

APPENDIX D: ANCILLARY SERVICES

D.1 OVERVIEW OF ANCILLARY SERVICES

Ancillary Services are the services provided by the RTO to the SCs. These services are intended to meet Order 2000's requirements that the RTO act as a provider of last resort for, at a minimum, the FERC-mandated ancillary services.

Interconnected Operating Services are the resources that enable the RTO to supply Ancillary Services to the SCs. The RTO will acquire these resources through the procurement processes described in this Appendix and through self-provision of such resources by SCs. In determining its needs, the RTO will also take into account the impact of any self-tracking that is performed by SCs.

[**Note:** Due to time limitations, this draft of the document does not clearly delineate between Ancillary Services and Interconnected Operations Services. To convert this draft to a final draft that is suitable for filing with an RTO Tariff, all of the language will need to be precisely reviewed and re-worked in order to precisely distinguish between Ancillary Services (i.e., the services provided by the RTO to the SCs) and the IOS (the resources procured by, or self-provided to, the RTO.)]

D.1.1 Regulation Services

D 1.1.1 Regulation (Ancillary Service)

The coordinated adjustment by the RTO of generation capacity on a second-by-second basis in real-time in order to continuously balance generation and Demand within the RTO Control Area, thereby maintaining Area Control Error, system frequency and interchange with non-RTO Control Areas within acceptable limits.

D 1.1.2 Regulation (Interconnected Operating Service)

The provision by an SC to the RTO of generation capacity that the RTO can use for the purpose of continuously balancing generation and Demand within the RTO Control Area.

D.1.2 Load Following Up Services

D.1.2.1 Load Following Up (Ancillary Service)

The coordinated adjustment by the RTO of resources on a minute-by-minute basis in real-time in response to net increases in demand in the RTO Control Area.

D.1.2.2 Load Following Up (Interconnected Operations Service)

The provision by an SC to the RTO of generation or demand-side capacity that can be dispatched by the RTO in real-time on a minute-by-minute basis to respond to net increases in demand in the RTO Control Area.

D.1.3 Load Following Down Services

D.1.3.1 Load Following Down (Ancillary Service)

The coordinated adjustment by the RTO of resources on a minute-by-minute basis in real-time in response to net decreases in demand in the RTO Control Area.

D.1.3.2 Load Following Down (Interconnected Operations Service)

The provision by an SC to the RTO of generation or demand-side capacity that can be dispatched by the RTO in real-time on a minute-by-minute basis to respond to net decreases in demand in the RTO Control Area.

D.1.4 Spinning Reserve Services

D.1.4.1 Spinning Reserve (Ancillary Service)

The coordinated adjustment by the RTO of synchronized resources in real-time in response to loss-of-resource contingencies on the Grid.

D.1.4.2 Spinning Reserve (Interconnected Operations Service)

The provision by an SC to the RTO of generation capacity that is synchronized to the Grid and able to respond immediately to the RTO's real-time instructions in the event of a loss-of-resource contingency on the Grid.

D.1.5 Non-Spinning Reserve Services

D.1.5.1 Non-Spinning Reserve (Ancillary Service)

The coordinated adjustment by the RTO of resources, that may or may not have been synchronized to the Grid prior to the RTO's dispatch instructions, in real-time in response to loss-of-resource contingencies on the Grid.

D.1.5.2 Non-Spinning Reserve (Interconnected Operations Service)

The provision by an SC to the RTO of generation or demand-side capacity that can be made available on short-term notice to respond to the RTO's real-time instructions in the event of a loss-of-resource contingency on the Grid.

D.1.6 Replacement Reserve Services

D.1.6.1 Replacement Reserve (Ancillary Service)

The coordinated adjustment by the RTO of generation or demand-side capacity that can be made available to the RTO on sixty minute notice, to enable the RTO to maintain adequate capacity in the RTO's Balancing Energy stack.

D.1.6.2 Replacement Reserve (Interconnected Operations Service)

The provision by an SC to the RTO of generation or demand-side capacity that can be made available to the RTO on sixty-minute notice, to respond to the RTO's instructions to provide or consume Balancing Energy.

D.1.7 Congestion Redispatch Services

D.1.7.1 Congestion Redispatch (Ancillary Service)

The scheduling by the RTO of dispatchable blocks of energy from generation or demand-side resources during the RTO's Day-Ahead Scheduling Process or the RTO's Schedule Adjustment Process to enable the RTO to eliminate residual congestion prior to real-time.

D.1.7.2 Congestion Redispatch (Interconnected Operations Service)

The provision by an SC to the RTO of dispatchable blocks of energy from generation or demand-side resources, for use by the RTO during the RTO's Day-Ahead Scheduling Process or the RTO's Schedule Adjustment Process to enable the RTO to eliminate residual congestion prior to real-time.

D.1.8 Supplemental Energy Service

[**Note:** there is no Supplemental Energy Ancillary Service. Supplemental Energy is dispatched as part of Balancing Energy Ancillary Service.]

D.1.8.1 Supplemental Energy (Interconnected Operations Service)

The provision by an SC to the RTO of dispatchable blocks of energy from generation or demand-side resources, for use by the RTO in real-time to eliminate real-time congestion and to provide Balancing Energy Service.

D.1.9 Balancing Energy Service

D.1.9.1 Balancing Energy (Ancillary Service)

The RTO's coordinated use of Regulation, Load Following Up, Load Following Down, Replacement Reserve and Supplemental Energy resources, and to a limited extent, Spinning Reserve and Non-Spinning Reserve resources (for the period of time during which these two types of resources are dispatched in response to a contingency) - in real-time to deliver energy to, or acquire energy from, each SC's account in order to balance each SC's account on a periodic (ten-minute) basis and to enable the RTO to comply with NERC and WSCC control area performance standards.

[**Note:** There is no Balancing Energy Interconnected Operations Service. Balancing Energy is acquired through the dispatch of the IOS resources that listed above.]

D.1.10 Voltage Support Services

D.1.10.1 Voltage Support (Ancillary Service)

The coordinated scheduling by the RTO of generation resources to maintain transmission voltages within acceptable limits throughout the Grid.

D.1.10.2 Voltage Support (Interconnection Operations Service)

The provision by a Generator or an SC to the RTO of generation capacity whose power factor and output voltage level can be scheduled by the RTO to maintain transmission voltages within acceptable limits throughout the Grid.

D.1.11 Black Start Services

D.1.11.1 Black Start (Ancillary Service)

The procurement by the RTO, and emergency dispatch by the RTO pursuant to emergency restoration plans, of generation resources that are capable of self-starting without support from the Grid in the event of a blackout, in order to restore the Grid to a secure operating state.

D.1.11.2 Black Start (Interconnection Operations Service)

The provision by a Generator or an SC to the RTO of generation resources that are capable of self-starting without support from the Grid in the event of a blackout and that can be used to restore the RTO grid to a secure operating state.

D.1.12 Scheduling and Dispatch Service

D.1.12.1 Scheduling and Dispatch (Ancillary Service)

The RTO's: (i) receipt, validation, coordination, adjustment and acceptance of scheduling information from SCs, in order to develop a secure Operating Plan for the Grid; and (ii) monitoring, control and redispatch of transmission and generation resources to operate the Grid within Applicable Reliability Criteria.

[**Note:** Applicable Reliability Criteria is intended to be a defined term that encompasses NERC, WSCC and other appropriate criteria with which the RTO must comply in operating the RTO Grid.]

D.2 RESPONSIBILITIES OF THE RTO AND SCS

The RTO shall secure rights to control sufficient quantities of resources, through the procurement processes specified in this Appendix and when necessary the procurement process specified in Appendix C of the RTO Tariff,¹ to enable the RTO to operate the grid in compliance with Applicable Reliability Criteria. The quantities of Ancillary Services secured by the RTO shall comply with the standards specified in Section D.3

1 **Note:** All references within this Appendix to "Appendix C" are to Appendix C of the Mountain West ISA Tariff, filed with FERC on July 23, 1999. No Appendix C has yet been developed for RTO West. Appendix C details the RTO's real-time operations authorities and obligations. The text referred to above described the RTO's real-time procurement processes - for acquisition of additional ancillary services in real-time or in response to System Insufficiencies.

- a) Pursuant to the provisions of Appendix D, the RTO is authorized to procure from SCs resources capable of providing the following services to the RTO:
- i) Regulation Service
 - ii) Load Following Up Service
 - iii) Load Following Down Service
 - iv) Spinning Reserve Service
 - v) Non-Spinning Reserve Service
 - vi) Replacement Reserve Service
 - vii) Congestion Redispatch Service
 - viii) Supplemental Energy Service
 - ix) Voltage Support Service
 - x) Black Start Service.
- b) SCs are encouraged to satisfy their Ancillary Services obligations by self-providing resources capable of meeting the RTO's Ancillary Services requirements. To the extent that SCs do not self-provide sufficient quantities of resources to the RTO, the RTO shall procure any additional resources it requires during the Day-Ahead Scheduling Process, the Schedule Adjustment Process, or in Real-time; with the exception of resources capable of providing Voltage Support Service and Black Start Service, which the RTO may procure through longer-term contracts or agreements.
- i) "Self-provision" is the satisfaction of all or a part of an SC's Ancillary Service obligation by the SC's provision to the RTO of suitable control over the capacity and/or the energy output of SC-designated resources, thereby enabling the RTO to reduce the amount of Ancillary Service resources that the RTO would otherwise be required to acquire through the RTO's Ancillary Service procurement process.
 - ii) An SC may self-provide Ancillary Services using resources for which the SC is the Scheduling Coordinator, or using resources provided by another SC through an inter-SC trade of Ancillary Services. Such resources must have previously been certified by the RTO as capable of providing the designated Ancillary Service(s).
- c) The RTO shall, as a provider of last resort, make the following Ancillary Services available to all users of the Grid:
- i) Regulation Service
 - ii) Load Following Up Service

- iii) Load Following Down Service
 - iv) Spinning Reserve Service
 - v) Non-Spinning Reserve Service
 - vi) Replacement Reserve Service
 - vii) Congestion Redispatch Service
 - viii) Balancing Energy Service
 - ix) Voltage Support Service
 - x) Black Start Service
 - xi) Scheduling and Dispatch Service.
- d) Each SC shall pay the RTO for that portion of the SC's allocated share of each of the Ancillary Service obligations that the SC does not meet through self-provision. The RTO shall bill each SC for the SC's net obligations in two stages.
- i) In the first stage, the SC shall be charged based on estimated data, using the schedule information submitted by the SC, as part of the daily settlement process.
 - ii) In the second stage, the RTO shall settle with SCs based on actual meter data, as part of the monthly settlement process. The daily settlement process and monthly settlement processes are specified in Appendix G.²
- e) The RTO shall not discriminate, in technical qualification criteria, scheduling, dispatch, compliance monitoring or any other way, between resources on the basis of whether they have been self-provided or procured directly by the RTO.

D.3 RTO STANDARDS FOR ANCILLARY SERVICES

- a) The RTO's Ancillary Services standards shall comply with WSCC Minimum Operating Reliability Criteria (MORC) on a continuing basis.

