



~~May~~~~April~~ 9~~12~~, 201~~65~~

PLANNING COMMITTEE

Dear Committee Members:

201~~56~~ PJM RESERVE REQUIREMENT STUDY - DETERMINATION OF THE PJM INSTALLED RESERVE MARGIN, FORECAST POOL REQUIREMENT AND DEMAND RESOURCE FACTOR FOR FUTURE DELIVERY YEARS

Attached for your review and endorsement is the timetable, study assumptions, and modeling assumptions for the 201~~56~~ PJM Reserve Requirement Study (RRS). The study will examine the period beginning June 1, 201~~56~~ through May 31, 202~~76~~.

This study is consistent with the provisions of the Reliability Assurance Agreement among Load Serving Entities in the PJM Region. In accordance with Reliability Pricing Model (RPM) requirements, the results of this study will be used to determine the Forecast Pool Requirement (FPR) for the 2017/18, 2018/19, 2019/20 and 2020/21 Delivery Years and Demand Resource (DR) Factor for the ~~2019~~2017/18~~20~~ Delivery Year, ~~and for any other applicable Delivery Years, by February 1, 2016. Note that the recently released Capacity Performance (CP) proposal introduces changes to the RPM construct. Such changes do not impact the current Reserve Requirement Study assumptions. However, the computation of one of the study outputs, the FPR, is impacted by the changes. Hence, the RRS this year will yield two sets of FPR values for the 2018/2019 Delivery Year and forward: one set under the current RPM rules and another set under the CP proposal. The FPR values that will ultimately be applied in RPM depend on the FERC decision regarding the CP proposal.~~

Specific items to note for the 201~~56~~ RRS include:

1. As specified in Schedule 4 of the Reliability Assurance Agreement, the Capacity Benefit Margin (CBM) modeled in this study will be 3500 MW. The CBM reflects the amount of transmission import capability reserved to capture the reliability benefit of emergency energy sales into PJM.
2. A Load Forecast Error Factor (FEF) of 1.0% will be modeled in all study years.
3. The load models for PJM and the World region will be based on assessment work performed by PJM staff and reviewed by the Resource Adequacy Analysis Subcommittee (RAAS). The assessment work will use a revised version of the load model selection methodology procedure originally endorsed by the Planning Committee at their July 15, 2009 meeting. This revision is described in Attachment III. The Planning Committee will be asked to endorse the load model selection no later than July, 201~~56~~.
4. As endorsed by the Planning Committee during the 2009 RRS, the World region will consist of the four external systems with direct ties to PJM (New York ISO, MISO, TVA and VACAR) and ISO New England which has historically provided emergency assistance to PJM. Each of these five World sub-regions will be modeled at its required or target reserve margin.

5. For this study, the generator unit model data will be available for review, per Section 2 of Manual 20 and must be performed by PJM Member representatives that own generation. This effort is targeted for May-June of 201~~5~~6.
6. A summary timeline of the RRS process is shown in Attachment IV.
7. Flexibility to allow for additional case development and analysis is requested for this study.

In communicating the study results, it is important to focus on the Forecast Pool Requirement which is used in the RPM Auction process.

PJM will request endorsement of these assumptions at the ~~April-May~~ 912th 201~~5~~6 Planning Committee meeting.

Sincerely,

Thomas A. Falin
Manager, Resource Adequacy Planning Department

Attachments

cc: w/attachments:
Resource Adequacy Analysis Subcommittee (via e-mail only)
Resource Adequacy Planning Department

20156 PJM RESERVE REQUIREMENT STUDY (RRS)

Summary of Annual Study Procedure

The primary focus of the PJM Reserve Requirement Study (RRS) is an analysis to determine the installed reserves required by the PJM RTO to satisfy the criterion specified in the Reliability Principles and Standards as defined in the PJM Reliability Assurance Agreement (RAA). This Study, in conjunction with PJM's Load Deliverability Test, satisfies the requirements of ~~RFC~~ReliabilityFirst Standard BAL-502-~~RFC~~ReliabilityFirst-02. The PJM Planning Committee (PC) has the primary responsibility to coordinate and complete activities to adhere to the requirements of the RAA. The Resource Adequacy Analysis Subcommittee (RAAS), established by the PC, has the responsibility to determine the proper assumptions used in this analysis and to review the final results.

