Balancing Reserve Capacity

BPA Transmission Business Practice

Version ~~2~~3

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BPA makes capacity for Balancing Reserves available under Schedule 3 and Schedule 10 to meet the Customer's Balancing Reserve needs under Schedule 4, Schedule 4E, Schedule 9, and Schedule 9E. ~~This business practice establishes the methodology for determining the amount of capacity for Balancing Reserves that BPA will supply.~~ This business practice addresses Balancing Reserve capacity planning, controls, acquisition of service, and establishes the methodology for determining the amount of Balancing Reserve capacity BPA will supply.

BPA Policy References

- Open Access Transmission Tariff (OATT): Schedules 3; 4; 4E; 9; 9E; 10

For more information, visit the BPA Transmission Business Practices webpage or submit questions to techforum@bpa.gov.

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A. General Criteria

1. BPA holds capacity for Balancing Reserves to maintain system reliability and to meet the North American Electric Reliability Corporation (NERC) standards and OATT requirements to maintain load-resource balance within its Balancing Authority Area boundaries.
2. The BPA OATT, Schedule 3, Regulation and Frequency Response Service, ~~(Schedule 3 of the BPA OATT)~~ and Schedule 10, Capacity for Generator Balancing Service, ~~(Schedule 10 of the BPA OATT) of BPA's OATT~~ describe the various forms of Balancing Reserve capacity that BPA holds to supply Ancillary and Control Area Services.

3. The BPA OATT, Schedule 4 and 4E, Energy Imbalance Service, ~~(Schedule 4 and Schedule 4E of the BPA OATT)~~ and Schedule 9 and 9E, Generatorion~~ion~~ Imbalance Service, ~~(Schedule 9 and Schedule 9E of the BPA OATT) are~~ describes energy services (MWh) ~~and~~ that 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 Balancing Authority Area are required to obtain. Rates are addressed in the ACS Rate Schedule.
5. Generators operating in the BPA Balancing Authority Area that provide power through an interconnected system without a transmission agreement ~~with~~ must obtain Balancing Services.
6. Generators may reference ~~BPA's~~the Self-Supply of Balanc~~e Reserves~~ing Services Business Practice and 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 from:
    a. ~~(a) from its~~ A Customer's own generation;~~,~~ or
    b. ~~(b) from a~~ A third-party supplier. See ~~BPA's~~the Self-Supply of Balancing Services Business Practice.
4. Resource service elections:
    a. Before each rate period, Dispatchable Energy Resource (DER) and Variable Energy Resource (VER) Customers must make a Balancing Service Election consistent with the Balancing Service Election for Dispatchable Energy Resource Balancing Service and Variable Energy Resource Balancing Service 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[4] percent planning standard for balancing error events (the difference between scheduled and actual generation or forecasted and actual load) without unreasonably impairing reliability. BPA will supply sufficient Balancing Reserve capacity to cover a 99.7 percent planning standard to provide the energy for ~~b~~Balancing ~~s~~Services to the extent it is physically feasible to do so from its resources or from resources available to it. BPA uses the Operational Controls for Balancing Reserves (OCBR) discussed in

[4] ~~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.~~

Section ~~E~~D to manage balancing error events not covered by the 99.7 percent planning standard.

a. Note: 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 percent probability as near certainty.

2. Pursuant to the terms of the BPA OATT Schedule 10, any changes to this business practice that affects the forecasted amount of Balancing Reserve capacity needed will not take effect until the start of the next rate period, unless needed for reliability or to comply with regulatory requirements.

   a. Notice of any such change shall be given to BPA's ~~c~~Customers not later than 120 Calendar ~~d~~Days prior to the date by which Customer's must make Balancing Service Elections ~~by Variable Energy Resource Balancing Service (VERBs) and Dispatchable Energy Resource Balancing Service (DERBs) c~~Customers must be ~~made~~ for such rate period. ~~If a change in the forecasted amount of capacity is needed for reliability or to comply with regulatory requirements prior to the next rate period, BPA will convene the parties to review options to revise rates to reflect the change in capacity, and take prudent steps to adjust rates either in accordance with the posted Rate Schedule or holding a hearing, either expedited or in the next scheduled hearing, under Section 7(i) of the Pacific Northwest Electric Power Planning and Conservation Act.~~

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 Section E, Determining the Amount of Balancing Reserves to be Supplied ~~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 ~~b~~Balancing ~~r~~Reserve capacity acquisitions without discussing the need for such acquisitions with ~~c~~Customers, unless BPA determines DEC ~~b~~Balancing ~~r~~Reserve capacity acquisitions are necessary to maintain system reliability.

~~D. Resource Service Elections~~

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

~~E.~~D. Operational Controls for Balancing Reserves

1. BPA deploys OCBR in order to comply with NERC standards and to maintain the reliability of the transmission system.

2. During times when BPA is not participating in the Energy Imbalance Market (EIM):
    a. OCBR provides directions to limit VER plant generation when there is insufficient DEC ~~b~~Balancing ~~r~~Reserves available to offset over-generation of resources and/or under-consumption by load within the BPA Balancing Authority Area.
    b. OCBR curtails a plant's schedules when its actual output is less than its scheduled amount and there is insufficient INC ~~b~~Balancing ~~r~~Reserves available to offset the under-generation of non-federal VERs and dispatchable energy resources and/or over-consumption by load within the BPA Balancing Authority Area.
3. During times when BPA is participating in the EIM:
    a. OCBR provides directions to limit plant generation when there is insufficient DEC regulating reserves available to offset the over-generation of resources and/or under-consumption by load within the BPA Balancing Authority Area.
    b. OCBR pauses the deployment of regulating reserves when there is insufficient INC regulating reserves available to offset the under-generation of non-federal VERs and DERs, and/or over-consumption by load within the BPA Balancing Authority Area, until such time that EIM ~~market~~ dispatch~~es~~ instructions relieve the INC regulating reserve deployment. ~~If an OCBR Under-Generation event persists, BPA may curtail a plant's schedules when its actual output is contributing to the under-generation event.~~

