



# Fuel Requirements for Black Start Resources PJM / Brookfield / DC OPC Package

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## Level of Fuel Assurance - Each transmission owner zone is required to be fuel assured in accordance with the following:

- **Minimum criteria:** One fuel-assured black start site per zone
- **Additional black start solutions beyond minimum fuel-assurance criteria:** Based on reliability criteria that identifies high-impact black start sites

### Key Benefit

Ensures a zonal minimum level of fuel-assured black start resources while using a reliability-focused approach to address only the more extreme cases of potential restoration time increases

## Key Fuel Assurance Enhancements:

- 16 hour run hour requirement
- Fuel assurance requirements by primary fuel type
- Testing and verification requirements
- Implementation through RTO wide RFP process / reliability backstop
- Compensation for black start resources on Base Formula Rate:
  - For fuel assured resources selected via RFP Z factor = 20%
  - For all other resources, Z factor = 10% (Status Quo)
- BS monthly revenues foregone where onsite fuel, water level, stored energy, etc. is not maintained for run hour requirement



# Consolidated PJM / Brookfield / DC OPC Package

## Thermal / Pumped Storage Hydro / Energy Storage Resource Summary

Fuel Assurance Requirements	Non-Fuel Assured (Status Quo)	Fuel Assured
Black Start MW	ICAP	ICAP
Run Hour Requirement	Thermal: 16 hours Pumped Storage Hydro / Energy Storage: Determined by TO restoration plan	16 hours at ICAP
Black Start Calculator MW	ICAP	ICAP

Text in red is change from Status Quo



# Consolidated PJM / Brookfield / DC OPC Package

## Run of River Hydro / Intermittent / Hybrid Resources Summary

Fuel Assurance Requirements	Non-Fuel Assured (Status Quo)	Fuel Assured
Black Start MW	ICAP	Run of River Hydro, Hybrid and Intermittent - PJM calculates black start MW unit can provide for the minimum run time duration with 90% confidence (calculated monthly)
Run Hour Requirement	Determined by TO restoration plan	16 hours at 90% confidence MW
Black Start Calculator MW	<b>ICAP * (% of year unit can provide ICAP for 16 hours)</b>	Run of River Hydro, Hybrid and Intermittent - MW the unit can provide for 16 hours with 90% confidence on an annual basis calculated every 5 years

Text in red is change from Status Quo



# Consolidated PJM / Brookfield / DC OPC Package Thermal / Pumped Storage Hydro / Energy Storage Resource Summary

Compensation	Non-Fuel Assured (Status Quo)	Fuel Assured
Revenue Calculation MW	ICAP	ICAP
X Factor	0.02 – Thermal 0.01 – Storage	0.02
Z Factor Incentive	10%	20%*
Penalties	None	BS monthly revenues foregone in months where onsite fuel, water level, stored energy, etc. is not maintained for run hour requirement

\*See slide #8 for cost impact



# Consolidated PJM / Brookfield / DC OPC Package Run of River Hydro / Hybrid/Intermittent Resources Summary

Compensation	Non-Fuel Assured (Status Quo)	Fuel Assured
Revenue Calculation MW	ICAP	Monthly MW calculation with 90% confidence value
X Factor	0.01	0.02 (same as CT)
Z Factor Incentive	10%	20%
Penalties	None	No penalties because of PJM calculation of confidence level



# RTO Annual Black Start Revenue Increase

Increase	20% Z Factor (Lowest Single Site Per Zone Cost)	20% Z Factor (Highest Single Site Per Zone Cost)	20% Z Factor (All Sites)
Total Cost (\$)	174,000	272,000	436,000
Cost Per MWh (\$/MWh)	0.0002	0.0003	0.0006

- Z Factor increase only impacts Black Start units on the Base Formula Rate and that store oil onsite
- For reference – 2021 RTO BS Annual Revenue Requirement: \$68,230,718/yr. (\$0.087/MWh)



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### **Fuel Requirements for Black Start Resources**



