

2020-2021 NYCA IRM Requirement Study

Preliminary Base Case (PBC) Model Assumptions

Assumption Matrix

Draft V 1.23

May 13 June 26, 2019

Load Parameters

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|--|---|---|---|--------------|--|
| 1 | Peak Load Forecast (Preliminary Base Case – Parametric & Sensitivities) | 2018 Gold Book NYCA: 32,857MW NYC: 11,474 MW LI: 5,323 MW G-J: 15,815 MW | 2019 Gold Book NYCA: 32,202MW ¹ NYC: 11,651 MW LI: 5,134 MW G-J: 15,911 MW | Most recent Gold Book Forecast is used for Preliminary Base Case parametric study and sensitivity cases | | |
| 2 | Peak Load Forecast (Final Base Case) | October 2018 Fcst. NYCA: 32,488 MW NYC: 11,585 MW LI: 5,346 MW G-J: 15,831 MW | October 2019 Fcst. NYCA: xxxxxMW NYC: yyyyy MW LI: zzzz MW G-J: rrrrr MW | Forecast based on examination of 2019 weather normalized peaks. Top three external Area peak days aligned with NYCA | | |
| 3 | Load Shape (Multiple Load Shape) | Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007 | Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007 | ICS Recommendation remains unchanged after NYISO review presentations of 4/3 and 5/1 | | |
| 4 | Load Forecast Uncertainty (LFU)- Summer | Zonal Model to reflect current data with input from Con Ed and LIPA. (Attachment A) | Zonal Model to reflect current data with input from Con Ed and LIPA. (Attachment A) ² | Based on TO and NYISO data and analyses. | <u>Y</u> | <u>TBD upon review of updated LFU values</u> |
| 5 | LFU Winter | No update | Updated See (Attachment A1) | Existing Winter LFU may no longer be representative. | | |

*(-) indicates a reduction in IRM while (+) indicates an increase. Range: Low < 0.5%, Medium 0.5% - 1%, High > 1%, Minimal indicates there may be some movement but within 0 to +/- 0.1%.

¹ The loads associated with the BTM-NG program need to be added to these values, see attachment B-4.

² The 2020 PBC will use the 2019 LFU model. LFU updates are expected for the 2020 FBC.

Generation Parameters

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|--|--|--|--|--------------|------------------|
| 1 | Existing Generating Unit Capacities | 2018 Gold Book values. Use min (DMNC vs. CRIS) capacity value | 2019 Gold Book values. Use min (DMNC vs. CRIS) capacity value | Latest Gold Book publication | | |
| 2 | Proposed New Units (Non-Renewable) and re-ratings | MW 11.1 MW of new non- wind resources, plus 209.3 MW of project related re-ratings. (Attachment B1) | MW <u>1099</u> MW of new non- wind resources, plus <u>0</u> MW of project related re-ratings. (Attachment B1) | Latest Gold Book publication, NYISO interconnection queue, and generator notifications | | |
| 3 | Retirements, Mothballed units, and ICAP ineligible units | 0 MW of retirements, 399.2 MW of unit deactivations, and 389.4 MW of IIFO and IR (Attachment B2) | <u>0</u> MW of retirements, <u>1023.4</u> MW of unit deactivations, and <u>0</u> MW of IIFO and IR ³ (Attachment B2) | Latest Gold Book publication and generator notifications | | |
| 4 | Forced and Partial Outage Rates | Five-year (2013-2017) GADS data for each unit represented. Those units with less than five years – use representative data. (Attachment C) | Five-year (2014-2018) GADS data for each unit represented. Those units with less than five years – use representative data. (Attachment C) | Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period | | |
| 5 | Planned Outages | Based on schedules received by the NYISO and adjusted for history | Based on schedules received by the NYISO and adjusted for history | Updated schedules | | |

³ ICAP Ineligible Forced Outage (IIFO) and inactive Reserve (IR)

