

PJM

Black Start Fuel Assurance Proposal for Run of River and Pumped Storage Hydro

Run Hour Requirements:

Hydro units provide fuel diversity and flexible operation down to zero load during restoration events. As such they provide value during a restoration and existing units will remain in the current restoration plan as non-fuel assured resources. There will be no set run hour requirement for either existing Run of River and/or Pumped Storage Hydro. ~~will be able to choose between a 10 hour or 16 hour minimum run requirement (or as defined by TO restoration plan) at full load. Hydro Units~~ units that choose ~~the~~ to offer Black Start MWs with a 16 hour minimum run time with a 90% confidence (equivalent to the 90% EAF of a CT) will be considered fuel assured and will be eligible for a greater Black Start Annual Revenue Requirement when on the Base Formula Rate.

Proposal for determining amount of Black Start MWs at a Hydro Station:

Non-Fuel Assured Hydro Units

Run of River Hydro with or without Storage shall use the sum of the current ICAP of the Black Start unit(s) (Status Quo) at the station. Black Start revenues will continue to be calculated using the unit's ICAP in accordance with the current rules for Hydro units in Schedule 6A of the Tariff. On a five year basis in coordination with the 5 Year RTO Wide RFP, PJM shall perform a historical flow analysis of all Run of River Hydro units simultaneously operating using the data provided to PJM for the unit's ELCC analysis to determine the confidence level the unit is capable of providing the unit's ICAP for 16 hours. PJM will use this confidence level times the unit ICAP to determine the unit's Black Start MWs used in the Black Start Calculator.

Pumped Storage Hydro with shall use the sum of the current ICAP of the Black Start unit(s) (Status Quo) at the station. Black Start revenues will continue to be calculated using the unit's ICAP in accordance with the current rules for Hydro units in Schedule 6A of the Tariff. On a five year basis in coordination with the 5 Year RTO Wide RFP, PJM shall perform a storage analysis of all Pumped Storage Hydro units simultaneously operating using the data provided to PJM for the unit's ELCC analysis to determine the MWs that the unit is capable of providing for 16 hours. PJM will use this MW value times an **availability factor (account for pumping time - TBD)** to determine the unit's Black Start MWs used in the Black Start Calculator.

Fuel Assured Hydro Units

Run of River Hydro with or without Storage can offer a fuel assured MW value based on a historical flow analysis with all units simultaneously operating using the data provided to PJM

~~for the unit's ELCC analysis shall use the daily volumetric inflow values for the past 20+ years from the appropriate USGS river flow gauges or other instrumentation agreed to by the Hydro Generation Owner and PJM with input from IMM to determine the maximum number of black start MWS that can be supported for chosen that supports a 16 hour minimum run hour requirement (10 or 16 hours). Run of River Hydro with storage can use the normal, daily starting elevation levels for storage values within licensing limits in the Black Start MW calculation with PJM concurrence.~~ The Black Start MW calculation shall be based on river flows of 90% Confidence level to correspond to the current average PJM CT Equivalent Availability Factor (e.g. - for a BS commitment of 100 MW assume 100 MW would be available, for ~~either 10hrs or~~ 16hrs, 90% of the time based on historical river flows and daily storage). The calculated Black Start MW value shall be used in both the unit's annual revenue calculation and in the Black Start Calculator.

Pumped Storage Hydro shall maintain sufficient pond level to support all units simultaneously operating for either a 10 hour or 16 hour minimum run requirement (or as defined by the Transmission Owner commensurate with the TO restoration plan) at full load of the assigned black start MW. This Black Start MW value shall be used in both the unit's annual revenue calculation and in the Black Start Calculator.

Black Start Annual Revenue Requirement for Hydro Units on the Base Rate Formula:

Current (Status Quo for non-fuel assured Hydro units):

Black Start Unit Capacity equal to ICAP

Black Start Calculator MW equal to ICAP multiplied by confidence level based on ELCC data provided river flows that unit can provide ICAP for 16 minimum run time

Fixed Black Start Service Costs (Fixed BSSC) – OATT Schedule 6A, Section 5

Formula = ((Net CONE * Black Start Unit Capacity * X) + Variable BSSC + Training) * (-1 + Z)

Net CONE = Current installed capacity ("ICAP") net Cost of New Entry (\$/MW year) for the CONE Area where the Black Start Unit is located.

Black Start Unit Capacity = ~~either (i) Black Start Unit's installed capacity (MWs); or (ii) awarded MWs by the Transmission Provider~~

X = Black Start Service allocation factor (Black Start Units with a commitment established under Schedule 6A, Section 5, X shall be .01 for Hydro units and .02 for CT units)

Variable BSSC = Black Start O&M Costs including NERC Reliability Standard Compliance Cost

Training = Black Start Training Cost = \$3,750.

