



Beacon Power, LLC
PJM RMISTF Package Proposal

December 5, 2016

Main Points

- ▶ PJM's Regulation Market Design was developed in response to FERC Order 755
 - ▶ Fair compensation for Energy Limited resources
 - ▶ Recognition of the benefits provided by Dynamic Resources
 - ▶ Payments based on mileage are required
- ▶ The energy neutral signal supports the complimentary relationship between RegD and RegA resources
 - ▶ RegD = fast response/energy limited; RegA = slow response/energy unlimited
 - ▶ Sufficient RegA required to permit RegD resources to manage State of Charge
 - ▶ Proper signal design is necessary to take advantage of these complementary benefits
 - ▶ Up to this point the RegD signal/market has sent a message to resources that 15-minutes (or less) of energy storage is sufficient
 - ▶ Consistent with the primary goal of the Regulation market
- ▶ The Benefits Factor curve signaled to market participants that a certain amount Dynamic Resources were more valuable than slower resources
 - ▶ Evidenced by the ~275 MW of fast-responding, energy-limited resources entering the PJM Regulation market since October 2012
- ▶ Any solution should provide PJM operators with greater operational flexibility while minimizing market disruption
 - ▶ Lessons learned from Regulation Performance Impacts reforms implemented in December 2015



Beacon Power Proposed Package Overview

- ▶ Excludes design components 1-9 which PJM can change unilaterally, with the exception of items 1b/9b
 - ▶ For Items 1b/9b, Beacon agrees with ESA that the signals & BF/MRTS curves should be defined in the Tariff
- ▶ Item 10 (Effective MW calculation)
 - ▶ Beacon Package reflects **Status Quo** rather than using the Area under the MRTS curve
- ▶ Item 11 (Procurement floor)
 - ▶ Beacon Package reflects Performance Adjusted RegD MW **capped at 35% of Regulation Requirements**
- ▶ Item 16 (Components of performance scoring and weighting)
 - ▶ Beacon Package reflects Status Quo if precision >75%, **precision score if <75%**
- ▶ Item 17 (Minimum allowable participation threshold)
 - ▶ Beacon Package = **60%**, with transition period (40% for 6-months)
- ▶ Item 19 (Application of a substitution factor)
 - ▶ Beacon Package reflects **Status Quo** rather than eliminating Mileage Ratio and adding MRTS to Capability and Performance Credits
- ▶ Other Items reflect same proposal as PJM per 11/16/2016 post-meeting matrix

