

Capacity Sales for Host Generation With Curtailable Co- located Load

April 2023

Brookfield
Renewable U.S.



Constellation[®]

Situation Overview

- PJM and its stakeholders are becoming increasingly concerned with reliability/resource adequacy issues as the load/supply mix evolves. They are also concerned about the costs of ensuring reliability in the face of that evolution
- As part the evolution, customers are seeking to procure increasing amounts of physical, clean electricity on a behind-the-meter basis.
- PJM should pursue rules that encourage such clean behind-the-meter load development in a manner that enables PJM to cost-effectively preserve reliability/resource adequacy.
- The Constellation/Brookfield Renewable proposal (summarized in the Appendix) does just that: it enables clean resources to satisfy growing customer behind-the-meter needs, while allowing these resources to remain available to PJM to cost-effectively ensure resource adequacy and respond to system stress situations

Proposal Summary

The Constellation/Brookfield proposal accomplishes these objectives without (i) implicating complicated federal/state jurisdictional issues, (ii) forcing capacity to de-list, (iii) ISA/Planning concerns or (iv) other issues:

- The co-located load does not consume any energy from the PJM system
- The co-located load is interruptible
- Relay schemes will curtail co-located load contemporaneous with generator trip
- Host generator retains existing Capacity Accreditation/CIRs
- Consistent with the IMM's definition of "Capacity Fulfilled" (i.e. physical deliverability, (re)callability in an emergency, competitive energy offer, and more).
- Host generator provides all Ancillary Services necessary for delivery of power from Host generator to co-located customer
- Interconnection Services Agreement: No change to ISA review process

Key Benefits of Proposed Reforms

1. Retains generation for reliability and to respond to system stress
2. No reliability, legal, or market impediments to the proposal
3. Preserves the existing Ancillary Services paradigm
4. Addresses all Planning, ISA and Reliability concerns by utilizing the existing Necessary Study Agreement process
5. Jurisdiction: No modification to existing federal/state jurisdiction
6. Allows low-cost resources to remain fully in the capacity market relative to status quo “de-list” scenario
7. Enhances customer choice for physical, clean, reliable power supply
8. States enjoy significant economic development benefits of new commercial activity

Appendix

PJM Rules Do Not Directly Address Capacity Market Participation of Generation with Co-located Load

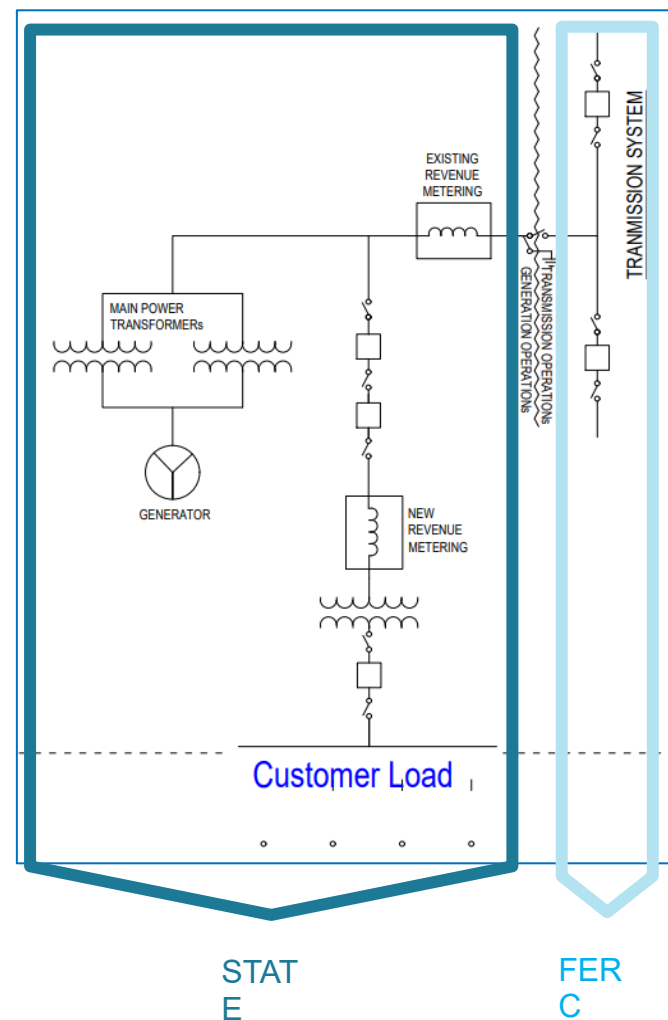
- New, large commercial customers are choosing to locate their highly interruptible loads behind the meter of generation resources to reduce cost and assure physical supply of carbon-free power (E.g., hydrogen electrolyzers, data centers)
- Currently, PJM rules do not *directly* address Host Generator market obligations in the presence of Co-located load
- Initially, PJM opined that Host Generators serving Co-Located Load must “de-list” (i.e., retire and forfeit Capacity Injection Rights) the portion of the unit serving the Co-located Load, depriving PJM of existing (potentially low-cost) capacity supply. See, [*PJM Rules Regarding the Siting of New Load Behind the Meter of Existing Generation*](#) (11/29/21)
- PJM also initially suggested that Behind the Meter *Generation* rules should be applied – *but our reform is **not addressing any generation behind a wholesale meter***
- Indeed, our reform effort is only addressing obligations of generators that are interconnected to the PJM grid (not BTM Generation).

