

1.11 Real-time Dispatch.

The Office of the Interconnection shall determine the least cost security constrained economic dispatch and send dispatch targets for each resource to Market Participants. The least cost security constrained economic dispatch is the least costly means of serving load and meeting reserve requirements at different locations in the PJM Region based on forecasted operating conditions on the power grid (including transmission constraints on external coordinated flowgates to the extent provided by Operating Agreement, Schedule 1, section 1.7.6) as described in the PJM Manuals and on the offers for energy and ancillary services at which Market Sellers have entered as described by Operating Agreement, Schedule 1, section 1.10 and Operating Agreement, Schedule 1, section 2.4 and on offers by Economic Load Response Participants to reduce demand that qualify to set Locational Marginal Prices in the PJM Interchange Energy Market.

(a) To determine actual operating conditions on the power grid in the PJM Region (including transmission constraints on external coordinated flowgates to the extent provided by Operating Agreement, Schedule 1, section 1.7.6), the Office of the Interconnection shall use a computer model of the interconnected grid that uses available metered inputs regarding generator output, loads, and power flows to model remaining flows and conditions, producing a consistent representation of power flows on the network as an input into the real-time security constrained economic dispatch. The computer model employed for this purpose, referred to as the State Estimator program, is a standard industry tool and is described in section 1.11A below. The State Estimator solution used by the real-time security constrained economic dispatch will be used to obtain information regarding the output of generation supplying energy to the PJM Region, loads at buses in the PJM Region, transmission losses, and power flows on binding transmission constraints. In addition, the Office of the Interconnection shall utilize Ambient-Adjusted Ratings for Transmission Facilities as an input into the real-time security constrained economic dispatch.

(b) The Office of the Interconnection shall execute real-time security constrained economic dispatch for each five (5) minute target time, unless the Office of the Interconnection is unable to generate real-time security constrained economic dispatch solutions due to operational or technical issues, including but not limited to those described in the PJM Manuals. Each execution of the real-time security constrained economic dispatch shall result in several solutions, taking into consideration different operational scenarios.

(c) The Office of the Interconnection shall approve the applicable real-time security constrained economic dispatch solution for each five (5) minute target time, unless the Office of the Interconnection is unable to approve a real-time security constrained economic dispatch solution for the applicable target time due to a failure of the real-time security constrained economic dispatch program or other operational reasons. In such situations, either the most recently approved real-time security constrained economic dispatch solution shall persist, or the Office of the Interconnection shall manually dispatch the system.

1.11A Determination of System Conditions Using the State Estimator.

Power system operations, including, but not limited to, the determination of the least costly means of serving load and meeting reserve requirements, depend upon the availability of a complete and

consistent representation of generator outputs, loads, and power flows on the network. In performing the security constrained economic dispatch of the system, the Office of the Interconnection shall obtain a complete and consistent description of conditions on the electric network in the PJM Region by using the most recent power flow solution produced by the State Estimator program. The State Estimator program is also used by the Office of the Interconnection for other functions within power system operations. The State Estimator is a standard industry tool that produces a power flow model based on available real-time metering information, information regarding the current status of lines, generators, transformers, and other equipment, bus load distribution factors, and a representation of the electric network, to provide a complete description of system conditions, including conditions at buses for which real-time information is unavailable. The Office of the Interconnection shall obtain the latest State Estimator solution each time a new security constrained economic dispatch is executed, which shall provide the megawatt output of generators and the loads at buses in the PJM Region, transmission line losses, and actual flows or loadings on transmission facilities as defined in the PJM Manuals.

1.11.1 Resource Output.

The Office of the Interconnection shall have the authority to direct any Market Seller to adjust the output of any pool-scheduled or self-scheduled resource increment within the operating characteristics specified in the Market Seller's offer. The Office of the Interconnection may cancel its selection of, or otherwise release, pool-scheduled resources, subject to an obligation to pay any applicable start-up, no-load or cancellation fees. The Office of the Interconnection shall adjust the output of pool-scheduled or self-scheduled resource increments as necessary: (a) to maintain reliability, and subject to that constraint, to minimize the cost of supplying the energy, reserves, and other services required by the Market Buyers and the operation of the PJM Region; (b) to balance load and generation, maintain scheduled tie flows, and provide frequency support within the PJM Region; and (c) to minimize unscheduled interchange not frequency related between the PJM Region and other Control Areas.

