RMDSTF Regulation Requirement

PJM's Proposal

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RMDSTF

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Recap of Past Requirement Presentations

- **August**: Peer requirement and initial data review (peg, renewables)
- **September**: Signal saturation (peg) metrics
  - Rules changes caused most significant impact
  - On/Off Ramp Hour breakdown suggested seasonal and hourly patterns (i.e. more in Summer/Winter On, less in Fall/Spring On)
- **November**: Initial proposal of dynamic adder model
  - Desire to ground in more explicit variables
- **December**: Data review of seasonal load, renewables, ACE
- **February**: New proposal of correlation based formulaic model

Recap of Past Requirement Presentations: **February**

- Presented formulaic requirement leveraging correlations of various timeseries factors with historic ACE metric(s)

  Regulation Requirement$_t$ = 600 MW + (C_1 * Loadt + C_2 * Delta Load$_t$ + C_3 * Delta Generation$_t$ + C_4 * Delta Interchange$_t$)

  – Introduced requirement floor value for stability

  – Factors selected with 1 day ahead horizon in mind

  – Factor relationship with ACE dictated strength of impact on req.

- Next steps included verification of factor correlations and requirement “mockup” for informational purposes

February Proposal: Correlation Methods

- Correlations executed against ACE metric ***hourly average absolute net ACE MW***
  - Net ACE MW = Control ACE MW - REGA – REGD

    e.g. 250 $MW_{CtrlACE}$ – (- 200 MW_{REGA}) – (-50 MW_{REGD}) = 500 MW
  - Other metrics tested as a backstop
- Variety of factors examined for completeness
  - Real-time included as well as those known a day in advance
- Annual, monthly, seasonal correlation scores calculated
- Sought correlations that **exceeded 0.5 strength of association**

February Proposal: Correlation Methods

- Factors examined included** the following:

Gen	Generation MW Raised by RAC
	Generation Expected by RAC
	Net Fleet Dispatch
	Maximum Up/Down Fleet Dispatch MW
IX	Intrahour Actual Net Interchange Volatility
	Scheduled Net Interchange
	Actual Net Interchange
	Hour-to-Hour Delta Actual Interchange

Load	Intrahour Actual Load Volatility
	Hour-to-Hour Actual Load Ramp
	Hour-to-Hour Forecasted Load Ramp
	Hourly Load Forecast Error (1800)
Solar/Wind	Actual Fleet Output MW
	Forecasted Fleet Output MW (1800)
	Intrahour Actual Volatility
	Renewable Forecast Error MW (1800)
CPS	Hourly CPS Scores

February Proposal: Correlation Results

- **No factor correlation exceeded 0.45**
- Highest (annual) correlations included:
  - Volatility of 5-min Actual Net Interchange (0.332)
  - Intrahour “Movement” of 5-min Actual Load (0.304)
  - Volatility of 5-min Actual Load (0.267)
  - Absolute Hour-to-Hour Load Ramp (0.253)
- **CPS Score moderately correlated**
  - **Hourly CPS Score (-0.66)**
- Annual vs. month vs. season produced consistent results, negligible improvement in correlation as granularity increased

Regulation Requirement: Revised Proposal

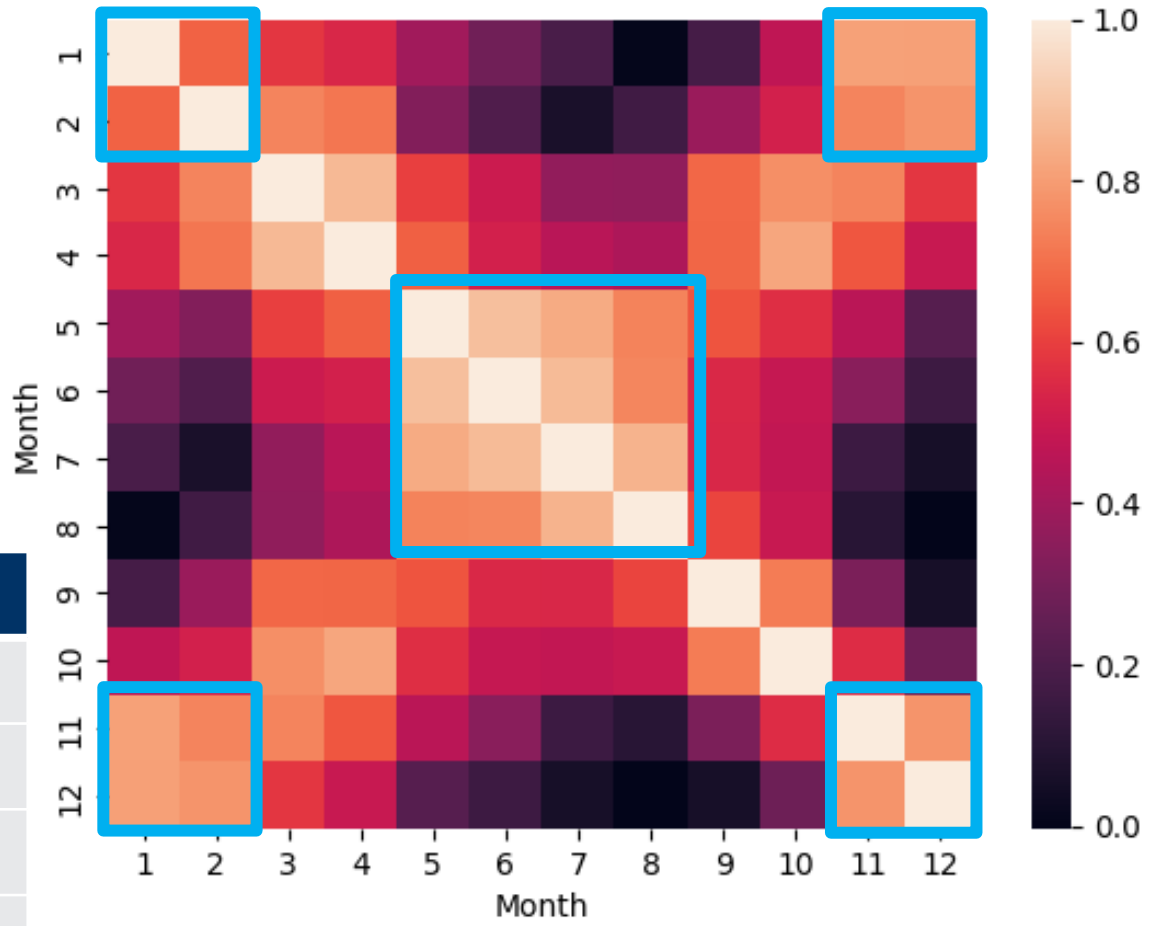
- Binary regulation requirement MW levels applicable based on season, hour of day
- Influenced by recent ACE and CPS historic data (2022)
- Modifications to the status quo to align with observed control outcomes
  1. Slight shift in seasonal definitions
  2. Change in “high” and “low” designated hours
  3. Slight change in “high” and “low” designated MW levels

Proposed Requirement Schedule

Season	1 Dates	2 Hours Ending 3	Requirement MW
Winter	Nov. 1 – Feb. 28	HE 5 – 10, HE 17 – 24	800
		HE 1 – 4, HE 11 - 16	500
Spring	March 1 - April 30	HE 19 – 1, HE 6 – 9	800
		HE 2 – 5, HE 10 – 18	500
Summer	May 1 – Sept. 15	HE 5 – 15, HE 20 – 1	800
		HE 2 – 4, HE 16 - 19	500
Fall	Sept. 15 – Oct. 31	HE 6 – 9, HE 18 – 24	800
		HE 1 – 5, HE 10 - 17	500

Seasonal Definition Shift

- Examined correlation matrix comparing **typical hourly ACE profiles** by month
- Strong association between
  - November – February
  - May – mid-September
  - Shoulder months less so
- Operations experience in September



Season	Old Dates	New Dates
Winter	**Dec. 1** – Feb. 28	**Nov. 1** – Feb. 28
Spring	March 1 – **May 31**	March 1 - **April 30**
Summer	**June 1** – **Aug. 31**	**May 1** – **Sept. 15**
Fall	**Sept. 1** – **Nov. 30**	**Sept. 15** – **Oct. 31**

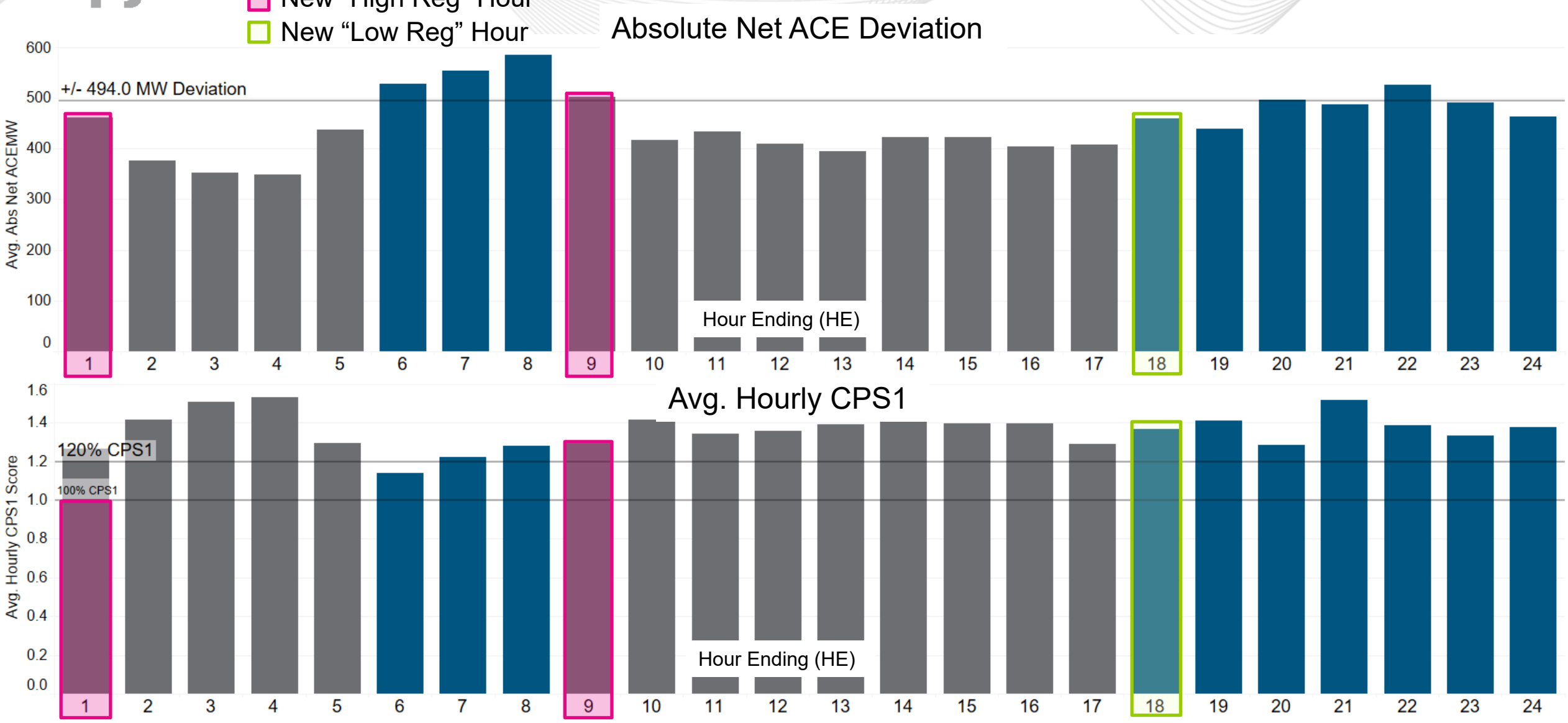
Hourly Definition Shift

- Based on metrics and operational need vs. historic ramp designations
- Examined typical hourly profiles of Absolute Net ACE Deviation and Hourly CPS1, bucketed by new seasonal definitions

