Balancing Reserve Capacity Business Practice

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Discussion Draft

Version 1

BPA makes capacity for Balancing Reserves available under Schedule 3 and Schedule 10 to meet the Customer's Balancing Reserve needs under Schedule 4 and Schedule 9. This Business Practice describes the methodology for determining the amount of capacity for Balancing Reserves that BPA will supply.

Table of Contents

BPA Policy Reference

- Open Access Transmission Tariff (OATT): Schedules 3, 4, 9, and 10
- Transmission, Ancillary, and Control Area Service Rate Schedules and General Rate Schedule Provisions

A. General Criteria

1. BPA Transmission Services holds capacity for Balancing Reserves to meet the North American Electric Reliability Corporation (NERC) standards and OATT requirements to maintain load-resource balance within its Balancing Authority Area (BAA) boundaries.

2. Regulation and Frequency Response Service (OATT Schedule 3) and Capacity for Generator Balancing Service (OATT Schedule 10) of BPA's Transmission Tariff describe the various forms of Balancing Reserve capacity that BPA holds to supply Ancillary and Control Area Services.

3. Energy Imbalance Service (OATT Schedule 4) and Generation Imbalance Service (OATT Schedule 9) are energy services (MWh) and are addressed in their respective Business Practices and in the Ancillary and Control Area Service Rate Schedule (ACS Rate Schedule).

4. Balancing Reserve capacity requirements apply to either Ancillary Services or Control Area Services that Customers with load or generation located within BPA's BAA are required to obtain. Rates are addressed in the Ancillary and Control Area Service Rate Schedule (ACS Rate Schedule).

5. Generators operating in the BPA BAA that provide power through an interconnected system without a transmission agreement with BPA Transmission Services must obtain Balancing Services.

6. Generators may contact BPA to discuss alternative arrangements for self-supply.

B. Acquiring Service

1. Customers must make arrangements for the provision of Balancing Services to meet their Balancing Reserve capacity requirements.

2. A Customer may purchase Balancing Reserve capacity to cover its Balancing Reserve capacity requirements from BPA.

3. A Customer may self-supply balancing reserve capacity to cover its Balancing Reserve capacity requirements (a) from its own generation, or (b) from a third-party supplier. See BPA's Self-Supply of Balancing Services Business Practice.

C. Quality of Service Planning Standard

1. BPA has determined that it can plan to provide Balancing Reserve capacity to cover a 99.7[1] percent planning standard of balancing error events (the difference between scheduled and actual generation or forecasted and actual load) without unreasonably impairing reliability. Forecasting above a 99.7 percent planning standard is unreasonable because data anomalies would require BPA to hold Balancing Reserve capacity in an amount that approaches the full nameplate capacity of generation in the BAA. BPA will supply sufficient Balancing Reserve capacity to cover a 99.7 percent planning standard to the extent physically feasible to do so.

2. Any changes to the service defined in this Business Practice will not take effect until the start of the next rate period, unless needed to comply with NERC or WECC requirements. Notice of any such change shall be given to

[1] In the empirical sciences the so-called three-sigma rule of thumb expresses a conventional heuristic that nearly all values are taken to lie within three standard deviation of the mean, and thus it is empirically useful to treat 99.7% probability as near certainty.

BPA's customers not later than 120 days prior to the date by which Balancing Service Elections by VERBs and DERBs customers must be made for such rate period.

3. BPA estimates the Balancing Reserve capacity amount needed to provide the capacity needed to cover the 99.7 percent planning standard using the long term planning process contained in Appendix A.

4. If BPA determines that the Federal Columbia River Power System (FCRPS) cannot meet the incremental (INC) capacity amount consistent with the planning standard, BPA will use reasonable efforts to acquire capacity supplied by non-federal sources to meet the planning standard for INC capacity.

5. If BPA determines that the FCRPS cannot meet the decremental (DEC) capacity amount consistent with the planning standard, BPA will not make any DEC balancing reserve capacity acquisitions unless BPA determines DEC balancing reserve capacity acquisitions are necessary to maintain system reliability.

D. Resource Service Elections

1. Before each rate period, Dispatchable Energy Resources must make a balancing service election consistent with BPA's Balancing Service Election for Dispatchable Energy Resource Balancing Service (DERBS) and Variable Energy Resource Balancing Service (VERBS) Business Practice

2. Before each rate period, Variable Energy Resources must make a balancing service election and a scheduling election consistent with BPA's Balancing Service Election for Dispatchable Energy Resource Balancing Service (DERBS), and Variable Energy Resource Balancing Service (VERBS) Business Practice.

E. Operational Controls for Balancing Reserves

1. BPA deploys Operational Controls for Balancing Reserves (OCBR) in order to comply with NERC standards and to maintain the reliability of the system.
2. OCBR provides directions to limit plant generation down to the scheduled value when there is insufficient DEC balancing reserves available to offset the over-generation of non-federal variable energy resources (VERs).
3. OCBR also curtails a plant's schedules when its actual output is less than its scheduled amount and there is insufficient INC balancing reserves available to offset the under-generation of non-federal VERs and dispatchable energy resources.