### **Member Hotline**

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# Appendix

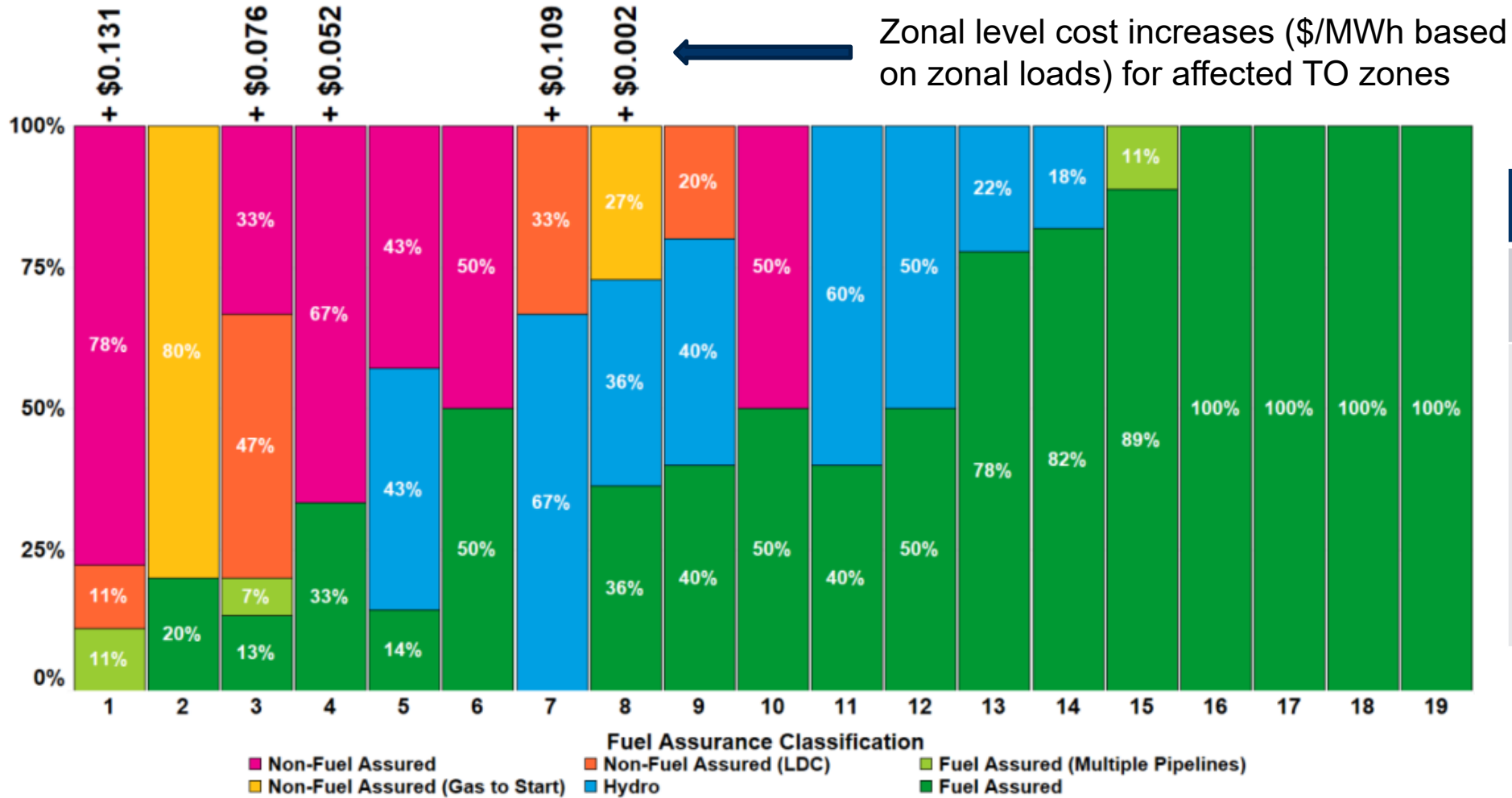
## Minimum One Fuel-Assured Black Start Site Per Zone

The majority of TO zones currently meet the minimum criteria, and there is no current projected capital cost impact.

### Additional Black Start (BS) Solutions Beyond Minimum Criteria

- Mitigation of 8 high-impact BS sites in 5 TO zones
- Est. additional RTO BS Annual Revenue Requirement for 8 high-impact BS sites: +\$28,175,000/yr. (+\$0.036/MWh based on RTO load; see slide 4 for projected zonal cost increases on \$/MWh basis)
- For reference – 2021 RTO BS Annual Revenue Requirement: \$68,230,718/yr. (\$0.087/MWh)

# Projected Zonal Cost Increase (\$/MWh) for High-Impact Black Start Sites



## Notes

Percentages based on a black start unit count basis

Costs represent the projected incremental zonal increase in black start annual revenue requirement on a cost per MWh basis for fuel-assurance conversions

## Cost Projection Assumptions/ Clarifications

- It is currently unknown which hydro resources would choose to be fuel assured.
- High impact black start sites agree to convert to become fuel assured (at black start resource owner discretion).
- Costs estimates based on dual fuel conversions, other fuel assurance solutions (e.g., LNG, CNG) could result in higher costs.

A minimum of one black start site per zone meeting the following fuel-assurance criteria, in order of preference:

1. On-site fuel storage (e.g., dual fuel)
2. Connected to multiple pipelines
3. Gas-only black start site connected to a single source fed directly from a gas supply basin/gathering system ahead of interstate pipeline
4. Fuel-assured hydro black start site in accordance with the new hydro proposal
5. Fuel-assured intermittent or hybrid black start site in accordance with methodology that aligns with the new hydro proposal and also meets all other black start technical requirements
6. Minimum of 2 separate gas-only black start sites in a TO zone connected to 2 separate interstate gas pipelines (excludes connections to LDCs) would also be acceptable to meet min. fuel assurance requirement if 1–5 are not currently available



- Additional black start solutions (fuel-assurance conversions or additional fuel-assured or non-fuel-assured black start generation) beyond minimum fuel-assurance criteria to be based on reliability criteria that identifies high-impact black start sites.
  - Reliability criteria is incremental increase in restoration time greater than 10 hours upon the loss of a non-fuel-assured black start site.



- Hydro units (run of river or pumped storage) to align with new hydro proposal
  - Fuel-assurance criteria for future intermittent black start resources to follow similar methodology as in new hydro proposal.
- Includes all the other key fuel assurance enhancements:
  - 16 hr. run-hour requirement, fuel-assurance requirements by primary fuel type, testing and verification requirements, compensation
- Implementation through RTO-wide RFP or future incremental RFP

- Reliability Backstop
  - Existing Reliability Backstop Process (in PJM Manual 14D, Section 10.3 and OATT Schedule 6A, Section 6A) to be implemented in the event of insufficient response to RTO-wide RFP or future incremental RFP (2 failed RFP processes), to meet minimum of one black start site per zone meeting fuel-assurance criteria **and** reliability (PLUS) criteria beyond minimum criteria for high-impact black start sites.
    - For Reliability Backstop RFP, TO required to submit RFP proposal.

# PJM Non-Fuel Assured Black Start Site Incremental Restoration Time Increase Results