PJM and customers can retain the full capacity supply of Host Generators where the behind the meter load is curtailable

Reform Opportunity

PJM rules must be developed to address the capacity obligations of Host Generation that can curtail BTML

- Customer takes service directly from Host Generator
- Customer does not need or want FERC-jurisdictional wholesale transmission service
- Host Generator provides all ancillary services necessary for delivery of power from generator to customer
- PJM studies the generator interconnection for reliability/stability issues (Necessary Studies Agreement)
- Relay schemes assure no BTML consumption from grid
- Generator sells full capacity to PJM
- Generator submits full committed capacity to PJM energy market in Delivery Year; PJM can fully-recall on cost-based offer for reliability
- Market-based energy offer for MW serving BTML are offered to PJM at the verified opportunity cost of curtailing the BTML
- PJM dispatches net output of Host Generator
- If generator is offline, BTML is interrupted or shifted to another generator at the station
- Full Host Generator response to an energy call is as fast as sync reserve requirements (much faster than response for many capacity resources)
- Any distribution costs are determined by local utility retail

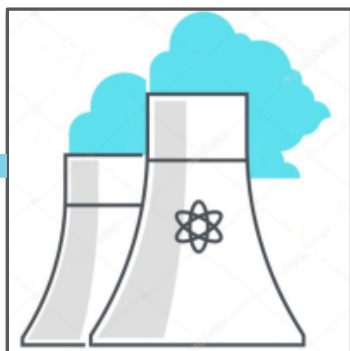


Simple Operation Example – Grid LMP Low

Generating Station

1000 MW Max Facility Output

1000 MW Capacity Sale



200 MW

STATE

JURISDICTION
AL

FERC JURISDICTIONAL
800 MW

ISO Grid

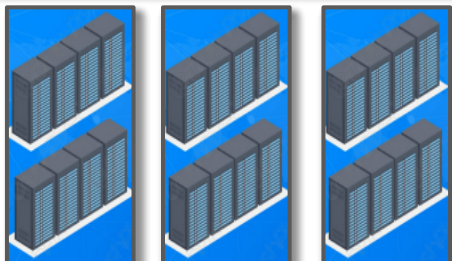
LMP = \$50



Behind the Meter Customer

200 MW

Fully Interruptible <10 min @
\$500



Operational Assumptions

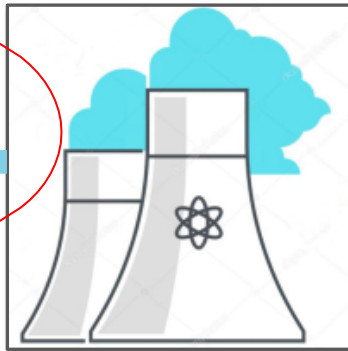
1. Generator commits full capacity value to ISO
2. Generator provides unit-specific interruptible power to BTM customer
3. Generator fulfills capacity commitment via daily DAM energy offer
 - 800 MW @ SRMC, e.g., \$0
 - 200 MW @ Opportunity Cost of BTML interruption, e.g., \$500
4. Generator curtails BTML when LMP exceeds market-based offer