The timetable shown in Attachment I lists the sequence of activities in this process. To accomplish this task, subcommittees and working groups reporting to the PC have been assigned the responsibilities shown in Attachment I.

The member representatives that own generation calculate and maintain information on individual generating units and operating statistics. These individual unit statistics must be submitted via a secure PJM Internet application designed for this purpose.

The Load Analysis Subcommittee (LAS) reviews the PJM Staff's efforts to calculate and maintain load forecasting values and associated probability of occurrence statistics. The PJM staff uses the information supplied from the Generation Owners, LAS, EIA-411 Report, NERC Electric Supply and Demand (ES&D) database, and the historic hourly peak loads to produce a probabilistic PJM system model. This model is used to determine the reserve requirement necessary to meet the ~~RFC~~ReliabilityFirst criterion for resource adequacy of a Loss of Load Expectation (LOLE) of one occurrence in ten years.

The initial task of the RAAS in this process is to develop the study and modeling assumptions and to seek approval of these assumptions from the PC.

ATTACHMENT I

SCHEDULED TARGET DATES FOR THE 201~~56~~ PJM RRS

Attachment IV

Corresponding

Timeline

Number

Target Date

Responsible Group

<u>Number</u>	<u>Corresponding Timeline</u>	<u>Target Date</u>	<u>Responsible Group</u>
1	Capacity Data Model Development		
	a) Begin update of capacity model.	January 201 65 ⁵⁶	PJM Staff
	b) Submit updated outage rate data to PJM Staff.	January 201 65	Generator Owner Reps
1	Load Data Model Development		
	a) Submit PJM Staff forecast to PC	January 201 65	PJM Staff
	b) Begin updating PJM load model.	January 201 65	PJM Staff
7	Capacity Models Finalized		
	a) Submit final GORP outage rate data to PJM Staff.	May 201 65	Generator Owner Reps
	b) Load & capacity models not changed after this date. Confirm that capacity and PJM reserves correspond to latest available information.	June 201 65	PJM Staff
8	FPR, IRM & DR Factor Analysis		
	PJM RTO region	July 201 65	PJM Staff
9	Approval of Load Model Time Period		
	RAAS Recommendation.	July 201 65	PC
8	Analysis of Winter Weekly Reserve Target for 20156-20176 Winter Period		
	PJM RTO region.	August 201 65	PJM Staff
13	Report on Winter Weekly Reserve Target for 20156-20176 Winter Period		
	This is based on the approved 201 56 PJM RTO Region Reserve Study results.	September 201 56	RAAS
	a) Forward letter to OC with recommended Winter Weekly Reserve Target.	Sept PC Mtg.	PC
13	Distribute Final Report to PC		
	Final Draft	Sept PC Mtg.	RAAS
	Final Report	Oct PC Mtg.	RAAS
14 A	Endorsement/Recommendation of applicable Factors (IRM, FPR, DR Factor)	Oct PC Mtg.	PC

ATTACHMENT II

STUDY ASSUMPTIONS FOR THE 2015~~6~~ PJM RRS

1. The 2015~~6~~ RRS will be conducted as outlined in the “PJM Generation Adequacy Analysis: Technical Methods,” and PJM Manual M20 revision 5, “PJM Resource Adequacy Analysis”.
2. The PJM Installed Reserve Margin (IRM) will be determined using PJM’s two-area model, the Probabilistic Reliability Index Study Model (PRISM). The analyses will focus on results for Area 1, the PJM RTO representation. The Area 2 model represents the electrically significant regions adjacent to the PJM RTO as described in Item 8. The modeling details of performing a two-area study are described in Attachment III. The Demand Response (DR) Factor will be based on a PJM RTO single-area model as was done in previous studies. MARS will be used to supplement the PRISM study results, specifically concerning issues that require multi-area modeling techniques.
3. The PJM RTO footprint will be modeled as Area 1 in the study. Area 1 load will consist of the combined coincident loads of the following regions: PJM Mid-Atlantic, APS, AEP, ComEd, Dayton, DomVP, DLCO, ATSI, DEOK and EKPC.
4. All generators will be modeled as capacity units per the modeling assumptions in Attachment III. A wind or solar generator’s modeled capacity, in megawatts, is based on either actual unit performance data or the class average value of 13% or 38%, respectively, of the name-plate rating if insufficient actual unit performance data is available.
5. Planned Ambient outages ~~derates~~ of generating units will be represented via planned outages over the throughout the summer period. This is done to reflect operating experience related to a reduction of generating capability due to extreme ambient temperatures that would not be captured otherwise.
6. The reserve requirement base reserve levels for the DR Factor calculations~~s~~ will be set by the recommended PJM Installed Reserve Margins~~s~~. The DR Factor may be recalculated if the PJM Board of Managers approves an installed reserve margins for the 2017/18 Delivery Year other than that~~ese~~ prescribed by the analysis.
7. The Capacity Benefit Margin (CBM) modeled in this study will be varied between zero and saturation. All reserve requirement values shown in the analysis results summary will assume a CBM of 3500 MW.