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|----|--------------------------------------|---|---|---|--------------|------------------|
| 6 | Summer Maintenance | Nominal 50 MWs – divided equally between zones J and K | Nominal iii ⁴ MWs – divided equally between zones J and K | Review of most recent data | | |
| 7 | Combustion Turbine Derates | Derate based on temperature correction curves provided | Derate based on temperature correction curves provided | Operational history indicates the derates are in-line with manufacturer's curves | | |
| 8 | Existing and Proposed New Wind Units | 158.3 MW of Wind Capacity additions totaling 1891.7 MW of qualifying wind (Attachment B3) | <u>78.4</u> MW of Wind Capacity additions totaling <u>1891.7</u> MW of qualifying wind (Attachment B3) | ICAP units based on RPS agreements, interconnection queue, and ICS input. | | |
| 9 | Wind Shape | Actual hourly plant output over the period 2013-2017. New units will use zonal hourly averages or nearby units. | Actual hourly plant output over the period 2014-2018. New units will use zonal hourly averages or nearby units. | Program randomly selects a wind shape of hourly production from the most recent five-year period for each model iteration. | | |
| 10 | Solar Resources (Grid connected) | Total of 31.5 MW of qualifying Solar Capacity. (Attachment B3) | Total of <u>51.5</u> MW of qualifying Solar Capacity. (Attachment B3) | <u>New 20 MW solar resource.</u> ICAP Resources connected to Bulk Electric System | | |
| 11 | Solar Shape | Actual hourly plant output over the period 2013-2017. New units will use zonal hourly averages or nearby units. | Actual hourly plant output over the period 2014-2018. New units will use zonal hourly averages or nearby units. | Program randomly selects a solar shape of hourly production from the most recent five-year period for each model iteration. | | |

⁴ Summer Maintenance data will become available in early July and be used in the PBC

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|----|------------------------------------|---|---|--|--------------|------------------|
| 12 | BTM- NG Program | Addition of Greenidge 4 to BTM NG program. 104.3 MW unit. Forecast load adjustment of 11.6 MW (Attachment B4) | <u>No new BTM NG resources</u> (Attachment B4) | Both the generation of the participating resources and the full host loads are modeled. | | |
| 13 | Small Hydro Resources | Actual hourly plant output over the period 2013-2017. | Actual hourly plant output over the period 2014-2018. | Program randomly selects a Hydro shape of hourly production from the most recent five-year period for each model iteration. | | |
| 14 | Large Hydro | Probabilistic Model based on 5 years of GADS data (2013-2017) | Probabilistic Model based on 5 years of GADS data (2014-2018) | Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period | | |
| 15 | Land Fill Gas | Actual hourly plant output over the period 2013-2017. | Actual hourly plant output over the period 2014-2018. | Program randomly selects a LFG shape of hourly production from the most recent five-year period for each model iteration. | | |
| 16 | New ESR (Energy Storage Resources) | None Modeled | 10 MW of battery storage scheduled (see attachment B3) | Sensitivities on simplified model and GE software enhancement | <u>Y</u> | <u>Minimal</u> |

Transactions – Imports and Exports

| | # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|--|---|--|--|--|--|--------------|------------------|
| | 1 | Capacity Purchases | Existing Rights: PJM – 1080 MW HQ – 1110 MW All contracts model as equivalent contracts | Existing Rights: PJM – 1080 MW HQ – 1110 MW All contracts model as equivalent contracts | Grandfathered Rights, ETCNL, and other awarded long-term rights. | | |
| | 2 | Capacity Sales | Long Term firm sales Summer 279.3 MW | Long Term firm sales Summer 281.1 MW | These are long term federal contracts. | | |
| | 3 | FCM Sales from a Locality ⁵ | No Sales modeled within study period | No Sales modeled within study period | White Paper, NYISO recommendation, and ICS discussions | | |
| | 4 | Wheels through NYCA | None Modeled | 300 MW HQ to NE equivalent contract | ICS developed model | y | |
| | 5 | New UDRs (Unforced capacity Deliverability Rights) | No new UDR projects | No new UDR projects | Existing UDR elections are made by August 1 st and will be incorporated into the model. | | |
| | 6 | New EDRs (External Deliverability Rights) | None | 0 MWs for 2020 Study | 80 MW scheduled for 2021 Study. Sensitivity to be performed. | | |

⁵ Final FCM sales that will materialize are unknowable at the time of the IRM study. To reflect the impact these sales have on reliability, the NYISO applies a Locality Exchange Factor in the market.

