BTM Solar Modeling – Separation from Load

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Agenda

- Background
- Methodologies
- Impact Assessment
- Next Steps

Background

Background

- **In the current IRM study, the estimated behind-the-meter (BTM) solar impact on load is embedded on the load side**
  - The IRM load shapes are adjusted annually to reflect the impact of the increased penetration of BTM solar
    - For example, the 2013 actual load shapes have embedded the BTM solar impact at the 2013 penetration level. To use the 2013 load shapes for study year 2024, the 2013 load shapes are adjusted to account for the expected penetration of BTM solar in year 2024
  - The peak load forecast used in the IRM study is developed from the actual summer peak with the impact of BTM solar
  - Load Forecast Uncertainty (LFU) multipliers are developed based on the net load shapes including the BTM solar impact
  - Since the IRM is calculated with the capacity supply resources only, the current process supports the proper calculation for the IRM to be used in the ICAP market
- **With the expectation of increasing BTM solar penetration over time, it is important to monitor its impact on the system**
  - While the current process reflects the penetration of BTM solar, the impact cannot be quantified due to the embedded nature of including BTM solar in load
- **Therefore, the ICS expressed interest to explore ways to model BTM solar explicitly in the IRM study**

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Methodologies

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Overview of Alternative Methodologies

- **To model BTM solar explicitly adjustments need to be made on both resource side and load side to properly account for the BTM solar impact in MARS simulations**
  - On the load side, gross load shapes and gross peak load forecast were developed with BTM solar impact backed out from the current inputs
    - For 2024-2025 study, 1,720 MW of BTM solar peak impact is estimated
  - On the resource side, NYISO explored the two approaches to explicitly model BTM solar
- **With BTM solar being modeled explicitly in the MARS model, the calculation for the IRM should remain unchanged**
  - Net demand forecast should continue to be used as the denominator of the IRM calculation
  - The MW of BTM solar would not be counted in the total ICAP in the numerator of the IRM calculation
  - The derating factor of BTM solar would not be included in the IRM zonal derating factors as a part of the shifting methodology

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Treatment on Load Side

- **On the load side, BTM solar would be modeled with the following characteristics:**
  - 2013, 2017 and 2018 gross load shapes (with the estimated BTM solar impact added back)
    - LFU Bin 1 & 2: 2013
    - LFU Bin 3 & 4: 2018
    - LFU Bin 5 – 7: 2017
  - Gross peak load forecast would be developed to be used in load shape adjustment
    - Gross peak load forecast = IRM Coincident, Non-Coincident, and G-J peak + BTM solar peak load delta by zone
      - ❖ BTM Solar peak load deltas represent estimated peak load impact of BTM solar penetration

BTM Solar Peak Load Delta (MW)												
Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
2024	139	169	280	20	188	235	205	31	35	140	278	1,720

  - Subject to existing LFU multipliers

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Treatment on Resource Side

- **On the resource side, BTM solar would be modeled with the following generic characteristics:**
  - Modeled as Demand Side Management (DSM) units with hourly profiles ("BTM solar units")
  - MW will be aggregated to one BTM solar unit per zone
  - The NYISO's BTM solar data would be utilized to develop the hourly profiles for BTM solar units. Inputs include:
    - BTM solar PV Annual Energy Reduction (Gold Book Baseline Forecast Table I-9b)
    - Representative hourly values of BTM solar by zone (energy normalized)
      - To be multiplied by the Gold Book Table I-9b for hourly production in MW for the projected year
- **The NYISO explored two different approaches for modeling the BTM solar units**
  - Modeling the BTM solar units using the past 5 years of hourly profiles and let MARS randomly select the profile during the simulation
  - Modeling the BTM solar units using the hourly profiles that are aligned with the load shapes for each LFU bins

Modeling Option 1: Random Selection of Solar Production Shapes

- **BTM solar units would be modeled using the most recent 5 years of historical hourly production shapes**
  - 2018 – 2022 shapes used for the impact assessment presented herein
    For 2025-2026 IRM study, 2019 – 2023 shapes would be used
  - One of the historical shapes is chosen randomly for each replication during the MARS simulations
    - The selection will be consistent with the selection of the other DSM resources

- **Pros**
  - Probabilistic study approach
    - Aligns with NYISO Reliability Needs Assessment (RNA) study modeling method
  - Provides a representation for the variability of solar production
  - Consistent with existing renewable resources' modeling in the IRM study

- **Cons**
  - May result in a less accurate representation of load and weather correlation
    - High load days during summer should correlate to higher solar production
  - May overstate the variability of solar production
  - Selected solar shapes are applied to all LFU bins
    - Consistent with all DSM shape selection

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Modeling Option 2: Aligning BTM Solar Shapes to Load Shapes

- **BTM solar units are modeled using 2013, 2017, and 2018 historical production shapes**
  - Solar shapes are aligned with the load shapes without random selection
    - e.g., the 2013 BTM solar shapes will be applied only the LFU Bin 1 and 2, where the 2013 load shape is applied
- **Solar production shapes are subject to LFU multipliers**
- **Pros**
  - Consistent with the current IRM study modeling construct
    - The current IRM study uses BTM solar embedded in load shapes
  - May provide more accurate representation of load and weather correlation
- **Cons**
  - May be less representative of the variability of solar production
    - Removing the randomness in the Monte-Carlo simulation

