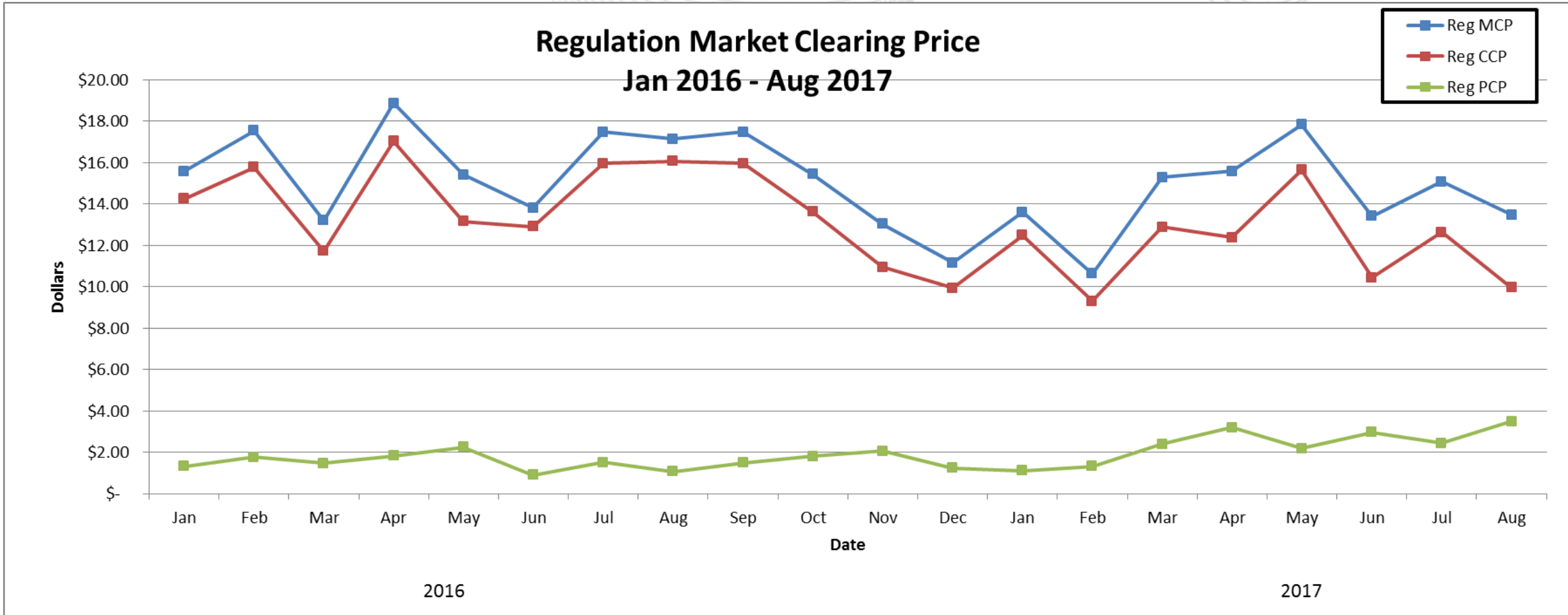




# Regulation Update



Operating Committee  
September 12, 2017



\*Data up to Aug 22

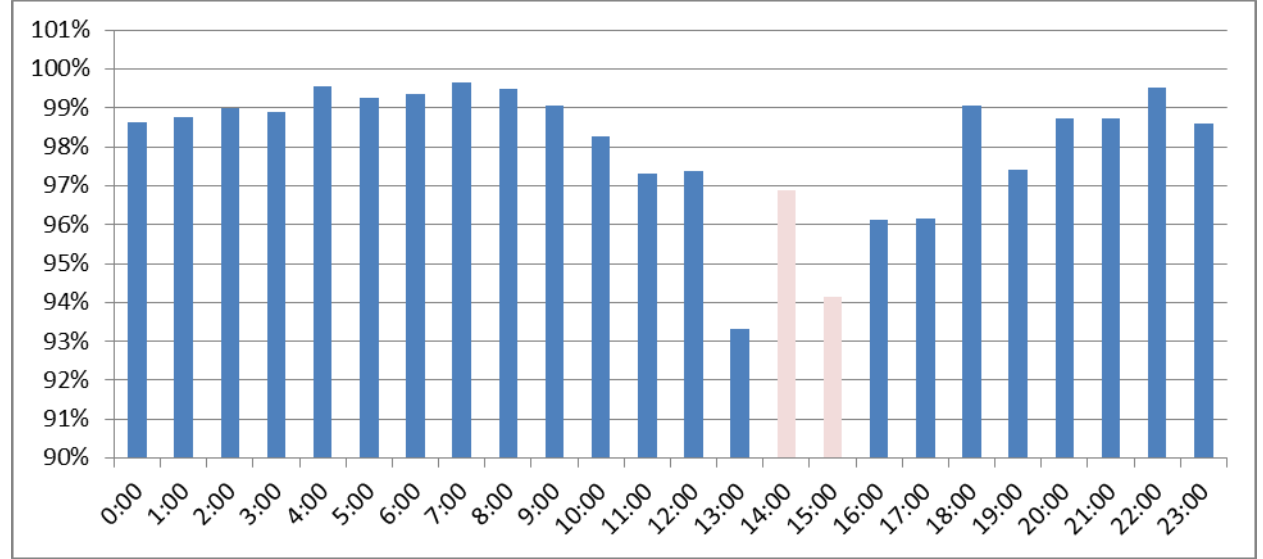
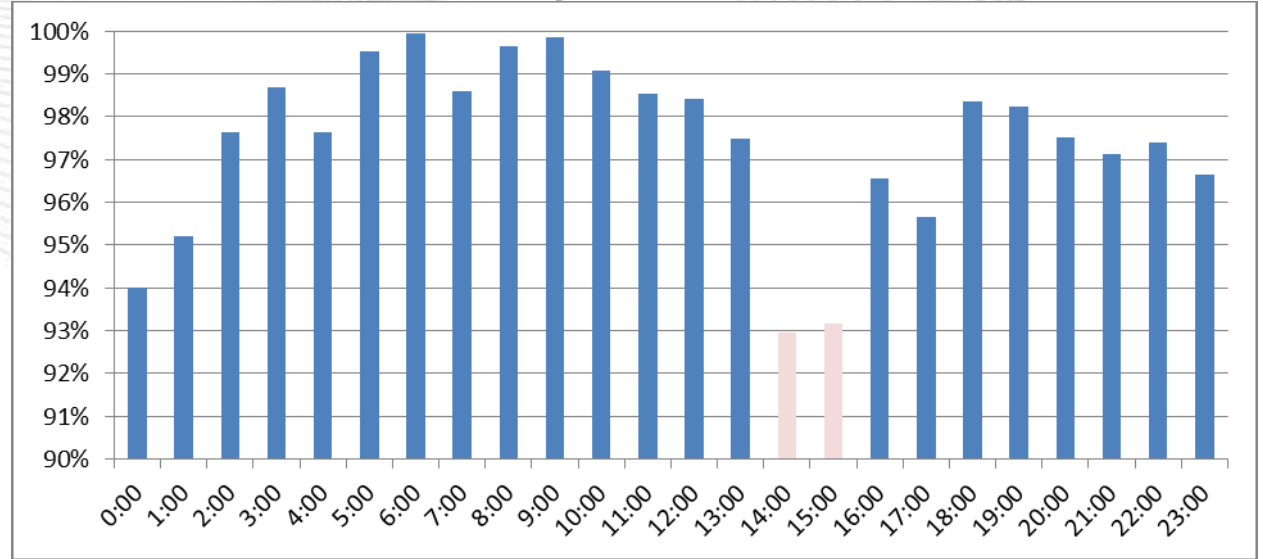
- Mileage Ratio has increased since the new signal implementation
  - Larger Utilization of Regulation D resources
  - Regulation A signal better aligned with unit ramp

Average Mileage Ratio	
Sep-16	2.93
Oct-16	2.44
Nov-16	2.76
Dec-16	2.42
Jan-17	5.17
Feb-17	5.94
Mar-17	6.38
Apr-17	6.22
May-17	6.12
Jun-17	6.19
Jul-17	6.44
Aug-17	6.36