~~F.~~E. Determining the Amount of Balancing Reserves to be Supplied

1. BPA provides BPA OATT, Schedule 3 (Balancing Reserve capacity for Regulation and Frequency Response Service ~~(Schedule 3 of the BPA OATT~~), and BPA OATT Schedule 10 (Capacity for Generator Balancing Services ~~(Schedule 10 of the BPA OATT~~). ~~Incremental and decremental~~ INC and DEC capacity amounts consistent with the planning standard~~s~~ that 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 ~~s~~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 Balancing Authority Area~~;~~.
    b. A historical dataset of individual generation resources output, individual generation resources schedules, actual load and load forecasts within the BPA Balancing Authority Area.~~, and;~~
    c. ~~As needed, h~~Historical meteorological data used to forecast variable energy resources, as needed.
    d. BPA's historical database of VER forecasts, where all VER plant schedules are modeled on a per plant basis.

i. For periods of missing hourly VER forecast data, including any new VER generation, a scheduling proxy of a ~~30~~35-minute persistence schedule on a 60-minute basis is used.

~~G.~~F. Calculation Methodology ~~for cCalculating 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 and maintain system reliability.
2. The methodology for calculating Balancing Reserve capacity relies on the following historical one-minute average data ~~-~~sets:
    a. ~~a~~Actual BAA load~~,~~.
    b. BAA load forecast~~,~~.
    c. ~~t~~Total actual dispatchable generation~~,~~.
    d. ~~t~~Total dispatchable schedules~~,~~.
    e. ~~t~~Total actual FCRPS generation.~~,~~
    f. ~~t~~Total FCRPS schedules.~~,~~
    g. ~~t~~Total actual solar generation~~,~~.
    h. ~~t~~Total solar generation schedules~~,~~.
    i. ~~t~~Total actual wind generation.~~, and~~
    j. ~~t~~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 Section F.2 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 wind 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 the~~se~~ data ~~-~~sets described in Section F.2 and F.3, the actual load net generation is determined on a minute-by-minute basis as the difference between Balancing Authority Area actual load and the summation of actual generation from all resource types.
    a. $Load\ Net\ GenActual = LoadActual - \Sigma\ GenActual$
5. Similarly, the load net generation forecast is determined on a minute-by-minute basis as the difference between Balancing Authority Area load forecast and the summation of schedules for all resource types.
6. Post-processing calculations on the data are then applied to calculate the ramped EIM Dispatch Operating Target (DOT) for the following:
    a. Load: Based on 10-minute persistence of actual load.

b. Wind and Solar: Based on 10-minute persistence of plant output.

c. Dispatchable and FCRPS Generation: Based on submitted schedule.

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~~ Total Balancing Reserve error data.

8. Two components make up the total Balancing Reserve capacity: regulating reserves and non-regulating reserves. The error dataset for the total Balancing Reserve capacity is divided into error datasets for both components.

   a. The ~~regulating reserves component~~ Total Regulating Reserve error data is defined by the minute-by-minute variations of actual load net generation dataset around the ramped EIM DOT of the load net generation dataset.

   b. The non-regulating reserves component is defined by the ~~difference~~ minute-by-minute difference between the ramped EIM DOT of the load net generation dataset and the load net generation forecast dataset.

9. Using percentile distribution, ~~incremental and decremental~~ INC and DEC requirements are calculated for the total Balancing Reserve capacity, and the regulating reserves and non-regulating reserves components.

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

   b. Percentile distribution is used to calculate:

      i. The Total Balancing Reserve capacity; and

      ii. The ~~Total Regulation~~ Total Regulating Reserve capacity.

      iii. The Total Non-Regulating capacity is calculated as the remainder of the Total Balancing Reserve capacity minus the ~~Total Regulation~~ Total Regulating Reserve capacity.

10. The following equations ~~below~~ describe the~~se~~ Balancing Reserve calculations in F.9.b:

Total Balancing Reserve Capacity:

Total ~~inc~~ INC = p99.85(Total ~~b~~Balancing ~~r~~Reserve error data)

Total ~~dec~~ DEC = p00.15(Total ~~b~~Balancing ~~r~~Reserve error data)

~~Total Regulation~~ Total Regulating Reserve Capacity (Reg):

Total Reg ~~inc~~ INC = p99.85(Total ~~regulation~~ Regulating Reserve error data)

Total Reg ~~dec~~ DEC = p00.15(Total ~~regulation~~ Regulating Reserve error data)

Total ~~Non-Regulation~~ Non-Regulating Reserve Capacity (Imb):

Total Non-Reg ~~inc~~ INC = Total ~~inc~~ INC – Reg ~~inc~~ INC

Total Non-Reg ~~dec~~ DEC = Total ~~dec~~ DEC – Reg ~~dec~~ DEC

where

p99.85 is the 99.85% percentile distribution
p00.15 is the 0.15% percentile distribution