Z = Black Start Incentive Factor

Propose changes for fuel assured Hydro Black Start Resources:

~~X = .01 for 10 hour min run commitment, or as defined by the TO restoration plan = Net CONE * Black Start Unit Capacity * .01~~

~~Black Start Unit Capacity * .01~~

~~Z factor = 10% for 10 hour min run commitment~~

Black Start Unit Capacity = Black Start MW calculation based on ELCC data provided river flows with 90% Confidence level that correspond to a 16 minimum run time.

Black Start Calculator MW = Black Start MW calculation based on ELCC data provided river flows with 90% Confidence level that correspond to a 16 minimum run time.

X = .02 for 16 hour min run commitment = Net CONE * Black Start Unit Capacity * .02

Z factor = ~~20~~10% for 16 hour min run commitment

Example: Hydro ~~Resource~~ Resource with 100 MWs Black Start Commitment CAP capable of providing 70 MWs for 16 hours with 90% confidence, Net CONE = \$264.40/MW-Day

Run Hour <u>Fuel Assured</u>	Formula Rate	Fixed BSSC
10 hours <u>No</u>	100 MW * \$264.40 * 365 days * 0.01	\$ 96,506.00
16 hours <u>Yes</u>	100 <u>70</u> MW * \$264.40 * 365 days * 0.02	\$193,012 <u>\$135,108.00</u>

Add Variable BSSC, Training Costs, and Incentive Factor Z:

Example 100 MWs Black Start Commitment, Net CONE = \$264.40, VOM = \$100,000

Run Hour <u>Fuel Assured</u>	Base Formula Rate	Fixed BSSC
10 hours <u>No</u>	(\$96,506 + (\$100,000 * 0.01) + \$3,750) * 1.10	\$111,381.60
16 hours <u>Yes</u>	(\$193,012 <u>(\$135,108.40</u> + (\$100,000 * 0.01) + \$3,750) * 1.10	\$217,538.20 <u>\$153,844.24</u>

~~Proposed changes with additional increased Incentive Factor Z to 20 percent for 16 hours~~

Run Hour	Base Formula Rate	Fixed BSSC
10 hours	(\$96,506 + (\$100,000 * 0.01) + \$3,750) * 1.10	\$111,381.60
16 hours	(\$193,012 + (\$100,000 * 0.01) + \$3,750) * 1.20	\$237,314.40

Monthly Black Start Revenue Calculation:

Run of River Hydro, on the base formula rate, monthly revenue calculations for Fixed Black Start Service Costs will be calculated as the lesser of the assigned black start MW or the average MW achievable for either a 10 hour or 16 hour min run from the unit(s) for the prior month. The average achievable MW will be determined by PJM using the closest applicable USGS river flow meter capable of providing a daily flow. Alternatively, the unit owner can provide an estimate of the average 10 hour or 16 hour MW capability using flow and daily storage readings from dam instrumentation for PJM approval.

For Pumped Storage Hydro Black start resources, monthly revenues will be withheld for months in which water level falls below the run hour requirement. Monthly revenues will not be withheld if the water levels falls below the run hour requirement as a result of a regulatory requirement, an approved outage, or restoration event. If water levels fall below the run hour requirement during a PAI event, monthly Black Start revenues will be foregone.

Summary:

	<u>Non-Fuel Assured Hydro</u>	<u>Fuel Assured Hydro</u>
<u>Black Start MW</u>	<u>ICAP</u>	<u>ICAP * 90% confidence of 16 hours</u>
<u>Minimum Run Time</u>	<u>None</u>	<u>16 hours</u>
<u>Black Start Calculator MW</u>	<u>ICAP * confidence level for 16 hours</u>	<u>ICAP * 90% confidence of 16 hours</u>
<u>Revenue Calculation MW</u>	<u>ICAP</u>	<u>ICAP * 90% confidence of 16 hours</u>
<u>X factor</u>	<u>0.01 (status quo for Hydro)</u>	<u>0.02 (same as CT)</u>
<u>Z Factor Incentive</u>	<u>10%</u>	<u>10%</u>
<u>Penalty for lack of water</u>	<u>None</u>	<u>Pumped storage only if they fail to maintain 16 hours of storage</u>

Notes

- 1) Hydro confidence levels calculated on 5 year basis in coordination with Five Year RTO Wide RFP
- 2) Confidence levels are calculated based on all black start units at a plant operating simultaneously for 16 hours