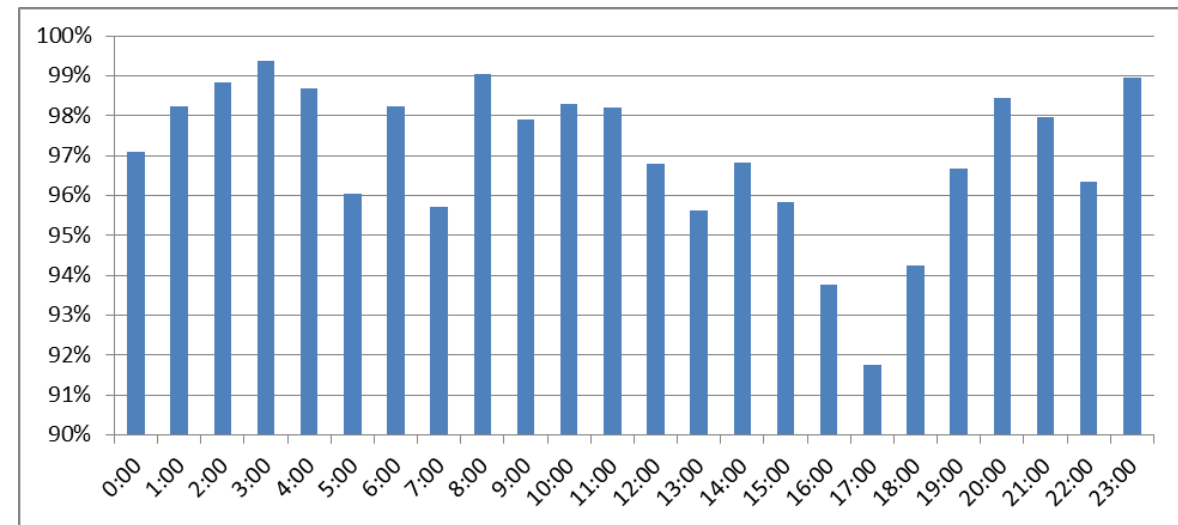
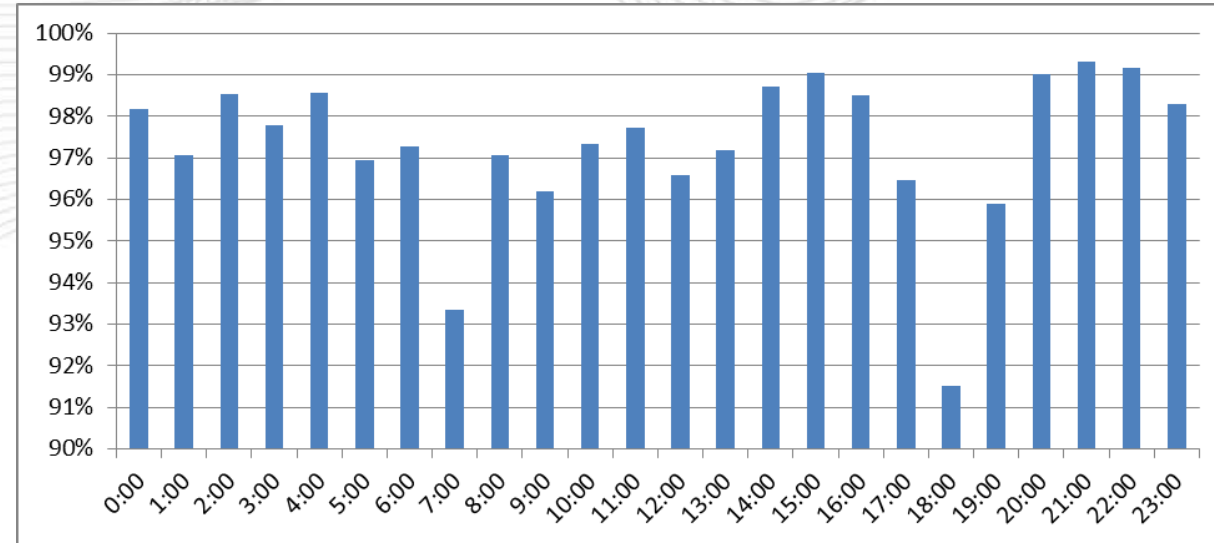
- PJM has been monitoring hourly performance of regulation since January 9 signal implementation
  - Developed score card for tracking regulation utilization, regulation pegging, ACE excursions, and large tie errors
- To-date assessments driving regulation requirement changes

- Extended ramp hours 2 hours (HE15, HE16) during the summer months
  - Monitor HE8, HE17 and HE18 during winter months for updates
- Changed monthly definition of seasonal requirements
  - Winter: Dec 1 – Mar 31
  - Spring: Apr 1 – May 31
  - Summer: Jun 1 – Sep 30
  - Fall: Oct 1 – Nov 30
- Will Extend ramp hours to all mid-day hours during CWA and HWA by all-call