² Appendix G defines the RTO's Settlements and Billing authorities and obligations. Due to limited time little effort was devoted by the work group to develop the technical aspects of a settlements appendix. In the future as work is undertaken to do so, those undertaking that effort need to make sure that such an appendix conforms to this two-step process, in which SCs are first charged for estimated uses of Ancillary Services (this settlement can be done daily, based on schedules); and two months later are charged or credited a true-up amount based on the difference between actual demand and scheduled demand. Without this two-step process, large amounts of credit would have to be floated for months. An additional part of this process - needed to avoid creating incentives to under-schedule in order to make money from the two month "float" - is to also charge/credit the SCs for the time value of the month based on the difference between actual and scheduled quantities.

- b) The RTO may change its Ancillary Services standards as needed to account for variations in system conditions, real-time dispatch constraints, contingencies, voltage stability and dynamic stability requirements, and other conditions.
- c) The RTO shall post its detailed Ancillary Services requirements on the RTO's Website. The RTO shall also post any changes to its Ancillary Services requirements on the RTO Website with as much advance notice as possible.
- d) The RTO shall periodically review the operation of the RTO-Controlled Grid to determine whether the RTO's Ancillary Services standards should be revised. Such periodic reviews may include, but are not limited to, analyses of:
 - i) Deviations between actual and forecasted Demand
 - ii) Patterns of unplanned Generating Unit outages
 - iii) Compliance with NERC and WSCC Criteria
 - iv) Operation during system disturbances
 - v) Patterns of shortfalls between final Day-Ahead Schedules, actual energy from Generating Units, and actual Demand
 - vi) Patterns of unplanned transmission outages.

D.4 DETERMINATION OF RTO REQUIREMENTS FOR ANCILLARY SERVICE RESOURCES

The RTO shall determine the quantities and locations of resources that are required to provide Ancillary Service. The RTO shall make such determinations on a Zone-specific³ basis, unless more location-specific requirements have been approved by the RTO Governing Board.

D.4.1 Use of the RTO Demand Forecasts to Determine Ancillary Service Requirements for each Zone

The RTO shall determine the Ancillary Services requirements for each Zone using Demand forecasts for the period(s) for which the Ancillary Services are to be procured. These forecasts shall take into account both: (i) The RTO's forecast of total Demand in the Zone and (ii) the SCs' Demand forecasts, as expressed in the SCs' Balanced Schedules.

D.4.2 Regulation Service

The RTO shall determine the amount of Regulation capacity, in MW, required for each Zone for each Settlement Period through studies that identify the amount of Regulation needed to

³ Note: Zone is a defined term that, means "Congestion Zone." The use of Zones in the Ancillary Services context may require that a different type of Zone be defined, depending on how the flowpath model impacts the locational requirements for ancillary services.

meet WSCC and NERC control performance criteria. The RTO's requirements shall take into account reductions in the RTO's need for Regulation Service due to self-tracking by SCs.

D.4.3 Load Following Up and Load Following Down Services

The RTO shall determine the amounts of Load Following Up capacity and Load Following Down capacity, in MW, required for each Zone for each Settlement Period based on:

- a) Analysis of the amount of ramping capability required to keep the RTO-wide Area Control Error within acceptable limits and maintain adequate Regulation capacity margins;
- b) Analysis of the amount of local ramping capability required to respond to local changes in Demand;
- c) Adjustments for ramping requirements that are met by SCs who self-track;
- d) Analysis of the amount of Supplemental Energy bids available to the RTO, so that the RTO has sufficient resources to keep the RTO-wide Area Control Error within acceptable limits through the combined use of Load Following Up capacity, Load Following Down capacity, Regulation capacity and Supplemental Energy;
- e) Analysis of the mismatch between the aggregate of the SCs' Demand forecasts and the RTO's Demand forecast;
- f) Analysis of patterns of mismatches between final Day-Ahead Schedules, actual energy from Generating Units and actual Demand;
- g) Analysis of seasonal variations that may require additional Load Following Up capacity or Load Following Down capacity;
- h) Analysis of the need for Zone-specific resources to operate the Grid securely in the event of credible transmission and generation contingencies;
- i) Other factors that affect the ability of the RTO to meet the standards specified in Section C.2 of Appendix C.

D.4.4 Spinning Reserve Service

The RTO shall determine the amount of Spinning Reserve capacity, in MW, required for each Settlement Period. The amount of capacity required shall at a minimum meet the requirements of the WSCC MORC. Subject to increases in the Spinning Reserve requirements made pursuant to Section D.3 (b), the RTO-wide Spinning Reserve requirement shall at a minimum be equal to the greater of:

- a) 50% of the amount of generating capacity that would be lost in the most severe single loss-of-generation or loss-of-transmission contingency; or

- b) The sum of two-and-one-half percent (2.5%) of the RTO-wide load responsibility served by hydro generation and three-and-one-half percent (3.5%) of the RTO-wide load responsibility served by thermal generation; where “RTO-wide load responsibility” is the RTO’s firm load (total Demand), plus firm capacity exports and firm energy exports to non-RTO Control Areas, minus firm capacity import and firm energy imports from non-RTO Control Areas for which reserve capacity is provided by the supplier.

The RTO may impose additional, Zone-specific Spinning Reserve requirements based on its analysis of the need for Zone-specific resources to operate the Grid securely in the event of credible transmission and generation contingencies.

D.4.5 Non-Spinning Reserve Service

The RTO shall determine the amount of Non-Spinning Reserve capacity, in MW, required for each Settlement Period. The amount of capacity required shall at a minimum meet the requirements of the WSCC MORC, but may be modified to be more stringent by the RTO. The Non-Spinning Reserve requirement for the RTO Grid shall be equal to:

- a) The greater of:
 - i) The amount of generating capacity that would be lost in the most severe single loss-of-generation or loss-of-transmission contingency, less the amount of Spinning Reserve capacity acquired by the RTO through direct procurement or through self-provision by SCs; or
 - ii) The sum of two-and-one-half percent (2.5%) of the RTO-wide load responsibility served by hydro generation and three-and-one-half percent (3.5%) of the RTO-wide load responsibility served by thermal generation, less the amount of excess Spinning Reserve capacity acquired by the RTO through direct procurement or through self-provision by SCs;
- b) *Plus* an additional amount of capacity equal to the sum of interruptible imports of capacity or energy into the RTO Grid plus the sum of on-demand exports of firm capacity or energy from the RTO Grid.

The RTO may impose additional, Zone-specific Non-Spinning Reserve requirements based on its analysis of the need for Zone-specific resources to operate the Grid securely in the event of credible transmission and generation contingencies.

D.4.6 Replacement Reserve Service

Requirements have not yet been discussed in the Working Group.

D.4.7 Voltage Support Service

- a) The RTO shall conduct technical studies based on the quantities, characteristics and locations of forecasted Demand to determine, for each Settlement Period, the quantities and locations of reactive support required to maintain voltage levels and reactive margins within WSCC and NERC criteria.
- b) The RTO shall publish the results of such studies (“voltage schedules”) daily on the RTO Website. The voltage schedules may be updated by the RTO, as necessary, to respond to anticipated or actual changes in Grid conditions.

D.4.8 Black Start Service

- a) The RTO shall prepare an emergency restoration plan. The RTO shall determine the quantities and locations of “black start” resources that are required in each RTO Control Area in order to provide Black Start Service. This determination shall be made based on contingency studies performed in the preparation of the emergency restoration plan. Such studies shall take into account:
 - i) A credible range of initiating disturbances, based on historical regional practices,
 - ii) The magnitude and extent of the outage (local area, Grid-wide, or WSCC-wide), the assumed status of Generation after the initiating disturbance, the status of interconnections, the system load level at the time of the disturbance, the interconnection support, and assumptions regarding the availability of support from other utilities to help restore Generation and Demand;
 - iii) Generator performance, including the probability that some resources used to provide Black Start Service may fail to start; and
 - iv) The possibility that transmission system damage may prevent some of the resources used to provide Black Start service from re-establishing the system and serving their intended loads.
- b) To assist the RTO in the preparation of emergency restoration plans, each Generator shall provide the RTO with startup and connection times for its black start-capable resources; and each SC shall provide the RTO with any restoration time requirements for any loads that require high priority restoration (for example, the loads of providers of emergency services).

D.4.9 Publication of the RTO Forecasts of Ancillary Service Requirements

- a) To assist SCs in estimating their Ancillary Service obligations, the RTO shall, at least thirty days in advance of the Settlement Period, publish on the RTO Website its forecasts of the loads for each RTO Zone and the amounts of Ancillary Service capacity required, for each Zone and Settlement Period.

- b) The RTO shall update this information in response to changes in forecasts or other system conditions. The RTO shall publish such updated information on the RTO Website with as much advance notice as is practicable.

D.5 GENERAL TECHNICAL REQUIREMENTS FOR PROVIDERS OF ANCILLARY SERVICE RESOURCES

D.5.1 Regulation Service

Regulation service is provided to the RTO by allowing the RTO to reserve and dispatch capacity from Generating Units within the RTO Grid or dynamically scheduled resources from non-RTO Control Areas.

D.5.1.1 Regulation from Generating Units

A Generating Unit that provides Regulation service must meet the following criteria:

- a) The Generating Unit must be capable of responding to direct digital control signals from the RTO's energy management system, in both an upward and downward direction.
- b) The real-time output of the Generating Unit must be capable of being monitored by the RTO's energy management system; and the Generating Unit's AGC status, indicating whether the Generating Unit is on or off Automatic Generation Control, must be observable by the RTO's telemetry in real-time.
- c) The Generating Unit must be capable of delivering the full amount of regulating capacity offered to the RTO, in both the upward and downward direction, within ten minutes.⁴
- d) The minimum amount of Regulation service that may be offered to the RTO is in one MW increments.
- e) The Generating Unit must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.

D.5.1.2 Dynamic Scheduling of Resources from non-RTO Control Areas

- a) Regulation service may be provided to the RTO by allowing the RTO to reserve and dispatch capacity from resources located outside the RTO Grid upon demonstration that the necessary computer links, control capabilities, modifications to the RTO energy management system software (including AGC and interchange scheduling programs), and coordination agreements with the Control Area within which the resource is located are in place.

⁴ Note: Some Work Group member(s) question whether the standard should be ten minutes. The issue has not been discussed in the Work Group.

- b) The SC that provides the Regulation service is responsible for acquiring and scheduling the transmission rights (FTRs, RTRs or NCRs) required to import the Regulation capacity from the non-RTO Control Area.
- c) Regulation provided in this manner must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.

D.5.2 Load Following Up Service

Load Following Up service is provided to the RTO by allowing the RTO to reserve and dispatch capacity from Generating Units or Dispatchable Demands.

- a) Load Following Up service may be provided by that portion of a Generating Unit's capacity, beyond the Generating Unit's scheduled operating point, that is capable of being loaded to the specified output level within ten minutes and capable of operating at the output level for at least one hour.⁵
- b) Load Following Up service may be provided to the RTO by an SC's designation of Demand that is capable of being reduced within ten minutes and capable of remaining at that reduced level for at least one hour ("Dispatchable Demand").
- c) Generating Units and Dispatchable Demands must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.
- d) The minimum amount of Load Following Up service that may be offered to the RTO is in one MW increments. Dispatchable Demands may be aggregated to meet the one MW increment requirement.

D.5.3 Load Following Down Service

Load Following Down service is provided to the RTO by allowing the RTO to reserve and dispatch capacity from Generating Units or Dispatchable Demands.

