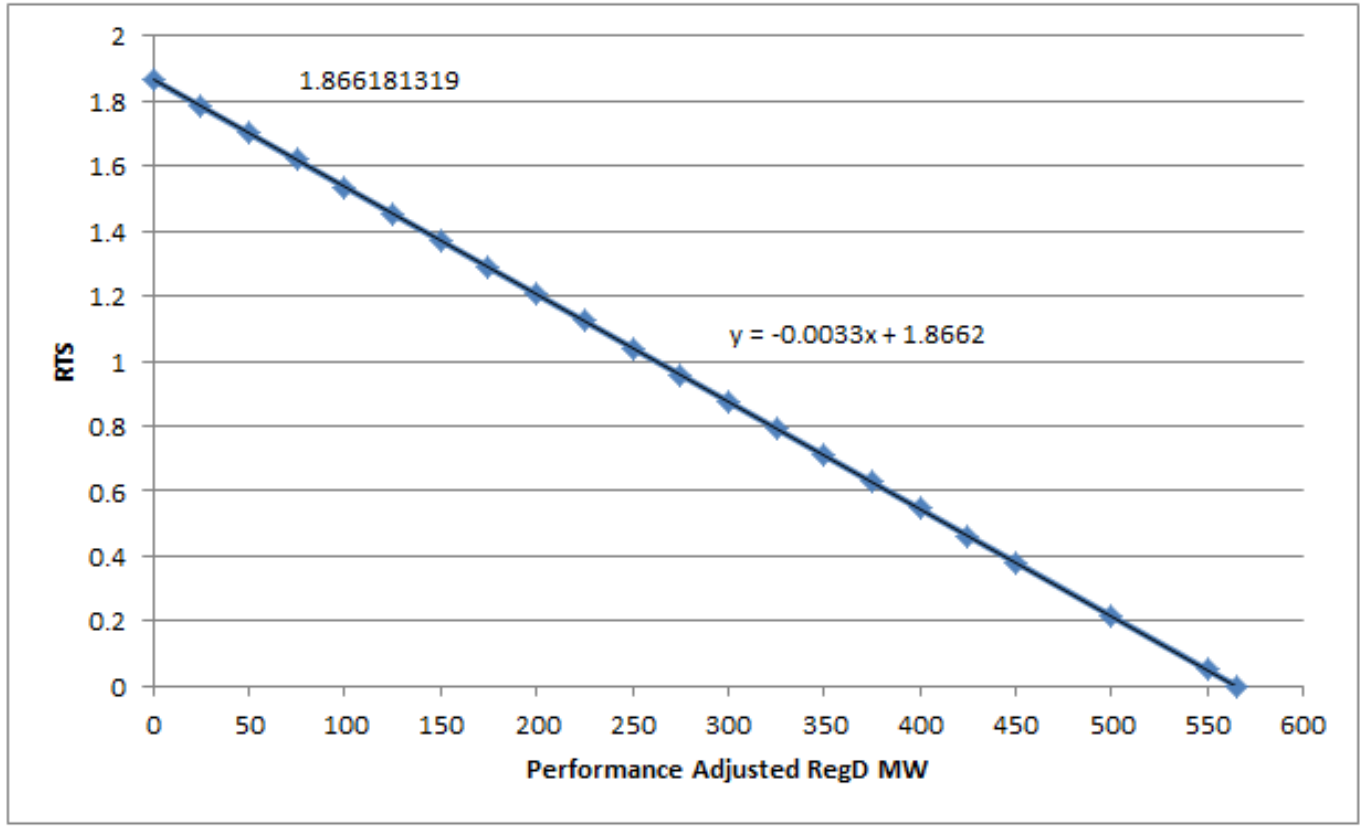
Fall Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									193,055	189,292	187,324	184,692	182,433	179,220	176,400	174,899	173,870	170,629	170,921	169,924	168,917
50								175,129	170,687	167,018	163,915	163,836	161,694	159,771	156,703	155,156	153,688	151,298	151,356	149,253	
100							160,620	157,213	154,720	149,540	144,966	139,961	136,736	133,723	130,990	129,673	127,313	127,633	125,470		
150						149,010	144,185	138,141	132,014	127,851	123,222	119,274	115,915	112,991	110,486	108,222	107,543	105,481			
200					142,196	133,727	126,618	122,979	115,102	112,015	107,168	103,083	99,590	96,544	93,731	91,362	88,777				
250				138,590	129,614	121,481	114,275	107,113	102,028	96,186	91,033	86,717	82,879	80,479	77,087	75,507					
300			136,031	126,055	121,414	113,460	105,250	97,823	91,222	85,375	80,193	75,761	71,394	67,704	64,610						
350		141,758	127,307	118,616	109,355	100,350	92,186	84,822	78,378	72,798	68,051	65,287	63,097	59,875							
400	150,297	132,904	120,258	108,381	98,464	89,701	82,138	75,448	69,490	65,567	60,929	57,053	55,139								
450	142,200	123,419	108,414	96,952	87,933	80,243	74,447	68,342	63,073	58,416	55,768	52,138									
500	133,386	113,142	100,047	89,028	80,350	73,150	66,713	61,012	56,262	53,560	49,916										
550	124,937	105,540	91,820	81,357	73,329	66,397	60,493	55,499	52,568	48,807											
600	116,610	98,066	85,017	74,996	67,367	60,972	55,594	52,437	48,414												
650	109,544	91,719	79,289	69,763	62,274	56,287	52,848	48,643													
700	103,605	86,390	74,468	65,238	58,089	52,493	49,360														
750	98,633	81,948	70,288	61,379	54,492	50,640															
800	**94,506**	78,205	66,686	58,199	53,043																
850	91,109	75,122	63,852	55,397																	
900	88,303	72,699	61,527																		
950	86,024	70,619																			
1000	84,215																				

