Appendix A
Base Case Modeling Assumptions for
20156 PJM RRS

Parameter	2015~~4~~ Study Modeling Assumptions	2015~~6~~ Study Modeling Assumptions	Basis for Assumptions
Load Forecast			
Unrestricted Peak Load Forecast	16~~4~~2,~~47~~9618 MW (2019~~8~~/2020~~19~~ DY)	16~~2~~256,~~61~~887 MW (2020~~19~~/2020~~1~~ DY)	Forecasted Load growth per 2015~~5~~6 PJM Load Forecast Report, using 50/50 normalized peak.
Historical Basis for Load Model	2004~~3~~-2012~~1~~	TBD	~~Will use~~ Revised version of the load model selection method approved at the July 15, 2009 PC meeting. The revision was performed in early 2016 under the auspices of the RAAS.
Forecast Error Factor (FEF)	Forecast Error held at 1 % for all delivery years.	Forecast Error held at 1 % for all delivery years.	Consistent with consensus gained through PJM stakeholder process.
Monthly Load Forecast Shape	Consistent with 2015~~4~~ PJM Load Forecast Report and 2013~~2~~ NERC ES&D report (World area).	Consistent with 2015~~6~~ PJM Load Forecast Report and 2013~~4~~ NERC ES&D report (World area).	Updated data.
Daily Load Forecast Shape	Standard Normal distribution and Expected Weekly Maximum (EWM) based on 5 daily peaks in week.	Standard Normal distribution and Expected Weekly Maximum (EWM) based on 5 daily peaks in week.	Consistent with consensus gained through PJM stakeholder process.
Capacity Forecast			
Generating Unit Capacities	Coordinated with eRPM databases, EIA-411 submission, and Generation Owner review.	Coordinated with eRPM databases, EIA-411 submission, and Generation Owner review.	New RPM Market structure required coordination to new database Schema. Consistency with other PJM reporting and systems.
New Units	Generation Interconnection Queues coordinated with forecast reserve margin graph which uses commercial probability. http://www.pjm.com/planning/resource-adequacy-planning/resource-reports-info.aspx .	Generation Interconnection Queues coordinated with forecast reserve margin graph which uses commercial probability. http://www.pjm.com/planning/resource-adequacy-planning/resource-reports-info.aspx .	Requirement using commercial probability for planned projects.
Wind Resources	Derived from hourly wind data over summer peak hours. Units can use a capacity factor of 13% or actual performance once historic data is available.	Derived from hourly wind data over summer peak hours. Units can use a capacity factor of 13% or actual performance once historic data is available.	Based on Manual 21 Appendix B for Intermittent Capacity Resources. 13% capacity factor based on PJM stakeholder process, February 22, 2008 Planning Committee, Agenda Item 9.

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Solar Resources	Derived from hourly solar data over summer peak hours. Units can use a capacity factor of 38% or actual performance once historic data is available.	Derived from hourly solar data over summer peak hours. Units can use a capacity factor of 38% or actual performance once historic data is available.	Based on Manual 21 Appendix B for Intermittent Capacity Resources. 38% capacity factor based on PJM stakeholder process, May 21, 2008 Planning Committee, Agenda Item 6.
Firm Purchases and Sales	Firm purchase and sales from and to external regions are reflected in the capacity model. External purchases reduce the World capacity and increase the PJM RTO capacity. External Sales reduce the PJM RTO capacity and increase the World capacity. This is consistent with EIA-411 Schedule 4 and reflected in RPM auctions.	Firm purchase and sales from and to external regions are reflected in the capacity model. External purchases reduce the World capacity and increase the PJM RTO capacity. External Sales reduce the PJM RTO capacity and increase the World capacity. This is consistent with EIA-411 Schedule 4 and reflected in RPM auctions.	Match EIA-411 submission and RPM auctions.
Retirements	Coordinated with PJM Operations, Transmission Planning models and PJM web site: http://www.pjm.com/planning/generation-retirements.aspx . Consistent with forecast reserve margin graph.	Coordinated with PJM Operations, Transmission Planning models and PJM web site: http://www.pjm.com/planning/generation-retirements.aspx . Consistent with forecast reserve margin graph.	Updated data available on PJM's web site, but model data frozen in May 2014~~5~~6.
Planned 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.	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.	Consistency with other PJM reporting and systems.