1.11.2 Operating Basis.

In carrying out the foregoing objectives, the Office of the Interconnection shall conduct the operation of the PJM Region in accordance with the PJM Manuals, and shall: (i) utilize available generating reserves and obtain required replacements; and (ii) monitor the availability of adequate reserves.

1.11.3 Pool-dispatched Resources.

As part of the real-time security constrained economic dispatch calculation, the Office of the Interconnection shall use submitted ramp rates to calculate the next dispatch point.

As part of the calculation, the Office of the Interconnection shall estimate the initial state of each generation resource based on its previous dispatch signal and the most recent State Estimator output. In the event the Office of the Interconnection is unable to approve a real-time security constrained economic dispatch solution for a period of time, due to a failure of the real-time security constrained economic dispatch program or other operational reasons, the most recent State

Estimator shall be used as the initial state. This evaluation methodology is calculated for all online dispatchable resources for each market solution in accordance with the PJM Manuals.

(a) The Office of the Interconnection shall implement the dispatch of energy from pool-scheduled resources with limited energy by direct request, by following the Day-ahead Market clearing, or by following the direct request of the Market Seller, subject to the Office of the Interconnection's determination of actions necessary to maintain reliability.

(b) The Office of the Interconnection shall implement the dispatch of energy from other pool-dispatched resource increments, including generation increments from Capacity Resources the remaining increments of which are self-scheduled, by sending appropriate signals and instructions to the entity controlling such resources, in accordance with the PJM Manuals. Each Market Seller shall ensure that the pool-dispatched resource offered or made available by that Market Seller complies with the energy dispatch signals and instructions transmitted by the Office of the Interconnection upon receipt.

1.11.3A Maximum Generation Emergency.

If the Office of the Interconnection declares a Maximum Generation Emergency, all deliveries to load that is served by Point-to-Point Transmission Service outside the PJM Region from Generation Capacity Resources committed to service of PJM loads under the Reliability Pricing Model or Fixed Resource Requirement Alternative may be interrupted in order to serve load in the PJM Region.

1.11.4 Regulation.

(a) A Market Buyer may satisfy its Regulation Obligation from its own generation resources and/or Economic Load Response Participant resources capable of performing Regulation service, by contractual arrangements with other Market Participants able to provide Regulation service, or by purchases from the PJM Interchange Energy Market at the rates set forth in Operating Agreement, Schedule 1, section 3.2.2. PJMSettlement shall be the Counterparty to the purchases and sales of Regulation service in the PJM Interchange Energy Market; provided that PJMSettlement shall not be a contracting party to bilateral transactions between Market Participants or with respect to a self-schedule or self-supply of generation resources by a Market Buyer to satisfy its Regulation Obligation.

(b) The Office of the Interconnection shall obtain Regulation service from the least-cost alternatives available from either pool-scheduled or self-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet Regulation Zone requirements not otherwise satisfied by the Market Buyers. Generation resources or Economic Load Response Participant resources offering to sell Regulation shall be selected to provide Regulation on the basis of each generation resource's and Economic Load Response Participant resource's regulation offer and the estimated opportunity cost of a resource providing regulation and in accordance with the Office of the Interconnection's obligation to minimize the total cost of energy, Operating Reserves, Regulation, and other ancillary services. Estimated opportunity costs for generation resources shall be determined by the Office of the Interconnection on the basis of the expected

value of the energy sales that would be foregone or uneconomic energy that would be produced by the resource in order to provide Regulation, in accordance with procedures specified in the PJM Manuals. Estimated opportunity costs for Economic Load Response Participant resources will be zero.

(c) The Office of the Interconnection shall dispatch resources for Regulation by sending Regulation signals and instructions to generation resources and/or Economic Load Response Participant resources from which Regulation service has been offered by Market Sellers, in accordance with the PJM Manuals. Market Sellers shall comply with Regulation dispatch signals and instructions transmitted by the Office of the Interconnection and, in the event of conflict, Regulation dispatch signals and instructions shall take precedence over energy dispatch signals and instructions. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.4A Synchronized Reserve.