- 60 minute energy storage modeled
- Effective requirement for ramping hours = 800MW
- Use control at 800MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Ramping MRTS Definition

Requirement: 800 Effective MW



- 60 minute energy storage modeled
- MRTS = 1
  - 38% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 262 Perf. Adj. MW of RegD
- MRTS = 0
  - 67% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 565 Perf. Adj. MW of RegD

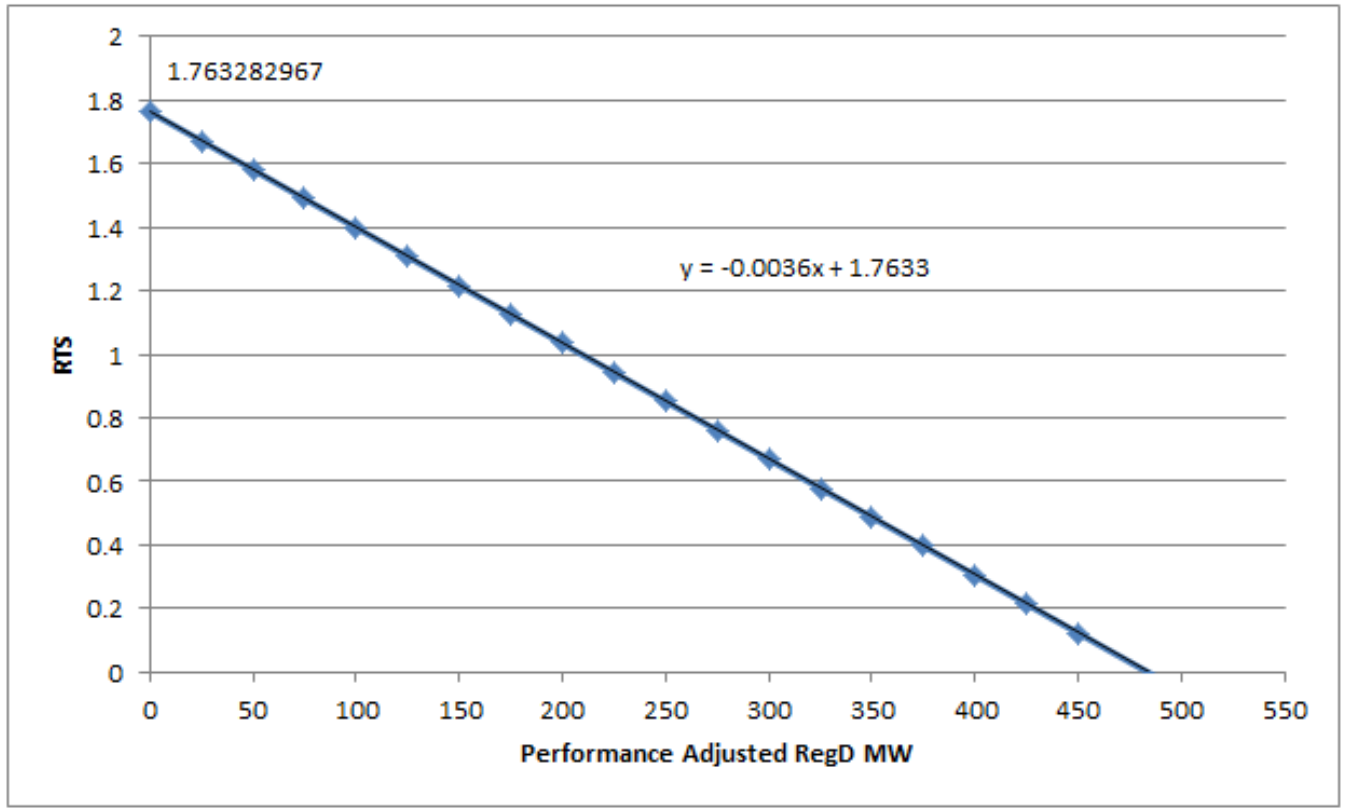
Fall Non-Ramping MRTS Definition

PS Adj. MW	RegD																				
RegA	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0									108,502	105,328	103,582	101,178	98,687	96,344	94,259	92,494	90,843	89,172	87,571	86,060	84,584
50								93,650	90,079	87,067	84,524	82,192	80,192	78,340	76,603	75,909	74,344	72,994	71,737	70,476	
100							80,438	76,474	73,155	70,404	68,087	66,136	64,251	**64,665**	63,107	61,595	60,323	59,139	58,009		
150						71,929	66,984	**62,957**	59,788	57,133	55,003	53,121	51,483	49,965	48,505	47,272	46,248	45,236			
200					**65,426**	59,514	54,847	50,915	47,616	44,891	42,737	40,910	39,429	38,215	37,163	36,250	35,271				
250				**62,818**	55,702	50,200	45,783	42,351	40,433	38,075	36,185	34,575	33,222	32,159	31,260	30,535					
300			**64,554**	55,835	49,201	44,178	40,320	37,290	34,878	32,887	31,330	29,960	28,834	27,922	27,168						
350		69,403	58,056	49,773	43,567	39,047	35,577	32,980	31,057	29,425	28,009	26,880	26,043	25,413							
