Co-Location Configurations

(Behind the Meter Load)

Brookfield
Renewable U.S.

Constellation
An Exelon Company

Presentation Purpose

- The purpose of this presentation is to inform stakeholder interest identification and provide tangible examples from which stakeholders can identify concerns and solution components.

- The examples herein are not fully-developed solutions.

- Through example, we are attempting to describe the status quo, highlight the limitations of the status quo, and provide a description of co-located, behind-the-meter-load service configurations and their potential operation that may satisfy commercial interests.

- There may be other configurations or market interactions, which this committee can consider.

Key Assumptions

- Consistent with the Problem Statement, we propose to assess co-located load configurations in which the customer can curtail quickly.

- All examples assume that the load can curtail in less than 10 minutes, although our commercial interactions suggest that many loads can interrupt faster.

Benefits to the Load and Grid

1. Further enables consumer choice for new, fast-response loads
2. Maximizes capacity supply for the grid
3. Potentially minimizes interconnection costs due to co-location configuration coupled with fast-response capability
4. Potential new ancillary service capability for relatively inflexible technologies (e.g., nuclear) coupled with flexible, co-located load
5. Opportunity for new interruptible customer types with shorter curtailment notice times relative to current DR program to obtain physical power supply

Fast-response, interruptible load unlocks the potential for innovative supply/demand configurations with reliability and market benefits

Status Quo

Any Generating Station

1000 MW Max Facility Output

800 MW Capacity Sale

200 MW

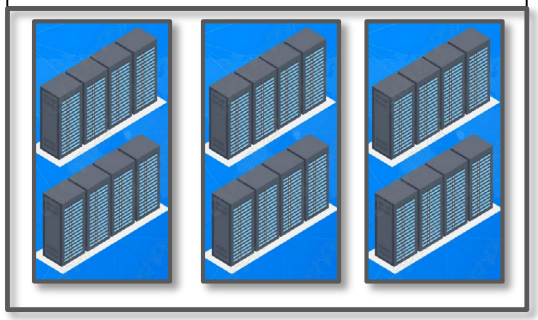
800 MW

ISO Grid

Behind the Meter Customer

200 MW

Fully Interruptible <10 min @ $500



Implications of Status Quo

1. Generator "delists" a portion of the unit to serve the co-located load
2. Generator commits residual capacity to ISO via auction
3. ISO has no call on the delisted capacity, despite load interruption capability
4. Generator fulfills capacity commitment via daily DAM energy offer
   - 800 MW @ short run marginal cost, e.g., $0

Linear (Single Source) Configuration – BTML Consuming

Nuclear Station

1000 MW Max Facility Output

1000 MW Capacity Sale

200 MW

800 MW

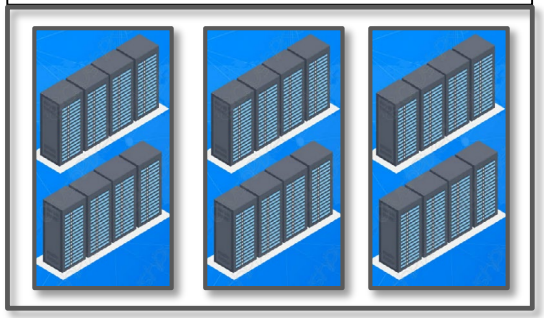
ISO Grid

LMP = $50

Behind the Meter Customer

200 MW

Fully Interruptible <10 min @ $500



Operational Assumptions

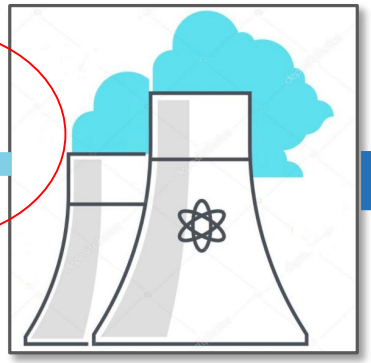
1. Generator commits full capacity value to ISO
2. Generator provides unit-specific interruptible power to BTM customer
3. Generator fulfills capacity commitment via daily DAM energy offer
   - 800 MW @ SRMC, e.g., $0
   - 200 MW @ Opportunity Cost of BTML interruption, e.g., $500
4. Load curtails at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

Linear (Single Source) Configuration – BTML Interrupted

Nuclear Station

1000 MW Max Facility Output

1000 MW Capacity Sale



0 MW

1,000 MW

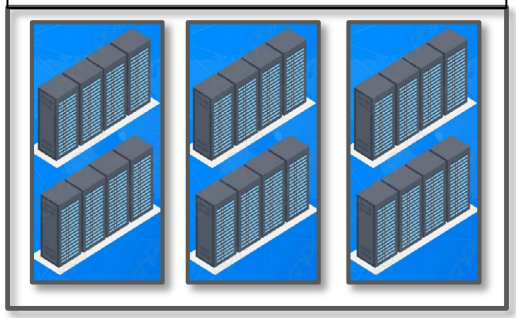
ISO Grid

LMP = $999

Behind the Meter Customer

0 MW

Fully Interruptible <10 min @ $500



Operational Assumptions

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4. Load curtails at Generator DAM strike price

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Looped (Dual Source) Configuration – Combined Load Service