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Unit Operational Factors			
Forced and Partial Outage Rates	5-year (20~~09~~10-1~~3~~4) GADS data. (Those units with less than five years data will use class average representative data.).	5-year (201~~0~~1-15~~4~~) GADS data. (Those units with less than five years data will use class average representative data.).	Most recent 5-year period. Use PJM RTO unit fleet to form class average values.
Planned Outages	Based on eGADS data, History of Planned Outage Factor for units.	Based on eGADS data, History of Planned Outage Factor for units.	Updated schedules.
Summer Planned Outage Maintenance	In review of recent Summer periods, no Planned outages have occurred.	In review of recent Summer periods, no Planned outages have occurred.	Review of historic 20~~09~~11 to 2015~~3~~ unit operational data for PJM RTO footprint.
Gas Turbines, Fossil, ~~Hydro~~ Nuclear Ambient Derate	Ambient Derate includes several categories of units. Based on additional assessments of operational data, for a wider time period, and discussion with Operations Staff the 2,500 MW out on planned outage over summer peak was determined to be the best value to use at this time.~~Ambient Derate includes several categories of units. Based on additional assessments of operational data, for a wider time period, and discussion with Operations Staff the 2,500 MW out on planned outage over summer peak was determined to be the best value to use at this time.~~	Ambient Derate includes several categories of units. Based on analysis of the Summer Verification Test data from the last 3 summers, ~~additional assessments of operational data, for a wider time period, and discussion with Operations Staff the~~ 2,500 MW out on planned outage over summer peak was ~~determined~~ confirmed to be the best value to use at this time. This analysis was performed early 2016 under the auspices of the RAAS.	Operational history and Operations Staff experience indicates unit derates during extreme ambient conditions. ~~Additional assessments were not conclusive; identifying data granularity reporting issues that require additional efforts to derive any correlation between ambient conditions on unit performance.~~Summer Verification Test data confirms this hypothesis.
Generator Performance	Peak period generator performance is consistent with year-round generator performance	Peak period generator performance is consistent with year-round generator performance.	Additional assessments were not conclusive to adjust the model. Assessments continue to quantify any change in the summer and non-summer unit performance or within the summer period (20 wks).
Class Average Statistics	PJM RTO fleet Class Average values. 73 categories based on unit type, size and primary fuel.	PJM RTO fleet Class Average values. 73 categories based on unit type, size and primary fuel.	PJM RTO values have a sufficient population of data for most of the categories. The values are more consistent with planning experience.
Uncommitted Resources	Behind the meter generation (BTMG) modeling: Per the June 28, 2004 PC meeting, 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.	Behind the meter generation (BTMG) modeling: Per the June 28, 2004 PC meeting, 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.	Consistency with other PJM reporting and systems.
Generation Owner Review	Generation Owner review and sign-off of capacity model.	Generation Owner review and sign-off of capacity model.	Annual review to insure data integrity of principal modeling parameters.

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Load Management and Energy Efficiency			
Load Management and Energy Efficiency	Procedure based on DR forecast methodology approved at March 26 2015, MRC meeting, Agenda Item 5.~~PJM RTO load management modeled per the January 2014 PJM Load Forecast Report (Table B8).~~	~~Procedure based on DR forecast methodology approved at March 26, MRC meeting, Agenda Item 5.~~PJM RTO load management modeled per the January 2016 PJM Load Forecast Report (Table B7)	Model latest load management and energy efficiency data. Based on Manual 19, Section 3 for PJM Load Forecast Model.
Emergency Operating Procedures	IRM reported for Emergency Operating Procedures that include invoking load management but before invoking Voltage reductions.	IRM reported for Emergency Operating Procedures that include invoking load management but before invoking Voltage reductions.	Consistent reporting across historic values.
Transmission System			
Interface Limits	The Capacity Benefit Margin (CBM) is an input value used to reflect the amount of transmission import capability reserved to reduce the IRM. This value is 3,500 MW.	The Capacity Benefit Margin (CBM) is an input value used to reflect the amount of transmission import capability reserved to reduce the IRM. This value is 3,500 MW.	Reliability Assurance Agreement, Schedule 4, Capacity Benefit Margin definition.
New Transmission Capability	Consistent with PJM's RTEP as overseen by TEAC.	Consistent with PJM's RTEP as overseen by TEAC.	Consistent with PJM's RTEP as overseen by TEAC.
Modeling Systems			
Modeling Tools	ARC Platform 2.0	ARC Platform 2.0	Per recommendation by PJM Staff. Latest available version.
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Modeling Tools	ARC Platform 2.0	ARC Platform 2.0	Per recommendation by PJM Staff. Latest available version.
Modeling Tools	Multi-Area Reliability Simulation (MARS) Version 3.1~~2~~6	Multi-Area Reliability Simulation (MARS) Version 3.16	Per recommendation by PJM Staff and General Electric Staff. Latest available version.
Outside World Area Models	Base Case world region include: NY, NE, MISO, TVA and VACAR.	Base Case world region include: NY, NE, MISO, TVA and VACAR.	Updated per publicly available data and by coordination with other region's planning staffs.