- a) Load Following Down service may be provided by that portion of a Generating Unit's capacity below the Generating Unit's scheduled operating point that is capable of being unloaded to the specified output level within ten minutes and capable of operating at that output level for at least one hour.⁶

⁵ Note: Some Work Group member(s) question whether the standard should be ten minutes. The issue has not been discussed in the Work Group.

⁶ Note: Some Work Group member(s) question whether the standard should be ten minutes. The issue has not been discussed in the Work Group.

- b) Load Following Down service may be provided to the RTO by an SC's designation of Demand that is capable of being increased within ten minutes and capable of remaining at that increased level for at least one hour ("Dispatchable Demand").
- c) Generating Units and Dispatchable Demands must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.
- d) The minimum amount of Load Following Down service that may be offered to the RTO is in one MW increments. Dispatchable Demands may be aggregated to meet the one MW increment requirement.

D.5.4 Spinning Reserve Service

Spinning Reserve service is provided to the RTO by allowing the RTO to reserve and implement: the right to dispatch capacity from Generating Units, the right to call upon capacity associated with imports of firm generating capacity that is on-line and synchronized to the non-RTO Grid (i.e., on-demand firm energy), or the right to recall non-firm energy exports.⁷

- a) Spinning Reserve service may be provided by that portion of a Generating Unit's capacity that is unloaded, synchronized to the Grid, immediately responsive to system frequency, capable of being ramped to a specified output level within ten minutes, and capable of operating at that output level for at least one hour.
- b) The Generating Unit must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.
- c) Spinning Reserve service may be provided to the RTO by designating: (i) imports of firm capacity that is on-line and synchronized to the non-RTO Grid (i.e., on-demand firm energy obligations) or (ii) non-firm energy exports, which can be called upon by the RTO in the event of a contingency. There are no certification procedures associated with such firm imports or non-firm exports; however, the RTO may confirm the recallability of the associated contracts with the relevant SCs.
- d) The minimum amount of Spinning Reserve service that may be offered to the RTO is in one MW increments.
- e) An SC that provides Spinning Reserve resources to the RTO through firm capacity imports must acquire and schedule transmission rights (FTRs, RTRs or NCRs) in an amount equal to the amount of Spinning Reserve service provided to the RTO.

⁷ Note: Issue under discussion: whether or not non-firm exports may qualify for provision of Spinning Reserve.

D.5.5 Non-Spinning Reserve Service

Non-Spinning Reserve service is provided to the RTO by allowing the RTO to reserve and to implement: the right to dispatch capacity from Generating Units, excess Spinning Reserve or Dispatchable Demand; the right to call upon capacity associated with imports of firm generating capacity i.e., on-demand firm energy); or the right to recall non-firm energy exports.

- a) Non-Spinning Reserve service may be provided by the portion of a Generating Unit's off-line generating capacity that is capable of being synchronized and ramped to a specified output level within ten minutes and capable of operating at that output level for at least one hour.
- b) Non-Spinning Reserve service may also be provided to the RTO by the portion of a Generating Unit's on-line capacity that meets the requirements for Spinning Reserve.
- c) Non-Spinning Reserve service may be provided to the RTO by an SC's designation of Demand that is capable of being reduced within ten minutes and capable of remaining at that reduced level for at least one hour ("Dispatchable Demand").
- d) Generating Units and Dispatchable Demands must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.
- e) Non-Spinning Reserve service may be provided to the RTO by designating: (i) firm capacity imports (i.e., on-demand firm energy obligations) or (ii) non-firm energy exports, which can be called upon by the RTO in the event of a contingency. There are no certification procedures associated with such firm imports or non-firm exports; however, the RTO may confirm the recallability of the associated contracts with the relevant SCs.
- f) The minimum amount of Non-Spinning Reserve service that may be offered to the RTO is in one MW increments. Dispatchable Demands may be aggregated to meet the one MW increment requirement.
- g) An SC that provides Non-Spinning Reserve resources to the RTO through imports of firm generating capacity must acquire and schedule transmission rights (FTRs, RTRs or NCRs) in an amount equal to the amount of Non-Spinning Reserve service provided to the RTO.

D.5.6 A similar section will need to be added here for Replacement Reserves. The criteria have not yet been discussed in the Working Group.

D.5.7 Congestion Redispatch Service

Congestion Redispatch Service is provided to the RTO by allowing the RTO to change, during the Day-Ahead Scheduling Process and Schedule Adjustment Process, the scheduled output or consumption levels of Generating Units and Demands.

- a) There are no technical requirements associated with the provision of Congestion Redispatch Service to the RTO in the Day-Ahead Scheduling Process or the Schedule Adjustment Process.

D.5.8 Supplemental Energy Service

Supplemental Energy service is provided to the RTO by allowing the RTO to change, in Real-time, the scheduled output or consumption levels of Generating Units and Dispatchable Demands.

- a) There are no technical requirements associated with the provision of Supplemental Energy services to the RTO in the Real-time environment, other than the capability to provide the amount of redispatch specified in the Supplemental Energy bid within ten minutes of the RTO's Dispatch Order.

D.5.9 Voltage Support Service

Voltage Support service is provided to the RTO by allowing the RTO to reserve and dispatch capacity from Generating Units.

- a) Each Generating Unit is required to provide Voltage Support to the RTO in accordance with the standards specified in Section D.6.7.
- b) Additional Voltage Support service may be provided by that portion of a Generating Unit's capacity that is capable of being re-dispatched in ten minutes, and capable of being operated at that re-dispatched output level for at least one hour.
 - i) The minimum amount of Voltage Support service that may be offered to the RTO is in one MVAR increments.⁸
 - ii) The Generating Unit must meet the additional technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.

D.5.10 Black Start Service

Black Start Service is provided to the RTO by making available to the RTO generating capacity that may be used by the RTO to restore service to the grid after a blackout.

⁸ Note: Some Working Group member(s) feel that only plants of greater than 30 MVA should be permitted to offer this service.

Generating Units that provide Black Start Service must meet the technical requirements specified in the RTO Protocol X and must be certified by the RTO in accordance with Protocol X.

D.6 RTO PROCUREMENT OF ANCILLARY SERVICES RESOURCES FROM SCS

D.6.1 SC Rights and Obligations to Self-Provide Ancillary Service Resources

- a) An SC may satisfy part or all of its obligations to the RTO for the following Ancillary Services through the designation of resources capable of meeting the RTO's requirements for the following Ancillary Services:
 - i) Regulation Service
 - ii) Load Following Up Service
 - iii) Load Following Down Service
 - iv) Spinning Reserve Service
 - v) Non-Spinning Reserve Service
 - vi) Congestion Redispatch Service
 - vii) Supplemental Energy Service.
- b) An SC may self-provide Ancillary Services by designating, in the RTO's Day-Ahead Scheduling Process or Schedule Adjustment Process: (i) resources for which the SC is the Scheduling Coordinator, or (ii) inter-SC Ancillary Services trades to the SC's account (i.e., purchases of Ancillary Services resources from other SCs).
- c) Inter-SC trades of Ancillary Services that have been validated by the RTO pursuant to Appendix B⁹ shall be deemed to take place: the purchasing SC shall be deemed to have provided to the RTO the amount of capacity associated with the inter-SC trade, and the selling SC shall acquire the obligation to provide the Ancillary Service to the RTO, including the provision of energy bid curve(s), the designation of specific physical resource(s), and the obligation to pay for replacement resources if the Ancillary Service is not provided.
- d) For each individual Ancillary Service other than Non-Spinning Reserve, each SC *must* self-provide to the RTO, through resources for which the SC is the Scheduling Coordinator, an amount of capacity greater than or equal to the SC's net inter-SC trades of the Ancillary Service to other SCs.

⁹ Appendix B specifies the RTO's scheduling requirements and processes.

- e) For Non-Spinning Reserve, an SC must self-provide, through resources for which the SC is the Scheduling Coordinator, an amount of Non-Spinning Reserve capacity greater than or equal to the sum of the SC's net inter-SC trades of Non-Spinning Reserves to other SCs *plus* the SC's interruptible imports of capacity or energy into the RTO Grid *plus* the SC's on-demand exports of firm capacity or energy from the RTO Grid.
 - i) Schedules for such imports or exports shall be validated for compliance with this self-provision requirement and shall be rejected if this requirement is not met.
- f) For each individual Ancillary Service, the maximum amount of self-provision by an SC may not exceed the sum of: (i) the SC's pro rata obligation for the Ancillary Service calculated pursuant to Section D.9.1, plus (ii) the net of the SC's inter-SC trades of the Ancillary Service to other SCs, plus (iii) in the case of Non-Spinning Reserve, the sum of the SC's interruptible imports of capacity or energy into the RTO Grid plus the SC's on-demand exports of firm capacity or energy from the RTO Grid. The SC shall not be credited for Ancillary Service self-provision beyond this amount.

D.6.2 Competitive Procurement of Ancillary Service Resources by the RTO

The RTO shall procure the resources required for the secure operation of the Grid using the following rules.

- a) Except where stated to the contrary in the Tariff, the RTO shall, to the extent the Ancillary Services are available, use competitive procurement processes to procure sufficient Ancillary Services to meet the requirements specified in Section D.3.
- b) Every resource offered to the RTO must meet the technical requirements specified in the RTO Protocol X and must be certified in accordance with the procedures specified in the RTO Protocol X.
- c) SCs may submit bids to provide Regulation, Spinning Reserve, Non-Spinning Reserve, Load Following Up, Load Following Down, Replacement Reserve, or Congestion Redispatch services as part of the Day-Ahead Scheduling Process and Schedule Adjustment Process.
- d) SCs may submit bids to provide Supplemental Energy service during the Day-Ahead Scheduling Process and Schedule Adjustment Process. Supplemental Energy bids offered to the RTO by an SC may be withdrawn at any time prior to the issuance of a Dispatch Instruction calling upon the Supplemental Energy bid.¹⁰
- e) SCs may submit bids from resources that were not part of the SC's Balanced Schedule.

¹⁰ Some Working Group member(s) feel that bids should not be withdrawal after "acceptance by the RTO." This begs the question of what "acceptance by the RTO" means, since no payment is made by the RTO to the bidder as a result of such acceptance.

- f) Every bid to provide Ancillary Services to the RTO must be submitted in accordance with the scheduling requirements specified in Appendix B.
- g) The RTO shall not differentiate between bids for a product (i.e., a specific Ancillary Service) other than through the capacity bid associated with the resource, except in the case of a tie, in which case the RTO shall break the tie by choosing the bid with the lowest energy bid price.
 - i) Should the RTO require a locational mix of an Ancillary Service, the RTO shall differentiate the Ancillary Service into distinct products and acquire each product through a separate procurement process for each location.
- h) The RTO shall select Ancillary Services capacity based on the lowest capacity reservation bids, and shall dispatch energy from a resource that has been committed to provide Ancillary Services based on its energy bid price and the rules specified in Appendix C for the use of the Balancing Energy stack.
- i) The RTO shall contract with Generators for resources needed to provide long-term Voltage Support service through a competitive procurement process. In addition, if the RTO determines that additional Voltage Support is required in the short-term, the RTO may, pursuant to Section D.6.7, instruct a reduction in the power output of a Generating Unit to enable the Generating Unit to operate outside the RTO-dispatchable power factor range specified in Section D.6.7. Subject to any locational requirements, the RTO shall select the Generating Units that are instructed to reduce output using a merit order stack that shall be ordered based on the price to be paid to the Generating Unit's SC.
- j) The RTO shall establish, through a competitive procurement process, long-term contracts with Generators for resources needed to provide Black Start capability.
- k) There is no procurement process for the provision of Scheduling and Dispatch Service. The RTO shall directly provide such service.