Hydroelectric Station

250 MW Max. Facility Output

250 MW Capacity Sale (ELCC Volume)

Real Time Output 250 MW

225 MW

ISO Grid

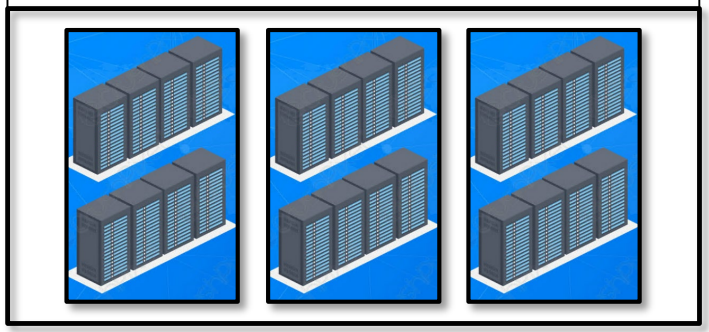
LMP = $30

25 MW

Behind the Meter Customer

50 MW

Fully Interruptible <10 min @ $500



25 MW

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
   - 225 MW @ SRMC, e.g., $0
   - 25 MW @ Opportunity Cost of BTML interruption, e.g., $ 500
   - 25 MW of grid service
4. Load curtails at Generator DAM strike price

Looped (Dual Source) Configuration – BTML Interrupted

Hydroelectric Station

250 MW Max. Facility Output

250 MW Capacity Sale (ELCC Volume)

Real Time Output 250 MW

250 MW

ISO Grid

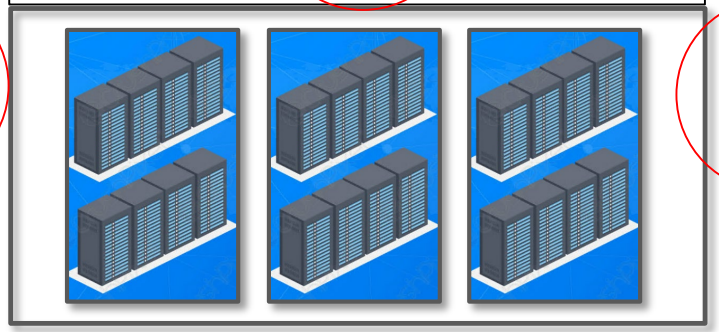
LMP = $999

0 MW

Behind the Meter Customer

0 MW

Fully Interruptible <10 min @ $500



0 MW

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
   - 225 MW @ SRMC, e.g., $0
   - 25 MW @ Opportunity Cost of BTML interruption, e.g., $ 500
   - 25 MW of grid service; interruptible
4. Load curtails at Generator DAM strike price

Looped (Dual Source) Configuration – BTML Consuming From Generator Only

Hydroelectric Station

250 MW Max. Facility Output

250 MW Capacity Sale (ELCC volume)

Real Time Output 250 MW

200 MW

ISO Grid

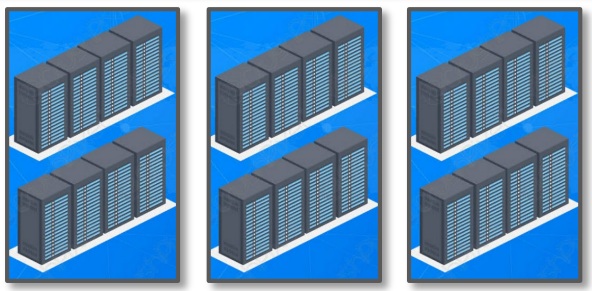
LMP = $30

50 MW

Behind the Meter Customer

50 MW

Fully Interruptible <10 min @ $500



0 MW

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
   - 200 MW @ SRMC, e.g., $0
   - 50 MW @ Opportunity Cost of BTML interruption, e.g., $ 500
4. Load curtails at Generator DAM strike price

Looped (Dual Source) Configuration – BTML Interrupted

Hydroelectric Station

250 MW Max. Facility Output

250 MW Capacity Sale (ELCC Volume)

Real Time Output 250 MW

250 MW

ISO Grid

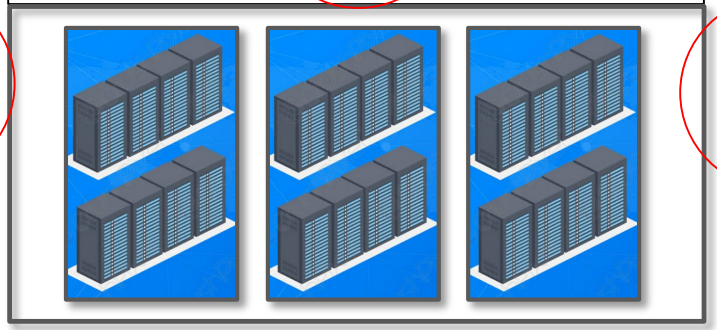
LMP = $999

0 MW

Behind the Meter Customer

0 MW

Fully Interruptible <10 min @ $500



0 MW

Operational Assumptions

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4. Load curtails at Generator DAM strike price

Conclusion & Next Steps

Summary of Key Benefits of Interruptible Behind the Meter Load

1. Flexible, interruptible, co-located load can enhance PJM grid reliability and maximize generator capacity market participation
2. Flexible, interruptible co-located load may offer new means of producing spinning reserves or similar ancillary service
3. Opportunity to add new interruptible customer types with shorter curtailment notice times relative to current DR customers
4. Market innovation is required to increase grid reliability and assure least-cost capacity supply

Next Steps

1. Brookfield and Exelon request that the MIC consider modifications to existing PJM market rules to accommodate this new co-located load/generation configuration
2. Explore market design innovations to enable physical power sales to interruptible BTML while enabling the full capacity and energy of the dedicated generator sold in PJM auctions and markets
3. Consider market design innovations to develop new methods of providing ancillary services

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