Topology

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|------------------------------|--|--|---|--------------|------------------|
| 1 | Interface Limits | Update provided to TPAS with updated VFT return path. B and C lines out of service for base case. Par 33 from Ontario out of service. (Attachment E) | (Attachment E) | Based on the most recent NYISO studies and processes, such as Operating Study, Operations Engineering Voltage Studies, Comprehensive System Planning Process, and additional analysis including interregional planning initiatives. | | |
| 2 | New Transmission | None Identified | None Identified | Based on TO provided models and NYISO's review. | | |
| 3 | AC Cable Forced Outage Rates | All existing Cable EFORs will be updated for NYC and LI to reflect most recent five-year history (2013-2017) | All existing Cable EFORs for NYC and LI to reflect most recent five-year history (2014-2018) | TO provided transition rates with NYISO review. | | |
| 4 | UDR Line Unavailability | Five year history of forced outages (2013-2017) | Five year history of forced outages (2014-2018) | NYISO/TO review. | | |

Emergency Operating Procedures

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|------------------------|--|---|--|--------------|------------------|
| 1 | Special Case Resources | July 2018 –1309 MW based on registrations and modeled as 903 MW of effective capacity. Monthly variation based on historical experience* | July 2019 –kkkk ⁶ MW based on registrations and modeled as mmm MW of effective capacity. Monthly variation based on historical experience* | SCRs sold for the program discounted to historic availability. Summer values calculated from July 2019 registrations. Performance calculation updated per ICS presentations on SCR performance. (Attachment F) | | |
| 2 | Other EOPs | 713.4 MW of non-SCR/non-EDRP resources (Attachment D) | nnn ⁷ MW of non-SCR/non-EDRP resources (Attachment D) | Based on TO information, measured data, and NYISO forecasts. | | |
| 3 | EOP Structure | 10 EOP Steps Modeled | 12 EOP Steps Modeled | Add one to separate EA from 10 min reserve. Add 2 nd as placeholder for Policy 5, Appendix C | | |

* The number of SCR calls is limited to 5/month when calculating LOLE based on all 8,760 hours.

⁶ SCR data will become available in early July and be used in the PBC

⁷ Voltage test data will become available in early July and be used in the PBC

External Control Areas

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|----------------------|--|--|--|--------------|--|
| 1 | PJM | Load and Capacity data provided by PJM/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 (Attachment E) | Load and Capacity data provided by PJM/NPCC CP-8 Data adjusted per NYSRC Policy 5 (Attachment E) | Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes. | <u>Y</u> | <u>Discussed within Externals Whitepaper</u> |
| 2 | ISONE, Quebec, IESO | Load and Capacity data provided by ISONE/NPCC CP-8 Data may be adjusted per NYSRC Policy 5 (Attachment E) | Load and Capacity data provided by ISONE/NPCC CP-8 Data adjusted per NYSRC Policy 5 (Attachment E) | Initial review performed by the NPCC CP-8 WG prior to Policy 5 changes. | <u>Y</u> | <u>Discussed within Externals Whitepaper</u> |
| 5 | Reserve Sharing | All NPCC Control Areas indicate that they will initially share reserves equally among all members and then among non-members | All NPCC Control Areas indicate that they will initially share reserves equally among all members and then among non-members | Per NPCC CP-8 WG. | | |
| 6 | Emergency Assistance | Statewide Limit of 3,500 MW of emergency assistance allowed from neighbors. | Statewide Limit of 3,500 MW of emergency assistance allowed from neighbors. | White paper on Modelling of Emergency Assistance for NYCA in IRM studies | | |

Miscellaneous

| # | Parameter | 2019 Model Assumptions | 2020 Model Assumptions | Basis for Recommendation | Model Change | Est. IRM Impact* |
|---|---------------------------|--|---|---|--------------|------------------|
| 1 | MARS Model Version | Version 3.22.6 | Version 3.22.6 | <u>NYISO Vetting of new version 3.23.460 is ongoing</u> | | |
| 2 | Environmental Initiatives | No estimated impacts based on review of existing rules and retirement trends | Proposed rules would not take effect until after the summer of 2020 | Review of existing regulations and rules. | | |