D.6.3 RTO Day-Ahead Ancillary Service Procurement

- a) The RTO shall conduct daily procurements, for each Zone, of the resources needed to provide Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve. The time line for such daily procurement auctions is specified in Appendix B.
- b) The RTO shall ensure that an Ancillary Services exchange meeting these criteria exists. If necessary, the RTO shall conduct a competitive solicitation process to establish such an Ancillary Services exchange.

- (i) To enable long-term self-provision of Ancillary Services by market participants, the exchange will provide a non-discriminatory marketplace for the trading of Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve resources for up to one year in advance of the Operating Hour;
- (ii) The exchange will use market clearing and price-setting mechanisms that meet the RTO's requirements for its daily procurement of Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve resources;
- (iii) The exchange will meet those scheduling requirements, communication interface requirements and settlements requirements necessary to enable the RTO to use the exchange for procurement of Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve resources;
- (iv) The exchange will calculate and publish Market Clearing Prices for the RTO's daily procurements of Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve resources;
- (v) The exchange will meet RTO-specified transparency requirements regarding the timing and amount of data to be released to the public, including the ongoing publication of forward market supply curves, demand curves and clearing prices for each Ancillary Service traded in the exchange, with the intent of making available to the public as much non-proprietary data as possible;
- (vi) The exchange will commit to compliance with those financial and operational audits that may be required by the RTO on an annual or more frequent basis;
- (vii) The exchange will provide data to meet the RTO's market monitoring requirements;
- (viii) The exchange will make the commercial commitments needed to ensure that the RTO will be able to rely on the exchange for the RTO's day-ahead Ancillary Services procurement, including a binding commitment to operate the Ancillary

Services exchange for an RTO-specified period of time or suffer financial consequences for not meeting that commitment.

- c) For each Ancillary Service, the RTO shall procure sufficient resources so that, after adjusting for self-provided resources and self-tracking by SCs, the total amount of capacity procured by the RTO meets the RTO's requirements as specified in Section D.4.
- d) RTO West shall determine a Market Clearing Price for each Zone for each of the following daily Ancillary Services: Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve. The Market Clearing Price shall equal the highest-priced capacity reservation bid accepted by RTO West for that Ancillary Service in that Zone.
- e) If during a System Emergency the Market Clearing Price cannot be calculated by RTO West, the Market Clearing Price for the particular Ancillary Service shall be deemed to be equal to the Market Clearing Price for that Ancillary Service in the same Settlement Period of the preceding Trading Day.
- f) If RTO West must differentiate between Ancillary Services on a locational basis within a Zone, the requirements of Section D.6.3 shall be applied to each sub-area within a Zone.

D.6.4 RTO Ancillary Services Procurement during the Schedule Adjustment Process

- a) The RTO shall conduct an ongoing Ancillary Service procurement process during the Schedule Adjustment Process through which the RTO may acquire additional Ancillary Services if the RTO's requirements change due to:
 - i) Changes in system conditions (for example, changes in Load Following requirements as a result of changes in the load ramp within a Zone)
 - ii) Scheduling of additional Demand by SCs or changes in the RTO's Demand forecast
 - iii) Changes in the availability of previously committed Ancillary Service resources.
- b) The RTO shall procure these additional Ancillary Service **[Option 1:** through the Ancillary Services exchange described in Section D.6.3; **Option 2:** by selecting, from stacks composed of Ancillary Services bids that have offered by the SCs to the RTO for use in the Schedule Adjustment Process, the lowest-price capacity bids for resources that meet the RTO's requirements. These stacks shall be continuously updated by the RTO as SCs provide additional bids and withdraw unaccepted bids.] [The work group did not develop a recommended approach for this situation.]
- c) Throughout the Schedule Adjustment Process, SCs' bids to provide Ancillary Services must be resource-specific. I.e., the use of Portfolio Resources as a means for submitting

Ancillary Service resource bids is only permitted during the Day-Ahead Scheduling Process, as described in Appendix B.

D.6.5 RTO Real-Time Ancillary Service Procurement

The Real-time procurement of Ancillary Services is detailed in Section C.4.4 of Appendix C.

D.6.6 Obligations to Honor Ancillary Services Commitments

- a) The Ancillary Services schedules in each SC's final Hour-Ahead Schedule (i.e., the SC's final Day-Ahead Schedule as modified to incorporate changes approved in the Schedule Adjustment Process), including the schedules for both self-provided Ancillary Services and Ancillary Services committed to the RTO through the RTO's Ancillary Services procurement processes, are binding commitments to the RTO. Each SC is obligated to honor such schedules. If an SC does not honor such a schedule, the SC shall be charged for the RTO's costs of acquiring replacement capacity, as described in section (c) below, and may in addition be subject to any non-compliance penalties instituted by the RTO Board and approved by the Commission; provided that:
 - i) An SC may offer a substitute resource to the RTO, provided that there is sufficient time for the RTO to evaluate the impacts of such a re-designation, the substitute resource meets the RTO's technical requirements, the RTO determines that the re-designation would not create congestion or Grid security problems, and provided that:
 - ii) An SC may not re-designate a resource after that resource has called upon by the RTO pursuant to either (i) a valid Dispatch Instruction; or (ii) a performance audit pursuant to Section D.11.
- b) The SC that is responsible for a resource that has been scheduled to provide an Ancillary Service is responsible for scheduling any minimum energy output associated with the resource. The SC must adjust its Balanced Schedule to accommodate such energy.
- c) If a resource that has been scheduled to provide an Ancillary Service is unavailable, the SC that is responsible for the unavailable resource must replace the resource within sixty minutes (but in any event no later than thirty minutes prior to the Settlement Period). If the SC fails to replace the resource, the RTO shall procure replacement capacity on behalf of the SC and the SC shall be charged for: (i) the capacity reservation cost of the replacement resource, and (ii) if the rate for energy payments to the SC for the replacement resource exceeds the Balancing Energy Clearing Price, the amount of the energy payment minus the amount that would have been paid had the rate for the energy payment been the Balancing Energy Clearing Price.

- d) Except as provided in Section D.6.7, a Generator or SC is not required to provide Ancillary Service resources to the RTO or to submit bids to the RTO's Ancillary Services procurement processes, unless the Generator or SC is otherwise obligated to do so by the terms of its regulator-approved generation tariff, Commission-approved tariff for the sale of Ancillary Services or other contractual agreements or obligations.

D.6.7 Mandatory Provision of Ancillary Service Capacity to the RTO

- a) The RTO may require an SC to provide Ancillary Service resources if necessary to avoid a System Insufficiency or System Emergency condition, pursuant to Sections C.8 or C.9.
- b) Subject to any limitations imposed by a pre-existing contract (PEC) or by a Generating Unit's interconnection agreement with the transmission or distribution utility to which the Generating Unit is interconnected, each Generating Unit shall comply with the voltage schedules that have been established for the Zone and shall comply with the RTO's instructions, as issued to the Generating Unit's SC, to operate at any voltage level or power factor within the ranges specified in such PEC or interconnection agreement. Generators shall receive no compensation from the RTO for complying with instructions to operate at any point within these specified ranges.
 - i) The power factor for Generating Units shall be measured at the [**Option 1:** interconnection point with the Grid; **Option 2:** grid-side of the Generating Unit's step-up transformer].
 - ii) The RTO Board may, upon the approval of the Commission, institute penalties for non-compliance with the RTO's Voltage Support requirements.
 - iii) If a Generating Unit is not obligated by a specific contractual requirement to operate within a specified power factor range or to comply with a the RTO instruction to operate at a specific power factor, this Tariff shall obligate the Generating Unit to comply with the RTO's instructions directing the Generating Unit to operate at any point within a band of 0.90 lagging (producing VARs) and 0.95 leading (absorbing VARs) power factor; provided that, a Generating Unit that was already interconnected as of the RTO Operations Date and is unable to meet these requirements may apply to the RTO for an exemption from these requirements. However, the RTO shall not grant any exemption under this Section from existing contractual requirements.
 - iv) If all other Voltage Support that can be obtained through contractual means has been scheduled and the RTO requires additional Voltage Support, the RTO may instruct a Generating Unit to move its MVAR output beyond the range for which the RTO would otherwise be entitled to issue instructions pursuant to Section (b) above. In

such a circumstance, the Scheduling Coordinator for the Generating Unit shall be compensated in accordance with Sections D.8.1.3 and D.8.2.3.

D.6.8 Provision of Multiple Ancillary Services from a Resource

An individual resource may provide more than one Ancillary Service, subject to the requirement that the sum of the Ancillary Service capacities committed to the RTO, when added to the scheduled dispatch level of the resource, is within the operating capability of the resource.

D.7 RTO PROVISION OF ANCILLARY SERVICES TO SCS

D.7.1 Provision of Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve, Replacement Reserve, Voltage Support and Black Start Services

The RTO shall provide Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve, Replacement Reserve, Voltage Support and Black Start services to SCs by: (i) acquiring the resources necessary to provide these services through the mechanisms described in Section D.6, and (ii) dispatching those resources pursuant to Appendix C.

D.7.2 Provision of Redispatch for Management of Congestion

- a) The RTO shall acquire Congestion Redispatch Services for the management of non-Real-time residual Congestion pursuant to Appendix A.
- b) The RTO shall acquire and dispatch Supplemental Energy and other Ancillary Services resources for Real-time Congestion pursuant to Appendix C.

D.7.3 Provision of Scheduling and Dispatch Service

The RTO shall provide Scheduling and Dispatch Service to SCs pursuant to Appendix B and Appendix C.

D.7.4 Provision of Balancing Energy Service

The RTO shall provide Balancing Energy Service to SCs through the dispatch of Ancillary Service resources in the Balancing Energy stack pursuant to Appendix C.¹¹

- a) The RTO shall create Balancing Energy stack for the RTO Grid. In the event of Congestion between Zones, the RTO shall create a separate Balancing Energy stack for each Zone that is affected by the inter-Zonal Congestion. Each stack shall be updated, as required, by the RTO in Real-time.

¹¹ The methodology for the RTO's dispatch of the Ancillary Services stack in the flowpath model (vs. the zonal model, for which this Appendix D was originally drafted) requires further discussion.

- b) Each Balancing Energy stack shall be created by sorting the following resources in order of increasing energy bid prices:
 - i) Regulation (which, for the purpose of creating and dispatching the Balancing Energy stack, shall be priced at zero), Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve capacity procured by the RTO, both through the RTO's competitive procurement processes and self-provision by SCs.
 - ii) Supplemental Energy bids submitted by SCs at any time during the Day-Ahead Scheduling Process or Schedule Adjustment Process (i.e., up to thirty minutes prior to the start of the Settlement Period).

D.8 COMPENSATION TO PROVIDERS OF ANCILLARY SERVICE RESOURCES

D.8.1 Capacity Reservation Payments to Providers of Ancillary Service Resources

D.8.1.1 Capacity Payments for Resources Supplied to the RTO for Regulation, Load Following Up, Load Following Down, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve Services

- a) An SC whose bid to provide an Ancillary Service resource to the RTO is accepted in the RTO's Day-Ahead Ancillary Service procurement process shall be paid the amount (in MW) of Ancillary Service capacity accepted by the RTO, multiplied by the Market Clearing Price for the Ancillary Service; provided that, in the event that the price that the SC may charge for the Ancillary Service capacity is limited by a contractual or regulatory-imposed price cap, the SC shall be paid the amount (in MW) of Ancillary Service capacity accepted by the RTO, multiplied by the lesser of the capped price or the Market Clearing Price associated with the Ancillary Service capacity provided by the SC.
- b) An SC whose bid to provide an Ancillary Service resource to the RTO is accepted in the Schedule Adjustment Process or in Real-time shall be paid the amount (in MW) of Ancillary Service capacity accepted by the RTO, multiplied by the SC's capacity bid price for the Ancillary Service capacity; provided that: in the event that the price that the SC may charge for the Ancillary Service capacity is limited by a contractual or regulatory-imposed price cap, the SC shall be paid the amount (in MW) of Ancillary Service capacity accepted by the RTO, multiplied by the lesser of the capped price or the SC's capacity bid price for the Ancillary Service capacity.
- c) An SC that provides an Ancillary Service resource to the RTO on an involuntary basis in the event of a System Insufficiency or a System Emergency pursuant to Section C.8 or C.9 shall be paid the amount (in MW) of capacity made available to the RTO by the SC,

multiplied by the higher of: (i) the Demonstrable Cost (in \$/MW) imposed upon the SC by the obligation to make the resource available to the RTO; or (ii) the Market Clearing Price of the Ancillary Service for the Settlement Period, as determined in the Day-Ahead Scheduling Process; capped by (iii) any contractual or regulatory-imposed cap on the price that the SC may charge for capacity from the resource.

D.8.1.2 Capacity Payments for Resources Supplied to the RTO for Provision of Supplemental Energy

There are no capacity reservation fees or payments associated with the provision of Supplemental Energy.

D.8.1.3 Capacity Payments for Resources Supplied to the RTO for Voltage Support Service

- a) For dispatch of the resource within the range specified in the Generator's long-term contract with the RTO, the Generator shall be paid pursuant to the terms of the contract.
- b) For dispatch of the resource beyond the range specified in the Generator's long-term contract with the RTO, the SC for the Generating Unit shall be paid the amount (in MW) of resource capacity made unavailable for energy production due to the redispatch for Voltage Support, multiplied by the higher of: (i) the Demonstrable Cost (in \$/MW) imposed upon the SC by the obligation to make the resource available for Voltage Support, or (ii) the Market Clearing Price of Spinning Reserve for the Settlement Period, as determined in the Day-Ahead Scheduling Process; capped by (iii) any contractual or regulatory-imposed cap on the price that the SC may charge for Voltage Support capacity from the resource.

D.8.1.4 Capacity Payments for Resources Supplied to the RTO for Black Start Service

Payment shall be made to the Generator pursuant to the terms of the Generator's long-term contract with the RTO.

D.8.2 Energy Payments to Providers of Ancillary Service Resources

The RTO shall pay SCs for energy produced by Ancillary Service resources and shall charge SCs for reductions in energy consumption by Ancillary Service resources as follows.

D.8.2.1 Payments for Balancing Energy Associated with Dispatch of Ancillary Service Resources

- a) Balancing Energy supplied by an Ancillary Service resource pursuant to a Dispatch Instruction shall be deemed to have been scheduled and delivered to or from the RTO.
- b) For each ten-minute interval within the Settlement Period, payment to an SC for Balancing Energy supplied to the RTO or payment from the SC for Balancing Energy supplied to the SC by the RTO as a result of a Dispatch Instruction shall equal the sum,

for each of the SC's resources dispatched by the RTO, of the Balancing Energy Clearing Price for the appropriate Zone multiplied by the net amount of energy deemed to have been produced or consumed by the resource as a result of compliance with the Dispatch Instruction; provided that, with the exception of capacity dispatched to provide Regulation Service:

- i) On an individual resource-by-resource basis: if the cumulative application of the Balancing Energy Clearing Prices for the six ten-minute intervals in the Settlement Period would result in the SC receiving less than it had bid to provide energy to the RTO, or would result in the SC paying more to the RTO than it had bid to consume energy from the RTO, the RTO shall provide supplemental compensation to the SC. This supplemental compensation shall equal the deemed amount of energy produced or consumed by the resource, multiplied by the difference between the energy bid price associated with the deemed production or consumption of energy and the Balancing Energy Clearing Price.
- c) If an SC is required to provide Ancillary Service resources to the RTO on an involuntary basis in the event of a System Emergency or a System Insufficiency:
- i) For each ten-minute interval within the Settlement Period, payment to the SC for incremental energy supplied to the RTO shall equal the quantity of energy delivered to the RTO by the SC (in MWh) multiplied by the higher of the SC's Demonstrable Cost or the Balancing Energy Clearing Price for the Zone and the interval.
 - ii) For each ten-minute interval within the Settlement Period, payment by an SC to the RTO for decremental energy supplied by the RTO shall equal the quantity of energy delivered to the SC by the RTO (in MWh) multiplied by the lower of the SC's Demonstrable Cost or the Balancing Energy Clearing Price for the Zone and the interval.

D.8.2.2 Payment for Energy for Intra-Zonal Congestion Management

An SC's resources may be incremented or decremented, voluntarily or involuntarily, for residual Congestion management in accordance with Appendices A and C.

- a) Incremental or decremental energy shall be deemed to have been scheduled and delivered to or from the RTO.
- b) For redispatch services, whether acquired through the acceptance of Congestion Redispatch energy bids during the Day-Ahead Scheduling Process or Schedule Adjustment Process, or acquired through the dispatch of Supplemental Energy bids or Load Following bids in Real-time:

- i) For each ten-minute interval within the Settlement Period, payment to an SC for incremental energy supplied to the RTO shall equal the quantity of energy delivered by the SC (in MWh) multiplied by the higher of: (a) the SC's incremental Congestion Redispatch energy bid price, Supplemental Energy bid price or Load Following Up energy bid price, as appropriate, or (b) the Balancing Energy Clearing Price for the Zone and interval.
 - ii) For each ten-minute interval within the Settlement Period, payment by an SC to the RTO for decremental energy supplied by the RTO shall equal the quantity of energy delivered to the SC (in MWh) multiplied by the lower of: (a) the SC's decremental Congestion Redispatch energy bid price, Supplemental Energy bid price or Load Following Down energy bid price, as appropriate, or (b) the Balancing Energy Clearing Price for the Zone and interval.
 - iii) If necessary to mitigate the exercise of local market power by SCs in the provision of redispatch services, the RTO may, upon approval of the RTO Board and the Commission and notice to market participants via the RTO Website, substitute Demonstrable Cost-based price caps or floors for SCs' incremental or decremental Congestion Redispatch energy bid prices, Supplemental Energy bid prices or Load Following energy bid prices, when such bids are used for the purpose of residual Congestion management.
- c) For redispatch service acquired under the mandatory redispatch authority of the RTO:
- i) For each ten-minute interval within the Settlement Period, payment to an SC for incremental energy supplied to the RTO shall equal the quantity of energy delivered to the RTO by the SC (in MWh) multiplied by the higher of the SC's Demonstrable Cost or the Balancing Energy Clearing Price for the Zone and interval.
 - ii) For each ten-minute interval within the Settlement Period, payment by an SC to the RTO for decremental energy supplied by the RTO shall equal the quantity of energy delivered to the SC by the RTO (in MWh) multiplied by the lower of the SC's Demonstrable Cost or the Balancing Energy Clearing Price for the Zone and interval.

D.8.2.3 Payment for Other Energy Associated with the Dispatch of Ancillary Service Resources

- a) The RTO may, pursuant to the Tariff, schedule energy from or to an SC's resources for purposes other than the provision of Balancing Energy. Such purposes include: (i) scheduling of energy, other than Congestion Redispatch energy or Supplemental Energy, for congestion management, (ii) curtailment of energy output of Voltage Support

resources, (iii) testing and use of Black Start resources, and (iv) performance auditing of Ancillary Services resources.

- b) Such energy shall be deemed to have been scheduled and delivered to or from the RTO.
- c) For each ten-minute interval within the Settlement Period, payment to an SC for energy provided to the RTO shall be made on a resource-by-resource basis, by multiplying: (i) the net amount of energy deemed to have been produced by the resource as a result of compliance with the RTO's Dispatch Instruction, and (ii) the higher of the energy bid price associated with the resource or the Balancing Energy Clearing Price for the Zone and Settlement Period.
- d) For each ten-minute interval within the Settlement Period, payment by an SC to the RTO for energy provided by the RTO shall be made on a resource-by-resource basis, by multiplying: (i) the net amount of energy deemed to have been delivered to the SC by curtailing the output of the resource as a result of compliance with the RTO's Dispatch Instruction, and (ii) the lower of the energy bid price associated with the resource or the Balancing Energy Clearing Price for the Zone and Settlement Period.
- e) If there is no energy bid price for the resource, the SC's Demonstrable Cost for the resource shall be used in lieu of the energy bid price.

D.8.3 Costs of Equipment Required to Meet Ancillary Services Requirements

- a) The RTO shall bear no cost responsibility or functional responsibility for the design, procurement, or installation of equipment (including, but not limited to, hardware, software, and telecommunications equipment) that is required to enable a Generating Unit or Dispatchable Demand to provide Ancillary Services.

D.9 CHARGES FOR RTO-PROVIDED ANCILLARY SERVICES

D.9.1 Settlement Obligations for Regulation, Load Following Up, Load Following Down, Spinning Reserve and Non-Spinning Reserve Services

Note: A section will need to be developed for settlements for Replacement Reserves. This is a complex issue because the RTO costs of procuring such reserves should be allocated to the entities that are responsible for forcing the RTO to procure the Replacement Reserves. Since Replacement Reserves are required for multiple reasons - including load forecast errors - the details of the cost allocation will not be simple. [Although the work group did not develop the mechanism it did recommend that allocation be done on a causal basis for any incremental reserves purchased to address the action or inaction of individual SCs.]

D.9.1.1 SC's Settlement Obligation (in MW)

Each SC's settlement obligation, in MW, for the particular Ancillary Service for each Settlement Period and Zone, shall be equal to the SC's pro rata obligation, plus the SC's non-pro rata obligation, minus the SC's credit for self-provision, plus the SC's replacement capacity obligation, where:

- a) The SC's pro rata obligation shall equal: (i) the actual amount of capacity (in MW) acquired by the RTO (including all amounts accepted by the RTO through self-provision and including all amounts procured by the RTO through the RTO's day-ahead, post-day-ahead, Real-time and longer-term procurement processes, but excluding replacement capacity acquired to replace unavailable capacity pursuant to Section D.6.6(c) and excluding capacity associated with SC obligations to self-provide capacity in conjunction with an interruptible import into the RTO Grid or an on-demand energy export from the RTO Grid) to provide the Ancillary Service for that Settlement Period and Zone; multiplied by (ii) the SC's billing determinant for the Ancillary Service; and divided by (iii) the sum of the billing determinants for all of the SCs.
- b) The SC's non-pro rata obligation shall equal the amount of Ancillary Service capacity (in MW) associated with the SC's interruptible imports into the RTO Grid plus the SC's on-demand exports from the RTO Grid.
- c) The SC's credit for self-provision shall equal: (i) the amount of SC-designated capacity (in MW) associated with resources for which the SC is the Scheduling Coordinator, plus (ii) the quantity of the Ancillary Service (in MW) traded to the SC from another SC through an inter-SC Ancillary Service trade, minus (iii) the quantity of the Ancillary Service (in MW) traded to another SC from the SC through an inter-SC Ancillary Service trade; subject to (iv) the limit on self-provision specified in Section D.6.1(f).
- d) The SC's replacement capacity obligation shall equal the amount of additional capacity (in MW) that the RTO procured to replace capacity that the SC committed to provide to the RTO but was not available to the RTO.
- e) The SC's billing determinant is as follows.

Note: In this document, the SC's obligations for Ancillary Services are independent of *where* the SC's load is located. If it is decided that the obligation should be different depending on where the SC's loads are located, and that the RTO's ancillary service requirements should be allocated to the different Zones, then (i) the obligations will need to be defined, and (ii) this section of the document may need to be updated.

- i) For Regulation: the SC's billing determinant shall be the greater of the SC's (a) actual load or (b) the SC's actual generation minus the SC's inter-SC energy trades to other SCs.
- ii) For Load Following Up, Load Following Down, Spinning Reserve and Non-Spinning Reserve: the SC's billing determinant shall be the SC's actual load plus exports.

All quantities are calculated in MWh, for each Zone for each Settlement Period.

D.9.1.2 SC's Settlement Obligation (in Dollars)

Each SC's settlement obligation, in dollars, for each Ancillary Service, Settlement Period and Zone, shall be equal to the sum of:

- i) The RTO's Ancillary Service procurement cost (in \$/MW) excluding costs associated with procurement of replacement capacity, multiplied by the SC's settlement obligation (in MW) excluding the SC's replacement capacity obligation; plus
 - ii) The RTO's average cost (in \$/MW) for replacement capacity, multiplied by the SC's replacement capacity obligation (in MW).
- b) The RTO's Ancillary Service procurement cost excluding costs associated with procurement of replacement capacity shall equal: (i) the total cost incurred by the RTO in the RTO's day-ahead, post-day-ahead, Real-time and longer-term processes for procurement of resources to provide the Ancillary Service, exclusive of costs to acquire replacement capacity pursuant to Section D.6.6(c); (ii) divided by the total amount of capacity (in MW) procured by the RTO to provide the Ancillary Service, but excluding self-provided Ancillary Service capacity and excluding replacement capacity acquired pursuant to Section D.6.6(c).
- c) The SC's settlement obligation (in MW) shall be as calculated in Section D.9.1.1.
- d) The SC's replacement capacity obligation (in MW) shall be as calculated in Section D.9.1.1(d).
- e) The RTO's average cost (in \$/MW) for replacement capacity shall be: (i) the RTO's total cost for replacement capacity for the particular Ancillary Service, determined in accordance with Section D.6.6(c), (ii) divided by the total amount of replacement capacity acquired for the particular Ancillary Service, for the relevant Zone and Settlement Period.

D.9.1.3 Exemption for Self-Tracking of Demand

- a) An SC may be exempted from all or a portion of its settlement obligations for Regulation, Load Following Up and/or Load Following Down upon the SC's demonstration, to the RTO's satisfaction, that the Zone's requirements for these Ancillary Services would be reduced by the SC's implementation of mechanisms to track the SC's Demand variations through corresponding changes in the SC's generation output.
- b) The RTO may require that appropriate monitoring equipment be installed to enable the RTO to monitor how well the SC matches its generation to its Demand on a second-to-second basis. The RTO may impose non-performance charges on an SC that has been granted such an exemption and fails to meet the associated commitments. Prior to instituting any such charges, the RTO shall file them with the Commission for approval.

D.9.2 Settlement Obligations for Voltage Support Service

- a) For those costs of Voltage Support service (both capacity costs and energy costs) that the RTO incurs on a short-term basis:
 - i) Each SC's settlement obligation (in \$) shall be: (i) the total cost incurred by the RTO in the RTO's day-ahead, post-day-ahead and Real-time processes for the procurement and use of Voltage Support for the Zone and Settlement Period, (ii) multiplied by the SC's billing determinant for Voltage Support, (iii) divided by the sum of the billing determinants for all of the SCs.
 - ii) Each SC's billing determinant shall be equal to the SC's actual load plus exports (in MWh) for the Zone and Settlement Period.
 - iii) These costs shall be billed to SCs as hourly Grid Usage Charges under Service Schedule x.
- b) For those costs of Voltage Support service that the RTO incurs under long-term contracts:
 - i) Each SC's settlement obligations (in \$) shall be equal to, for each Zone: (i) the monthly cost to the RTO to provide the Voltage Support service for the Zone under the terms of all long-term contracts for Voltage Support service, (ii) multiplied by the SC's billing determinant for long-term Voltage Support service, (iii) divided by the sum of the billing determinants for all of the SCs.
 - ii) Each SC's billing determinant shall be equal to the SC's actual load plus exports (in MWh) for the Zone, integrated over the month.
 - iii) These costs shall be billed to SCs as monthly Grid Usage Charges under Service Schedule x.

D.9.3 Settlement Obligation for Black Start Service

- a) For all costs of Black Start service:
 - i) Each SC's settlement obligations (in \$) shall be equal to, for each Zone: (i) the monthly cost to the RTO to provide the Black Start service for the Zone under the terms of all long-term contracts for Black Start service, including any net energy costs or other variable costs associated with providing the Black Start service, (ii) multiplied by the SC's billing determinant for Black Start service, (iii) divided by the sum of the billing determinants for all of the SCs.
 - ii) Each SC's billing determinant shall be equal to the SC's actual load plus exports (in MWh) for the Zone, integrated over the month.
 - iii) These costs shall be billed to SCs as monthly Grid Usage Charges under Service Schedule x.

D.9.4 Settlement Obligation for Scheduling and Dispatch Service

- a) The RTO's charges for Scheduling and Dispatch Service shall be based on the annual operating costs incurred by the RTO in providing this service..
- b) Each SC's settlement obligation for Scheduling and Dispatch Service shall equal:
 - i) The RTO's Scheduling and Dispatch Service rate (in \$/MWh) multiplied by the sum of: (i) the SC's actual Demand served within the RTO Grid for the applicable month, plus (ii) the SC's deliveries of energy and capacity outside the RTO Grid for the applicable month; plus
 - ii) If the number of schedule changes made by an SC during a Trading Day exceeds a specified threshold, the SC shall also pay an additional transaction-based charge (in \$/transaction) for each schedule change beyond the threshold.¹²
- c) Rates and transaction fees for Scheduling and Dispatch Service are specified in Service Schedule 1.

D.9.5 Settlement Obligation for Balancing Energy Service

D.9.5.1 Balancing Energy Clearing Price¹³

- a) A Balancing Energy Clearing Price shall be calculated for each Zone for each of the six ten-minute intervals during each Settlement Period. Except where stated otherwise in Appendix D, the Balancing Energy Clearing Price shall be used to:

12 Some work group members question whether this transaction-based charge should be created.

13 Note: The details of the calculation of the Balancing Energy Clearing Price have not been thoroughly discussed in the Working Groups.

- i) Pay and charge each SC, for each ten-minute interval, for energy deemed to be produced or consumed by Ancillary Services resources as a result of the RTO's dispatch of Ancillary Service resources; and
 - ii) Pay and charge each SC, for each ten-minute interval, for the net energy (after adjusting for energy deemed to be produced or consumed pursuant to section (a) above) sold to/purchased from the RTO as a result of any non-zero balance in the SC's energy imbalance account.
- b) The Balancing Energy Clearing Price for each Zone shall be calculated for each ten-minute interval as follows:
- i) For each resource (Generating Unit, Dispatchable Demand, import or export) that was called upon by the RTO to produce or consume energy, the RTO shall calculate the net amount of energy (in MWh) the resource would have produced or consumed under the assumption that the resource complied with the RTO's Dispatch Instruction by immediately initiating a ten-minute linear ramp from the initial output level of the resource to the instructed output level of the resource and remained at that instructed output level for the duration of the Dispatch Instruction. If a resource has been committed to provide multiple Ancillary Services to the RTO, this calculation shall apply separately to each service provided.
 - ii) For each resource dispatched by the RTO, the relevant energy bid price for the resource during the ten-minute interval shall equal the price on the resource's energy bid curve that corresponds to the resource's deemed production or consumption, as calculated in the paragraph (i) above; provided that, for the purpose of calculating the Balancing Energy Clearing Price, the energy bid price of resources that provide Regulation service shall be deemed to be zero.
 - iii) If during the ten-minute interval, all RTO-dispatched resources were net providers of Balancing Energy, the Balancing Energy Clearing Price shall be the highest of the energy prices calculated in paragraph (ii) above, except as provided in paragraph (vi) below.
 - iv) If during the ten-minute interval, all RTO-dispatched resources were net consumers of Balancing Energy, the Balancing Energy Clearing Price shall be the lowest of the energy prices calculated in paragraph (ii) above, except as provided in paragraph (vi) below.
 - v) If during the ten-minute interval, some RTO-dispatched resources were net producers of Balancing Energy and others were net consumers of Balancing Energy, the Balancing Energy Clearing Price shall be the weighted average of the two prices

calculated in paragraphs (iii) and (iv) above, using only the net producers in the first calculation and only the net consumers in the second calculation, and with the two weighting factors equal to the total MWh in each of the two calculations.

- vi) If either (a) a resource was called upon out of the merit order defined by the stack of Balancing Energy resources, as may be required from time to time in order to meet location-specific Grid security requirements, or (b) a resource was called upon on an involuntary basis to provide Balancing Energy: the energy price of that resource shall not be used in calculating the Balancing Energy Clearing Price.
- c) If during a System Emergency the Balancing Energy Clearing Price cannot be calculated, the Balancing Energy Clearing Price shall be deemed to be equal to the Balancing Energy Clearing Price in the same Settlement Period of the preceding Trading Day.

D.9.5.2 Settlement for Energy Imbalance Obligations

For each Zone and each Settlement Period, each SC's charge or credit for Balancing Energy consumed or provided in the Zone during the Settlement Period (after adjustments have been made pursuant to Section D.9.5.4) shall equal the sum, for each of the ten-minute intervals during the Settlement Period, of the products of the Zone's Balancing Energy Clearing Price for the ten-minute interval and the SC's energy imbalance obligation for that Zone for that ten-minute interval.

D.9.5.3 SC's Energy Imbalance Obligation

- a) Each SC's energy imbalance obligation for each ten-minute interval, for each Zone, shall be equal to the SC's net deemed energy production (equal to the sum of energy production from SC's Generating Units in the Zone plus the SC's imports into the Zone plus inter-SC energy trades to the SC, all in MWh) during the ten-minute interval, plus the replacement energy deemed to have been provided to the SC by the RTO during the ten-minute interval pursuant to Section D.9.5.5, minus: (i) the SC's net deemed energy consumption (equal to the sum of the SC's Demands in the Zone plus the SC's exports out of the Zone plus inter-SC energy trades from the SC plus the SC's allocated share of transmission losses, all in MWh) during the ten-minute interval, (ii) the energy deemed to have been provided from the SC to the RTO (which may be a positive or negative quantity) pursuant to Section D.9.5.4.
- b) Each SC's net deemed energy production and net deemed energy consumption in a Zone during a ten-minute interval shall be calculated based on the following:

- i) For a Generating Unit that is directly telemetered by the RTO, integrated megawatt-hour production for the resource shall be calculated at ten-minute intervals.
- ii) For a Generating Unit that is not telemetered at ten-minute intervals, a deemed ten-minute energy production shall be calculated by interpolating between integrated hourly megawatt-hour readings for the resource to create ten-minute estimates of production.
- iii) For a Dispatchable Demand that is directly telemetered by the RTO, integrated megawatt-hour consumption for the resource shall be calculated at ten-minute intervals.
- iv) For a Dispatchable Demand that is not telemetered at ten-minute intervals, a deemed ten-minute energy consumption shall be calculated by interpolating between integrated hourly megawatt-hour readings for the resource to create ten-minute estimates of production.
- v) For interval-metered Demands that provide hourly consumption readings, deemed ten-minute consumption shall be calculated by interpolating between the integrated hourly megawatt-hour readings to create ten-minute estimates of consumption.
- vi) For monthly cumulative-metered loads, the load profiling methodology defined in Appendix H shall be used either: (i) directly to produce ten-minute consumption estimates, or (ii) indirectly to produce ten-minute consumption estimates by interpolating between the sequence of hourly estimates.
- vii) The deemed energy production or consumption associated with imports and exports shall be equal to the scheduled quantity, unless the imports or exports were curtailed or otherwise adjusted during the Settlement Period, in which case the deemed production or consumption shall be adjusted based on the start time, ramp rate and duration of the curtailment or adjustment.

D.9.5.4 Adjustments to SC's Energy Imbalance Obligation

- a) Settlement for Balancing Energy supplied by an Ancillary Service resource pursuant to a Dispatch Instruction is specified in Section D.8.2.1. Such Balancing Energy shall be deemed to have been scheduled and delivered to or from the RTO and shall not contribute to an SC's energy imbalance obligation.
- b) Settlement for energy associated with the management of residual Congestion is specified in Section D.8.2.2. Such Balancing Energy shall be deemed to have been scheduled and delivered to or from the RTO and shall not contribute to an SC's energy imbalance obligation.

- c) Settlement for other energy associated with Ancillary Services is specified in Section D.8.2.3. Such energy shall be deemed to have been scheduled and delivered to or from the RTO and shall not contribute to an SC's energy imbalance obligation.

D.9.5.5 Settlement for Energy Associated with Real-Time Contingencies

- a) During the initial sixty minutes following a generation contingency that results in the loss of output from an SC's Generating Unit or a transmission system contingency that results in the curtailment of an SC's import, the RTO shall supply replacement energy to the SC's account from the RTO's Ancillary Services resources.
- b) Such replacement energy shall be deemed to have been scheduled and delivered from the RTO to the SC and shall not contribute to an SC's energy imbalance obligation.
- c) For each ten-minute interval within the Settlement Period, payment by the SC to the RTO for such replacement energy shall equal the Balancing Energy Clearing Price for the appropriate Zone multiplied by the net amount of replacement energy deemed to have been provided during the ten-minute interval.

D.9.6 Additional Settlement Obligations: Grid Usage Charge

- a) Each SC shall be assessed a Grid Usage Charge. The Grid Usage Charge shall include charges and credits for the following services.
 - i) The RTO's capital carrying charges and operating costs, excluding: (a) those costs collected for Scheduling and Dispatch Service under Service Schedule 1, (b) any administrative costs that are associated with Ancillary Service procurement and included in Service Schedules 27, and (c) the RTO's costs for administration of transmission rights auctions under Service Schedule 9.
 - ii) The RTO's costs for Black Start capacity, as described in Section D.9.3.
 - iii) The RTO's long-term costs for Voltage Support service, as described in Section D.9.2 (b).
 - iv) Credits associated with those financial penalties, imposed by the RTO pursuant to the Tariff, which cannot be reasonably be allocated on a Settlement Period basis.
 - v) The RTO's short-term costs for Voltage Support service, as described in Section D.9.2 (a).
 - vi) The RTO's Congestion management costs (the difference between the amounts paid by the RTO for incremental energy and the amounts charged by the RTO for decremental energy in the management of residual Congestion, as described in Section D.8.2.2).

- vii) Additional energy-related costs to the RTO, associated with: (a) supplemental compensation to Ancillary Service providers that would not be fully compensated through the Balancing Energy Clearing Price (Sections D.8.2.1 (b)(i) and D.8.2.1(c)), (b) other energy scheduled by the RTO, including costs associated with performance audits (Sections D.8.2.3 and D.11); and (c) any unaccounted-for energy on the Grid.
 - viii) Credits associated with those financial penalties, imposed by the RTO pursuant to the Tariff, which can be reasonably allocated on a Settlement Period basis, except as described in (ix) below.
 - ix) Credits associated with load deviation penalties and energy imbalance penalties imposed under Section D.10.
- b) The Grid Usage Charges shall be assessed to SCs as follows:
- i) For items (i) through (iv) in Section (a) above, for each Zone: costs and revenues shall be accumulated on a monthly basis and charges and credits shall be assessed on a monthly basis. Each SC shall be allocated its pro rata share of the monthly costs, based on the SC's actual Demand in the Zone for the month (in MWh) plus the SC's exports from the Zone (in MWh).
 - ii) For items (v) through (viii) in Section (a) above, for each Zone: costs and revenues shall be calculated for each Settlement Period and charges and credits shall be assessed for each Settlement Period. Each SC shall be allocated its pro rata share of the costs for the Settlement Period, based on the SC's actual Demand in the Zone for the Settlement Period (in MWh) plus the SC's exports from the Zone (in MWh) during the Settlement Period.
 - iii) For item (ix) in Section (a) above, for each Zone: (a) load deviation penalties collected for each Settlement Period shall be credited to those SCs who were not assessed load deviation penalties for the Settlement Period, pro rata based on those SCs' actual Demand in the Zone plus exports from the Zone (in MWh) during the Settlement Period; and (b) energy imbalance penalties collected for each Settlement Period shall be credited to those SCs who were not assessed energy imbalance penalties for the Settlement Period, pro rata based on those SCs' actual Demand in the Zone plus exports from the Zone (in MWh) during the Settlement Period.

D.10 PENALTIES

D.10.1 Load Deviation Penalties

SCs shall be assessed load deviation penalties for significantly under-scheduling or over-scheduling Demand during the Day-Ahead Scheduling Process.

- a) An SC's load deviation for a Settlement Period and Zone is defined to be the difference between (i) the SC's actual Demand for a Zone and Settlement Period, and (ii) the Demand that the SC scheduled for that Zone and Settlement Period during the Day-Ahead Scheduling Process.
- b) Except as provided in paragraph (d) below, the load deviation penalty for a Settlement Period and Zone shall be equal to the product of: (i) the absolute value of the SC's load deviation for the Settlement Period and Zone, and (ii) $LDPF_k$, a load deviation penalty factor whose magnitude depends on the relative size of the SC's load deviation.¹⁴
- c) The value of $LDPF_k$ to be applied to an SC's load deviation shall be equal to:
 - i) 0.0 when the absolute value of the SC's load deviation is less than 5% of the SC's scheduled Demand;
 - ii) $LDPF_{05-10}$ when the absolute value of the SC's load deviation is greater than or equal to 5% but less than 10% of the SC's scheduled Demand;
 - iii) $LDPF_{10-15}$ when the absolute value of the SC's load deviation is greater than or equal to 10% but less than 15% of the SC's scheduled Demand;
 - iv) $LDPF_{15-20}$ when the absolute value of the SC's load deviation is greater than or equal to 15% but less than 20% of the SC's scheduled Demand;
 - v) $LDPF_{20-100}$ when the absolute value of the SC's load deviation is greater than or equal to 20% of the SC's scheduled Demand.
- d) Each calendar month, and for each Zone, an SC shall be entitled to forgiveness of load deviation penalties, as follows:
 - i) The first $LDFC_{20-100}$ occasions during the calendar month for which the absolute value of the SC's load deviation is greater than or equal to 20% of the SC's scheduled Demand. If the number of occasions is less than $LDFC_{20-100}$, any unused forgiveness credits shall be used to increase the $LDFC_{15-20}$ for that SC.
 - ii) The first $LDFC_{15-20}$ occasions during the calendar month for which the absolute value of the SC's load deviation is greater than or equal to 15% but less than 20% of the SC's scheduled Demand. If the number of occasions is less than $LDFC_{15-20}$, any unused forgiveness credits shall be used to increase the $LDFC_{10-15}$ for that SC.
 - iii) The first $LDFC_{10-15}$ occasions during the calendar month for which the absolute value of the SC's load deviation is greater than or equal to 10% but less than 15% of

¹⁴ Sections (b) and (c) need to be rewritten to reflect the work group agreement that the penalties should be "smoothed" by applying the higher penalty factors to only those portions of the load deviation that exceed the lower deviation band threshold.

the SC's scheduled Demand. If the number of occasions is less than $LDFC_{10-15}$, any unused forgiveness credits shall be used to increase the $LDFC_{5-10}$ for that SC.

- iv) The first $LDFC_{05-10}$ occasions during the calendar month for which the absolute value of the SC's load deviation is greater than or equal to 5% but less than 10% of the SC's scheduled Demand.
- e) All revenues received by the RTO from the assessment of load deviation penalties shall be credited to the SCs who were not assessed load deviation penalties during the Settlement Period, through the Grid Usage Charge.
- f) The RTO shall, upon approval of the Board of Directors, define and publish the Load Deviation Penalty Factors (LDPFs) and Load Deviation Forgiveness Credits (LDFCs), and file them with the Commission for approval.

D.10.2 Energy Imbalance Penalties

SCs shall be assessed energy imbalance penalties for imposing significant Balancing Energy burdens on the RTO. However, SCs may reduce the Balancing Energy burdens imposed on the RTO, conduct inter-SC trades in Real-time, and avoid energy imbalance penalties through inter-SC coordination of Real-time schedule changes (which shall be subject only to the operational restrictions specified in Section C.4.2) and ex post trading of hourly energy imbalance obligations.

- a) For each Settlement Period and Zone, an SC's hourly energy imbalance obligation shall equal the algebraic sum of the SC's energy imbalance obligations for each of the six ten-minute intervals within the Settlement Period, where the ten-minute energy imbalance obligations are calculated as specified in Section D.9.5.3.
- b) SCs may reduce or eliminate their hourly energy imbalance penalties by trading their hourly energy imbalance obligations during the period permitted for trading of hourly energy imbalance obligations, as described in Section 10.3. Energy imbalance penalties shall be assessed, as described below, on SCs' residual hourly energy imbalance obligations (i.e., the obligations remaining after the close of the period during which trading of hourly energy imbalance obligations was permitted).
 - i) Settlement for actual energy *imbalances* is not affected by trading of hourly energy imbalance obligations. Such settlement shall take place on a ten-minute basis as specified in Section D.9.5.2.
- c) Except as provided in paragraph (e) below, the energy imbalance penalty for a Settlement Period and Zone shall be equal to the product of: (i) the absolute value of the SC's residual hourly energy imbalance obligation for the Settlement Period and Zone, (ii) the load-weighted average of the six ten-minute Balancing Energy Clearing Prices for the

Settlement Period and Zone, and (iii) $EIPF_k$, an energy imbalance penalty factor whose magnitude depends on the relative size of the SC's hourly energy imbalance obligation.