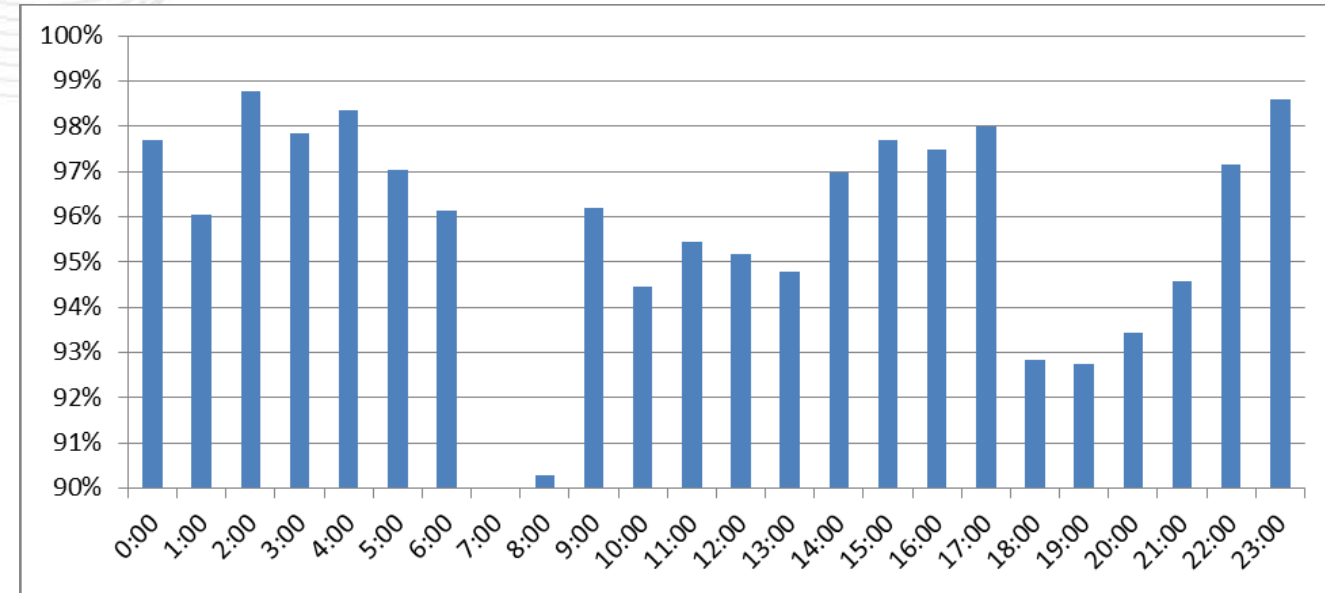
- Graphs show June (top) and July (bottom) hourly regulation performance metrics summary
- Performance metric shows lower scores during Hour 14 and Hour 15 in the summer
  - Increasing requirement to 800MW during these periods will help with summer loads and ramp



- Graphs show Jan (top) and Feb (bottom) hourly regulation performance metrics summary
- Continuing to monitor HE8, HE17 and HE18 for the winter period for additional requirement adjustments
  - With the implementation in January of the new signals PJM is waiting to observe the same poorer performance in these hours during winter of 2018



- Cold weather and winter load curves still visible in March and hot weather and summer load curves still visible in September
  - Moving these months out of the shoulder requirements and into winter and summer requirements, respectively
  - Will allow for better alignment to load and ramping



March Performance



Season	Dates	Off-Ramp	On-Ramp	Excursion	Effective MW Requirement
Winter	Dec 1 – Mar 31	HE1 – HE4, HE10 – HE16	HE5 – HE9, HE17 – HE24	HE7 – HE8, HE18 – HE21	Non-Ramp = 525MW Ramp = 800MW
Spring	Apr 1 – May 31	HE1 – HE5 HE9 – HE17	HE6 – HE8 HE18- HE24	HE7 – HE8, HE18 – HE21	Non-Ramp = 525MW Ramp = 800MW
Summer	Jun 1- Sep 30	<b>HE1 – HE5</b> <b>HE17 – HE18</b>	<b>HE6 – HE16</b> <b>HE19- HE24</b>	<b>HE7 – HE8,</b> <b>HE18 – HE21</b>	<b>Non-Ramp = 525MW</b> <b>Ramp = 800MW</b>
Fall	Oct 1 – Nov 30	HE1 – HE5 HE9 – HE17	HE6 – HE8 HE18- HE24	HE7 – HE8, HE18 – HE21	Non-Ramp = 525MW Ramp = 800MW

MW	Steam	Hydro	CT	DSR
<b>Regulation A</b>				
Avg. Performance Score (1/1)	75%	86%	84%	85%
Avg. Performance Score (5/1)	76%	87%	85%	86%
Avg. Performance Score (6/1)	76%	87%	85%	86%
Avg. Performance Score (8/1)	76%	87%	89%	85%
<b>Regulation A Qualified MW (8/1)</b>	4134.0	1051.0	1181.6	5.0