¹ PJM Mid-Atlantic includes: Atlantic City Electric; Baltimore Gas & Electric Co.; Delmarva Power; Jersey Central Power & Light Co. (JCP&L); Metropolitan Edison Co. (Met-Ed); PECO, an Exelon Company; Pepco; Pennsylvania Electric Co. (Penelec); PPL Electric Utilities; PSE&G; and UGI Utilities, Inc.; APS = Allegheny Power System; AEP = American Electric Power; ComEd = Commonwealth Edison; Dayton = Dayton Power & Light; DomVP = Dominion Virginia Power; DLCO = Duquesne Light Co. ATSI = American Transmission Systems, Inc; DEOK = Duke Energy Ohio/Kentucky; EKPC = Eastern Kentucky Power Cooperative.

8. World reserves will be modeled at the individual World sub-regions “one day in ten year” reserve levels. The World sub-regions shall be:
 - New York Independent System Operator (NYISO)
 - Independent System Operator of New England (ISO-NE)
 - Tennessee Valley Authority (TVA)
 - Virginia-Carolinas (VACAR)
 - Midwest Independent System Operator (MISO)
9. Behind the meter generation (BTMG) may be treated as either a capacity resource or may be used to reduce the 5 CP (coincident peak) load. The choice of the modeling method is left to the owner of the BTMG resource.
10. The Forecast Error Factor (FEF) will be held at one percent for all planning periods being evaluated. This practice is consistent with consensus gained through the PJM stakeholder process.

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ATTACHMENT III

MODELING ASSUMPTIONS FOR THE 20156 PJM RRS

1. Load Models

Both PJM and the World load models will be selected based on a revised version of the methodology approved by the Planning Committee at their July 15, 2009 meeting. The revision, performed in early 2016 under the auspices of the RAAS, amends the current procedure (Approaches 1 and 2) to reflect the fact that the annual peak can only occur in the week with the highest expected peak due to the magnitude-order nature of the load models considered for the RRS.

2. PJM RTO Capacity Model

The generating units within the PJM RTO Study region will use statistics as detailed in the PJM Manual M22 revision 16, "Generator Resource Performance Indices," dated November 16, 2011. The statistics used are: Equivalent Demand Forced Outage Rate (EFORd), Effective EFORd (EEFORd), Capacity Variance, and Planned Outage Factor (POF).

The data for these statistics is primarily provided through PJM's electronic Generation Availability Data System (eGADS) web interface, per the online help function within eGADS. A five year time period (20101-20154) is used for the calculation of these statistics. These statistics are compared, for consistency, to those calculated and shown in the NERC Brochure for units reporting events (20101-20154). The Generation Owners of the various individual units are required to review and provide changes.

3. World Capacity Model

The 20145 NERC Electricity Supply & Demand (ES&D) will be the basis for future World generating unit information. Future capacity plans for World areas will be obtained from neighboring NERC regions. All World unit EEFORds and maintenance cycles will be updated using the latest Class Average Outage Rates. These rates, obtained from the NERC's pc-based Generation Availability Report (pc-GAR) application or applicable PJM eGADS summaries, will be based on a five year period.

4. Planning and Operating Treatment of Generation

All generators that have been demonstrated to be deliverable will be modeled as PJM capacity resources in the PJM study area. External capacity resources will be modeled as internal to PJM if they meet the following requirements:

1. Firm Transmission service to the PJM border
2. Firm ATC reservation into PJM
3. Letter of non-recallability from the native control zone

Assuming that these requirements are fully satisfied, the following comments apply:

- Only PJM's "owned" share of generation will be modeled in PJM. Any generation located within PJM that serves World load with a firm commitment will be modeled in the World.
- Firm capacity purchases will be modeled as generation located within PJM. Firm capacity sales will be modeled by decreasing PJM generation by the full amount of the sale.