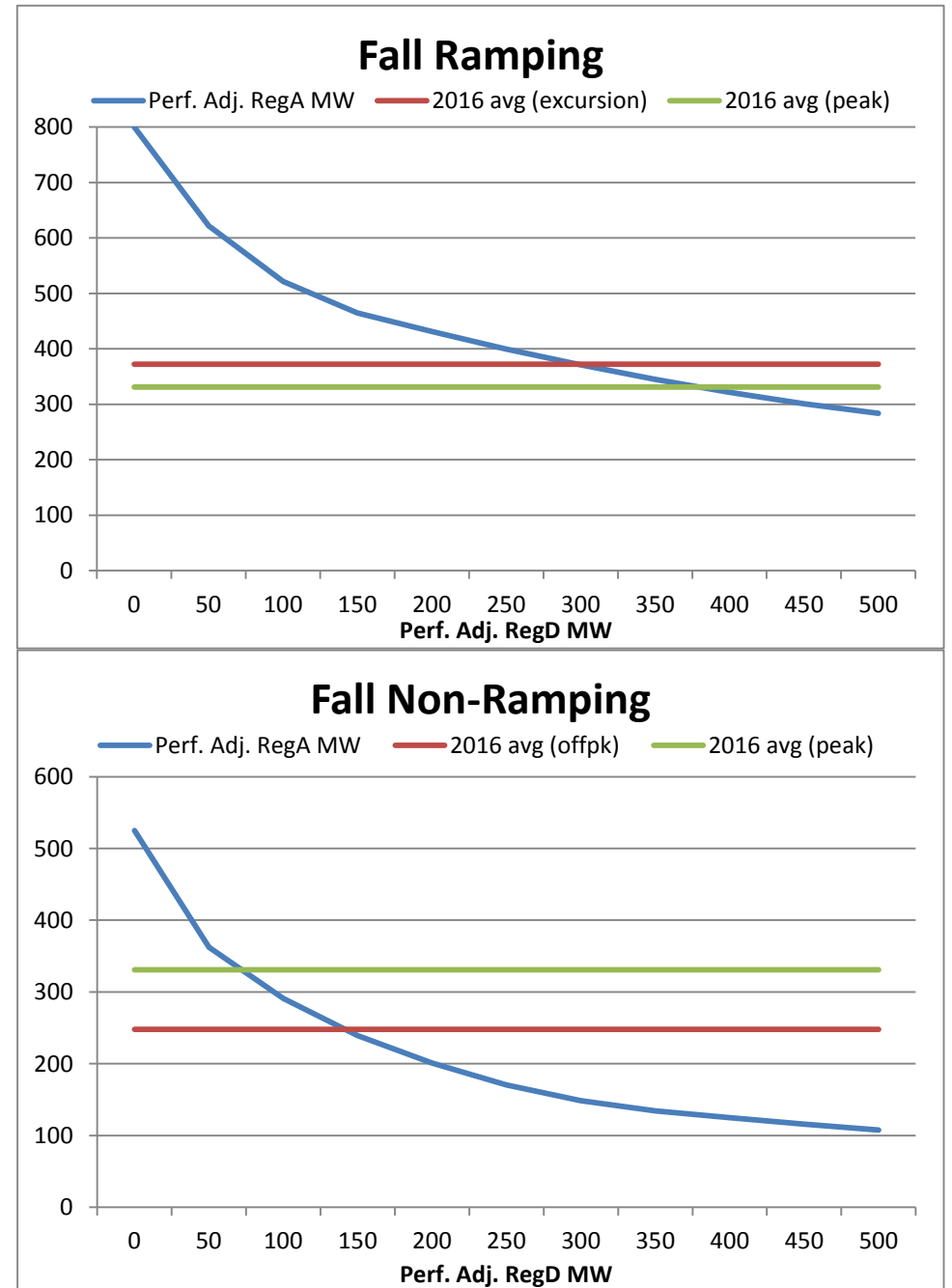


Effective MW Calculation (Item #10)

- ▶ PJM operators need more Regulation capacity to control ACE
- ▶ PJM is proposing to keep Regulation Requirements unchanged on average, with different seasonal/hourly shapes
 - ▶ Current daily procurement = 15,925 MWh
 - ▶ Proposed = 15,350 MWh Fall/Spring (-3.6%); 15,625 MWh Winter (-1.9%); 17,000 MWh Summer (+6.8%); 15,831 MWh annual avg.
- ▶ PJM is proposing to calculate RegD effective MW using the area under the curve
 - ▶ Doing so will further reduce the amount of RegA MW available to correct operational issues
 - ▶ Based on current Benefits Factor Curve:
 - ▶ Off-peak hours = 320 effective RegD MW using area under curve vs. 277 MW average for 2016 (-43 MW RegA)
 - ▶ Excursion hours = 358 effective RegD MW using area under curve vs. 328 MW average for 2016 (-30 MW RegA)
 - ▶ Non-excursion hours = 426 effective RegD MW using area under curve vs. 369 MW average for 2016 (fully saturated?)
 - ▶ Lessons learned from RPI reforms implemented in December 2015
 - ▶ PJM shifted the Benefits Factor/Technical Rate of Substitution Curve to the left which caps RegD market presence at 40% of MW requirement during non-excursion hours and 26.2% during excursion hours
 - ▶ PJM implemented a tie-breaker logic to assign unit-specific benefits factors to self-scheduled and \$0 offered resources based on Performance Score rather than treating these units as a single block, which increased the RegD effective MW and offset some/all of the BF curve changes
- ▶ The Beacon Package reflects **Status Quo** for item #10 to eliminate this impact
- ▶ In the alternative, PJM should consider increasing the Regulation Requirement to offset this effect

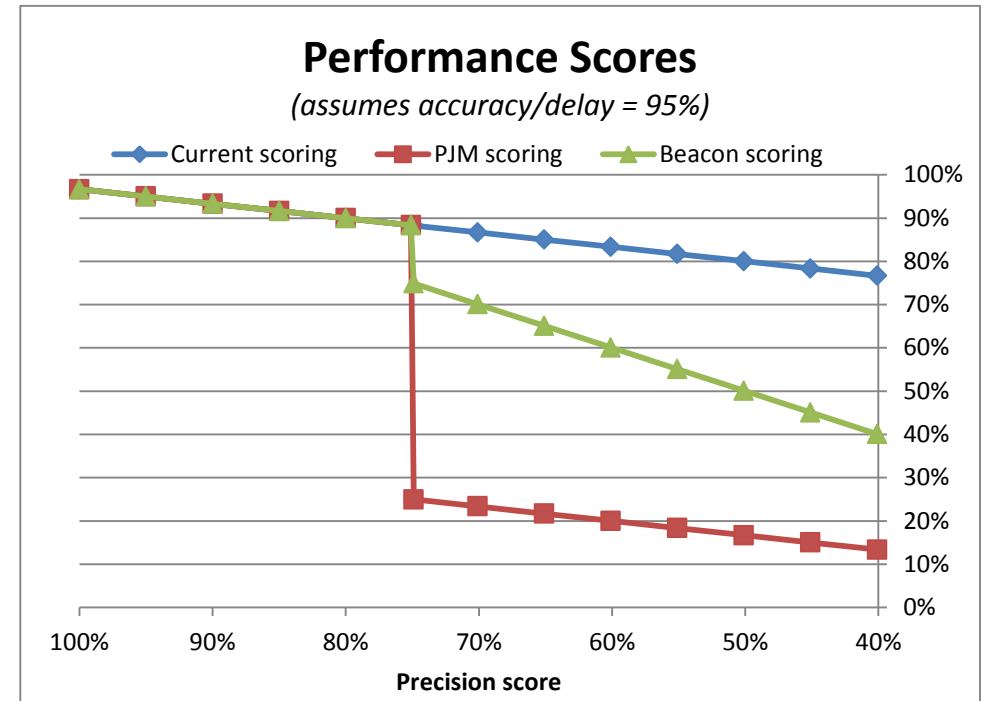
Procurement Floor (Item #11)