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Attachment A

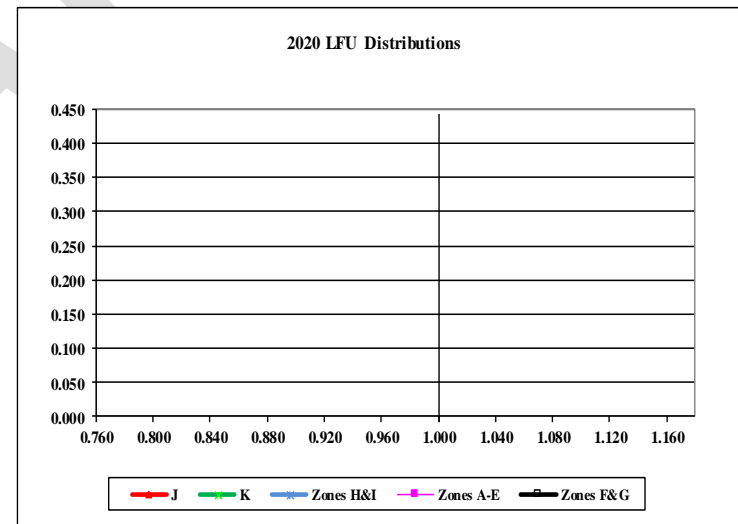
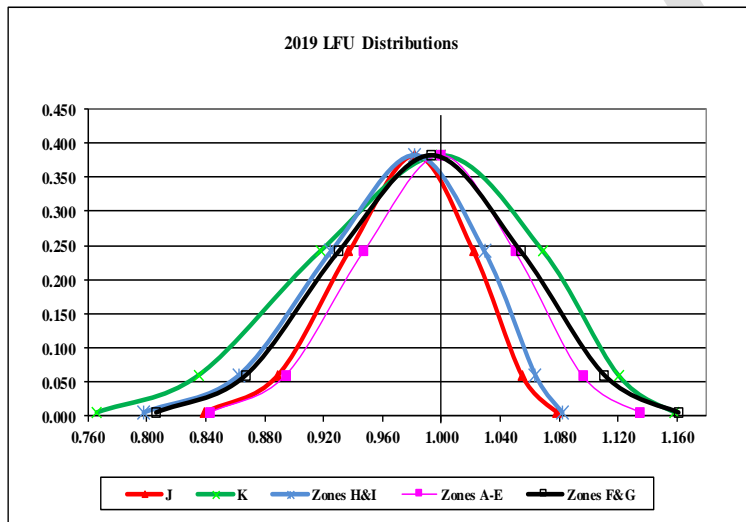
NYCA Summer Load Forecast Uncertainty Model

2019 and 2020 Summer LFU Models

2019 Model is Unchanged from 2018- tbd

| <u>2019 Load Forecast Uncertainty Models</u> | | | | | | |
|--|------------|-----------|-----------|-----------|------------|----------|
| Step | Multiplier | Zones A-E | Zones F&G | Zones H&I | Con Ed (J) | LIPA (K) |
| 1 | 0.0062 | 0.8431 | 0.8067 | 0.7978 | 0.8388 | 0.7659 |
| 2 | 0.0606 | 0.8944 | 0.8674 | 0.8624 | 0.8887 | 0.8351 |
| 3 | 0.2417 | 0.9474 | 0.9303 | 0.9249 | 0.9371 | 0.9175 |
| 4 | 0.3830 | 1.0000 | 0.9933 | 0.9817 | 0.9821 | 1.0000 |
| 5 | 0.2417 | 1.0502 | 1.0541 | 1.0293 | 1.0219 | 1.0695 |
| 6 | 0.0606 | 1.0959 | 1.1107 | 1.0639 | 1.0547 | 1.1206 |
| 7 | 0.0062 | 1.1351 | 1.1608 | 1.0822 | 1.0786 | 1.1586 |

| <u>2020 Load Forecast Uncertainty Models</u> | | | | | | |
|--|------------|-----------|-----------|-----------|------------|----------|
| Step | Multiplier | Zones A-E | Zones F&G | Zones H&I | Con Ed (J) | LIPA (K) |
| 1 | 0.0062 | | | | | |
| 2 | 0.0606 | | | | | |
| 3 | 0.2417 | | | | | |
| 4 | 0.3830 | | | | | |
| 5 | 0.2417 | | | | | |
| 6 | 0.0606 | | | | | |
| 7 | 0.0062 | | | | | |