(a) A Market Buyer shall satisfy its Synchronized Reserve Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A. PJMSettlement shall be the Counterparty to the purchases and sales of Synchronized Reserve in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain Synchronized Reserve from available pool-scheduled or self-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the Synchronized Reserve Requirement of the Reserve Zone. The Office of the Interconnection shall clear both the Day-ahead Synchronized Reserve Market and the Real-time Synchronized Reserve Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market, and the offers submitted in the Synchronized Reserve Market. Resources shall be cleared to provide Synchronized Reserve on the basis of each generation resource's and/or Economic Load Response Participant resource's Synchronized Reserve offer and the product substitution cost of providing Synchronized Reserve, energy and any other product the resource is capable of providing, and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy, and of meeting the Synchronized Reserve Requirement, 10-minute Ramp and Uncertainty Reserve Up Requirement; 10-minute Ramp and Uncertainty Reserve Down Requirement; 30-minute Ramp and Uncertainty Reserve Requirement, 30-minute Reserve Requirement; in the day-ahead energy and reserve markets, the Day-Ahead Scheduling Reserve Requirement; and, in the real-time energy and reserve markets, Regulation Requirement. However, any synchronous condenser or Economic Load Response Participant resource with a notification offer parameter of at least ten minutes but no more than 30 minutes, and with a minimum run time (or minimum down time for Economic Load Response Participant resources) no greater than one hour, and which receives a commitment to provide Synchronized Reserve in the Day-ahead Synchronized Reserve Market shall be committed to provide Synchronized Reserve in the Real-time Synchronized Reserve Market, unless the resource is committed in real-time to provide energy or another reserve product.

(c) The Office of the Interconnection shall dispatch generation resources and/or Economic Load Response Participant resources for Synchronized Reserve by sending Synchronized Reserve instructions to generation resources and/or Economic Load Response Participant resources from which Synchronized Reserve has been offered by Market Sellers, in accordance with the PJM Manuals. Market Sellers shall comply with Synchronized Reserve dispatch instructions transmitted by the Office of the Interconnection and, in the event of a conflict, Synchronized Reserve dispatch instructions shall take precedence over energy dispatch signals and instructions. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their generation resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.4B 10-minute Ramp and Uncertainty Reserve Up.

(a) A Market Buyer shall satisfy its 10-minute Ramp and Uncertainty Reserve Up Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A.001. PJM Settlement shall be the Counterparty to the purchases and sales of 10-minute Ramp and Uncertainty Reserve Up in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain 10-minute Ramp and Uncertainty Reserve Up from the least-cost alternatives available from pool-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the 10-minute Ramp and Uncertainty Reserve Up Requirement of the Reserve Zone. The Office of the Interconnection shall clear both the Day-ahead 10-minute Ramp and Uncertainty Reserve Up Market and the Real-time 10-minute Ramp and Uncertainty Reserve Up Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market, and the offers submitted in the 10-minute Ramp and Uncertainty Reserve Up Market. Resources eligible to sell 10-minute Ramp and Uncertainty Reserve Up shall be cleared to provide 10-minute Ramp and Uncertainty Reserve Up on the basis of each generation resource's and/or Economic Load Response Participant resource's 10-minute Ramp and Uncertainty Reserve Up offer and the product substitution cost of providing 10-minute Ramp and Uncertainty Reserve Up, energy and any other product the resource is capable of providing; and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy, and of meeting the Synchronized Reserve Requirement, 10-minute Ramp and Uncertainty Reserve Up Requirement; 10-minute Ramp and Uncertainty Reserve Down Requirement; 30-minute Ramp and Uncertainty Reserve Requirement; 30-minute Reserve Requirement; in the day-ahead energy and reserve markets, the Day-Ahead Scheduling Reserve Requirement; and, in the real-time energy and reserve markets, Regulation Requirement.

(c) The Office of the Interconnection shall dispatch generation resources and/or Economic Load Response Participant resources for 10-minute Ramp and Uncertainty Reserve Reserve Up through economic dispatch, in accordance with the PJM Manuals. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their generation resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good

Utility Practice.

1.11.4C Secondary Reserve.

(a) A Market Buyer shall satisfy its Secondary Reserve Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A.01. PJMSettlement shall be the Counterparty to the purchases and sales of Secondary Reserve in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain Secondary Reserve from the least-cost alternatives available from pool-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the 30-minute Reserve Requirements of the Reserve Zone not otherwise satisfied by resources providing 30-minute Ramp and Uncertainty Reserve. The Office of the Interconnection shall clear both the Day-ahead Secondary Reserve Market and the Real-time Secondary Reserve Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market and the offers submitted in the Secondary Reserve Market. Resources shall be cleared to provide Secondary Reserve on the basis of each generation resource's and/or Economic Load Response Participant resource's Secondary Reserve offer and the product substitution cost between providing Secondary Reserve, energy and any other product the resource is capable of providing, and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy and of meeting the Synchronized Reserve Requirement; 10-minute Ramp and Uncertainty Reserve Up Requirement; 10-minute Ramp and Uncertainty Reserve Down Requirement; 30-minute Ramp and Uncertainty Reserve Requirement; 30-minute Reserve Requirement; in the day-ahead energy and reserve markets, the Day-Ahead Scheduling Reserve Requirement; and, in the real-time energy and reserve markets, Regulation Requirement. However, any synchronous condenser or Economic Load Response Participant resource with a notification offer parameter of at least ten minutes greater but no more than 30 minutes, and with a minimum run time (or minimum down time for Economic Load Response Participant resources) no greater than one hour, and which receives a commitment to provide Secondary Reserve in the Day ahead Secondary Reserve Market shall be committed to provide Secondary Reserve in the Real-time Secondary Reserve Market, unless the resource is committed in real-time to provide energy or another reserve product.

(c) The Office of the Interconnection shall dispatch generation resources and/or Economic Load Response Participant resources for Secondary Reserve by sending Secondary Reserve instructions to generation resources and/or Economic Load Response Participant resources from which Secondary Reserve has been offered by Market Sellers, in accordance with the PJM Manuals. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their generation resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.4D 10-minute Ramp and Uncertainty Reserve Down.

(a) A Market Buyer shall satisfy its 10-minute Ramp and Uncertainty Reserve Down Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A.002. PJMSettlement shall be the Counterparty to the purchases and sales of 10-minute Ramp and Uncertainty Reserve Down in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain 10-minute Ramp and Uncertainty Reserve Down from the least-cost alternatives available from pool-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the 10-minute Ramp and Uncertainty Reserve Down Requirement of the Reserve Zone. The Office of the Interconnection shall clear both the Day-ahead 10-minute Ramp and Uncertainty Reserve Down Market and the Real-time 10-minute Ramp and Uncertainty Reserve Down Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market, and the offers submitted in the 10-minute Ramp and Uncertainty Reserve Down Market. Resources eligible to sell 10-minute Ramp and Uncertainty Reserve Down shall be cleared to provide 10-minute Ramp and Uncertainty Reserve Down on the basis of each generation resource's and/or Economic Load Response Participant resource's cost associated with the energy dispatch to provide 10-minute Ramp and Uncertainty Reserve Down and any opportunity cost between providing 10-minute Ramp and Uncertainty Reserve Down and any other product the resource is capable of providing; and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy and of meeting the Synchronized Reserve Requirement; 10-minute Ramp and Uncertainty Reserve Up Requirement; 10-minute Ramp and Uncertainty Reserve Down Requirement; 30-minute Ramp and Uncertainty Reserve Requirement; 30-minute Reserve Requirement; in the day-ahead energy and reserve markets, the Day-Ahead Scheduling Reserve Requirement; and, in the real-time energy and reserve markets, Regulation Requirement.

(c) The Office of the Interconnection shall dispatch generation resources and/or Economic Load Response Participant resources for 10-minute Ramp and Uncertainty Reserve Down through economic dispatch, in accordance with the PJM Manuals. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their generation resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.4E 30-minute Ramp and Uncertainty Reserve.

(a) A Market Buyer shall satisfy its 30-minute Ramp and Uncertainty Reserve Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A.003. PJMSettlement shall be the Counterparty to the purchases and sales of 30-minute Ramp and Uncertainty Reserve in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain 30-minute Ramp and Uncertainty Reserve from the least-cost alternatives available from pool-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the 30-minute Ramp and Uncertainty Reserve Requirement of the Reserve Zone. The Office of the Interconnection shall clear both the Day-ahead 30-minute Ramp and Uncertainty Reserve Market and the Real-time 30-

minute Ramp and Uncertainty Reserve Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market, and the offers submitted in the 30-minute Ramp and Uncertainty Reserve Market. Resources eligible to sell 30-minute Ramp and Uncertainty Reserve shall be cleared to provide 30-minute Ramp and Uncertainty Reserve on the basis of each generation resource's and/or Economic Load Response Participant resource's 30-minute Ramp and Uncertainty Reserve offer and the product substitution cost of providing 30-minute Ramp and Uncertainty Reserve, energy and any other product the resource is capable of providing; and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy and of meeting the Synchronized Reserve Requirement; 10-minute Ramp and Uncertainty Reserve Up Requirement; 10-minute Ramp and Uncertainty Reserve Down Requirement; 30-minute Ramp and Uncertainty Reserve Requirement; 30-minute Reserve Requirement; in the day-ahead energy and reserve markets, the Day-Ahead Scheduling Reserve Requirement; and, in the real-time energy and reserve markets, Regulation Requirement.

(c) The Office of the Interconnection shall dispatch generation resources and/or Economic Load Response Participant resources for 30-minute Ramp and Uncertainty Reserve through economic dispatch, in accordance with the PJM Manuals. Market Sellers shall exert all reasonable efforts to operate, or ensure the operation of, their generation resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.4F 60-minute Reserve.

(a) A Market Buyer shall satisfy its 60-minute Reserve Obligation at the rates set forth in Operating Agreement, Schedule 1, section 3.2.3A.004. PJMSettlement shall be the Counterparty to the purchases and sales of 60-minute Reserve in the PJM Interchange Energy Market.

(b) The Office of the Interconnection shall obtain 60-minute Reserve from the least-cost alternatives available from pool-scheduled generation resources and/or Economic Load Response Participant resources as needed to meet the Day-Ahead Scheduling Reserve Requirement of the Reserve Zone not otherwise satisfied by resources providing 10-minute Ramp and Uncertainty Reserve Up, 30-minute Ramp and Uncertainty Reserve, and Secondary Reserve. The Office of the Interconnection shall clear the Day-ahead 60-minute Reserve Market in accordance with the applicable Operating Reserve Demand Curve established in accordance with Operating Agreement, Schedule 1, section 3.2.3A.02, the offers submitted in the PJM Interchange Energy Market and the offers submitted in the 60-minute Reserve Market. Resources eligible to sell 60-minute Reserve shall be cleared to provide 60-minute Reserve on the basis of each generation resource's and/or Economic Load Response Participant resource's 60-minute Reserve offer and the product substitution cost of providing 60-minute Reserve, energy and any other product the resource is capable of providing, and in accordance with the Office of the Interconnection's obligation to jointly procure and minimize the total production cost of energy and of meeting the Synchronized Reserve Requirement, 10-minute Ramp and Uncertainty Reserve Up Requirement, 10-minute Ramp and Uncertainty Reserve Down Requirement, 30-minute Ramp and Uncertainty Reserve Requirement, 30-minute Reserve Requirement, and Day-Ahead Scheduling Reserve Requirement in the day-ahead energy and reserve markets.

(c) Market Sellers shall exert all reasonable efforts to maintain their ability to operate if called upon, or ensure the operation of, their generation and/or Economic Load Response Participant resources supplying energy in the PJM Region as close to desired output levels as practical, consistent with Good Utility Practice.

1.11.5 PJM Open Access Same-time Information System.

The Office of the Interconnection shall update the information posted on the PJM Open Access Same-time Information System to reflect its dispatch of generation resources.

1.11.6 Real-time Energy Market Suspension.

If the Office of the Interconnection declares a Market Suspension (the inability of the Office of the Interconnection to produce Zonal Dispatch Rates for a total of seven (7) or more Real-time Settlement Intervals within a clock hour), Real-time Prices shall be determined pursuant to Operating Agreement, Schedule 1, section 2.5.2 and the Office of the Interconnection shall notify Market Participants of the Market Suspension as soon as practicable.