Simple Operation Example – Grid LMP High

Nuclear Station

1000 MW Max Facility Output

1000 MW Capacity Sale



0 MW

STATE

JURISDICTION
AL

FERC JURISDICTIONAL
1,000 MW

ISO Grid

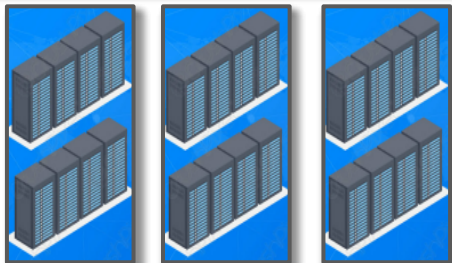
LMP = \$501



Behind the Meter Customer

0 MW

Fully Interruptible <10 min @
\$500



Operational Assumptions

1. Generator commits full capacity value to ISO
2. Generator provides unit-specific interruptible power to BTM customer
3. Generator fulfills capacity commitment via daily DAM energy offer
 - 800 MW @ SRMC, e.g., \$0
 - 200 MW @ Opportunity Cost of BTML interruption, e.g., \$500
4. Generator curtails BTML when LMP exceeds market-based offer

Capacity Status

CEG/BRE

Host Gen Must Offer All ICAP

- ✓ Maintains grid capacity supply
- ✓ Enhances reliability
- ✓ Maintains prevailing capacity prices

IMM

Host Gen Must Retire ICAP Equal to BTML

- Decreases capacity supply
- Decreases reliability
- Increases capacity prices

Constellation/Brookfield propose no change to capacity offer obligations

- ✓ Capacity must-offer requirement at full ICAP (same as status quo)
- ✓ DA & RT cost-based energy offer of all committed capacity (same as status quo)
- ✓ Existing cost-development rules applied to full committed capacity (same as status quo)

IMM Definition of Capacity Fulfilled

Definition of Capacity Characteristic	Host Generator	Consistent with Status Quo
Physical Deliverability	Full ICAP, up to unit CIR, subject to must-offer requirement	Yes
(Re)callability in an emergency	Full committed capacity volume available to PJM at cost-based price	Yes
Physical Offer of Committed Capacity in Energy Market	Full committed capacity of host load offered daily	Yes
Competitive Energy Offer	<p>Full volume of cleared capacity must be offered 8760 in the Energy market, at cost-based rate that PJM/IMM approves, that PJM can strike if unit is needed for reliability.</p> <p>[Note: Units with MBR authorization may provide market-based offers but are not required to do so.]</p>	Yes
Capacity Must-offer	Full ICAP of unit offered	Yes
Capacity Competitive Offer	PJM market & contract revenues offset from gross unit cost to establish ACR	Yes
Testing	Unit must test annually to demonstrate deliverability	Yes

See, Monitoring Analytics, “Capacity” (May 26, 2022 RASTF) at slide 4.

Interconnection Services Agreement

CEG/BRE

No Change to ISA Review Process

- ✓ PJM performs “necessary studies” to amend ISA (resulting in “Necessary Studies Agreement”)
 - ✓ TO engaged with PJM in studies
 - ✓ Host Gen pays for studies and any system upgrades, security measures, or metering that PJM determines are necessary for reliability
 - ✓ Host Gen provides equipment to ensure that BTML cannot consume grid services
 - ✓ RT metering and telemetry if required
- See, PJM, “Interconnection Requirements for New Commercial Load Behind the Meter of an Existing Generator” (Feb. 9, 2022 MIC)

IMM

Radical changes to ISA Study Process

- New standards for Host Gen study
- Discriminatory application of ISA amendment process to Host Gen
- Unlimited contingency analysis
- Turns PJM reliability studies into unbounded stakeholder debate
- Expands IMM role beyond market monitoring into reliability analysis
- Outside the scope of Issue Charge