Attachment A1

NYCA Winter Load Forecast Uncertainty Model

Previous and 2020 Winter LFU Models

2019 Model is Unchanged from 2018- tbd

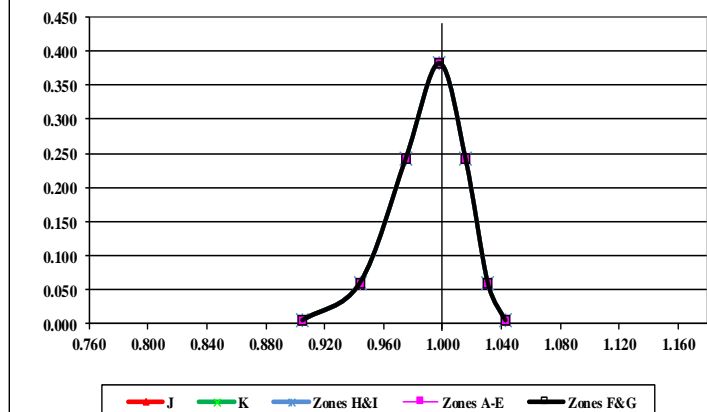
Previous Winter Load Forecast Uncertainty Models

| Step | Multiplier | Zones A-E | Zones F&G | Zones H&I | Con Ed (J) | LIPA (K) |
|------|------------|-----------|-----------|-----------|------------|----------|
| 1 | 0.0062 | 0.9050 | 0.9050 | 0.9050 | 0.9050 | 0.9050 |
| 2 | 0.0606 | 0.9440 | 0.9440 | 0.9440 | 0.9440 | 0.9440 |
| 3 | 0.2417 | 0.9750 | 0.9750 | 0.9750 | 0.9750 | 0.9750 |
| 4 | 0.3830 | 0.9980 | 0.9980 | 0.9980 | 0.9980 | 0.9980 |
| 5 | 0.2417 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 |
| 6 | 0.0606 | 1.0310 | 1.0310 | 1.0310 | 1.0310 | 1.0310 |
| 7 | 0.0062 | 1.0430 | 1.0430 | 1.0430 | 1.0430 | 1.0430 |

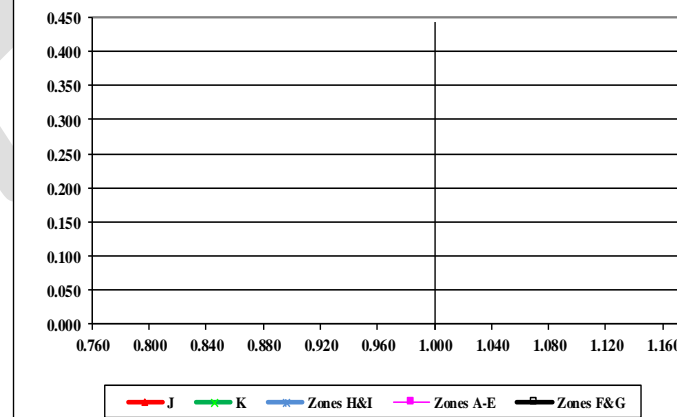
2020 Winter Load Forecast Uncertainty Models

| Step | Multiplier | Zones A-E | Zones F&G | Zones H&I | Con Ed (J) | LIPA (K) |
|------|------------|-----------|-----------|-----------|------------|----------|
| 1 | 0.0062 | | | | | |
| 2 | 0.0606 | | | | | |
| 3 | 0.2417 | | | | | |
| 4 | 0.3830 | | | | | |
| 5 | 0.2417 | | | | | |
| 6 | 0.0606 | | | | | |
| 7 | 0.0062 | | | | | |

Previous Winter LFU Distributions



2020 Winter LFU Distributions



Attachment B1

New Non-Intermittent Units and Unit Re-ratings⁸

| B1 - Proposed Non-Intermittant Units and Unit Re-ratings (summer ratings) | | | | | |
|---|------|----------------------|---------------------|-------------------------|----------------------|
| Project or Generator Name | Zone | 2019 MARS Model (MW) | 2019 Gold Book (MW) | New or Incremental (MW) | 2020 MARS Model (MW) |
| New Units | | | | | |
| Cricket Valley Energy Center, LLC | G | 0 | 1,020.0 | 1,020.0 | 1,020.0 |
| AEP-Ogdensburg | E | 0 | 79.0 | 79.0 | 79.0 |
| | | | | | |
| Total New Units | | 0 | 1,099.0 | 1,099.0 | 1,099.0 |

⁸ Unit re-ratings are for generation facilities that have undergone uprate projects.