- Non-firm sales and purchases will not be modeled. The general rule is that any generation that is recallable by another control area does not qualify as PJM capacity and therefore will not be modeled in the PJM Area.
- Active generation projects in the PJM interconnection queues will be modeled in the PJM RTO after applying a suitable commercial probability.

5. Reserve levels in the World region

The World will be modeled at the higher installed reserve margin resulting from the following two approaches:

- The world combined reserve margin yielded by setting each area at its respective installed reserve margin adjusted to account for intra-world diversity.
- The world combined reserve margin yielded by collectively solving at the 1 in 10 criteria.

ATTACHMENT IV

Time Line for 20156 Reserve Requirement Study

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Annual Reserve Requirement Study (RRS) Timeline - Milestones (Green) and Deliverables (Blue)														
Resource Adequacy Analysis Subcommittee (RAAS) related activities														
Description	January	February	March	April	May	June	July	August	September	October	November	December	January	February
1 Data Modeling efforts by PJM Staff	Blue	Blue	Blue	Blue	Blue									
2 Produce draft assumptions for RRS				Blue	Blue									
3 RAAS comments on draft assumptions				Blue	Blue									
4 RAAS & PJM Staff finalize Assumptions					Green									
5 PC receive update and final Assumptions. Review/discuss/provide feedback					Blue									
6 PC establish / endorse Study assumptions					Green									
7 Generation Owners review Capacity model					Blue									
8 PJM Staff performs assessment/analysis					Blue	Blue	Blue							
9 PC establish hourly load time period							Green							
10 Status update to RAAS by PJM staff							Blue							
11 PJM Staff produces draft report						Blue	Blue							
12 Draft Report, review by RAAS								Blue	Blue					
13 RAAS finalize report, distribute to PC. Winter Weekly Reserve Target Recommendation									Green					
14 Stakeholder Process for review, discussion, endorsement of Study results (PC, MRC,MC).									Blue	Blue	Blue	Blue		
14 A Planning Committee Review & Recommendation									Blue	Blue				
14 B Markets and Reliability Committee Review & Recommendation										Blue	Blue			
14 C Members Committee Review & Recommendation											Blue	Blue		
15 PJM Board of Managers approve IRM, FPR, DR Factor													Blue	
16 Posting of Final Values for RPM BRA - FPR & DR Factor														Blue

Annual Reserve Requirement Study (RRS) Timeline - Milestones (Green) and Deliverables (Blue)														
Resource Adequacy Analysis Subcommittee (RAAS) related activities														
Description	January	February	March	April	May	June	July	August	September	October	November	December	January	February
1 Data Modeling efforts by PJM Staff	Blue	Blue	Blue	Blue	Blue									
2 Produce draft assumptions for RRS		Blue	Blue											
3 RAAS comments on draft assumptions			Blue	Blue										
4 RAAS & PJM Staff finalize Assumptions				Green										
5 PC receive update and final Assumptions. Review/discuss/provide feedback			Blue	Blue										
6 PC establish / endorse Study assumptions					Green									
7 Generation Owners review Capacity model					Blue									
8 PJM Staff performs assessment/analysis					Blue	Blue	Blue							
9 PC establish hourly load time period							Green							
10 Status update to RAAS by PJM staff							Blue							
11 PJM Staff produces draft report						Blue	Blue							
12 Draft Report, review by RAAS								Blue	Blue					
13 RAAS finalize report, distribute to PC. Winter Weekly Reserve Target Recommendation									Green					
14 Stakeholder Process for review, discussion, endorsement of Study results (PC, MRC,MC).									Blue	Blue	Blue	Blue		
14 A Planning Committee Review & Recommendation									Blue	Blue				
14 B Markets and Reliability Committee Review & Recommendation										Blue	Blue			
14 C Members Committee Review & Recommendation											Blue	Blue		
15 PJM Board of Managers approve IRM, FPR, DR Factors													Blue	
16 Posting of Final Values for RPM BRA - FPR & DR factors for 3 year forward Delivery year														Blue

The 20156 Study activities last for approximately 14 months. Some current Study activities, shown in items 1 and 2, overlap the previous Study timeframe. The posting of final values occurs on or about February 1st.