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Impact Assessment

Impact on 2024-2025 IRM FBC (Tan45)

	IRM	J LCR	K LCR	G-J LCR
2024-2025 FBC	23.10%	72.73%	103.21%	84.58%
Option 1: Random Selection	26.32% (▲3.22)	73.82% (▲1.09)	106.15% (▲2.94)	85.38% (▲0.80)
Option 2: Aligning Solar	24.93% (▲1.83)	73.25% (▲0.52)	104.96% (▲1.75)	84.96% (▲0.38)

- **Random selection of solar shapes increases the IRM by ~3.2%**
- **Aligning solar shapes to load increases the IRM by ~1.8%**
- **With either treatment, IRM increases more than the locational capacity requirements (LCRs)**
  - Zones A-F has significantly more BTM solar available compared to Zone J, Zone K, and the G-J Locality
- **Zone K LCR increases by similar margin to IRM, while the Zone J LCR increases moderately**
  - There is twice as much BTM solar available in Zone K compared to Zone J

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Impact on 22% IRM + Respecting TSL Floor Values

	IRM	J LCR	K LCR	G-J LCR
2024-2025 Approved IRM + LCRs	22.00%	81.70%	105.30%	81.00%
Option 1: Random Selection	26.48% (▲4.48)	81.70%	105.30%	81.00%
Option 2: Aligning Solar	24.50% (▲2.50)	81.70%	105.30%	81.00%

- **Using the LCR optimizer, the LCRs are locked at the applicable transmission security limit (TSL) floor values and solved for IRM**
- **Both test cases are at 0.089 loss of load expectation (LOLE)**
- **The IRM movements are greater than the Tan45 results**
  - Random selection of solar shapes increases the IRM by ~4.5%
  - Aligning solar shapes to load increases the IRM by ~2.5%
  - Tan45 cases have greater LCRs for Zone K and G-J Locality
    - Excess capacity from the lowered Zone K and G-J Locality LCRs negates the increased Zone J LCR

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Hourly LOLE Distribution (Tan45)

	HB00	HB01	HB02	HB03	HB04	HB05	HB06	HB07	HB08	HB09	HB10	HB11	HB12	HB13	HB14	HB15	HB16	HB17	HB18	HB19	HB20	HB21	HB22	HB23
2024-25 FBC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	6%	7%	13%	20%	21%	12%	6%	7%	4%	0%	0%
Random Selection	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	7%	8%	13%	23%	28%	11%	3%	2%	1%	0%	0%
Aligned Solar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	5%	6%	11%	22%	29%	13%	5%	4%	2%	0%	0%

- Both methodologies of separating BTM solar from load shapes constrict the high-risk hours
- Random selection reduces the risks during later in the day (HB18 – HB21)
- Aligning solar shapes to load reduces the early hour risks (HB11 – HB15)

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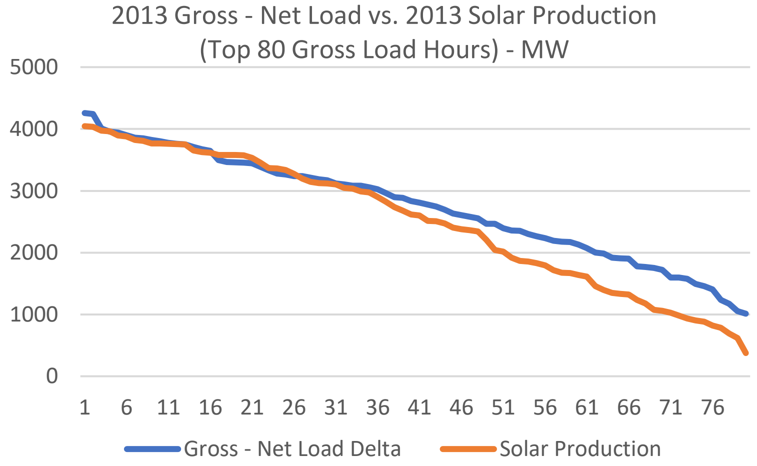
Key Takeaways

- **With either methodology, separating BTM solar from load increases the IRM and LCRs significantly**
  - 2 – 3% increase in IRM is expected (based on Tan45 results)
  - The increase in IRM is greater than the increase in LCRs due to less BTM solar in Zones J and K compared to Zones A-F
    - The Zone K LCR increases in greater margin than the Zone J LCR due to the higher amount of BTM solar in Zone K

- **To investigate the magnitude of the modeling impact, the NYISO reviewed the top 80 gross load hours for 2013. Delta between gross and net load exceeds the modeled solar production by ~20 GWh**
  - 2013 shapes are underlying load shapes for LFU Bin 1 and 2
  - Based on the peak-adjusted pre-LFU load shapes
  - High impact on IRM and LCRs are likely attributed to the greater load increase than the modeled BTM solar production



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Next Steps

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- The NYISO will continue to explore the BTM solar modeling methodology and bring subsequent impact assessment results for ICS review
- The NYISO will continue working with ICS towards a recommendation for the BTM solar modeling methodology to be used in the 2025-2026 IRM study over the next few months

- Future work:
  - Consider future improvement on load shape adjustment procedure

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Questions?

Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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