Attachment B2

Retiring and Ineligible Generating Units

| Attachment B2 -Announced Unit Retirements, Deactivations, and ICAP Ineligible Forced Outage (IIFO) since 2019 IRM Study | | | |
|--|-------------|------------------|--|
| Generator Name | Zone | CRIS (MW) | CRIS adusted value from 2019 Gold Book (MW) |
| <i>Retirements</i> | | 0.0 | 0.0 |
| Monroe Livingston | B | 2.4 | 2.4 |
| Steuben County LF | C | 3.2 | 3.2 |
| Auburn - State St. | C | 5.8 | 1.7 |
| Indian Point 2 | H | 1026.5 | 1016.1 |
| <i>Deactivations</i> | | 0.0 | 1023.4 |
| HUDSON AVE_GT_4 | J | <u>13.9</u> | <u>0.0</u> |
| <i>ICAP Ineligible*</i> | | 13.9 | 0.0 |
| Total Removals | | 13.9 | 1023.4 |

Attachment B3

New Intermittent⁹ Resources

| B3 - New Intermittent Resources | | | | |
|--|-------------|------------------|-------------------------------|--|
| Resource | Zone | CRIS (MW) | Summer Capability (MW) | CRIS adusted value from 2019 Gold Book (MW) |
| New Wind Units | | | | |
| Arkwright Summit Wind Farm | A | 78.4 | 78.4 | 78.4 |
| Total New Wind | | | | 78.4 |
| New (bulk power) Solar Units | | | | |
| Riverhead Solar Farm, LLC | K | 20.0 | 20.0 | 20.0 |
| Total New Solar | | | | 20.0 |
| Other Intermittent | | | | |
| East Hampton Battery Storage | K | 5.0 | 5.0 | 5.0 |
| Montauk Batter Storage | K | 5.0 | 5.0 | 5.0 |
| Total New Other | | | | 10.0 |
| Total New Intermittent | | | | 108.4 |

⁹ Resources appearing in assumptions matrix tables are indexed from the 2019 Gold Book- table III-2

Attachment B4

Resources in the Behind the Meter Net Generation Program (BTM-NG)

| Attachment B4 -Units in the Behind the Meter Net Generation Program* | | | |
|---|-------------|--|--|
| Generator Name | Zone | Resource Value (MW)¹ | Peak Load Adjustment (MW)² |
| Existing: | | | |
| Stonybrook | K | 39.8 | 38.9 |
| Greenidge 4 ³ | C | 104.3 | 11.6 |
| Total BTM Gen | | 144.1 | 50.5 |

* The IRM study independently models the generation and load components of BTM:NG Resources