- d) The value of $EIPF_k$ to be applied to an SC's residual hourly energy imbalance obligation shall be equal to:
 - i) 0.0 when the absolute value of the SC's residual hourly energy imbalance obligation is less than two megawatts or less than 5% of the SC's net deemed energy consumption, as calculated in Section D.9.5.3 (b);
 - ii) $EIPF_{0.5-10}$ when the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts and greater than or equal to 5% but less than 10% of the SC's net deemed energy consumption;
 - iii) $EIPF_{10-15}$ when the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts and greater than or equal to 10% but less than 15% of the SC's net deemed energy consumption;
 - iv) $EIPF_{15-20}$ when the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts and greater than or equal to 15% but less than 20% of the SC's net deemed energy consumption;
 - v) $EIPF_{20-100}$ when the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts and greater than or equal to 20%.
- e) Each calendar month, and for each Zone, an SC shall be entitled to forgiveness of energy imbalance penalties, as follows:
 - i) $EIFC_{10}$ occasions during the calendar month for which the absolute value of the SC's hourly residual energy imbalance obligation is greater than two megawatts but less than 10% of the SC's net deemed energy consumption;
 - ii) $EIFC_{15}$ additional occasions during the calendar month for which the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts but less than 15% of the SC's net deemed energy consumption;
 - iii) $EIFC_{20}$ additional occasions during the calendar month for which the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts but less than 20% of the SC's net deemed energy consumption;
 - iv) $EIFC_{100}$ additional occasions during the calendar month for which the absolute value of the SC's residual hourly energy imbalance obligation is greater than two megawatts and up to 100% of the SC's net deemed energy consumption.
- f) Each SC may specify the Settlement Periods to which it chooses to apply its credits for forgiveness from energy imbalance penalties.

- g) All revenues received by the RTO from the assessment of hourly energy imbalance penalties shall be credited to the SCs who were not assessed energy imbalance penalties during the Settlement Period, through the Grid Usage Charge.
- h) The Energy Imbalance Penalty Factors (EIPFs) and Energy Imbalance Forgiveness Credits (EIFCs) shall initially be set equal to zero. If the RTO Governing Board determines that large energy imbalances are responsible for creating excessive operational burdens on the RTO, the Governing Board may define and publish non-zero EIPFs and EIFCs and file them with the Commission for approval.

D.10.3 Ex-Post Trading of Hourly Energy Imbalance Obligations

SCs may trade their hourly energy imbalance obligations with one another, enabling an SC with a positive imbalance and an SC with a negative imbalance to, in effect trade between one another in real-time and announce the inter-SC energy trade through the RTO settlement process. The RTO shall facilitate such trading through the following process.

- a) The RTO shall notify each SC of its hourly energy imbalance obligations (in MWh) for each Zone and Settlement Period in accordance with Appendix G of the Tariff.
- b) Concurrent with this, or prior to this notification, the RTO shall also publish on the RTO Website the ten-minute and hourly Balancing Energy Clearing Prices, and the net energy imbalances for each Zone and Settlement Period.
- c) Three days following this notification, each SC may provide the RTO with the following information regarding trades of its energy imbalance obligations:
 - i) SC ID
 - ii) Settlement Period
 - iii) ID of the SC that is counter-party to the trade
 - iv) Zone ID
 - v) Hourly energy imbalance obligations (MWh) traded. Trades of hourly imbalance energy obligations to the SC are reported as negative quantities and trades from the SC are reported as positive quantities.
- d) For each Zone and Settlement Period, an SC may submit trades with more than one SC, but may submit only one trade with any individual SC.
- e) An SC that does not submit the information specified above shall be presumed to have not made any trades of its hourly energy imbalance obligations.
- f) The RTO shall validate the trading information and notify each SC if there is any mismatch in the data submitted by the SC's counter-party.

- g) SCs with mismatched information shall be given twenty-four hours to correct mismatches and resubmit their trades of hourly energy imbalance obligations to the RTO.
- h) At the end of the validation period the RTO shall perform a final validation. Any remaining mismatched inter-SC trades shall be rejected, and the RTO shall so notify the affected SCs.

D.10.4 Forgiveness from Hourly Energy Imbalance Penalties: Notification to the RTO

- a) Each SC may specify the Settlement Periods to which it chooses to apply its credits for forgiveness from hourly energy imbalance penalties by notifying the RTO of the following, one day after the day on which SCs are required to notify the RTO of inter-SC trades of hourly energy imbalance obligations:
 - i) SC ID
 - ii) Settlement Period
 - iii) Zone ID
 - iv) Energy Imbalance Forgiveness Credit Identifier.
- b) If an SC does not submit information the Settlement Periods to which it chooses to apply its energy imbalance forgiveness credits, the RTO shall apply those forgiveness credits to the SC's hourly energy imbalance accounts in chronological order.
- c) Validation shall take place following the validation of trades of hourly energy imbalance obligations, and shall therefore be based on the final, validated information regarding trades of hourly energy imbalance obligations.
- d) The RTO shall validate forgiveness elections to ensure that: (i) the SC does not exceed its quota of credits, and (ii) the residual hourly energy imbalance obligations for the Settlement Period does not exceed the value of the corresponding EIFC.
- e) The RTO shall notify each SC of any invalid forgiveness elections, and provide the SC with four hours to resubmit its forgiveness data.
- f) Any invalid forgiveness elections that remain after this time shall be rejected. The RTO shall notify the SC of these rejections.
- g) Any hourly energy imbalance penalties assessed against SCs shall be determined based on the SC's residual hourly energy imbalance obligations, after SC trades of hourly energy imbalance obligations and hourly energy imbalance forgiveness elections have been finalized.

D.11 PERFORMANCE AUDITS FOR COMPLIANCE WITH RTO STANDARDS

- a) The RTO shall periodically audit the performance of resources that provide Ancillary Services to confirm the ability of such resources to meet the RTO's standards for performance and control.
- b) Such audits shall be conducted by examining the response of the Generating Unit or Dispatchable Demand to Dispatch Instructions issued by the RTO. Dispatch Instructions may be issued by the RTO in accordance with Appendix C of the Tariff. The RTO may also issue Dispatch Instructions for the purpose of determining compliance.
- c) If the RTO issues a Dispatch Instruction for the purpose of performing a compliance test, the RTO shall reimburse the SC for all demonstrable out-of-pocket costs associated with the Dispatch Instruction. The RTO shall recover costs associated with issuing Dispatch Instructions for the purposes of determining compliance through the Grid Usage Charge.

D.11.1 Performance Audit for Regulation Service

The RTO shall audit the performance of a Generating Unit that provides Regulation Service by auditing the response of the Generating Unit to the RTO's Dispatch Instructions through analysis of meter data associated with the Generating Unit.

- a) The RTO shall audit the Generating Unit's response to the RTO's AGC commands around the mid-point of the Generating Unit's regulating range and within the Generating Unit's rated MW/minute capability over the range of Regulation capacity scheduled for the current Settlement Period.

D.11.2 Performance Audit for Spinning Reserve Service

The RTO shall audit the performance of a Generating Unit or import that provides Spinning Reserve by auditing the resource's response to the RTO's Dispatch Instructions through analysis of meter data associated with the resource.

- a) A Generating Unit that provides Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, provide the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten minutes of issue of the Dispatch Instruction, and respond to system frequency deviations outside the allowed frequency deadband.
- b) An import that provides Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction and its ability to provide the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten minutes of issue of the Dispatch Instruction.

D.11.3 Performance Audit for Non-Spinning Reserve Service

The RTO shall audit the performance of a Generating Unit or import that provides Non-Spinning Reserve by auditing the resource's response to the RTO's Dispatch Instructions through analysis of meter data associated with the resource.

- a) A Generating Unit or import that provides Non-Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, and to provide the amount of Non-Spinning Reserve capacity scheduled for the current Settlement Period within ten minutes of issue of the Dispatch Instruction.

D.11.4 Performance Audit for Load Following Up and Load Following Down Services

The RTO shall audit the performance of a Generating Unit that provides Load Following Up or Load Following Down by auditing the resource's response to the RTO's Dispatch Instructions through analysis of meter data associated with the resource.

- a) A Generating Unit that provides Load Following Up or Load Following Down shall be evaluated on its ability to respond to a Dispatch Instruction, start within the designated time frame, provide the amount of Load Following Up or Load Following Down capacity scheduled for the Settlement Period within ten minutes of issue of the Dispatch Instruction, and sustain operation at this level for a sufficient time to assure availability over the specified period.

D.11.5 New section needed for Performance Audit for Replacement Reserve.

D.11.6 Performance Audit for Voltage Support Service

The RTO shall audit the performance of a resource that provides Voltage Support by auditing the resource's response to the RTO's Dispatch Instruction, through analysis of meter data associated with the resource.

- a) A resource that provides Voltage Support shall be evaluated on its ability to provide reactive support over the stated power factor range of the resource, provide reactive power support within the prescribed time periods, and demonstrate the effective function of automatic voltage control equipment for the amount of Voltage Support under the control of the RTO for the current Settlement Period.

D.11.7 Performance Audit for Black Start Service

The RTO shall audit the performance of a Generating Unit that provides Black Start Service by analysis of meter data and other records to determine that the performance criteria related to the Black Start from that Black Start Generating Unit were met, based on periodic testing by the RTO of the Generating Unit's Black Start Service response.

D.11.8 Notification of Performance Audit Results

The RTO shall provide written notice of the results of a performance audit to the SC that is responsible for the audited resource.

D.11.9 Penalties for Failure to Pass Performance Audits

- a) If an Ancillary Service resource fails a performance audit, the resource's certification shall be reduced to the quantity of Ancillary Service that the resource actually provided during the performance audit. This restriction shall apply to all future sales and/or self-provision of Ancillary Services from the resource until such time that the SC can demonstrate to the RTO that the resource is capable of delivering the previously certified amount of Ancillary Services.
- b) The SC that is responsible for an Ancillary Service resource that has failed a performance audit may also be subject to such financial penalties that are developed by the RTO, approved by the Commission, and published in the RTO Tariff.
 - i) Any such penalties shall first be approved by the Board of Directors.
- c) The RTO may exercise judgment in imposing such penalties and sanctions, depending upon the circumstances that caused the SC to fail the performance audit.
- d) The RTO shall maintain records for at least thirty-six months documenting all audits performed, the results of such audits, any penalties and sanctions that were imposed, dispensations or reductions in penalties and sanctions, and the reasons for such dispensations or reductions.

D.11.10 SC's Right to Request Re-Test

- a) The SC for a resource that has failed a performance audit may request the RTO to re-test the capability of the Ancillary Service resource at any time.
- b) The RTO shall carry out such test as soon as practicable but in no event longer than three days after receiving the request.
- c) The cost of such test shall be paid by the SC irrespective of the result of the test.
- d) If the RTO fails to perform the test within three days of the request, the SC's resource shall be deemed capable of delivering the full amount of Ancillary Services for which it was previously certified.