See, Monitoring Analytics, “Market Approach to Behind the Generator Load (BGL)” (Oct. 13, 2022 MIC)

Jurisdiction & Grid Services

CEG/BRE

No modification of federal/state jurisdiction

- ✓ Behind the meter load is not FERC-jurisdictional*
 - Not a sale for resale
 - Not a sale in interstate commerce
 - BTML not in privity with PJM
- ✓ Any retail requirements (e.g., demand charges, distribution charges, metering) subject to discussion with TO and/or state, as applicable under state law
- ✓ Host Gen reactive sales to grid decrease
- ✓ Behind the meter customer does not want or need grid services
- ✓ Facilitates customer choice
- ✓ Fosters customer access to 100% carbon-free power

*See, PJM, "Jurisdiction Over Wholesale/Retail Loads" (10/13/22)

IMM

Oversteps federal/state jurisdictional divide

- Proposes to expand PJM/IMM role to retail
- Proposes to illegally force customer to take unwanted/unneeded wholesale service
- Proposes new *state jurisdictional* notice obligations, outside the scope of Issue Charge
- Undermines customer choice
- Impedes state commerce by imposing unnecessary public notice requirements

See, Monitoring Analytics, "Market Approach to Behind the Generator Load (BGL)" (Oct. 13, 2022 MIC)

Cost Impacts to System Load

Wholesale Cost Category <i>Capacity Market</i>	Scenario 1 Wholesale Grid Load Interconnection <i>Increased Demand Constant Supply</i>	Scenario 2 Status Quo & IMM Co-Lo + Host Gen. Retires CIRs <i>Constant Demand Decreased Supply</i>	Scenario 3 Constellation/Brookfield Co-Lo + Host Gen. Remains Capacity Resource <i>Unchanged Supply/Demand</i>
Energy	Increase Demand increases requiring additional marginal supply	Increase Supply decreases due to Host Gen MW retirement to serve new BTML. Same impact as Scenario 1.	Increase Supply decreases due to Host Gen competitive energy service to new BTML. Same impact as Scenario 1.
Capacity	Increase Demand increases requiring additional marginal supply	Increase Supply decreases due to Host Gen. CIR retirement, requiring add'l. marginal supply.	No change Host Gen continues to offer full capacity output.. Host Gen curtails BTML when LMP exceeds market-based offer. The BTML requires no grid capacity or other services.
Transmission	Decrease for load in same zone, as new load shares cost. No impact for other zones	No change	No change

Market & Reliability Impacts

Market Impacts

- Could the PJM market design continue to function if 20,000 MW of generation adopted the Constellation BGL proposal?
- Impact on the cost of transmission?
 - Will transmission upgrades be required to offset the impact of removal of significant amounts of energy for most hours?
- Impact on cost of ancillary services?
 - Is a significant level of ancillary service supply removed with relevant generation?

www.monitoringanalytics.com

©2022

Market Impacts

- Could the PJM market design continue to function if 20,000 MW of generation adopted the Constellation BGL proposal?
- Impact on energy market prices?
 - Removal of 20,000 MW of low cost generation for almost all hours of the year will increase energy market prices.
 - Even a relatively small impact on energy market prices could change total load payments by billions of dollars

Market Impacts

- Could the PJM market design continue to function if 20,000 MW of generation adopted the Constellation BGL proposal?
- Impact on reliability?
 - Can system run reliably with significant amounts of energy removed from parts of grid for most hours?
 - Transmission upgrades required?
 - Impact on binding constraints?
 - Impact on congestion?
 - Impact on reserve prices?
 - PJM should perform retirement analysis for all such resources

www.monitoringanalytics.com

©2022



The IMM offers only speculation and rhetoric, but in fact there are no reliability, legal, or market impediments to the

PJM Reliability Forecast

PJM management made the following observations at the PJM Annual Meeting

- Up to 40 GW of thermal generation loss between 2023 and 2030
- Approximately 15-30 GW of data center entry, in addition to load growth from electrification
- Approximately 100 GW interconnection queue that is predominately variable energy resources
- Little new thermal entry

It makes little sense to force existing baseload generation to *retire* capacity commitments in the context of these challenges