Constellation's CIFP-RA Proposal

August 14, 2023

Constellation's perspective on Capacity Market Reform

- Constellation supports the RPM reform framework as directed by the PJM Board and the CIFP. We support the following elements of the PJM proposal:
  - Implement the best possible modeling of reliability risk in all periods of the year
  - Moving to an EUE-based, rather than LOLE-based, reliability standard
  - Resource accreditation based on marginal ELCC, applied to all resource types
  - Strong performance incentives tightly linked to the highest-risk periods of the year
- However, there are a few areas where PJM's proposal should be modified or maintained to produce improved reliability and/or higher economic efficiency

Constellation recommended five specific improvements to PJM's proposal

1. Shorten the forward term of the capacity auction
2. Implement the two-season capacity market
3. Modeling assumption tweaks
4. Meeting the reliability standard also requires energy and ancillary services market reform reflecting need for additional "uncertainty reserves." PJM, IMM, and stakeholders should commit to an energy market reform to support the CIFP. (Reserve Certainty at MRC)

1. Shorten the forward term of the capacity auction

Acknowledges change in construction timeline for new resources

- Constellation proposes moving to a single prompt auction from the current 3-year forward
  - Base residual auction occurs 6 - 12 months prior to delivery year
  - Incremental auctions eliminated or reduced to one depending on timing
  - Pre-auction timeline/signposts otherwise unchanged
  - Auction mechanics (demand, offers, clearing) unchanged
- Moving to prompt auction will improve reliability and market efficiency
- From 2007/08 through 2029/30, a majority of the BRAs are already less than a 3 year forward time horizon

PY	BRA Start Date	Years Prior to DY
07/08	4/2/2007	0.2
08/09	7/2/2007	0.9
09/10	10/1/2007	1.7
10/11	1/21/2008	2.4
11/12	5/5/2008	3.1
12/13	5/4/2009	3.1
13/14	5/3/2010	3.1
14/15	5/2/2011	3.1
15/16	5/7/2012	3.1
16/17	5/13/2013	3.1
17/18	5/12/2014	3.1
18/19	8/10/2015	2.8
19/20	5/11/2016	3.1
20/21	5/10/2017	3.1
21/22	5/10/2018	3.1
22/23	5/19/2021	1.0
23/24	6/8/2022	1.0
24/25	12/7/2022	1.5
25/26	*6/1/2024*	1.0
26/27	*12/1/2024*	1.5
27/28	*6/1/2025*	2.0
28/29	*12/1/2025*	2.5
29/30	*6/1/2026*	3.0

2. Implement the two-season capacity market

- Previously ignored winter risk will be acknowledged through PJM's improved risk modeling and accreditation
- Moving to the two-season design better aligns with the modelling changes while providing a more direct market signal in support of reliability
- More intuitive and transparent

	Summer	Winter	Annual Equivalent
Onshore Wind	9%	36%	25%
Offshore Wind	17%	68%	47%
Solar Fixed Panel	18%	1%	8%
Solar Tracking Panel	31%	2%	13%
4-hr Storage	90%	38%	59%
6-hr Storage	97%	48%	67%
8-hr Storage	99%	58%	75%
10-hr Storage	100%	69%	81%
Solar Hybrid Open Loop	53%	11%	28%
Solar Hybrid Closed Loop	53%	11%	28%
Hydro Intermittent	40%	44%	42%
Landfill Gas Intermittent	60%	51%	55%
Hydro with Non-Pumped Storage	97%	82%	88%

	Summer	Winter	Annual Equivalent
Thermals (Overall)	**94%**	**78%**	**84%**
Nuclear	97%	95%	96%
Coal	89%	83%	86%
Gas CC	97%	75%	83%
Gas CT	98%	62%	76%

