# Regulation and Control Metrics

- Regulation Signals are in a full raise or lower state (+/- TREG) when there is a generation/load imbalance and ACE is at extremes
    - o Regulation A will continues to hold at a full raise or lower until ACE returns to normal bounds
    - o Regulation D logic brings the signal back to zero, which goes against ACE correction

- Operators utilize the regulation manual move to force signal to specific utilization percentages
    - o Forcing Regulation D to extreme depletes batteries, lowering scores

- **Reg A Signal Pegged-** represents the number of hours when the RegA signal was pegged (either high or low) for a duration of longer than 15 minutes

- **Operator Manual Moves-** represents the number of hours when the regulation signals were manually moved by the operator
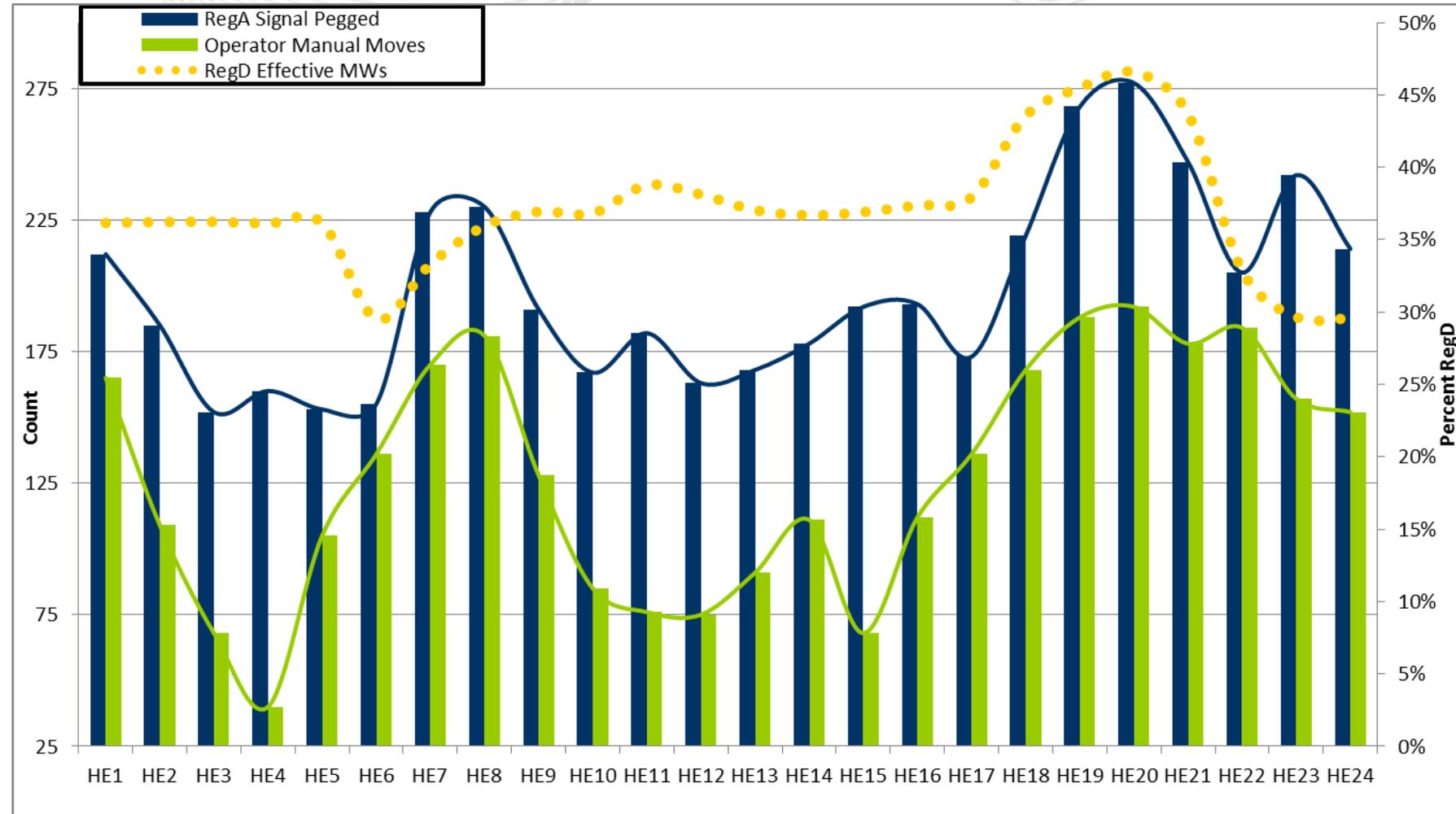
- **R1.** The Responsible Entity **shall operate such that the Control Performance Standard 1 (CPS1)**, calculated in accordance with Attachment 1, **is greater than or equal to 100 percent** for the applicable Interconnection in which it operates for each preceding 12 consecutive calendar month period, evaluated monthly.

$$CPS1 = 100 \left[2 - \frac{(RTO\ ACE)(FA - FS)}{-10\beta\ \varepsilon1^2} \right]$$

- **R2.** Each Balancing Authority **shall operate such that its clock-minute average of Reporting ACE does not exceed its clock-minute Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes**, calculated in accordance with Attachment 2, for the applicable Interconnection in which the Balancing Authority operates

$$BAAL_{Low} = \left(-10B_i \times \left(FTL_{Low} - F_S\right)\right) \times \frac{\left(FTL_{Low} - F_S\right)}{\left(F_A - F_S\right)}$$

$$BAAL_{High} = \left(-10B_i \times \left(FTL_{High} - F_S\right)\right) \times \frac{\left(FTL_{High} - F_S\right)}{\left(F_A - F_S\right)}$$

- Contour plots developed suggesting that CPS1 performance can be maintained with the relationship between increased fast resources and the regulation requirement


Contour plot for CPS1, 4-11-2011
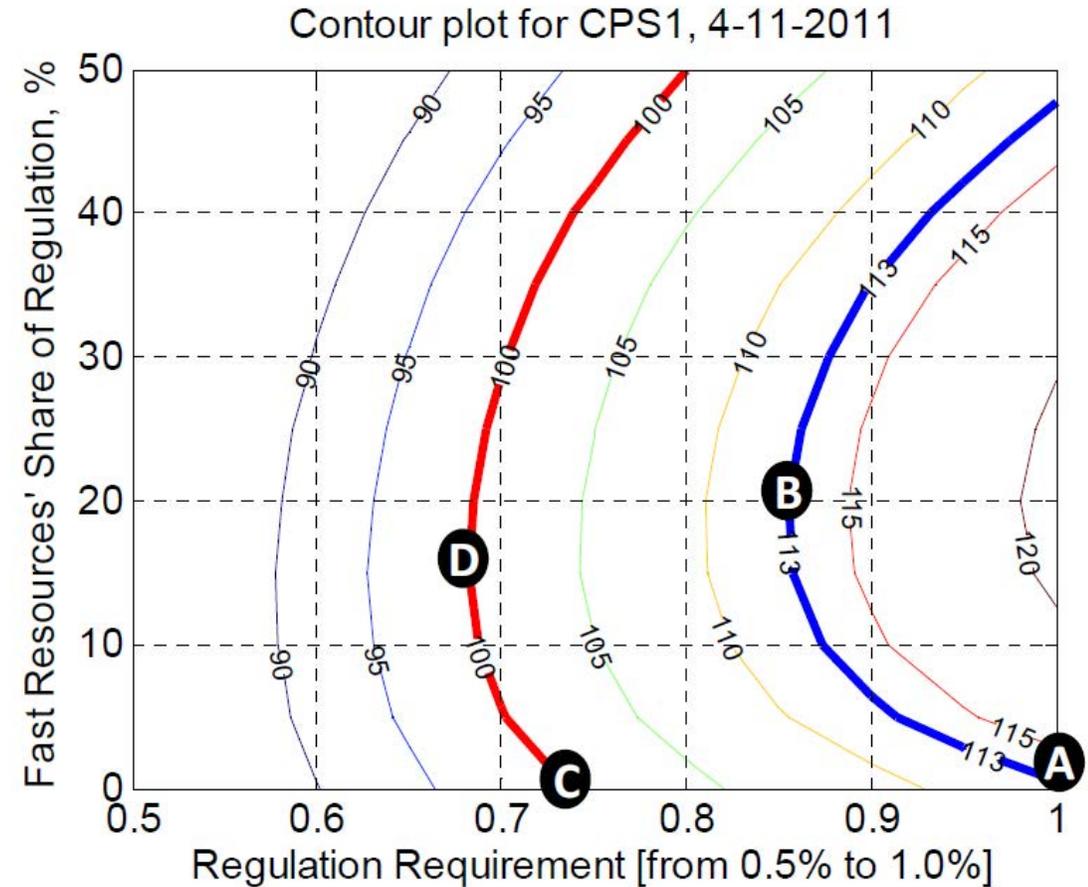
- When CPS1 is already very high, the BAAL violations tend also to be low; when CPS1 is closer to the lower ranges, BAAL violations tend to increase more quickly than CPS1 decreases

- Decreasing regulation requirements and increasing fast regulation participation in regulation tends to increase the number of BAAL violations

- The degree with which the BAAL worsens appears to be aligned with the days with lower CPS1 scores


5-10-2011

Fast Resources' Share of Regulation →	0.50%	0.55%	0.60%	0.65%	0.70%	0.75%	0.80%	0.85%	0.90%	0.95%	1.00%
50%	48	43	38	31	28	25	22	18	13	10	9
45%	46	40	34	28	26	23	21	17	12	10	6
40%	45	37	32	27	26	21	19	16	12	7	6
35%	43	36	31	26	22	21	18	13	10	6	6
30%	41	36	29	25	22	20	16	12	9	6	6
25%	40	33	28	24	20	19	15	12	9	6	6
20%	39	33	28	22	19	18	12	11	9	6	5
15%	38	32	25	22	18	14	12	10	8	5	4
10%	36	29	25	23	16	14	11	10	7	5	3
5%	35	28	26	21	16	13	11	10	6	5	3
0%	34	28	24	20	16	12	11	9	6	4	3

Regulation Requirement (as % of Daily Load) →

- PJM currently controls ACE to BAAL limits and has been a field trial participant since 2005

- BAAL (Balancing Authority ACE Limit) is used to maintain interconnection frequency and RTO ACE within a predefined profile

- Any excursion outside of the BAAL limits will be considered a 'BAAL minute'
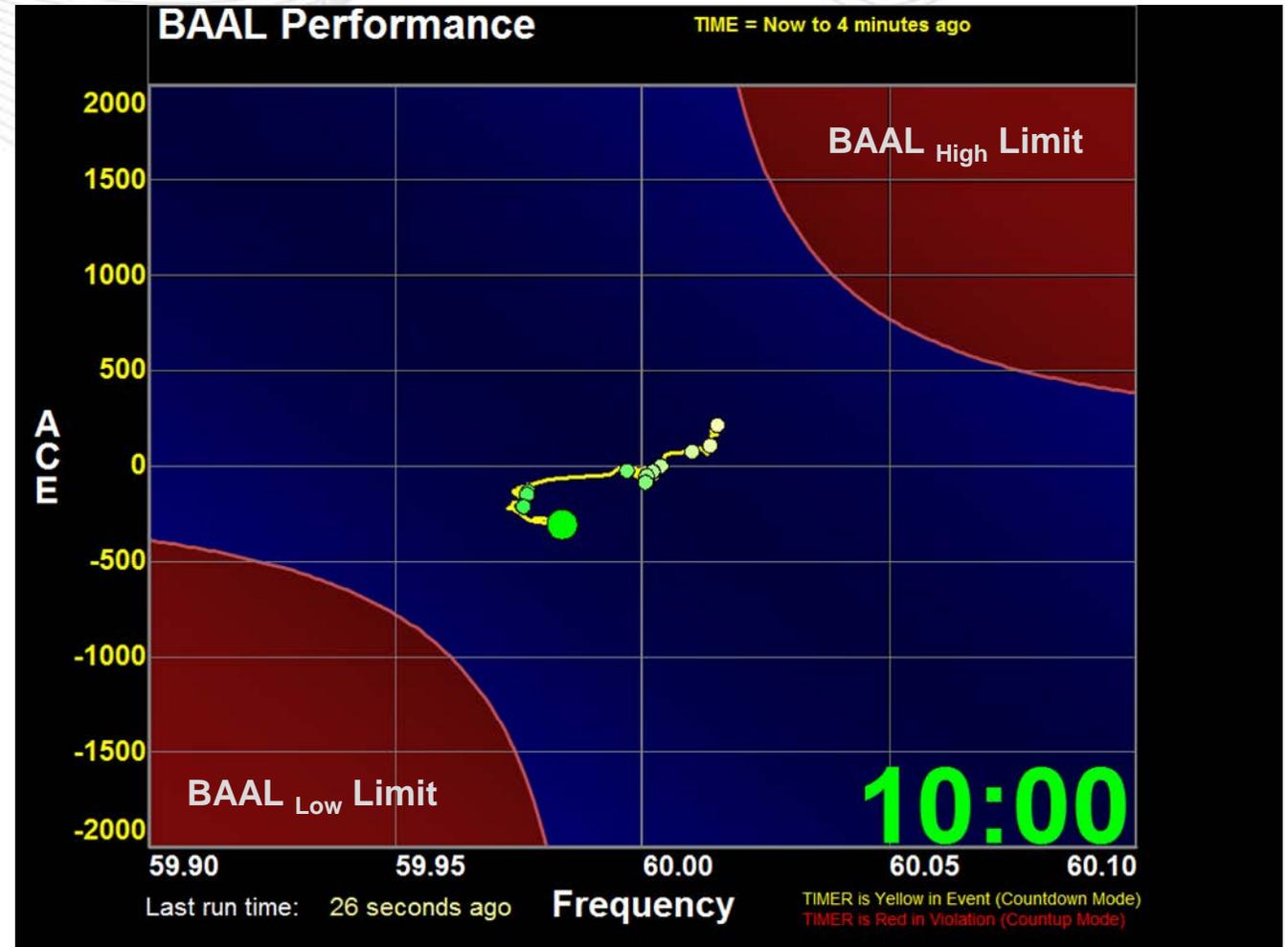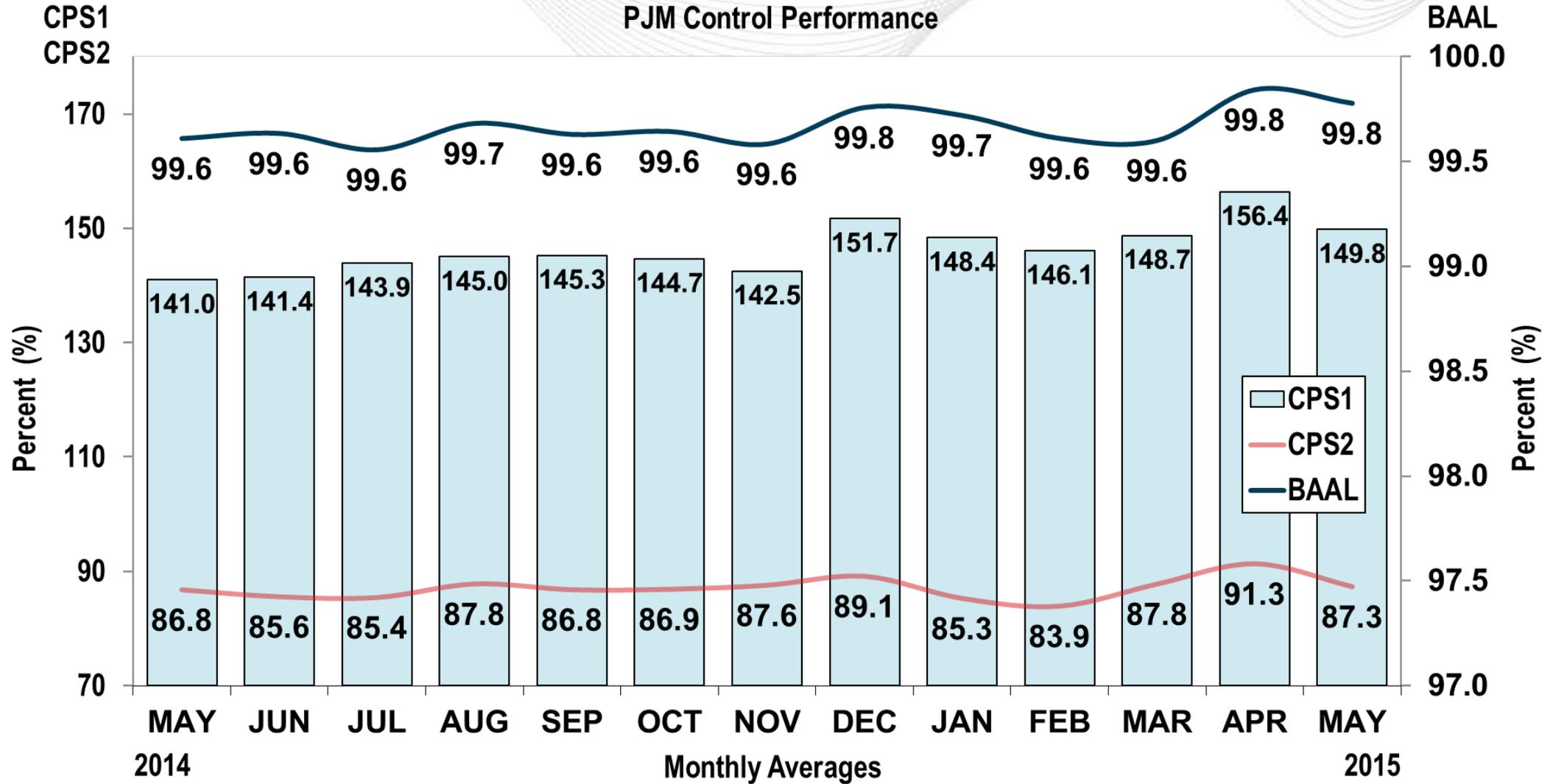
Hourly Average CPS1 Performance

Hourly CPS1 Performance