Season	Hours Ending Status Quo	Hours Ending Proposed	MW Level
Winter	HE 5 – 9, HE 17 – 24	HE 5 – **10**, HE 17 – 24	**High**
	HE 1 – 4, HE 10 – 16	HE 1 – 4, HE **11** - 16	Low
Spring	HE 6 – 8, HE 18 – 24	HE **19** – **1**, HE 6 – **9**	**High**
	HE 1 – 5, HE 9 – 17	HE **2** – 5, HE **10** – **18**	Low
Summer	HE 6 – 14, HE 19 – 24	HE **5** – **15**, HE **20** – **1**	**High**
	HE 1 – 5, HE 15 – 18	HE **2** – **4**, HE **16** - **19**	Low
Fall	HE 6 – 8, HE 18 – 24	HE 6 – **9**, HE 18 – 24	**High**
	HE 1 – 5, HE 9 - 17	HE 1 – 5, HE **10** - 17	Low

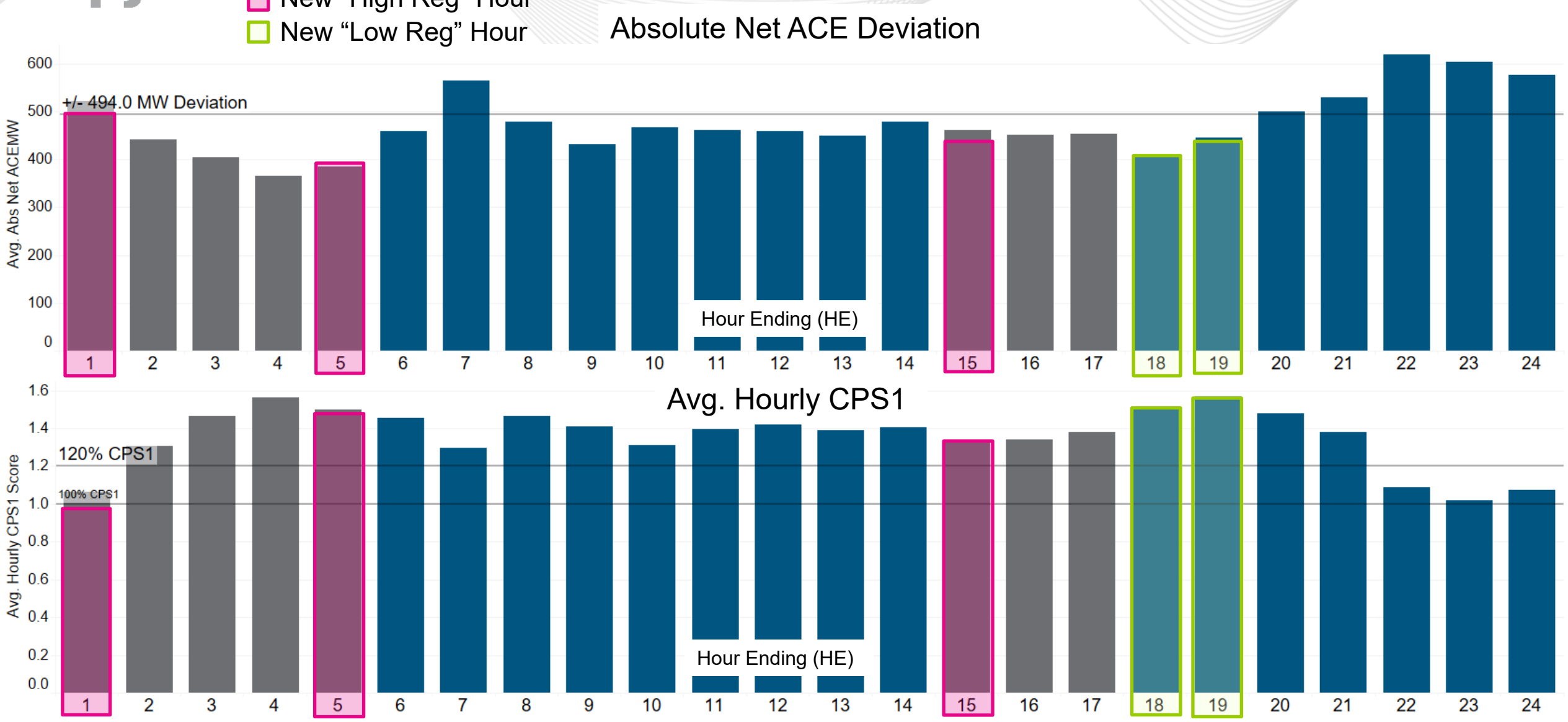
Hourly Definition Shift: Spring

Status Quo “On Ramp”
Status Quo “Off Ramp”
New “High Reg” Hour
New “Low Reg” Hour



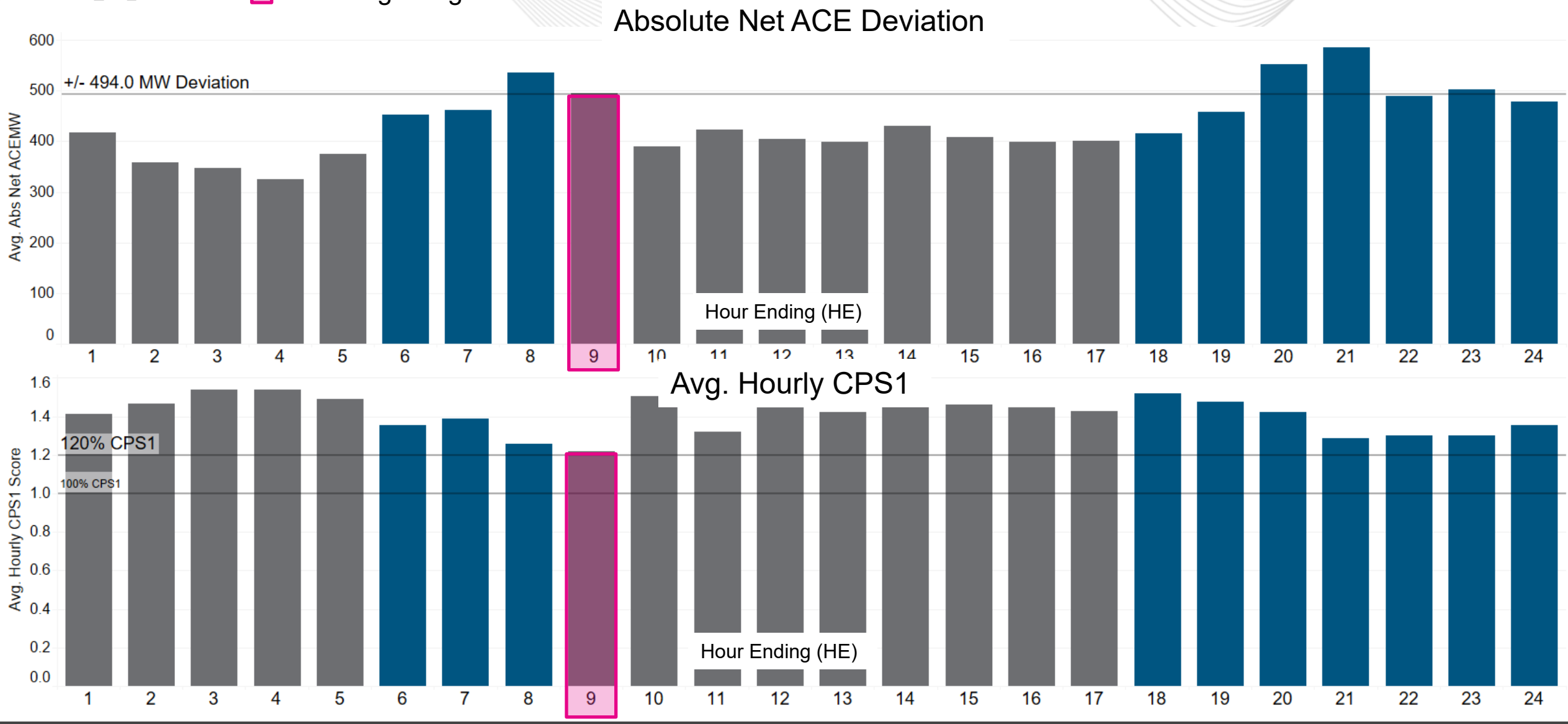
Hourly Definition Shift: Summer

- Status Quo “On Ramp”
- Status Quo “Off Ramp”
- New “High Reg” Hour
- New “Low Reg” Hour



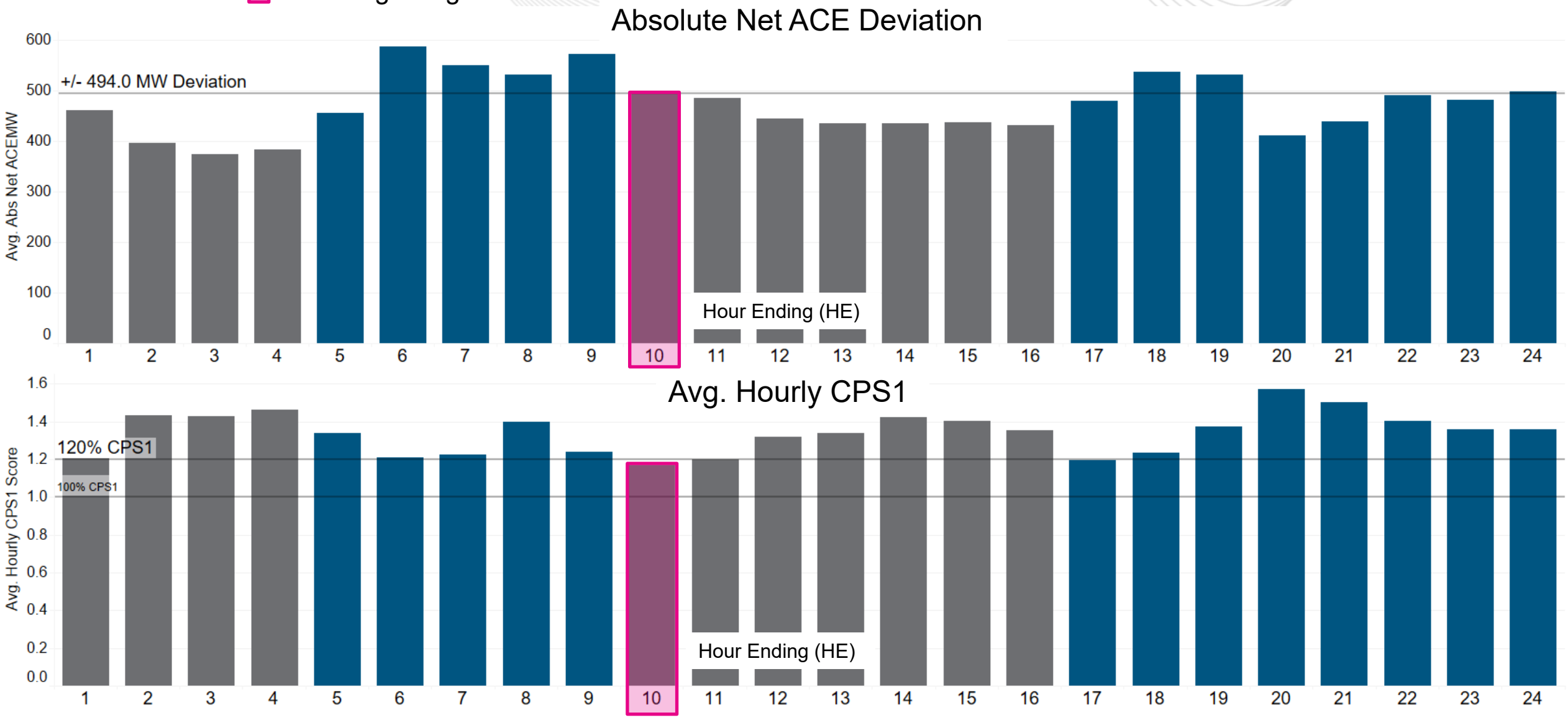
Hourly Definition Shift: Fall

Status Quo “On Ramp”
Status Quo “Off Ramp”
New “High Reg” Hour



Hourly Definition Shift: Winter

Status Quo “On Ramp”
Status Quo “Off Ramp”
New “High Reg” Hour



Summary of Regulation Requirement Proposal

Season	Dates	Hours Ending	Requirement MW
Winter	Nov. 1 – Feb. 28	HE 5 – 10, HE 17 – 24	800
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Annual Review Process

- Codify an annual review of system performance metrics and adjust requirement based seasonal hourly profiles of past year
  - Season-Hours with average CPS <120% and <100% see requirement raised by 10% and 25%, respectively

Maintain Discretion

- Preserve operator discretion in times of immediate need
  - Account for unpredictability and emergency conditions

Contact

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PJM RMDSTF Regulation Requirement

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