- ▶ PJM operators need more Regulation capacity to control ACE
- ▶ When the new MRTS curves are translated into performance adjusted RegA MW & compared with 2016 averages, there is a significant risk that less RegA capacity will be procured, thus exacerbating PJM’s operational issues
- ▶ The Beacon Package reflects a cap on performance adjusted RegD MW = **35% of Regulation Requirement** to mitigate this potential impact
 - ▶ Ramping cap = 800 MW x 35% = 280 MW
 - ▶ Non-Ramp cap = 525 MW x 35% = 184 MW
- ▶ 2016 average performance adjusted RegA capacity =
 - ▶ 372 MW excursion hours (700 MW – 328 MW RegD)
 - ▶ 331 MW non-excursion hours (700 MW – 369 MW RegD)
 - ▶ 248 MW off-peak hours (525 MW – 277 MW RegD)



Performance Scoring & Weighting (Item #16)

- ▶ PJM is concerned that performance score is not a good representation of effectiveness if precision <75%
- ▶ Beacon agrees with other stakeholders that PJM's proposal reflects an unreasonable step-change if precision is slightly less than 75%
- ▶ For example, assuming accuracy & delay = 95%
 - ▶ With precision = 78%, performance score = 89.3%
 - ▶ With precision = 72%, performance score = 24.0%
- ▶ Beacon Package reflects Status Quo if precision >75%, **precision score if <75%** to provide better incentives to improve precision without including unreasonable step-change



Application of Substitution Factor (Item #19)

- ▶ PJM/IMM are proposing to replace the Mileage Ratio in settlements with the MRTS on both Capability and Performance
- ▶ This proposal is no different than the original proposal that was rejected by FERC in 2012
 - ▶ “In Order No. 755, the Commission found that, while the resources relied upon by regional transmission operators (RTOs) and independent system operators (ISOs) to provide frequency regulation service differ in both their ramping ability and the accuracy with which these resources can respond to the system operator’s dispatch signal, existing compensation policies failed to acknowledge these operational differences.” (July 18, 2013 FERC Order at P 2)
 - ▶ “A mileage-based performance payment component ... will provide compensation that appropriately recognizes a resource’s actual ramp rate capability.” (FERC Order 755 at P 177)
 - ▶ “By failing to include actual mileage in the settlement equation, PJM appears to be inconsistent with Order 755.” (November 16, 2012 Order at P 46.)
- ▶ Which markets under FERC jurisdiction account for mileage?

	PJM (current)	PJM (proposed)	ISO-NE	MISO	NYISO	CAISO
Yes	✓		✓	✓	✓	✓
No		✓				



Application of Substitution Factor (Item #19), cont'd

- ▶ The Marginal Rate of Technical Substitution does provide compensation that reflects the difference between fast and slow responding resources and would not provide adequate compensation for Regulation resources in accordance with Order 755
- ▶ Including the MRTS in settlement will result in **unfair treatment** of fast, energy-limited resources
 - ▶ PJM will receive the benefit of the fast response of these resources without recognizing energy limitations
 - ▶ The RegD signal reflects a faster ramp rate than the RegA signal
 - ▶ Conditional neutrality only accounts for energy-limits in certain circumstances
 - ▶ PJM does recognize ramp limitations of slower resources by slowing down signal response requirements for RegA
 - ▶ PJM is removing the faster ramp rate for the RegA signal when needed to correct ACE
 - ▶ Ramp limits are always honored
- ▶ Inherent in the MRTS curve development is PJM's reliance on Regulation for long (> 5 minute) ACE corrections in one direction when needed
 - ▶ This situation indicates that more energy should be procured in the energy market
 - ▶ The Regulation market should not be relied upon for long (> 5 minute) ACE corrections – mileage is more relevant for regulation
 - ▶ As a result, too much value is placed on RegA relative to RegD

Application of Substitution Factor (Item #19), cont'd

- ▶ Including the MRTS in settlement will result in **unjust and unreasonable compensation** for Regulation resources
 - ▶ Resources performing the same function will be paid different amounts
 - ▶ Example: Fall Ramping period; 350 MW RegD (performance adjusted)
 - ▶ MRTS = 0.5
 - ▶ Based on area under the curve, 455 effective MW RegD (i.e., more than 350 MW of RegA is displaced); therefore the RTS curve signals that the value of 350 MW RegD is greater than the value of 350 MW RegA
 - ▶ In settlements, RegD would be paid 50% of RegA resources on a per MW basis if the MRTS is reflected
 - ▶ **A lower payment (\$/MW) for a higher valued product is not a reasonable market outcome**
- ▶ PJM's ability to review and unilaterally change the MRTS on a quarterly basis (without stakeholder approval) would make the payment mechanism a “black box” if MRTS is included in settlements
 - ▶ Not a stable/sustainable market design