400	79,833	**63,712**	52,962	45,167	39,288	35,068	32,129	29,901	28,171	26,792	25,746	24,861	24,087								
450	74,669	59,204	48,910	41,563	36,054	32,068	29,473	27,572	26,070	24,913	24,011	23,291									
500	70,562	55,782	46,834	39,759	34,754	31,167	28,626	26,818	25,510	24,544	23,841										
550	68,316	53,955	44,184	37,366	32,634	29,364	27,117	25,539	24,429	23,673											
600	**65,773**	51,727	42,112	35,410	30,884	27,884	25,939	24,581	23,617												
650	63,797	49,954	40,371	33,840	29,503	26,712	24,869	23,664													
700	62,247	48,471	39,033	32,708	28,544	25,832	24,151														
750	61,060	47,339	38,059	31,856	27,832	25,262															
800	60,110	46,467	37,318	31,189	27,260																
850	59,356	45,836	36,727	30,651																	
900	58,774	45,362	36,259																		
950	58,333	45,003																			
1000	57,970																				

- 60 minute energy storage modeled
- Effective Requirement for non-ramping hours = 600MW
- Use control at 600MW of RegA only to find RegA-RegD ‘MW pairs’ which yield equivalent control
- Data interpolation used between control points to increase accuracy

Fall Non-Ramping MRTS Definition

Requirement: 600 Effective MW



- 60 minute energy storage modeled
- MRTS = 1
  - 40% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 209 Perf. Adj. MW of RegD
- MRTS = 0
  - 74% Perf. Adj. MW of RegD make up total Regulation Requirement
  - 484 Perf. Adj. MW of RegD