Appendix A

A. Determining the Amount of Balancing Reserves to be Supplied

1. BPA provides Balancing Reserve capacity for Regulation and Frequency Response Service (OATT Schedule 3), and Capacity for Generator Balancing Services (OATT Schedule 10). Incremental and decremental capacity amounts consistent with the planning standard are calculated pursuant to the methodology specified in this business practice.

2. The calculation of the Balancing Reserve capacity needed to provide the quality of service specified in section C.1 of the business practice is based primarily on the following factors:
    a. A forecast of the variable and dispatchable energy resources expected to be on line in the BPA BAA;
    b. A historical dataset of individual generation resources, actual load and load forecasts within the BPA BAA, and;
    c. As needed, historical meteorological data used to forecast variable energy resources.

3. For purposes of the calculation of the Balancing Reserve capacity, all Variable Energy Resource (VER) plant schedules are modeled on a per plant basis consistent with that plant's scheduling election, except for VERs that use "Hourly Forecast" scheduling for which a 45-minute persistence schedule on a 60-minute basis is used as a proxy.

B. Methodology for calculating Balancing Reserve Capacity

1. BPA will analyze Balancing Reserve capacity in accordance with BPA's automatic generation control (AGC) methodology used in real-time operations to meet the NERC Resource and Demand Balancing (BAL) standards.

2. The methodology for calculating Balancing Reserve capacity relies on the following historical one-minute average data sets:
    a. actual BAA load,
    b. BAA load forecast,
    c. total actual dispatchable generation,
    d. total dispatchable schedules,
    e. total actual solar generation,
    f. total solar generation schedules,
    g. total actual wind generation, and
    h. total wind generation schedules.

3. For VER plants forecasted to come online, data must be appropriately synthesized as follows for inclusion in the applicable dataset from the list above, as historical data is not available.

a. For wind plants, an algorithm is employed to time-shift and scale data from an existing highly correlated generator.

b. For solar plants, an algorithm is employed to use measured irradiance and meteorological data from a nearby location. The algorithm uses a rolling average calculation to scale the data based on plant size.

4. Using these data sets, the actual load net generation is determined on a minute-by-minute basis as the difference between BAA actual load and the summation of actual generation from all resource types.

    a. $Load\ Net\ Gen_{Actual} = Load_{Actual} - \sum Gen_{Actual}$

5. Similarly, the load net generation forecast is determined on a minute-by-minute basis as the difference between BAA load forecast and the summation of schedules for all resource types.

6. Two post-processing calculations on the data are then applied:

    a. A "perfect" schedule for each hour is developed for actual load net generation by averaging each hour and including a 20-minute ramp across the top of the hour.

    b. Similarly, ten-minute average datasets are developed for actual load net generation without ramps between the ten-minute segments.

7. For purposes of calculating the Balancing Reserve capacity, an error dataset for the total Balancing Reserve capacity is calculated using the difference between the minute-by-minute actuals and the forecast schedules of the load net generation dataset, also known as balancing error.

8. Three components make up the total Balancing Reserve capacity: regulating reserves, following reserves, and imbalance reserves. The error dataset for the total Balancing Reserve capacity is divided into error datasets for each of the three components.

    a. The regulating reserves component is defined by the minute-by-minute variations around the ten-minute average of the load net generation dataset.

    b. The following reserves component is defined by the difference minute by minute between the ten-minute average of the load net generation dataset and the associated perfect schedule dataset.

    c. The imbalance reserves component is defined as the incremental amount of additional reserve that results from using the load net generation forecast instead of the load net generation perfect schedule dataset.

9. Using percentile distribution, incremental and decremental requirements are calculated for the total Balancing Reserve capacity, and the regulating reserves, following reserves, and imbalance reserves components.

    a. Percentile distribution identifies the values at the upper and lower 0.15 percent, producing values that provide for 99.7 percent coverage of the Balancing Reserve capacity required for the BAA to meet the planning standard.

    b. Percentile distribution is done to calculate the total Balancing Reserve capacity, the total regulation capacity, and the total following capacity. The total imbalance capacity is calculated as the remainder of the total Balancing Reserve capacity minus the total regulation capacity minus the total following capacity. The equations below describe these calculations.

    Total Balancing Reserve Capacity

    Total inc = $p_{99.85}$(Total balancing reserve error data)

    Total dec = $p_{00.15}$(Total balancing reserve error data)

    Total Regulation Capacity (Reg)

    Total Reg inc = $p_{99.85}$(Total Regulation error data)

    Total Reg dec = $p_{00.15}$(Total Regulation error data)

    Total Following Capacity (Fol)

    Total Fol inc = $p_{99.85}$(Total Following error data)

    Total Fol inc = $p_{00.15}$(Total Following error data)

    Total Imbalance Capacity (Imb)

    Total Imb inc = Total inc – Reg inc – Fol inc

    Total Imb dec = Total dec – Reg dec – Fol dec

    where

    $p_{99.85}$ is the 99.85% percentile distribution

    $p_{00.15}$ is the 0.15% percentile distribution