MW	Hydro	CT	Energy Storage	DSR
<b>Regulation D</b>				
Avg. Performance Score (1/1)	77%	90%	96%	85%
Avg. Performance Score (5/1)	78%	92%	88%	82%
Avg. Performance Score (6/1)	78%	91%	91%	82%
Avg. Performance Score (8/1)	78%	92%	90%	82%
<b>Regulation D Qualified MW (8/1)</b>	420.0	121.6	286.5	17.0

- Signals are continuing to provide improvement to ACE control
  - Regulation signals are always controlling ACE

Signal Type	Date	Avg. Median Daily ACE	Avg. Daily Stdv
New Signal	Jan 2017(1/9-1/31)	34	244
	Feb 2017	32	236
	Mar 2017	38	269
	Apr 2017	38	254
	May 2017	30	245
	Jun 2017	39	247
	Jul 2017	47	240
	Aug 2017*	48	230
Old Signal	Jan 2017(1/1 - 1/8)	68	285
	2016	56	274
	2015	52	284

\*Data up to Aug 28

- For the majority, RegD signal is pegged for only small durations of time, which is to be expected for ACE control
  - Occasional longer pegged due to system conditions
  - Less RegD pegging observed with signal tuning
  - Peg = 99% of TREG

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug*
20-30 minute duration	8	11	20	13	12	6	10	2
>30 minute duration	3	2	4	1	2	0	0	1

\*Data up to Aug 22

- RegA is pegged more often than RegD – RegA resources typically do not have an energy duration limitation
  - Pegged for system conditions, no limitations built into regulation signal to minimize pegging
  - Will be pegged longer on occasion for conditional neutrality
  - Peg = 99% of TREG

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug*
20-30 minute duration	86	96	129	93	89	40	56	42
>30 minute duration	55	53	93	63	30	14	14	10

\*Data up to Aug 22

	<b>Ramp, Excursion</b>	<b>Ramp</b>	<b>Non-Ramp</b>
	AVG MW	AVG MW	AVG MW
<b>NEW SIGNAL</b>	197	200	196
<b>OLD SIGNAL</b>	195	245	218

# Appendix



- On Jan 9<sup>th</sup> 2017 PJM put new regulation signals and requirements in operations
  - Regulation Signals implemented 30 minute conditional neutrality
    - Signal tuning has occurred since implementation to enhance signal performance
  - Regulation requirement defined seasonally and as ramp/non-ramp periods
    - 800 MW Ramp Requirement, 525MW Non-Ramp Requirement
- RMISTF remaining design components endorsed at June MRC and July MC
  - See Appendix for design components and PJM/IMM package summary

Total Unique Responders	29				
Total Companies	159				
Voting Members	52				
Affiliates	107				
Question	Yes	No	Abstain	#	%
1. Do you support Package E – PJM/IMM? -- Response	114	39	6	159	75%
2. Do you support Package F - Beacon? -- Response	23	118	18	159	16%
3. Do you support Package G - ESA? -- Response	33	108	18	159	23%
4. Do you support Package H – Steel Producers? -- Response	11	106	42	159	9%
5. Do you support Package I – Mosaic & A.F. Mensah? -- Response	33	108	18	159	23%
6. Do you support Package J – NextEra? -- Response	23	117	19	159	16%
7. Do you support Package K – ESA Compromise? -- Response	39	107	13	159	27%
	Make a Change	Retain the Status Quo	Abstain	#	%
8. Do you prefer to make a change to Regulation Market regarding performance score, clearing, and settlements, or retain the status quo? -- Response	126	19	14	159	87%

## Benefit Factor - Application and clearing

- Replace Benefit Factor (BF) with Regulation Rate of Technical Substitution (RRTS)
- Effective MW calculation will be area under the RRTS curve

## Performance Scoring

- Precision only calculation
- Minimum allowable participation threshold to be raised from status quo 40% to 50%

## Settlements

- Replace Mileage Ratio from the Regulation Performance Credit with Marginal Rate of Technical Substitution
- Marginal Rate of Technical Substitution will be added to the Regulation Capability Credit

## Transition Plan

- The 1st 12 months of the 24 month transition period will have a minimum (floor) RRTS value of 0.65. The last 12 months of the 24 month transition period would have a minimum (floor) RRTS value of 0.50.