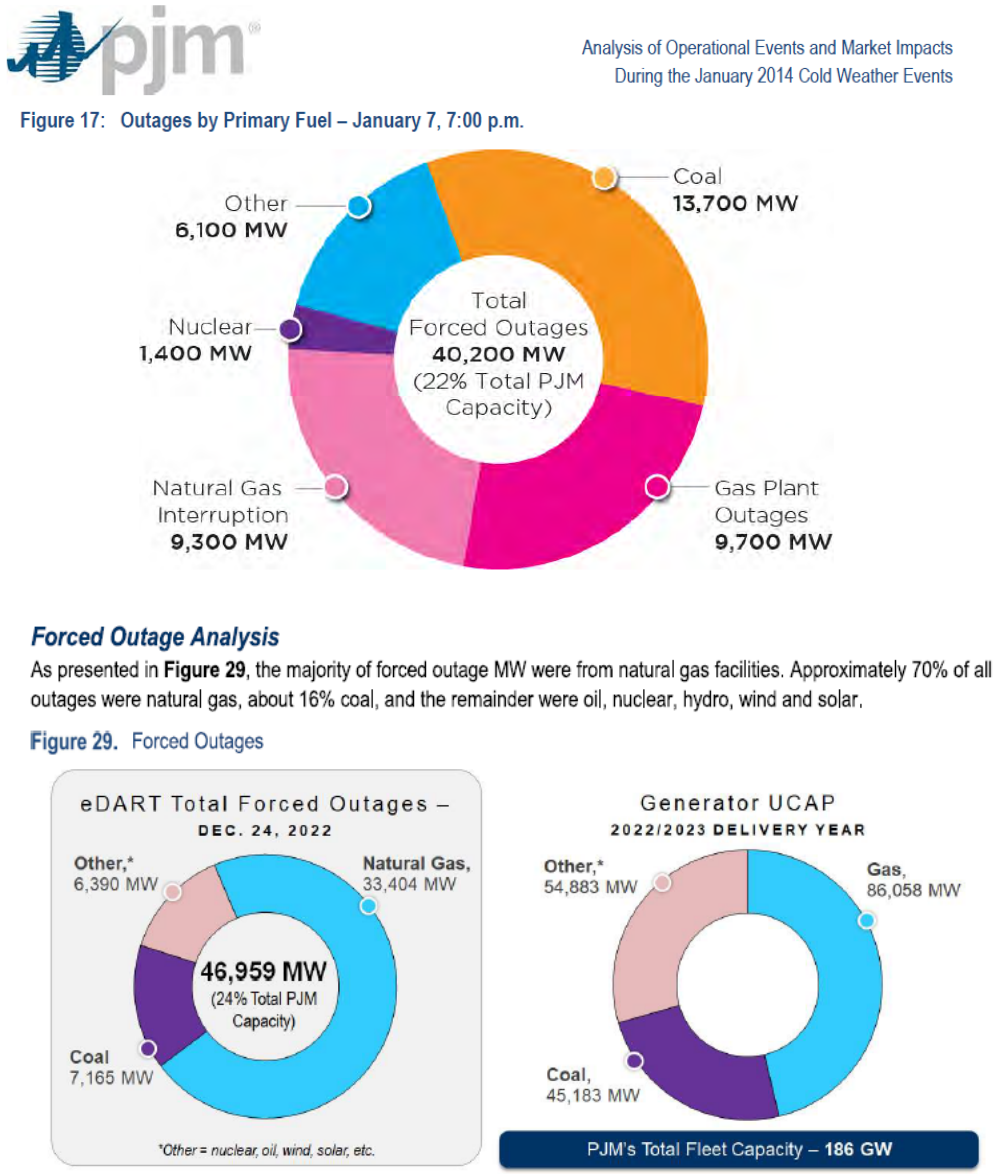
** Additional thermal class accreditations forthcoming*

	Summer	Winter	Annual Equivalent
DR	109%	73%	87%

** DR values reflect status quo performance windows; assessment of 24-hour availability DR forthcoming*

Resource Accreditation Should Be Based On All Historical Performance Data
Including the 2014 Polar Vortex

- PJM risk modeling must include observed data especially for calculation of ELCC values
  - If only looking back to 2012 now for resource performance, we could lose valuable information in just a few years.
  - PJM's proposal to base ELCC on 10 years of performance data is the bare minimum and ideally should be double that. Going forward the start date lookback period for performance data should remain 2012 until a full 20 years of historical data is included.
- According to PJM's published reports:
  - 2014 Polar Vortex – 40,200 MW of forced outages – 22% of the total PJM capacity
  - 2022 Winter Storm Elliott – 46,959 MW of forced outages – 24% of the total PJM capacity



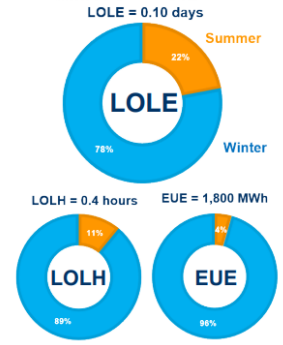
Risk Modeling to Include All Data Observations

- Extended history provides useful data observations regarding the impact of extreme weather
- Move to 50-year history without the climate change adjustment
- Agree that it can't be known how the different weather events from the 70s and 80s would look today, but incorporating them into the models still provides beneficial insights
- Use of the actual data without the climate change adjustments best approach at this time

Model Updates Since Initial Preliminary Results

Summary of Model Updates	Relative Shift in Risk
1. Adjusted modeling of resource performance in extreme hot temperatures (now slightly worse than before)	+ Summer risk
2. Applied weather rotation across days of week (impacting load forecast, not generation)	+ Summer risk
3. Updated thermal fleet to derive performance shapes	Negligible
4. Capped resource output at CIRs	Negligible
5. Expanded weather history to 50 years*	+ Winter risk
6. Applied adjustment to account for climate change*	+ Summer risk

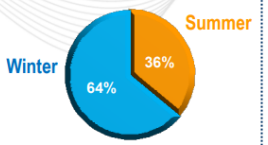
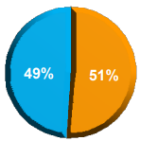
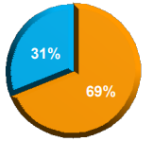
Previously Shared Preliminary Results



May 30 CIFP Presentation

** Simulations run with and without extended weather history and climate change adjustments*

Summary of Latest Simulations and Results

Simulation		EUE	LOLH	LOLE
1	Updated risk modeling with: - Weather history back to **1993** - No climate change adjustment	 EUE = 1,400 MWh	 LOLH = 0.33 hours	 LOLE = 0.10 days
Simulations that use extended weather history back to **1973**				
2	With no climate change adjustment	W:71% S:29% 1,700 MWh	W:57% S:43% 0.38 hours	W:42% S:58% 0.10 days
2A	With climate change adjustment using Method A	W:35% S:65% 1,200 MWh	W:25% S:75% 0.31 hours	W:17% S:83% 0.10 days
2B	With climate change adjustment using Method B (mean trend only)	W:46% S:54% 1,400 MWh	W:30% S:70% 0.33 hours	W:21% S:79% 0.10 days

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