1. Based on adjusted DMGC value
2. Based on ACHL.
3. Greenidge values will be updated for FBC

Attachment C

NYCA Five Year Derating Factors

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Attachment D

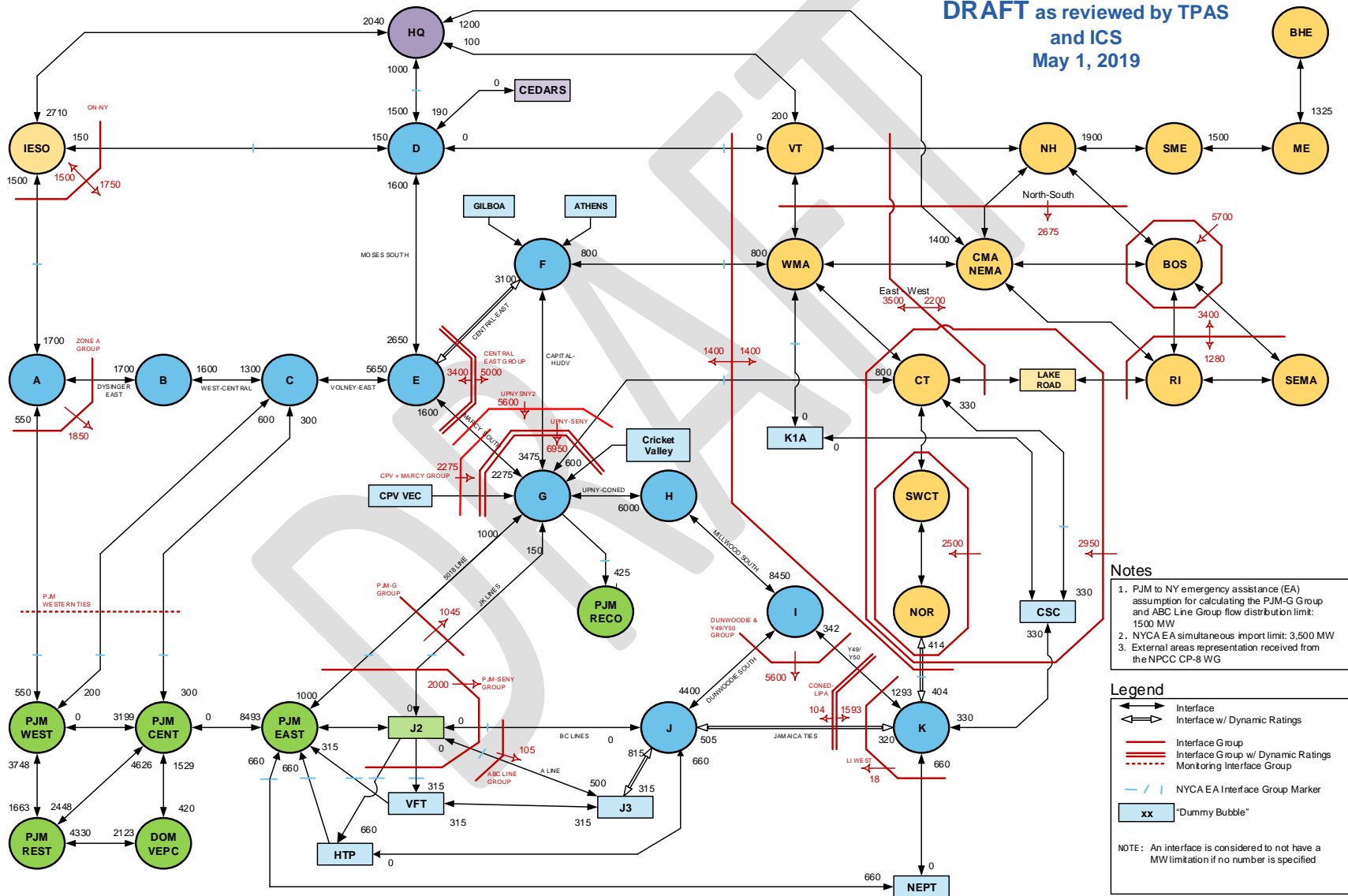
Emergency Operating Procedures

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Attachment E - IRM Topology

2020 IRM Topology (Summer Limits)

DRAFT as reviewed by TPAS
and ICS
May 1, 2019



- Notes**
1. PJM to NY emergency assistance (EA) assumption for calculating the PJM-G Group and ABC Line Group flow distribution limit: 1500 MW
 2. NYCA EA simultaneous import limit: 3,500 MW
 3. External areas representation received from the NPCC CP-8 WG

Legend

- ↔ Interface
- ↔↔ Interface w/ Dynamic Ratings
- ▬ Interface Group
- ▬▬ Interface Group w/ Dynamic Ratings
- ▬▬▬ Monitoring Interface Group
- - - - NYCA EA Interface Group Marker
- xx "Dummy Bubble"

NOTE: An interface is considered to not have a MW limitation if no number is specified

Attachment F

SCR Determinations

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Assumption Matrix History

| Date | Ver | Preliminary Base Case | Date | Ver | Final Base Case |
|----------------|-------------|---|------|-----|-----------------|
| 1/29/19 | V0.0 | Preliminary assumptions without attachments. | | | |
| 4/3/19 | V0.1 | Adds winter LFU update, removes EDRP in model- | | | |
| 4/30/19 | V1.0 | Added GB forecast, added attachments A-B4,E. Added row for energy storage resources | | | |
| 5/1/19 | V1.2 | Updated tables B1 through B4 per ICS meeting. Updates on pages 2, 5, 6, 7 (mostly clerical) | | | |
| <u>6/26/19</u> | <u>V1.3</u> | <u>Filled out summary table (clerical)</u> | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |