

# **2019 Congestion Assessment and Resource Integration Study**

## **Comprehensive System Planning Process**

### **CARIS - Phase 1**

### **Appendices B-M**

**A Report by the  
New York Independent System Operator**

June 2020

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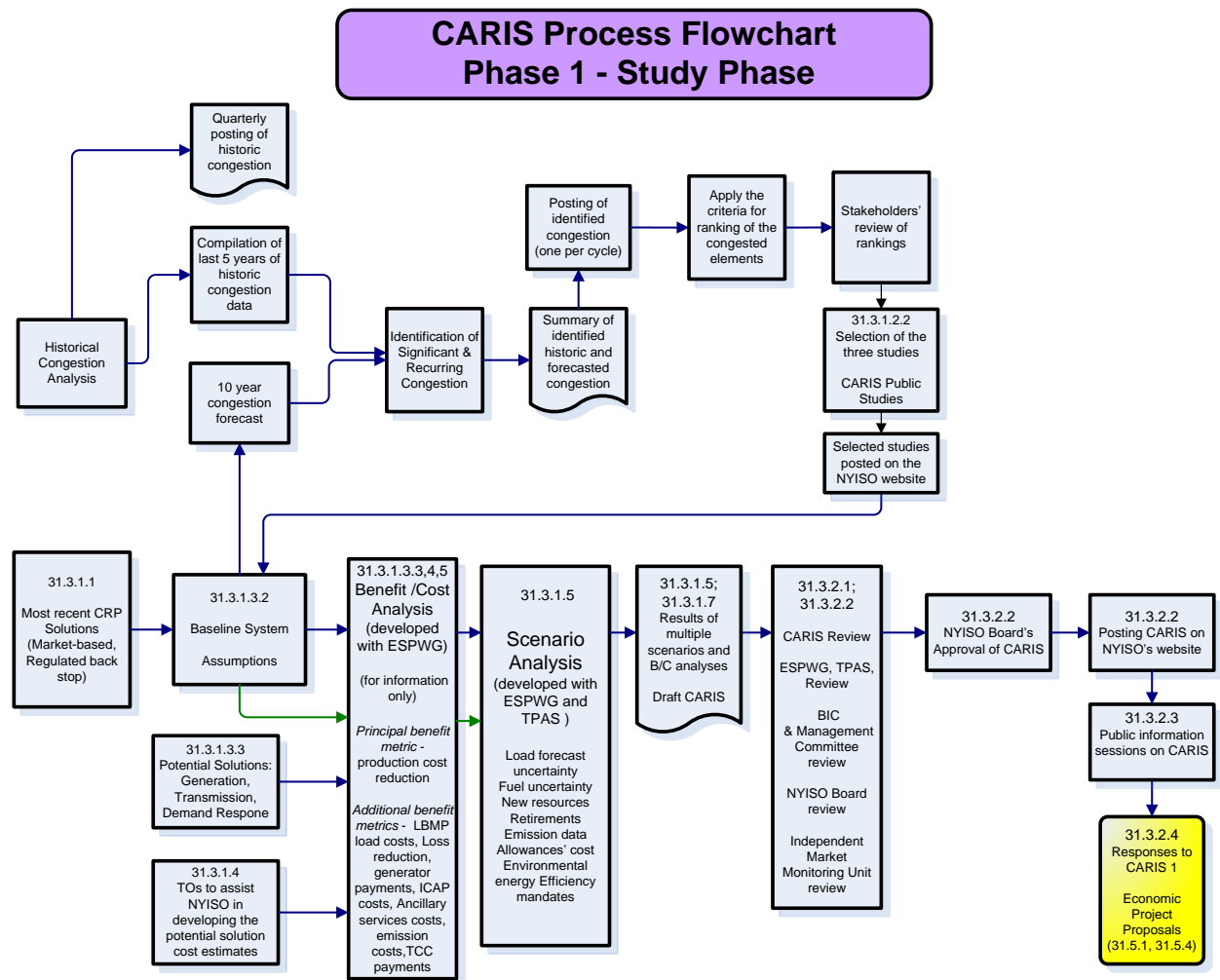
# Appendix B - Congestion Assessment and Resource Integration Study Process

CARIS consists of two phases: Phase 1 (the Study Phase) and Phase 2 (the Project Phase). This two-phase process is described below and explained in full detail in the *Economic Planning Process Manual - Congestion Assessment and Resource Integration Studies Manual*.<sup>1</sup>

## Phase 1 - Study Process

Phase 1 of the CARIS is depicted in Figure 1.

**Figure 1: Phase 1 or Study Phase of the CARIS Process**



<sup>1</sup>[https://www.nyiso.com/documents/20142/2924447/epp\\_caris\\_mnl.pdf/6510ece7-e0a6-7bee-e776-694abf264bae](https://www.nyiso.com/documents/20142/2924447/epp_caris_mnl.pdf/6510ece7-e0a6-7bee-e776-694abf264bae)

## Phase 2 - Projects Phase

Phase 2 of the CARIS is depicted in Figure 2 and Figure 3.

**Figure 2: Phase 2 or Project Phase of the CARIS Process**

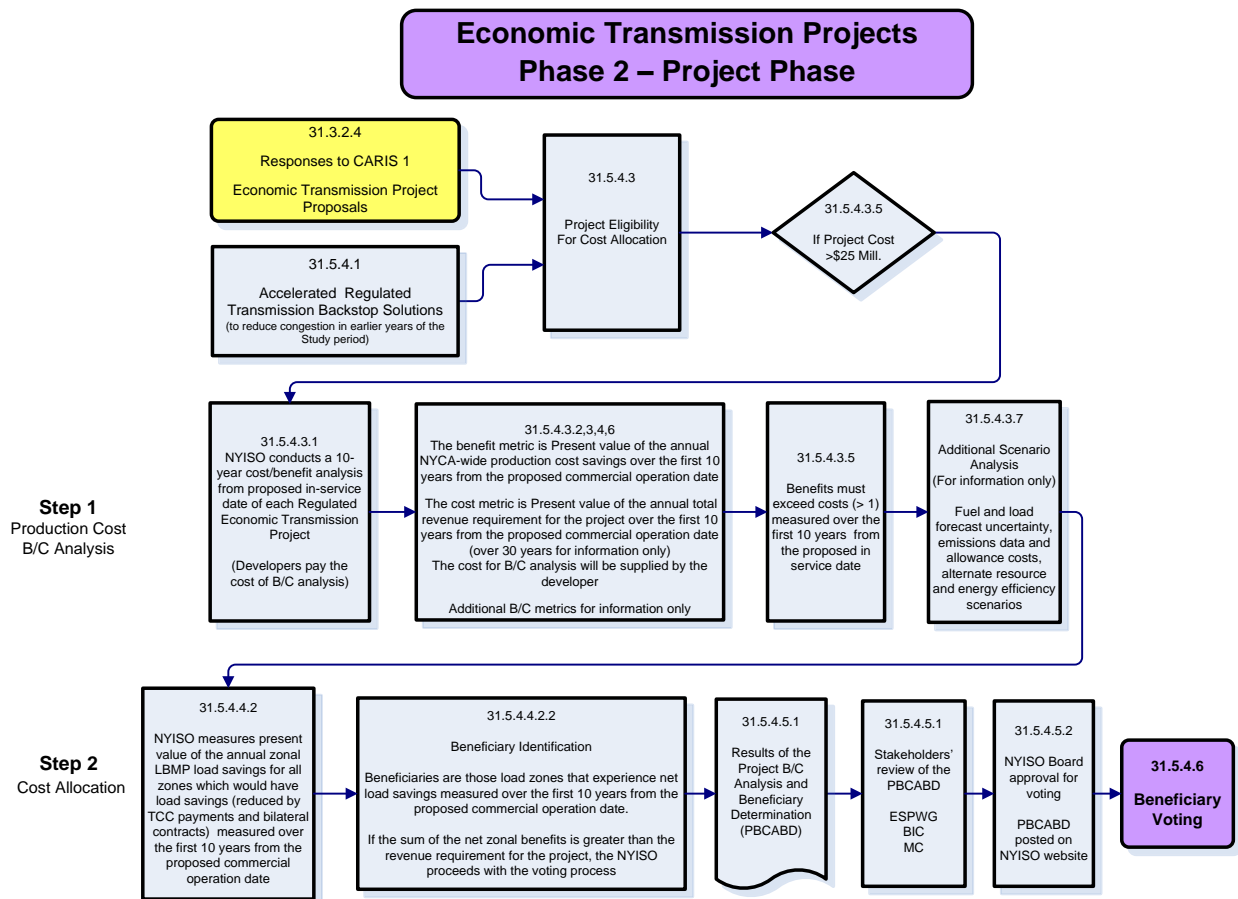
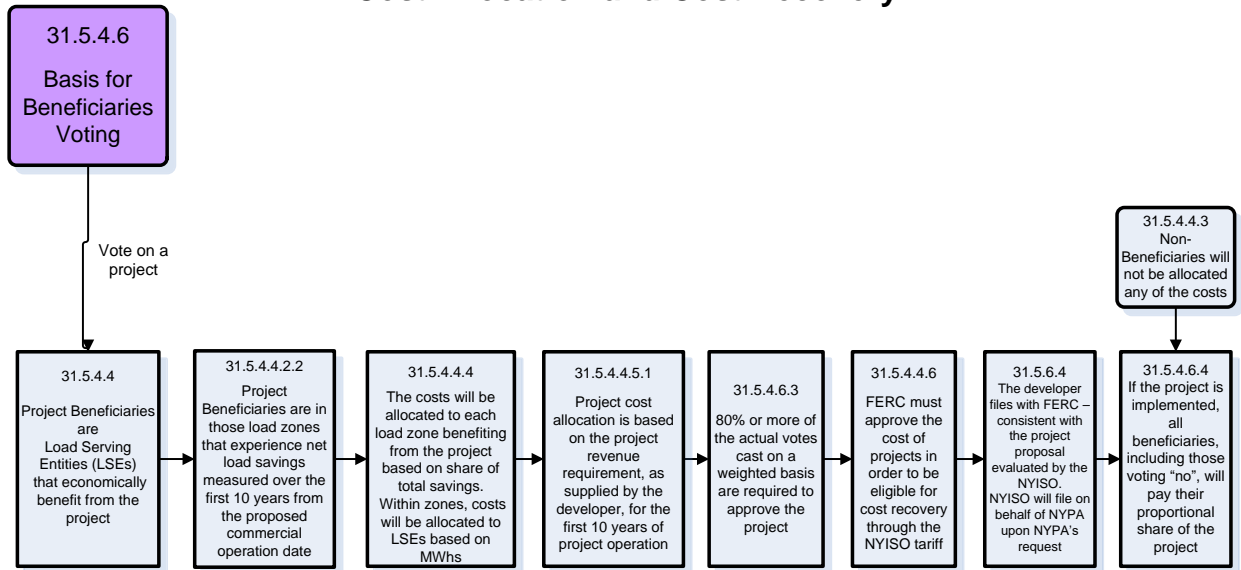




Figure 3: Voting, Cost Allocation, and Cost Recovery of the CARIS Process

### Economic Project Beneficiaries Voting, Cost Allocation and Cost Recovery



## Appendix C - Base Case System Assumptions and Methodology

### CARIS Model - Base Case Modeling Assumptions for 2019-2028

As described in Section 31.3.1 of Attachment Y, the CARIS will align with the Reliability Planning Process, and the ten-year Study Period covered by the most recently approved CRP shall be the same as the CARIS Phase 1 Study Period. The CARIS will assume a reliable system throughout the Study Period, based first upon the solutions identified in the most recently completed and approved CRP.

The data utilized in the base case simulations for 2019 CARIS Phase 1 is largely derived from the 2019-28 CRP, 2019 Gold Book and CARIS Assumptions Matrix, Figure 4, shown below. Major components of the data include base load flow data, unit heat rates, unit capacities, fuel prices, transmission constraint modeling, load forecasts, load shape, both simulated and actual and scheduled interchange values, O&M cost, and emission costs.

Detailed descriptions of key data used in the 2019 CARIS are listed below. The data was developed based on the NYISO’s Tariff requirements and procedures and in collaboration with stakeholders at ESPWG. Key changes from 2017 are noted in red.

**Figure 4: 2017 and 2019 CARIS Base Case Assumptions Matrix Comparison**

| Parameter   | Modeling for 2017 CARIS Base Case   | Modeling for 2019 CARIS Base Case   |
|---|---|---|
| <b>Peak Load</b>                                  | Based on 2017 Load & Capacity Data Report (“Gold Book”) Baseline Forecast of Non-Coincident Peak Demand , including impacts of statewide Energy Efficiency programs (Table 1-2b-1)                  | Based on <b>2019 Load &amp; Capacity Data Report (“Gold Book”)</b> Baseline Forecast of Non-Coincident Peak Demand , including impacts of statewide Energy Efficiency programs (Table 1-3a and 1-3b)          |
| <b>Load Shape Model</b><br><b>Energy Forecast</b> | 2002 Load Shape. Energy Forecast based on 2017 Load & Capacity Data Report (“Gold Book”) Baseline Forecast of Annual Energy, including impacts of statewide Energy Efficiency programs (Table 1-2a) | 2002 Load Shape. Energy Forecast based on <b>2019 Load &amp; Capacity Data Report (“Gold Book”)</b> Baseline Forecast of Annual Energy, including impacts of statewide Energy Efficiency programs (Table 1-2) |
| <b>Load Uncertainty Model</b>                     | Only Base Level Forecast utilized; the impact of energy or peak forecasts may be utilized in scenarios  | Only Base Level Forecast utilized; the impact of energy or peak forecasts may be utilized in scenarios  |

| Parameter   | Modeling for 2017 CARIS Base Case  | Modeling for 2019 CARIS Base Case  |
|---|--|--|
| <b>Generating Unit Capacities</b>                       | Updated to reflect 2017 Gold Book winter and summer DMNC values  | Updated to reflect <b>2019 Gold Book</b> winter and summer DMNC values   |
| <b>New Units</b>  | Updated as per 2017 Gold Book (Application of inclusion rules identified in Reliability Planning Process Manual, Section 3.1.1 and procedures)procedures)  | Updated as per <b>2019 Gold Book</b> (Application of inclusion rules identified in Reliability Planning Process Manual, Section 3.2 and procedures)  |
| <b>Wind Resource Modeling</b>                           | Units and capacities updated as per 2017 Gold Book. Existing wind resources are modeled based on unit capacities and actual 2015 shapes. New units modeled based on proximate existing units.  | Units and capacities updated as per <b>2019 Gold Book</b> . Existing wind resources are modeled based on unit capacities and actual <b>2017 shapes</b> . New units modeled based on proximate existing units.  |
| <b>Solar BTM-PV Resource Modeling</b>                   | Modeled as distributed hourly resource modifiers. Zonal capacities as per 2017 Gold Book. BTM-PV resources are modeled based on synthetically derived historical shapes from NREL PV Watts tool.   | Modeled as distributed hourly resource modifiers. Zonal capacities as per <b>2019 Gold Book</b> . BTM-PV resources are modeled based on synthetically derived historical shapes from NREL PV Watts tool.   |
| <b>Special Case Resources</b>                           | Not utilized in MAPS production cost modeling; incorporated in ICAP Metric calculation   | Not utilized in MAPS production cost modeling; incorporated in ICAP Metric calculation   |
| <b>EDRP Resources</b>                                   | N/A for production cost modeling   | N/A for production cost modeling   |
| <b>External Capacity – Purchases and Wheel-Throughs</b> | Flows across schedulable and non-schedulable transmission lines are based on economics.  | Flows across schedulable and non-schedulable transmission lines are based on economics.  |
| <b>Retirements</b>                                      | Updated as per 2017 Gold Book (Application of inclusion rules; specific assumptions concerning mothball announcement post-CRP; units with completed studies indicating that the unit is required for reliability are retained in the Base Case; units whose studies are pending are retained in the Base Case; others are excluded from the Base Case) | Updated as per <b>2019 Gold Book</b> (Application of inclusion rules; specific assumptions concerning mothball announcement post-CRP; units with completed studies indicating that the unit is required for reliability are retained in the Base Case; <b>units whose studies are pending are retained in the Base Case; others are excluded from the Base Case; units that have filed compliance plans prior to July 31<sup>st</sup> 2019 that are in response to regulatory mandates and indicate that the unit will retire will also be excluded.</b> ) |

| Parameter  | Modeling for 2017 CARIS Base Case  | Modeling for 2019 CARIS Base Case   |
|--|--|---|
| <b>Generator Outages</b>                               | Scheduled to levelize reserves; as per the maintenance schedules in long term adequacy studies.  | Scheduled to levelize reserves; as per the maintenance schedules in long term adequacy studies.   |
| <b>Gas Turbines Ambient Derate</b>                     | Modeling utilizes summer and winter DMNC ratings for all units.  | Modeling utilizes summer and winter DMNC ratings for all units.   |
| <b>Environmental Modeling Externalities Allowances</b> | Allowance costs based on projected RGGI costs. SO <sub>2</sub> and NO <sub>x</sub> Allowance Prices reflect CSAPR markets.<br><br>Detailed allowance costs are provided in the 6/22/17 ESPWG meeting materials.  | Allowance costs based on projected RGGI costs. SO <sub>2</sub> and NO <sub>x</sub> Allowance Prices reflect CSAPR markets.<br><br><b>Detailed allowance costs are provided in the 6/25/19 ESPWG meeting materials.</b>  |
| <b>Commitment and Dispatch Options</b>                 | Each Balancing Authority commits to serve its own load, firm transactions, and potential transfers<br><br>Hurdle rates – flat. As presented on 6/22/17 to ESPWG.   | Each Balancing Authority commits to serve its own load, firm transactions, and potential transfers<br><br>Hurdle rates – flat<br>As presented on 8/6/19 to <b>ESPWG.</b>  |
| <b>Operating Reserves</b>                              | Operating Reserves as per NYCA requirements.   | Operating Reserves as per NYCA requirements.  |
| <b>Fuel Price Forecast</b>                             | Annual bases updated to more heavily weight recent trends (2014-075., 2015-0.3, 2016-0.625).<br><br>Seasonality and spikes based on five-year history (2012-2016).<br><br>Calculated natural price forecasts based on blends of hub price forecasts for four hubs (A-E, F-I, J and K). | Annual bases updated to more heavily weight recent trends <b>(2016-0.075, 2017-0.3, 2018-0.625).</b><br><br>Seasonality and spikes based on five-year history <b>(2014-2018).</b><br><br>Calculated natural price forecasts based on blends of hub price forecasts for four hubs (A-E, F-I, J and K). |

| Parameter   | Modeling for 2017 CARIS Base Case   | Modeling for 2019 CARIS Base Case  |
|---|---|--|
|   | <p>Utilized unit capacities and reported pricing hubs to weight price forecasts.</p> <p>Fuel oil and coal price forecasts are developed utilizing the EIA’s annual forecast of national delivered prices. Regional bases are derived using EIA Form 923 data. The seasonality for fuel oils is based on an analysis of New York Harbor Ultra-Low Sulfur Diesel (ULSD) prices. Coal has no seasonality.</p> <p>Illustrative fuel costs are presented in the 8/28/17 ESPWG meeting materials.</p> | <p>Utilized historic unit <b>production</b> and reported pricing hubs to weight price forecasts.</p> <p>Fuel oil and coal price forecasts are developed utilizing the EIA’s annual forecast of national delivered prices. Regional bases are derived using EIA Form 923 data. The seasonality for fuel oils is based on an analysis of New York Harbor Ultra-Low Sulfur Diesel (ULSD) prices. Coal has no seasonality.</p> <p>Illustrative fuel costs are presented in the <b>8/06/2019 ESPWG</b> meeting materials.</p> |
| <b>Cost Curve Development (including heat rates and emission rates)</b>   | Unit heat rates (and emission rates) developed from vendor supplied data, USEPA CAMD fuel input and emissions data matched with NYISO production data for NYCA and USEIA production data for non NYCA units.  | Unit heat rates (and emission rates) developed from vendor supplied data, USEPA CAMD fuel input and emissions data matched with NYISO production data for NYCA and USEIA production data for non NYCA units.   |
| <b>Local Reliability Rules</b>  | List and develop appropriate nomograms. Fuel burn restrictions, operating restrictions and exceptions, commitment/dispatch limits   | List and develop appropriate nomograms. Fuel burn restrictions, operating restrictions and exceptions, commitment/dispatch limits  |
| <b>Energy Storage<br/>Gilboa PSH<br/>Lewiston PSH</b>   | Scheduling checked to conform to historical operations.   | Scheduling checked to conform to historical operations.  |
| <b>Power Flow Cases</b>   | Consistent with 2017-2026 Comprehensive Reliability Plan  | Consistent with <b>2019-2028</b> Comprehensive Reliability Plan  |
| <b>Interface Limits</b><br><br><b>Monitored/contingency pairs</b><br><br><b>Nomograms</b><br><br><b>Joint, Grouping</b> | Data from the results of internal and external planning studies; vendor-supplied data; operational voltage studies; operational limits; transfer limit analysis for critical interfaces.  | Data from the results of internal and external planning studies; vendor-supplied data; operational voltage studies; operational limits; transfer limit analysis for critical interfaces.   |

| Parameter  | Modeling for 2017 CARIS Base Case   | Modeling for 2019 CARIS Base Case  |
|--|---|--|
| <b>Unit Sensitive Voltage</b>                      |   |  |
| <b>New Transmission Capability</b>                 | Updated as per 2017 Gold Book (Application of base case inclusion rules)  | Updated as per <b>2019 Gold Book</b> (Application of base case inclusion rules)  |
| <b>Internal Controllable Lines (PARs, DC, VFT)</b> | Optimized in simulation.  | Optimized in simulation.   |
| <b>Neighboring Systems</b>                         |   |  |
| <b>Outside World Area Models</b>                   | Power flow data from CRP, “production” data developed by NYISO with vendor and neighbor input.  | Power flow data from CRP, “production” data developed by NYISO with vendor and neighbor input.   |
| <b>Fuel Forecast</b>                               | Fuel forecasts developed utilizing same methodology as NYCA fuel forecasts.   | Fuel forecasts developed utilizing same methodology as NYCA fuel forecasts.  |
| <b>External Capacity And Load Forecast</b>         | Neighboring systems modeled consistent with reserve margins in the RNA/CRP analysis. Neighboring systems data reviewed and held at required reserve margin.   | Neighboring systems modeled consistent with reserve margins in the RNA/CRP analysis. Neighboring systems data reviewed and held at required reserve margin.  |
| <b>System Representation in Simulation</b>         | <p>HQ modeled as fixed hourly schedule, synchronized with all other external injections.</p> <p>Full Representation/Participation:<br/>           NYISO<br/>           ISONE<br/>           IESO<br/>           PJM Classic &amp; AP,AEP,CE,DLCO, DAY, VP, EKPC<br/>           Proxy Bus Injection:<br/>           HQ-NYISO, HQ-NE-ISO, HQ – IESO</p> <p>Transmission Only/Zeroed Out:<br/>           MECS,FE,SPP, MAR, NIPS,OVEC,TVA, FRCC,SERC,ERCOT,WECC</p> | <p>HQ modeled as fixed hourly schedule, synchronized with all other external injections.</p> <p>Full Representation/Participation:<br/>           NYISO<br/>           ISONE<br/>           IESO<br/>           PJM Classic &amp; AP, AEP, CE, DLCO, DAY, VP, EKPC<br/>           Proxy Bus Injection:<br/>           HQ-NYISO, HQ-NE-ISO, HQ – IESO</p> <p>Transmission Only/Zeroed Out:<br/>           MECS,FE,SPP, MAR, NIPS,OVEC,TVA, FRCC,SERC,ERCOT,WECC</p> |

| Parameter  | Modeling for 2017 CARIS Base Case   | Modeling for 2019 CARIS Base Case   |
|--|---|---|
| <b>External Controllable Lines (PARs,DC,VFT, Radial lines)</b> | <p>Western ties to carry 32% of PJM-NYISO AC Interchange + 20% of RECO Load</p> <p>5018 line to carry 32% of PJM-NYISO AC Interchange + 80% of RECO Load</p> <p>PAR ABC to carry 21% of PJM-NYISO AC Interchange + 400 MW OBF (note: OBF to 0 as of 6/1/2021)</p> <p>PAR JK to carry 15% of PJM-NYISO AC Interchange - 400 MW OBF (note: OBF to 0 as of 6/1/2021)</p> <p>Norwalk (-200MW, +200MW)<br/>L33,34 (-300MW, +300MW)<br/>PV20 (0MW, +150MW)<br/>Neptune (0MW, +660MW)<br/>CSC (0MW, +330MW)<br/>CSC and Neptune optimized subject to “cost of use”</p> <p>HTP (0, 660)<br/>Linden VFT (-315,315)</p> | <p><b>B and C modeled as out of service. Current JOA modeled under these outage conditions.</b></p> <p><b>Western ties to carry 46% of PJM-NYISO AC Interchange + 20% of RECO Load</b></p> <p><b>5018 line to carry 32% of PJM-NYISO AC Interchange + 80% of RECO Load</b></p> <p><b>PAR A to carry 7% of PJM-NYISO AC Interchange + 100 MW OBF (note: OBF to 0 as of 11/1/2019)</b></p> <p><b>PAR J-K to carry 15% of PJM-NYISO AC Interchange - 100 MW OBF (note: OBF to 0 as of 11/1/2019)</b></p> <p>Norwalk (-200MW, +200MW)<br/>L33,34 (-300MW, +300MW)<br/>PV20 (0MW, +150MW)<br/>Neptune (0MW, +660MW)<br/>CSC (0MW, +330MW)<br/>CSC and Neptune optimized subject to “cost of use”</p> <p>HTP (0, 660)<br/>Linden VFT (-315,315)</p> |

**Base Case Load Forecast**

CARIS Base Case load forecasts, from the 2019 Gold Book baseline forecast, are presented in

Figure 5 and Figure 6.



Figure 5 presents the Annual Zonal Energy in gigawatt-hours (GWh) and Figure 6 presents summer non-coincident peak demand in megawatts (MW).

**Figure 5: Annual Zonal Energy (GWh)**

| Year | A      | B     | C      | D     | E     | F      | G     | H     | I     | J      | K      | NYCA    |
|------|--------|-------|--------|-------|-------|--------|-------|-------|-------|--------|--------|---------|
| 2019 | 15,550 | 9,975 | 16,213 | 4,845 | 7,815 | 12,117 | 9,793 | 2,739 | 5,895 | 51,874 | 20,643 | 157,459 |
| 2020 | 15,327 | 9,850 | 15,983 | 5,397 | 7,650 | 11,847 | 9,657 | 2,725 | 5,840 | 51,391 | 20,377 | 156,044 |
| 2021 | 15,172 | 9,781 | 15,830 | 5,386 | 7,536 | 11,705 | 9,568 | 2,719 | 5,805 | 51,080 | 20,018 | 154,600 |
| 2022 | 15,078 | 9,760 | 15,747 | 5,382 | 7,457 | 11,629 | 9,540 | 2,720 | 5,803 | 51,067 | 19,972 | 154,155 |
| 2023 | 14,955 | 9,724 | 15,649 | 5,373 | 7,368 | 11,540 | 9,509 | 2,728 | 5,807 | 51,102 | 19,817 | 153,572 |
| 2024 | 14,879 | 9,724 | 15,602 | 5,367 | 7,306 | 11,489 | 9,515 | 2,733 | 5,823 | 51,245 | 19,703 | 153,386 |
| 2025 | 14,738 | 9,676 | 15,485 | 5,355 | 7,214 | 11,390 | 9,475 | 2,742 | 5,824 | 51,248 | 19,492 | 152,639 |
| 2026 | 14,656 | 9,668 | 15,428 | 5,348 | 7,158 | 11,341 | 9,476 | 2,757 | 5,834 | 51,336 | 19,378 | 152,380 |
| 2027 | 14,596 | 9,666 | 15,385 | 5,341 | 7,112 | 11,304 | 9,492 | 2,782 | 5,852 | 51,494 | 19,347 | 152,371 |
| 2028 | 14,590 | 9,695 | 15,394 | 5,337 | 7,095 | 11,312 | 9,544 | 2,807 | 5,881 | 51,749 | 19,608 | 153,012 |

Note: Forecast above includes Retail Solar PV. In the MAPS model, Retail Solar PV is modeled explicitly as a distributed resource at the zonal level.<sup>2</sup>

**Figure 6: Summer Non-Coincident Peak Demand by Zone (MW)**

| Year | A     | B     | C     | D   | E     | F     | G     | H   | I     | J      | K     |
|------|-------|-------|-------|-----|-------|-------|-------|-----|-------|--------|-------|
| 2019 | 2,732 | 1,983 | 2,847 | 569 | 1,351 | 2,425 | 2,249 | 640 | 1,407 | 11,608 | 5,240 |
| 2020 | 2,691 | 1,959 | 2,801 | 666 | 1,320 | 2,367 | 2,232 | 637 | 1,412 | 11,651 | 5,134 |
| 2021 | 2,672 | 1,953 | 2,779 | 663 | 1,301 | 2,342 | 2,210 | 637 | 1,417 | 11,695 | 5,056 |
| 2022 | 2,653 | 1,953 | 2,759 | 663 | 1,284 | 2,317 | 2,207 | 637 | 1,418 | 11,704 | 5,035 |
| 2023 | 2,625 | 1,947 | 2,735 | 662 | 1,264 | 2,291 | 2,213 | 635 | 1,407 | 11,608 | 4,969 |
| 2024 | 2,602 | 1,944 | 2,714 | 661 | 1,246 | 2,264 | 2,209 | 634 | 1,406 | 11,598 | 4,894 |
| 2025 | 2,582 | 1,940 | 2,695 | 658 | 1,229 | 2,242 | 2,206 | 635 | 1,408 | 11,616 | 4,823 |
| 2026 | 2,565 | 1,937 | 2,678 | 657 | 1,214 | 2,225 | 2,196 | 636 | 1,408 | 11,616 | 4,758 |
| 2027 | 2,548 | 1,937 | 2,666 | 654 | 1,203 | 2,208 | 2,184 | 636 | 1,406 | 11,598 | 4,719 |
| 2028 | 2,537 | 1,937 | 2,653 | 654 | 1,193 | 2,197 | 2,174 | 637 | 1,405 | 11,589 | 4,730 |

Note: Forecast above includes Retail Solar PV. In the MAPS model, Retail Solar PV is modeled explicitly as a distributed resource at the zonal level.

**Power Flow Data**

The CARIS uses the network topology, transmission line impedance and ratings as set forth in the assumptions matrix.

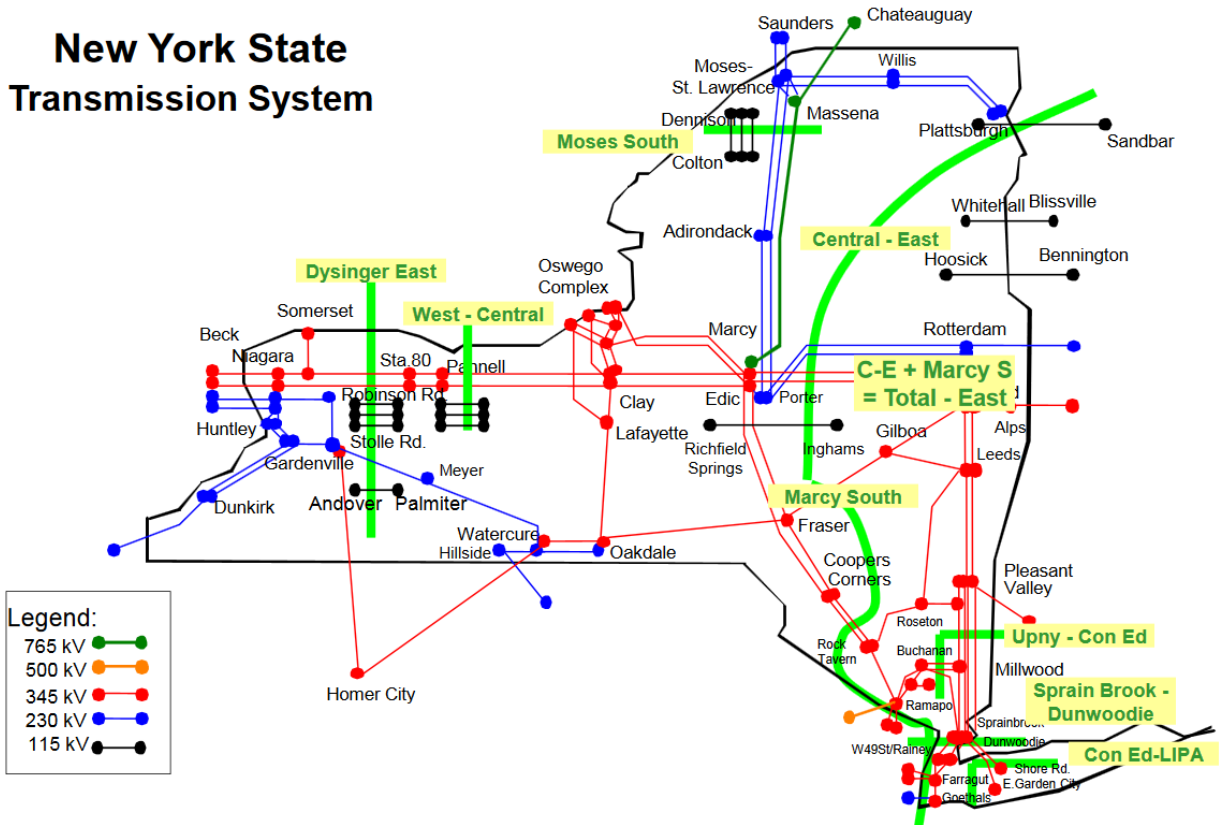
**Transmission Model**

**New York Control Area Model**

<sup>2</sup> The Retail Solar PV model shapes were based on the publicly available data from U.S. Department of Energy/National Renewable Energy Lab/Alliance for Sustainable Energy, LLC.

Figure 7 below displays the bulk power system for NYCA, which generally consists of facilities 230 kV and above, but also includes certain 138 kV facilities and a small number of 115 kV facilities. The balance of the facilities at 138 kV and below are considered non-bulk or sub-transmission facilities for purposes of this study. The figure also displays key transmission interfaces for New York.

Figure 7: NYISO 115 kV and Above Transmission Map



**New York Control Area Changes, Upgrades and Resource Additions**

System changes modeled for 2019 and beyond are as follows:

- Conforming the modeling of the PJM/NYISO interface to the current NYISO-PJM Joint Operating Agreement
- Seasonal (winter) by-pass of the Marcy South Series Compensation (MSSC)
- Erie – South Ripley series reactor in-service (2019)
- Rainey – Corona PAR in-service (2019)
- Leeds Hurley SDU in-service (2020)
- Empire State Line/Western NY Public Policy Transmission project modeled in-service (2022)
- Selected AC Public Policy Transmission projects (segments A and B) modeled in-service (2024)

**External Area Model**

ISO-NE, IESO, and PJM are actively modeled in the production cost simulation. HQ is not since it is asynchronously tied to the bulk system. Proxy buses representing the direct ties from HQ to NYISO, HQ to IESO and HQ to ISO-NE are modeled. The HQ to NYISO capacity modeled is 1,310 MW.

Figure 8 through Figure 10 lists the additions, retirements and rerates for the external control areas by fuel source by year as reported by the external control areas in their planning documents. Figure 11 and Figure 12 present the aggregate capacities by unit type, and the peak and energy forecasts for each external control area modeled.

**Figure 8: PJM Unit Additions, Retirements and Rerates (MW)**

| Year | Source           | Additions | Retirements | Rerates |
|------|------------------|-----------|-------------|---------|
| 2019 | Coal             |           | 3,183       | -       |
|      | Fossil Fuel      | 485       | 198         | 410     |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           | 805         |         |
|      | Solar            | 447       |             |         |
|      | Wind             | 1,065     |             |         |
| 2020 | Coal             |           | 1,850       |         |
|      | Fossil Fuel      | 1,157     | 233         |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           | 60          |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             | 300       |             |         |
| 2021 | Coal             |           | 850         |         |
|      | Fossil Fuel      | 2,162     | 1,221       | 50      |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           | 1,852       |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2022 | Coal             |           | 1,288       |         |
|      | Fossil Fuel      |           |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |

**Figure 9: IESO Unit Additions, Retirements and Rerates (MW)**

| Year | Source           | Additions | Retirements | Rerates |
|------|------------------|-----------|-------------|---------|
| 2019 | Coal             |           |             |         |
|      | Fossil Fuel      | 903       |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            | 98        |             |         |
|      | Wind             | 300       |             |         |
| 2020 | Coal             |           |             |         |
|      | Fossil Fuel      |           |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             | 160       |             |         |
| 2021 | Coal             |           |             |         |
|      | Fossil Fuel      | 224       |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2022 | Coal             |           |             |         |
|      | Fossil Fuel      |           | 38          |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           | 1,030       |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2023 | Coal             |           |             |         |
|      | Fossil Fuel      | 1,120     |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2024 | Coal             |           |             |         |
|      | Fossil Fuel      |           |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           | 2,064       |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2025 | Coal             |           |             |         |
|      | Fossil Fuel      | 1,568     |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |

**Figure 10: ISO-NE Unit Additions, Retirements and Rerates (MW)**

| Year | Source           | Additions | Retirements | Rerates |
|------|------------------|-----------|-------------|---------|
| 2019 | Coal             |           |             |         |
|      | Fossil Fuel      | 817       |             |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           | 702         |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2020 | Coal             |           |             |         |
|      | Fossil Fuel      |           | 17          | 54      |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2021 | Coal             |           |             |         |
|      | Fossil Fuel      |           | 383         |         |
|      | Hydro            |           |             | 80      |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            | 100       |             |         |
|      | Wind             |           |             |         |
| 2022 | Coal             |           |             |         |
|      | Fossil Fuel      | 1,521     | 651         |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |
| 2024 | Coal             |           |             |         |
|      | Fossil Fuel      |           | 1,382       |         |
|      | Hydro            |           |             |         |
|      | Landfill Gas/Bio |           |             |         |
|      | Nuclear          |           |             |         |
|      | Solar            |           |             |         |
|      | Wind             |           |             |         |

**Figure 11: Control Area Capacity Values**

| SUMMER CAP (MW)             | 2019           | 2020           | 2021           | 2022           | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| <b>IESO</b>                 | <b>35,176</b>  | <b>35,336</b>  | <b>35,559</b>  | <b>35,637</b>  | <b>35,689</b>  | <b>35,689</b>  | <b>35,115</b>  | <b>35,115</b>  | <b>35,115</b>  | <b>35,193</b>  |
| Combined Cycle              | 6,923          | 6,923          | 6,923          | 6,923          | 6,885          | 6,885          | 6,885          | 6,885          | 6,885          | 6,885          |
| Combustion Turbine          | 493            | 493            | 716            | 716            | 1,836          | 1,836          | 3,404          | 3,404          | 3,404          | 3,404          |
| Conventional Hydro          | 7,034          | 7,034          | 7,034          | 7,112          | 7,112          | 7,112          | 7,034          | 7,034          | 7,034          | 7,112          |
| Other Steam Turbines        | 332            | 332            | 332            | 332            | 332            | 332            | 332            | 332            | 332            | 332            |
| Pumped Storage Hydro        | 175            | 175            | 175            | 175            | 175            | 175            | 175            | 175            | 175            | 175            |
| Solar                       | 478            | 478            | 478            | 478            | 478            | 478            | 478            | 478            | 478            | 478            |
| Steam Turbine (Nuclear)     | 12,959         | 12,959         | 12,959         | 12,959         | 11,929         | 11,929         | 9,865          | 9,865          | 9,865          | 9,865          |
| Steam Turbine (Oil and Gas) | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          | 2,018          |
| Wind                        | 4,764          | 4,924          | 4,924          | 4,924          | 4,924          | 4,924          | 4,924          | 4,924          | 4,924          | 4,924          |
| <b>NYISO</b>                | <b>39,715</b>  | <b>40,841</b>  | <b>39,693</b>  | <b>38,675</b>  | <b>38,675</b>  | <b>38,675</b>  | <b>38,655</b>  | <b>38,655</b>  | <b>38,655</b>  | <b>38,675</b>  |
| Combined Cycle              | 9,941          | 10,961         | 10,961         | 10,961         | 10,961         | 10,961         | 10,961         | 10,961         | 10,961         | 10,961         |
| Combustion Turbine          | 4,493          | 4,478          | 4,478          | 4,478          | 4,478          | 4,478          | 4,478          | 4,478          | 4,478          | 4,478          |
| Conventional Hydro          | 4,480          | 4,480          | 4,480          | 4,500          | 4,500          | 4,500          | 4,480          | 4,480          | 4,480          | 4,500          |
| Internal Combustion Engine  | 22             | 22             | 22             | 22             | 22             | 22             | 22             | 22             | 22             | 22             |
| Landfill Gas                | 102            | 97             | 97             | 97             | 97             | 97             | 97             | 97             | 97             | 97             |
| Other Steam Turbines        | 205            | 205            | 224            | 224            | 224            | 224            | 224            | 224            | 224            | 224            |
| Pumped Storage Hydro        | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          | 1,410          |
| Solar                       | 77             | 77             | 77             | 77             | 77             | 77             | 77             | 77             | 77             | 77             |
| Steam Turbine (Coal)        | 837            | 837            | 686            | 686            | 686            | 686            | 686            | 686            | 686            | 686            |
| Steam Turbine (Nuclear)     | 5,400          | 5,400          | 4,384          | 3,346          | 3,346          | 3,346          | 3,346          | 3,346          | 3,346          | 3,346          |
| Steam Turbine (Oil and Gas) | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         | 10,662         |
| Wind                        | 2,086          | 2,212          | 2,212          | 2,212          | 2,212          | 2,212          | 2,212          | 2,212          | 2,212          | 2,212          |
| <b>PJM</b>                  | <b>203,191</b> | <b>200,452</b> | <b>200,472</b> | <b>196,513</b> | <b>195,225</b> | <b>195,225</b> | <b>195,261</b> | <b>195,261</b> | <b>195,261</b> | <b>195,225</b> |
| Combined Cycle              | 49,194         | 50,351         | 52,513         | 52,513         | 52,513         | 52,513         | 52,513         | 52,513         | 52,513         | 52,513         |
| Combustion Turbine          | 30,389         | 30,288         | 30,056         | 29,736         | 29,736         | 29,736         | 29,736         | 29,736         | 29,736         | 29,736         |
| Conventional Hydro          | 2,951          | 2,951          | 2,951          | 2,915          | 2,915          | 2,915          | 2,951          | 2,951          | 2,951          | 2,915          |
| Internal Combustion Engine  | 664            | 664            | 664            | 651            | 651            | 651            | 651            | 651            | 651            | 651            |
| Landfill Gas                | 406            | 406            | 406            | 406            | 406            | 406            | 406            | 406            | 406            | 406            |
| Other Steam Turbines        | 3,495          | 3,398          | 3,228          | 3,228          | 3,228          | 3,228          | 3,228          | 3,228          | 3,228          | 3,228          |
| Pumped Storage Hydro        | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          | 5,182          |
| Solar                       | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          | 2,226          |
| Steam Turbine (Coal)        | 55,834         | 52,738         | 50,998         | 50,148         | 48,860         | 48,860         | 48,860         | 48,860         | 48,860         | 48,860         |
| Steam Turbine (Nuclear)     | 34,223         | 33,418         | 33,418         | 31,566         | 31,566         | 31,566         | 31,566         | 31,566         | 31,566         | 31,566         |
| Steam Turbine (Oil and Gas) | 8,051          | 7,954          | 7,954          | 7,066          | 7,066          | 7,066          | 7,066          | 7,066          | 7,066          | 7,066          |
| Wind                        | 10,576         | 10,876         | 10,876         | 10,876         | 10,876         | 10,876         | 10,876         | 10,876         | 10,876         | 10,876         |
| <b>ISO-NE</b>               | <b>32,382</b>  | <b>31,735</b>  | <b>31,899</b>  | <b>33,447</b>  | <b>32,796</b>  | <b>32,796</b>  | <b>31,387</b>  | <b>31,387</b>  | <b>31,387</b>  | <b>31,414</b>  |
| Combined Cycle              | 13,934         | 13,988         | 13,988         | 15,509         | 15,446         | 15,446         | 14,064         | 14,064         | 14,064         | 14,064         |
| Combustion Turbine          | 3,429          | 3,429          | 3,413          | 3,413          | 3,403          | 3,403          | 3,403          | 3,403          | 3,403          | 3,403          |
| Conventional Hydro          | 1,961          | 1,961          | 1,961          | 1,988          | 1,988          | 1,988          | 1,961          | 1,961          | 1,961          | 1,988          |
| Internal Combustion Engine  | 185            | 185            | 185            | 185            | 185            | 185            | 185            | 185            | 185            | 185            |
| Landfill Gas                | 62             | 62             | 62             | 62             | 62             | 62             | 62             | 62             | 62             | 62             |
| Other Steam Turbines        | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          | 1,052          |
| Pumped Storage Hydro        | 1,780          | 1,780          | 1,860          | 1,860          | 1,860          | 1,860          | 1,860          | 1,860          | 1,860          | 1,860          |
| Solar                       | 10             | 10             | 110            | 110            | 110            | 110            | 110            | 110            | 110            | 110            |
| Steam Turbine (Nuclear)     | 4,081          | 3,380          | 3,380          | 3,380          | 3,380          | 3,380          | 3,380          | 3,380          | 3,380          | 3,380          |
| Steam Turbine (Oil and Gas) | 4,751          | 4,751          | 4,751          | 4,751          | 4,173          | 4,173          | 4,173          | 4,173          | 4,173          | 4,173          |
| Wind                        | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          | 1,137          |
| <b>Grand Total</b>          | <b>310,464</b> | <b>308,364</b> | <b>307,623</b> | <b>304,272</b> | <b>302,385</b> | <b>302,385</b> | <b>300,418</b> | <b>300,418</b> | <b>300,418</b> | <b>300,507</b> |



**Figure 12: External Area Forecasted Load Values**

| Year | IESO      |              | ISONE     |              | PJM       |              |
|------|-----------|--------------|-----------|--------------|-----------|--------------|
|      | Peak (MW) | Energy (GWh) | Peak (MW) | Energy (GWh) | Peak (MW) | Energy (GWh) |
| 2019 | 22,061    | 136,145,332  | 25,323    | 125,825      | 151,357   | 801,154      |
| 2020 | 22,094    | 136,577,634  | 25,025    | 123,562      | 150,869   | 802,388      |
| 2021 | 22,372    | 136,973,890  | 24,794    | 121,876      | 151,545   | 803,791      |
| 2022 | 22,649    | 137,370,146  | 24,620    | 121,288      | 152,252   | 809,281      |
| 2023 | 22,819    | 137,958,727  | 24,480    | 120,575      | 152,853   | 812,713      |
| 2024 | 23,128    | 139,912,143  | 24,384    | 120,543      | 153,435   | 818,415      |
| 2025 | 23,307    | 141,353,379  | 24,328    | 119,924      | 153,989   | 819,914      |
| 2026 | 23,195    | 142,127,738  | 24,315    | 119,918      | 154,494   | 823,256      |
| 2027 | 23,289    | 143,288,003  | 24,341    | 120,226      | 155,107   | 826,768      |
| 2028 | 23,723    | 145,343,816  | 24,408    | 121,336      | 155,892   | 833,280      |

**Hurdle Rates and Interchange Models**

Hurdle rates set the conditions under which economic interchange is transacted between neighboring markets/control area in the model. They represent a minimum savings level that needs to be achieved before energy will flow across the interface. Hurdle rates help ensure that the production-cost simulation is reasonably consistent with the historical pattern of internal NYCA generation and imports. Hurdle rates are used to allow the simulation model to reflect inter-regional energy market transaction costs.

Two independent hurdle rates are used in the CARIS, one for the commitment of generation and a separate one for the dispatch of generation. Both commitment and dispatch hurdle rates are held constant throughout the 2019-2028 study period, as discussed with NYISO stakeholders at ESPWG. The hurdle rate values produce results consistent with NYCA historic total import levels.

The flow on the CSC line was modeled to allow up to 330 MW from ISO-NE to Long Island. The flow on the Linden VFT was modeled to allow up to 315 MW in both directions. The Neptune and HTP flows were modeled to allow up to 660 MW of flow from PJM into Long Island and New York City respectively.

The hourly interchange flow for each interface connecting the NYISO with neighboring control areas was priced at the LBMP of its corresponding proxy bus. The summation of all 8,760 hours determined the annual cost of the energy for each interface. Figure 13 lists the proxy bus location for each interface.

**Figure 13: Interchange LBMP Proxy Bus Area**

| <b>Interface</b>        | <b>Proxy Bus</b>       |
|-------------------------|------------------------|
| PJM                     | Keystone               |
| Ontario                 | Bruce                  |
| Quebec                  | Chateauguay and Cedars |
| Neptune                 | Raritan River          |
| New England             | Sandy Pd               |
| Cross Sound Cable       | New Haven Harbor       |
| HTP                     | Bergen                 |
| VFT                     | Linden 138 kV          |
| Northport Norwalk Cable | Norwalk Harbor         |

**Production Cost Model**

Production cost models require input data to develop cost curves for the resources that the model will commit and dispatch to serve the load, subject to the constraints given in the model.

This section discusses how the “production cost input data” is developed. The incremental cost of generation is the product of the incremental heat rate multiplied by the sum of fuel cost, emissions cost, and variable operation and maintenance expenses.

**Heat Rates**

Fuel costs represent the largest variable expense for fossil fueled generating units. Cost curves are the product of fuel prices and incremental heat rates. Individual unit heat rates are commercially sensitive confidential information and thus are not widely available from generator owners. Unit heat rate input data is based on the U.S. Environmental Protection Agency’s (EPA) Clean Air Market Data and, where available, unit production data from the U.S. Energy Information Administration (EIA). e

CARIS simulation models employ power points which represent minimum, intermediate, and maximum power production levels where generating units can be simulated to operate on a sustained basis. Each power point is tied to a point on the heat rate curve allowing incremental heat rates to be determined for each unit. The power points and incremental heat rates are developed on a Summer/Winter capability period basis.

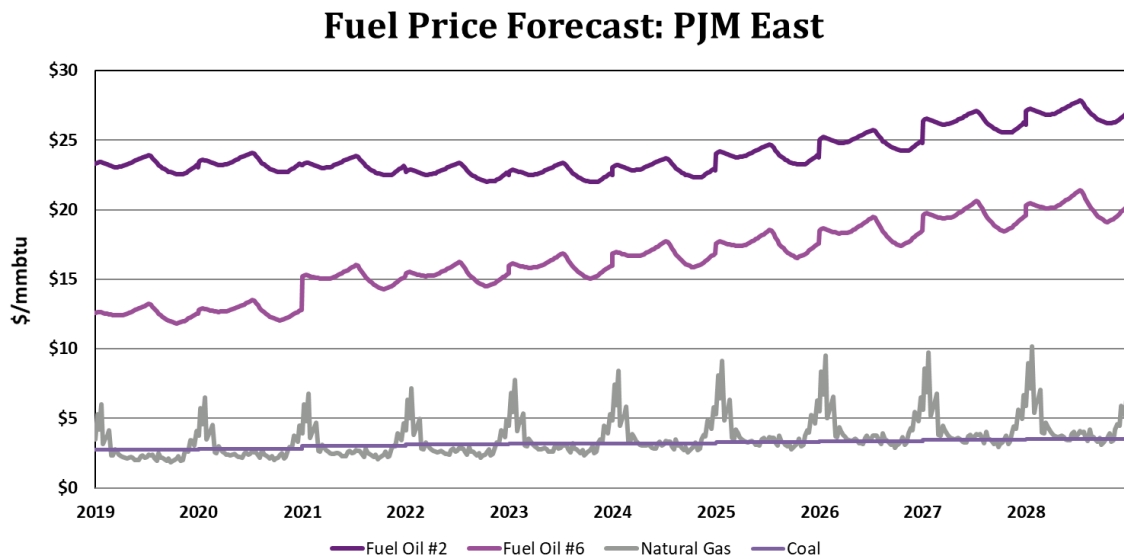
**External Area Fuel Forecasts**

Figure 14 shows the regional bases expressed as a multiple of the U.S. national average annual price for each fuel. Figure 15 through Figure 18 illustrate forecasted fuel price prices for external areas from which weekly fuel price forecasts were developed.

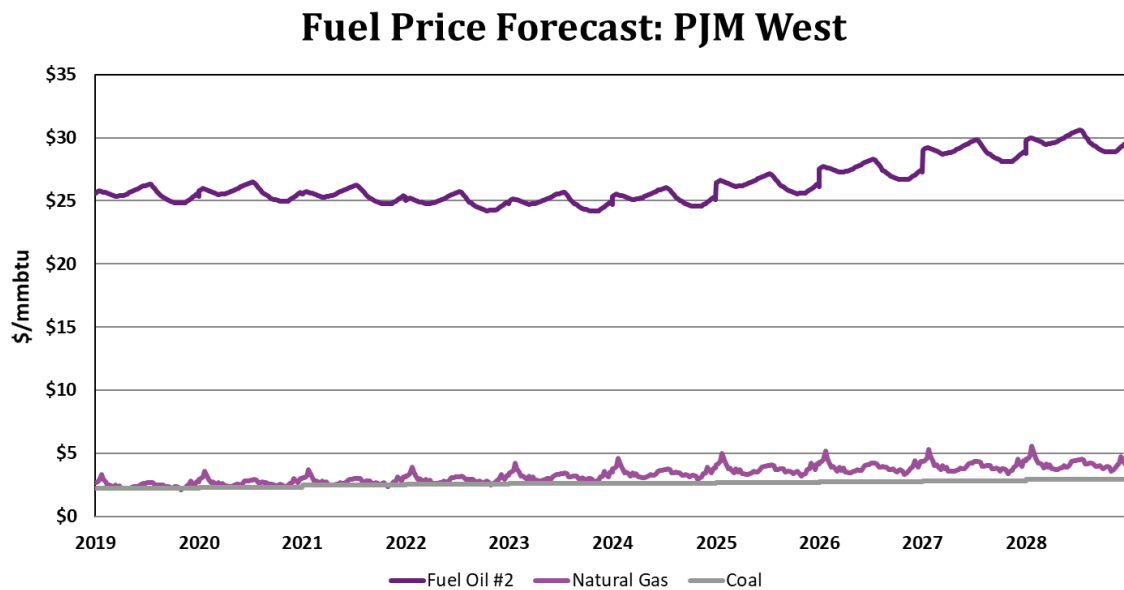
**Figure 14: External Areas Fuel Forecast Regional Multiplier**

| Fuel        | PJM-East | PJM-West | ISONE-North | ISONE-South | IESO  |
|-------------|----------|----------|-------------|-------------|-------|
| Fuel Oil #2 | 1.000    | 1.100    | 0.970       | 0.970       | 1.075 |
| Fuel Oil #6 | 1.000    | 1.100    | 0.970       | 0.970       | 1.075 |
| Natural Gas | 0.914    | 0.858    | 1.116       | 1.076       | 0.987 |
| Coal        | 1.275    | 1.050    | 2.000       | 2.000       | 1.300 |

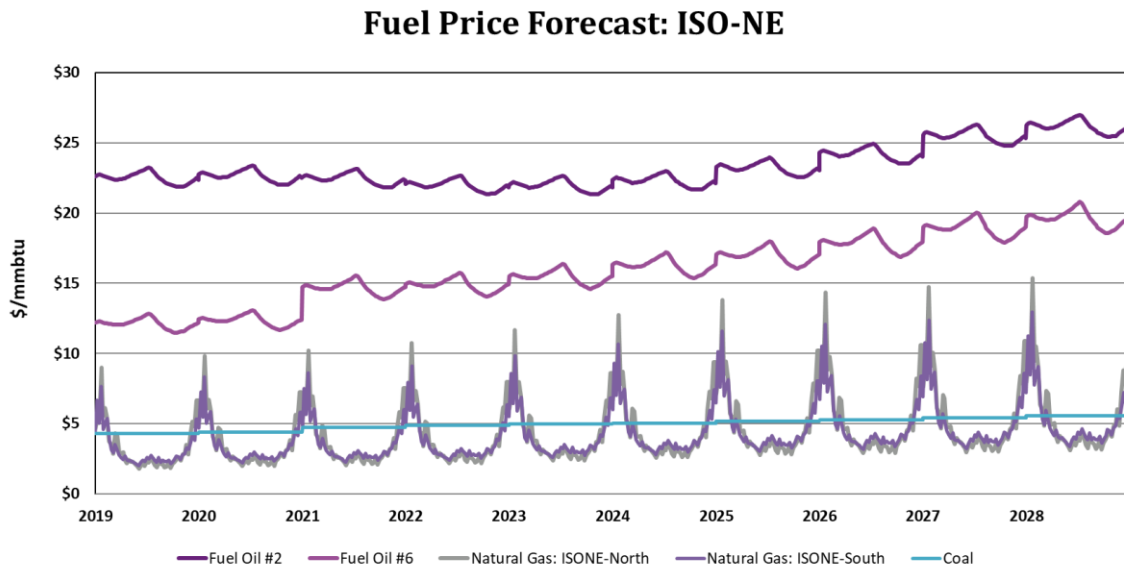
**Figure 15: Forecasted Fuel Prices for PJM East (nominal \$)**



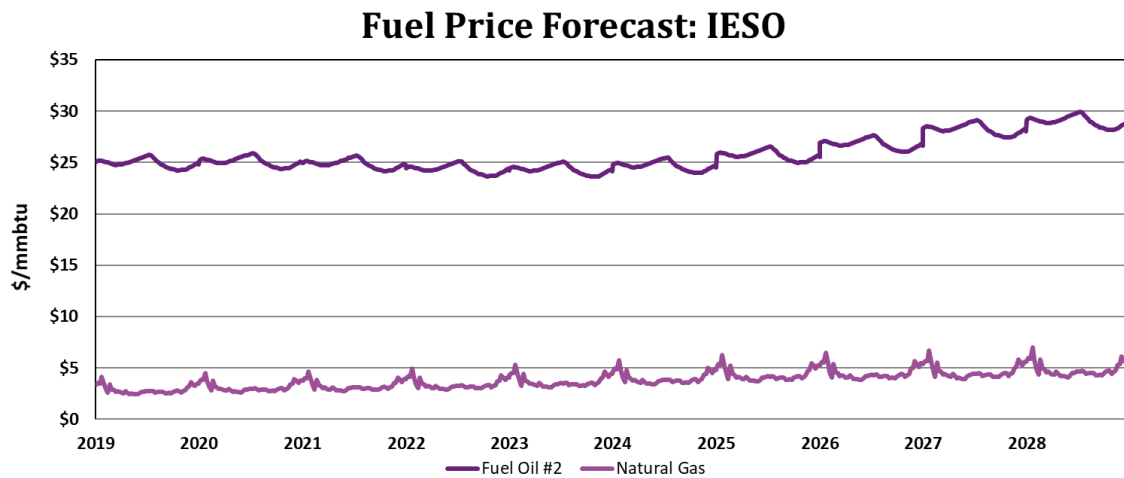
**Figure 16: Forecasted Fuel Prices for PJM West (nominal \$)**



**Figure 17: Forecasted Fuel Prices for ISO-NE (nominal \$)**



**Figure 18: Forecasted Fuel Prices for IESO (nominal \$)**



**Fuel Switching**

Fuel switching capability is widespread within the NYCA. According to date from the 2017 Gold Book, 46% of the 2017 generating capacity in the NYCA – 17,684 MW of generation – has the ability to burn either oil or gas. For such units, the production-cost simulation model selects the economic fuel based on weekly production costs for units with dual-fuel capability.

The New York State Reliability Council (NYSRC) establishes rules for the reliable operation of the New York Bulk Power System. Two of those rules guard against the loss of electric load because of the loss of gas supply. The loss of a gas facility may lead to the loss of some generating units. This

loss becomes critical because it may result in voltage collapse when load levels are high enough. Therefore, criteria are established whereby certain units that are capable of doing so are required to switch to minimum oil burn levels so that in the event of the worst single gas system contingency these units stay on-line at minimum generation levels and support system voltage.

Rule I-R3 states that “The New York State bulk power system shall be operated so that the loss of a single gas facility does not result in the loss of electric load within the New York City zone.” Rule I-R5 similarly states “The New York State bulk power system shall be operated so that the loss of a single gas facility will not result in the uncontrolled loss of electricity within the Long Island zone.”

To satisfy the I-R3 and I-R5 criteria, annual studies are performed by the TOs that update the configurations of the electricity and gas systems and simulate the loss of critical gas supply facilities.

Some new combined cycle gas turbine units in the New York City and Long Island Zones have the ability to “auto-swap” from gas-burn to oil-burn with a limited loss of output that can be quickly recovered. As the generator fleets in these zones have experienced a shift to increased use of combined cycle units with auto-swap capability, the amount of oil used in steam units to satisfy minimum oil burn criteria has decreased.

Minimum oil burn rules have not been explicitly modeled in the production cost simulations for the 2019 CARIS. Minimum oil burn units are committed and dispatched in the NYISO markets using the cost of the most economic fuel. Any cost incurred from firing oil when it is not economic to do so is recovered outside the market. Consequently, the minimum oil burn program does not affect LBMPs or any derivative metric (Demand Congestion, Load, Payment, *etc.*) and is more appropriately accounted for outside the GE-MAPS simulation.

#### **Generation Maintenance**

NYCA generation maintenance modeling was updated for this CARIS cycle utilizing the latest planned and random outage rates from the 2019-2028 CRP process. External control areas (IESO, ISO-NE, and PJM) generation planned and forced outage were developed using the latest NERC class average outage data.

#### **Hourly Modifier Models (HRMs)**

Several types of generation technologies, such as non-pondage hydro, wind, and solar were represented using MAPS hourly modifier models. This approach uses a fixed 8,760 hourly input

schedule that represents the hourly generation dispatch for each unit. The shape applied to the HRM inputs for each generator type is based on historical data. Capacity and energy capabilities are adjusted for individual generator parameters.

Hourly modifier output matches the input schedule with the one exception of energy curtailment mostly due to transmission constraints. In MAPS, curtailment occurs when the LBMP at a generator node drops below the modeled dispatch cost of the hourly modifier which is an indication of local transmission congestion caused by renewable generation injection. The amount of energy curtailed is approximately the amount necessary to limit LBMP at or above the dispatch cost of the generator, to the extent that a generator has energy to curtail.

The dispatch costs modeled for hydro, wind, and solar in the 2019 CARIS database were based on historical observations. Hydro generators are modeled with a lower dispatch cost compared with Wind and Solar. This implies that if a hydro generator and a wind generator were sited at the same exact location and LBMP were to approach \$0, the wind generator would be curtailed first.

Generally, as hydro, wind, and solar units are not co-located they experience different nodal LBMP impacts of transmission congestion and losses. In the base, sensitivity, and scenario analyses performed in the 2019 CARIS study a majority of the curtailment observed was a direct result of local transmission congestion.

## Appendix D - Overview of CARIS Model

### Model Overview (MAPS)

The NYISO primarily employs two software tools to construct the fifteen-year time-series of congestion and production costs. The NYISO utilizes Security Constrained Unit Commitment (SCUC) results to develop the five-year historic values and General Electric's Multi Area Production Simulation ("MAPS") to construct the ten-year projected values. In each case the software performs a security constrained economic commitment and dispatch, and calculates the minimum hourly production cost of supply resources to meet the load.

#### Historic Congestion

Historic Congestion is reported using actual congestion related data from the Day-Ahead market. The following elements of historic congestion-related data are reported: (i) LBMP load costs (energy, congestion and losses) by Load Zone; (ii) LBMP payments to generators (energy, congestion and losses) by Load Zone; (iii) congestion cost by constraint; and (iv) congestion cost of each constraint to load (demand\$ congestion).

#### MAPS

In conducting the 2019 CARIS analysis and developing projected congestion and production costs (as well as other metrics), the NYISO utilized GE MAPS Version 14.300 as the production cost simulation software. MAPS software mimics the operation of the NYISO Day-Ahead market by simulating SCUC and economic dispatch of the generation, and by monitoring transmission system flows under both normal and contingency conditions, including thunder storm alerts. This enables calculation of hourly production costs accounting for the constraints imposed by the transmission system on the economic dispatch of generation.

MAPS features the following:

- **Detailed representation of the large scale transmission network.** The transmission system is modeled in terms of individual transmission lines, interfaces (group of lines), phase-angle regulators (PARs), and HVDC lines. MAPS software models voltage and stability considerations through operating nomograms that define how voltage and stability limits can change hourly as a function of loads, generation, and flows elsewhere on the system.
- **Detailed generation modeling for thermal, hydro, pumped storage, wind, solar, and other renewables.** Generation system data capabilities include multi-step cost

curves based on heat rates, emission costs, fuel costs, and unit cycling capabilities. The generation units, along with chronological hourly load profiles, are assigned to individual buses on the system. Hourly load profiles are adjusted to meet peak and energy forecasts, which are inputs entered into the model on a monthly or annual basis. Information on hourly loads at each bus in the system is required to calculate electrical flows on the transmission system. This parameter is specified by assigning one or a combination of several hourly load profiles to each load bus.

The major difference between the projected MAPS results and historic congestion is that MAPS does not simulate: (a) virtual bidding; (b) transmission outages; (c) price-capped load; (d) production costs based on mitigated bids; (e) Bid Production Cost Guarantee (BPCG) payments; and (f) co-optimization with ancillary services.

## **Modeling Validation**

### **Database Verification**

To verify the 2019 CARIS database, the NYISO conducted a data and modeling verification process in conjunction with GE. First, the NYISO Planning Staff reviewed all input data and program parameters. After Staff completed its review, modifications and any necessary corrections, the base cases were sent to GE for further verification.

The following topics were examined as part of data verification:

- Spinning reserves and thermal unit commitment options;
- Generation planned and random outages;
- Transmission interface transfer limits, contingencies and nomograms;
- Commitment and dispatch hurdle rates;
- Generator incremental heat rates, variable O&M, startup costs, installed reserve margin, and emissions rates;
- Fuel price forecasts;
- Modeling of pumped storage and hydro units; and,
- Accuracy of generator size, type and location

GE reviewed all the warnings created by the programs to ensure that the results were not affected. Discrepancies noted by GE were corrected by NYISO as necessary. All of these changes were accomplished before the finalization of the 2019 CARIS base case.

### **Benchmark Summary**

The final 2019 CARIS Phase 1 benchmark results are listed in Figure 19 to



Figure 28 below for the 2017 benchmark year. The results were presented to NYISO stakeholders for discussion at the ESPWG.

**Figure 19: Zonal Load Payment Summary (nominal \$M)**

| <b>2017 Zonal Load Payment</b> | <b>Actual</b> | <b>Benchmark</b> |
|--------------------------------|---------------|------------------|
| <b>West</b>                    | 412           | 384              |
| <b>Genesee</b>                 | 243           | 245              |
| <b>Central</b>                 | 409           | 405              |
| <b>North</b>                   | 96            | 97               |
| <b>Mohawk Valley</b>           | 203           | 182              |
| <b>Capital</b>                 | 387           | 414              |
| <b>Hudson Valley</b>           | 316           | 314              |
| <b>Millwood</b>                | 96            | 92               |
| <b>Dunwoodie</b>               | 197           | 191              |
| <b>New York City</b>           | 1,786         | 1,764            |
| <b>Long Island</b>             | 817           | 742              |
| <b>NYCA</b>                    | 4,963         | 4,830            |

**Figure 20: Zonal Generator Payment Summary (nominal \$M)**

| <b>2017 Zonal Generation Payment</b> | <b>Actual</b> | <b>Benchmark</b> |
|--------------------------------------|---------------|------------------|
| West                                 | 423           | 418              |
| Genesee                              | 115           | 128              |
| Central                              | 665           | 684              |
| North                                | 168           | 219              |
| Mohawk Valley                        | 71            | 83               |
| Capital                              | 437           | 449              |
| Hudson Valley                        | 82            | 58               |
| Millwood                             | 469           | 508              |
| Dunwoodie                            | 0             | 0                |
| New York City                        | 809           | 781              |
| Long Island                          | 395           | 323              |
| <b>NYCA</b>                          | <b>3,634</b>  | <b>3,651</b>     |

**Figure 21: Zonal Demand Congestion Summary (nominal \$M)**

| <b>2017 Zonal Demand Congestion</b> | <b>SCUC</b>  | <b>Benchmark</b> |
|-------------------------------------|--------------|------------------|
| West                                | 63           | 31               |
| Genesee                             | 12           | 7                |
| Central                             | 40           | 24               |
| North                               | 6            | 2                |
| Mohawk Valley                       | 10           | 10               |
| Capital                             | 90           | 102              |
| Hudson Valley                       | 66           | 67               |
| Millwood                            | 21           | 21               |
| Dunwoodie                           | 44           | 41               |
| New York City                       | 443          | 398              |
| Long Island                         | 287          | 190              |
| <b>NYCA</b>                         | <b>1,082</b> | <b>893</b>       |

**Figure 22: Top Constraint Congestion Summary (nominal \$M)**

| <b>2017 Top 10 Demand Congestion Constraints</b> | <b>SCUC</b> | <b>Benchmark</b> |
|--|-------------|------------------|
| CENTRAL EAST                                     | 598         | 539              |
| EDIC MARCY                                       | 125         | 85               |
| LEEDS PLEASANT VALLEY                            | 101         | 56               |
| DUNWOODIE TO LONG ISLAND                         | 88          | 24               |
| MOTTHAVEN RAINEY                                 | 32          | 1                |
| DUNWOODIE MOTTHAVEN                              | 30          | 4                |
| PACKARD HUNTLEY                                  | 30          | 26               |
| NEW SCOTLAND LEEDS                               | 18          | 3                |
| GREENWOOD  | 14          | 23               |
| NIAGARA PACKARD                                  | 12          | 0                |

**Figure 23: Zonal LBMP Summary (\$/MWh)**

| <b>2017 Zonal Average LBMP</b> | <b>Actual</b> | <b>Benchmark</b> |
|--------------------------------|---------------|------------------|
| West                           | \$25.55       | \$25.61          |
| Genesee                        | \$23.44       | \$24.96          |
| Central                        | \$24.40       | \$26.53          |
| North                          | \$21.30       | \$23.51          |
| Mohawk Valley                  | \$24.63       | \$26.59          |
| Capital                        | \$31.04       | \$33.89          |
| Hudson Valley                  | \$30.62       | \$32.38          |
| Millwood                       | \$30.93       | \$32.65          |
| Dunwoodie                      | \$30.93       | \$32.63          |
| New York City                  | \$32.29       | \$33.35          |
| Long Island                    | \$36.17       | \$34.73          |

**Figure 24: Zonal Generation Summary (GWh)**

| <b>2017 Zonal Generation</b> | <b>Actual</b>  | <b>Benchmark</b> |
|------------------------------|----------------|------------------|
| West                         | 17,450         | 17,504           |
| Genesee                      | 5,071          | 5,240            |
| Central                      | 29,252         | 29,441           |
| North                        | 9,474          | 9,474            |
| Mohawk Valley                | 3,445          | 3,466            |
| Capital                      | 13,915         | 14,129           |
| Hudson Valley                | 1,807          | 1,855            |
| Millwood                     | 15,692         | 15,771           |
| Dunwoodie                    | 0              | 0                |
| New York City                | 23,199         | 23,090           |
| Long Island                  | 9,288          | 8,856            |
| <b>NYCA</b>                  | <b>128,593</b> | <b>128,825</b>   |

**Figure 25: Zonal Load Summary (GWh)**

| <b>2017 Zonal Load</b> | <b>Actual</b>  | <b>Benchmark</b> |
|------------------------|----------------|------------------|
| West                   | 15,066         | 14,992           |
| Genesee                | 9,907          | 9,859            |
| Central                | 15,614         | 15,532           |
| North                  | 4,187          | 4,161            |
| Mohawk Valley          | 7,702          | 7,656            |
| Capital                | 12,014         | 11,966           |
| Hudson Valley          | 9,734          | 9,683            |
| Millwood               | 2,813          | 2,796            |
| Dunwoodie              | 5,822          | 5,797            |
| New York City          | 52,055         | 51,938           |
| Long Island            | 20,898         | 20,843           |
| <b>NYCA</b>            | <b>155,813</b> | <b>155,223</b>   |

**Figure 26: Import Summary (GWh)**

| <b>2017 Import Energy</b> | <b>Actual</b> | <b>Benchmark</b> |
|---------------------------|---------------|------------------|
| PJM-NYISO                 | 3,662         | 3,600            |
| LINDEN VFT                | 1,380         | 1,134            |
| NEPTUNE                   | 4,555         | 4,172            |
| HTP                       | 274           | 210              |
| ISONE-NYISO               | 520           | 329              |
| CROSS SOUND CABLE         | 1,814         | 1,496            |
| NORTHPORT NORWALK         | 560           | 386              |
| IMO-NYISO                 | 8,030         | 8,261            |
| HQ-NYISO CHAT             | 10,525        | 10,509           |
| HQ-NYISO CEDARS           | 1,009         | 1,007            |
| <b>TOTAL IMPORT</b>       | <b>32,329</b> | <b>31,104</b>    |

**Figure 27: Export Summary (GWh)**

| <b>2017 Export Energy</b> | <b>Actual</b> | <b>Benchmark</b> |
|---------------------------|---------------|------------------|
| PJM-NYISO                 | 460           | 339              |
| LINDEN VFT                | 82            | 53               |
| NEPTUNE                   | 2             | 0                |
| HTP                       | 0             | 0                |
| ISONE-NYISO               | 4,261         | 4,202            |
| CROSS SOUND CABLE         | 7             | 0                |
| NORTHPORT NORWALK         | 66            | 86               |
| IMO-NYISO                 | 21            | 24               |
| HQ-NYISO CHAT             | 3             | 3                |
| HQ-NYISO CEDARS           | 4             | 4                |
| <b>TOTAL EXPORT</b>       | <b>4,904</b>  | <b>4,711</b>     |

**Figure 28: Net Import Summary (GWh)**

| <b>2017 Net Import Energy</b> | <b>Actual</b> | <b>Benchmark</b> |
|-------------------------------|---------------|------------------|
| PJM-NYISO                     | 3,202         | 3,261            |
| LINDEN VFT                    | 1,298         | 1,081            |
| NEPTUNE                       | 4,554         | 4,172            |
| HTP                           | 274           | 210              |
| ISONE-NYISO                   | -3,740        | -3,873           |
| CROSS SOUND CABLE             | 1,808         | 1,496            |
| NORTHPORT NORWALK CABLE       | 494           | 300              |
| IMO-NYISO                     | 8,010         | 8,237            |
| HQ-NYISO CHAT                 | 10,522        | 10,506           |
| HQ-NYISO CEDARS               | 1,005         | 1,003            |
| <b>TOTAL NET IMPORT</b>       | <b>27,425</b> | <b>26,393</b>    |

## Appendix E - Detailed Results of 2019 CARIS Phase 1

### Congestion Assessment - Historic and Projected

One of the features of a Locational Based Marginal Price (LBMP) market is the ability to identify grid locations that are difficult to serve with economic generation due to transmission bottlenecks (constraints) and quantify the cost of this congestion. The NYISO calculates and publishes LBMP's with three components:

1. **Energy component** – marginal electricity cost without the adjusted cost of congestion and losses;
2. **Congestion component** – the cost of out-of merit generation dispatch relative to an assumed unconstrained reference point at Marcy substation; and
3. **Losses component** – the cost for supplying the losses from the accessible marginal generators to a specific point on the grid.

#### Historic Congestion Reporting

The NYISO reports historic congestion results on its website<sup>3</sup> as required in OATT, Section 31.7. The cost of congestion reported is the sum of the day ahead market LBMP congestion component multiplied by the amount of load being affected (positively or negatively) by congestion (later referred to as “congestion payments”).

#### Historic Congestion Results

The historic congestion analysis results for a constrained system (base case) are presented in

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<sup>3</sup> <https://www.nyiso.com/ny-power-system-information-outlook>

Figure 29 through Figure 31.



**Figure 29: Historic Congestion Demand\$ Congestion (2014-2018) by Zone (nominal \$M)**

| Zone              | 2014           | 2015           | 2016           | 2017           | 2018           |
|-------------------|----------------|----------------|----------------|----------------|----------------|
| West              | \$36           | \$83           | \$116          | \$63           | \$65           |
| Genesee           | \$9            | \$9            | \$7            | \$12           | \$10           |
| Central           | \$38           | \$34           | \$29           | \$40           | \$37           |
| North             | \$3            | \$5            | \$7            | \$6            | \$15           |
| Mohawk Valley     | \$12           | \$10           | \$7            | \$10           | \$7            |
| Capital           | \$149          | \$123          | \$95           | \$90           | \$80           |
| Hudson Valley     | \$95           | \$86           | \$64           | \$66           | \$50           |
| Millwood          | \$30           | \$26           | \$19           | \$21           | \$16           |
| Dunwoodie         | \$55           | \$49           | \$41           | \$44           | \$34           |
| New York City     | \$531          | \$459          | \$378          | \$443          | \$405          |
| Long Island       | \$409          | \$404          | \$339          | \$287          | \$303          |
| <b>NYCA Total</b> | <b>\$1,367</b> | <b>\$1,287</b> | <b>\$1,102</b> | <b>\$1,082</b> | <b>\$1,022</b> |

Notes: Reported values do not deduct TCCs. DAM data include Virtual Bidding & planned Transmission outages.

For Figure 30, year 2017 and 2018 values are calculated using DSS net meter energy and actual hourly LBMP.

**Figure 30: Historic Generator Payments (2014-2018) by Zone (nominal \$M)**

| Generator Payment (\$M) | Historic       |                |                |                |                |
|-------------------------|----------------|----------------|----------------|----------------|----------------|
|                         | 2014           | 2015           | 2016           | 2017           | 2018           |
| West                    | \$924          | \$472          | \$358          | \$423          | \$571          |
| Genesee                 | \$388          | \$199          | \$141          | \$115          | \$146          |
| Central                 | \$1,854        | \$1,133        | \$752          | \$665          | \$929          |
| North                   | \$447          | \$255          | \$182          | \$168          | \$225          |
| Mohawk Valley           | \$181          | \$100          | \$72           | \$71           | \$81           |
| Capital                 | \$873          | \$647          | \$529          | \$437          | \$503          |
| Hudson Valley           | \$326          | \$210          | \$141          | \$82           | \$154          |
| Millwood                | \$1,033        | \$642          | \$475          | \$469          | \$618          |
| Dunwoodie               | \$34           | \$19           | \$54           | \$0            | \$0            |
| NY City                 | \$1,679        | \$1,023        | \$837          | \$809          | \$1,072        |
| Long Island             | \$932          | \$637          | \$487          | \$395          | \$560          |
| <b>NYCA Total</b>       | <b>\$8,670</b> | <b>\$5,337</b> | <b>\$4,028</b> | <b>\$3,634</b> | <b>\$4,859</b> |

Note: Reported values are exclusive of BPCG and Ancillary Services

**Figure 31: Historic Load Payments (2014-2018) by Zone (nominal \$M)**

| Load Payment (\$M) | Historic        |                |                |                |                |
|--------------------|-----------------|----------------|----------------|----------------|----------------|
|                    | 2014            | 2015           | 2016           | 2017           | 2018           |
| West               | \$873           | \$595          | \$501          | \$412          | \$542          |
| Genesee            | \$545           | \$291          | \$206          | \$243          | \$327          |
| Central            | \$1,183         | \$715          | \$499          | \$409          | \$557          |
| North              | \$243           | \$117          | \$80           | \$96           | \$124          |
| Mohawk Valley      | \$395           | \$231          | \$152          | \$203          | \$273          |
| Capital            | \$808           | \$513          | \$374          | \$387          | \$504          |
| Hudson Valley      | \$656           | \$424          | \$309          | \$316          | \$399          |
| Millwood           | \$195           | \$122          | \$88           | \$96           | \$117          |
| Dunwoodie          | \$375           | \$240          | \$203          | \$197          | \$244          |
| NY City            | \$3,358         | \$2,184        | \$1,721        | \$1,786        | \$2,328        |
| Long Island        | \$1,712         | \$1,208        | \$938          | \$817          | \$1,036        |
| <b>NYCA Total</b>  | <b>\$10,343</b> | <b>\$6,640</b> | <b>\$5,071</b> | <b>\$4,963</b> | <b>\$6,451</b> |

### Metrics Assessment

#### CARIS Metrics

In conducting the CARIS analysis, seven metrics are used. The primary metric is the production cost metric. Additional metrics that are included in this report are load payments, generator payments, emissions, TCCs, losses, and the ICAP metric. All benefit metrics are determined by measuring the difference (change) between the CARIS base case system value and a system value when the generic solution is added. The discount rate of 7.08% used for the present value analysis is the current weighted average cost of capital for the NYTOs.

#### 1. NYCA Production Cost Metric

NYCA production cost is the total generation cost of producing power to serve NYCA load. The total cost includes the following components:

1. Fuel cost (fuel consumption mmBtu multiplied by fuel cost \$/mmBtu);
2. Variable O&M cost (VOM adder \$/MWh);
3. Emission cost (emission allowance price multiplied by total allowance);
4. Start-up Cost (number of starts multiplied by start-up cost); and
5. NYCA Imports and Exports evaluated at the solution case proxy bus LBMP values.

## 2. Demand\$ Congestion Metric

The congestion value (Demand\$ Congestion) is calculated as the congestion component of the LBMP paid by NYCA load (sum of the total zonal loads). It is defined as the shadow price of each constrained element multiplied by the load affected. The Demand\$ Congestion for all areas and all hours is equal to the product of the Shadow Price, the Zonal Generation Shift Factor, and the Zonal Load. The Total Demand\$ Congestion is equal to the summation of Demand\$ Congestion across all constraints.

Demand\$ Congestion by constraint for all areas and all hours =

$$\{Shadow Price * (Zonal Generation Shift Factor (GSF) * Zonal Load)\}$$

Total Demand\$ Congestion =  $\sum_{constraints} Demand\$ Congestion$

## 3. Generator Payment Metric

This metric measures the change in NYCA generation payments plus net imports. The NYCA generation payments are calculated by measuring only the LBMP payments (energy, congestion, losses). Thus, total generator payments are estimated for this information metric as the sum of the LBMP payments to NYCA generators plus the payments for net imports.

Generator payment by zone represents zonal LBMP based payment to generators located in a zone. The hourly payment to each generator is determined as the hourly generator MW dispatch multiplied by the generator's LBMP or spot price. The annual generator payment for NYCA generators is then the sum of all 8,760 hourly generator payments.

$$\text{Annual generator LBMP payment} = \sum_{Hour} (\text{generator LBMP} \times \text{generator MW dispatch})$$

$$\text{Zonal generator payment} = \sum_{Generator\ in\ Zone} \text{Generator LBMP payment}$$

## 4. LBMP Load Payment Metric

The LBMP Load Payment metric is the hourly load-weighted average LBMP price for each Zone multiplied by the zonal load. The annual load payment is then the sum of all 8,760 hourly load payments.

$$\text{Annual Zonal LBMP payment} = \sum_{Hour} (\text{zonal LBMP} \times \text{zonal load})$$

$$\text{Zonal LBMP} = \text{zonal average load} - \text{weighted LMP}$$

Note: actual consumer payments will be net of any TCC hedges or bilateral contracts.

## 5. TCC Payment Metric

The TCC payment metric is calculated differently for Phase 1 than for Phase 2 of the CARIS process, as described in the NYISO Tariff. In this CARIS Phase 1, the TCC Payment is calculated as (Demand Congestion Costs + Export Congestion Costs) – (Supply Congestion Costs + Import Congestion Costs). This is not a measure of the Transmission Owners' TCC auction revenues.

## 6. ICAP Metric

The Installed Capacity (ICAP) savings metric quantifies the potential NYISO ICAP market savings created by a generation, transmission, demand response, or energy efficiency project.

The ICAP savings calculation<sup>4</sup> consists of two steps, which are performed for each NYISO capacity zone<sup>5</sup>. In the first step, the MW impact of a generic solution is determined through Loss of Load Expectation (LOLE) analysis, where LOLE is the resource adequacy criterion. The MW impact is indicative of reduced installed capacity requirement made possible by the congestion mitigation solutions. A transmission solution that enables better utilization of the existing generating resources in the State will allow a lower IRM and lower LCRs. Generation solutions, depending on their location in the NYCA, will contribute as an ICAP source and may reduce the IRM and LCR requirements. For DR and EE, the reduced load downstream of congestion will lower both the overall ICAP and the LCR requirements. The ICAP reduction can be larger than the nameplate of the solution. Using year 2028, the ICAP MW impact for each study area resulting from the application of generic solutions is calculated. This represents the potential reduction in ICAP procurement obligations and the associated ICAP costs.

Second, the ICAP cost reduction benefit is translated to a dollar amount through two pricing variations for each of the years of the ten year study period. For Variant 1, the ISO measured the cost impact of a solution for each planning year by: (i) forecasting the cost per megawatt-year of Installed Capacity under the assumption that the solution is not in place, based on the latest

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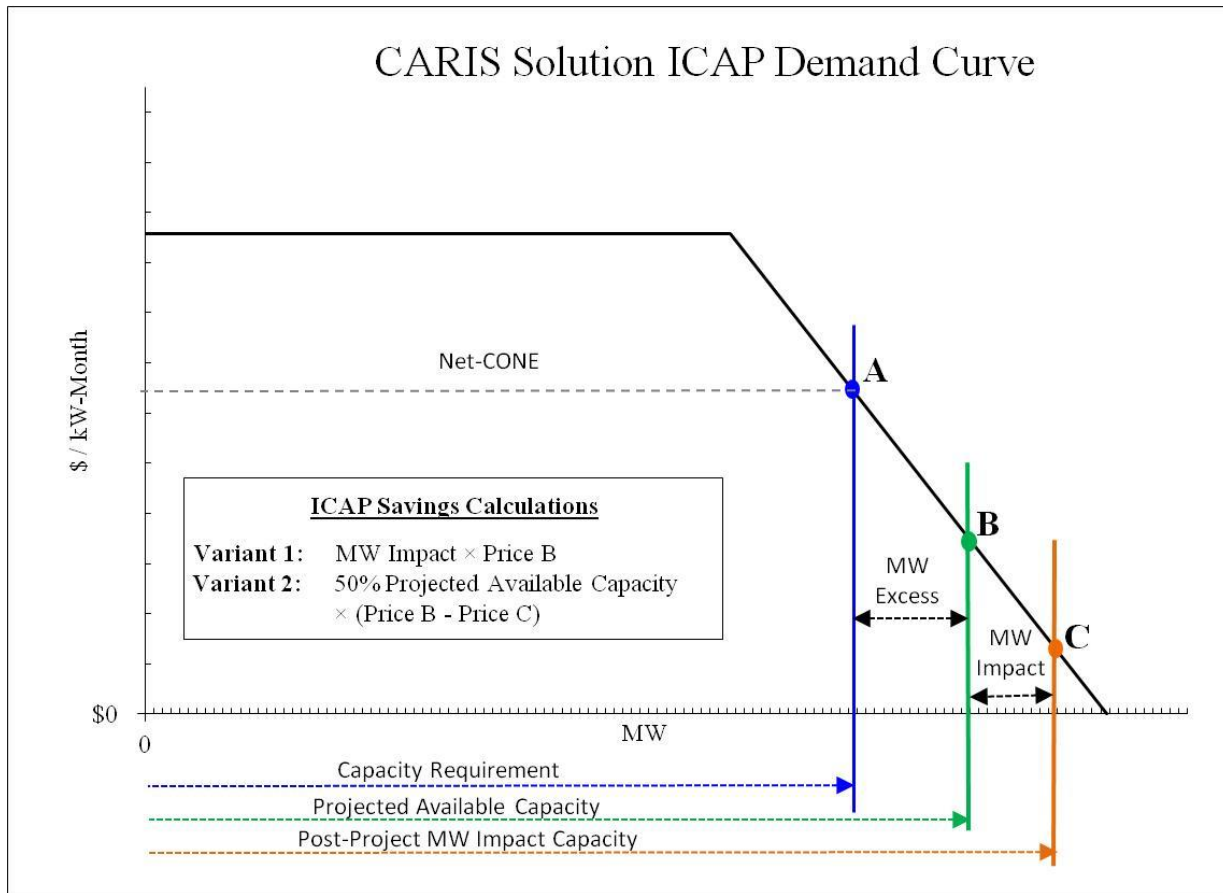
<sup>4</sup> Calculations used to determine ICAP savings are described in NYISO OATT Attachment Y Section 31.3.1.3.5.6. Information regarding the determination of the currently published NYISO ICAP demand curve is beyond the scope of this document and can be found in the NYISO Installed Capacity Manual ([https://www.nyiso.com/documents/20142/2923301/icap\\_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338](https://www.nyiso.com/documents/20142/2923301/icap_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338))

<sup>5</sup> As of 2013, The NYISO has four separate capacity zones: New York City (NYC), Long Island (LI), Lower Hudson Valley (G-J), and the New York Control Area (NYCA). Capacity demand curves are used to set the clearing price for existing generation capacity in the capacity market auctions. Locational capacity requirements are inherent within each demand curve so as to meet reliability criteria.

available Summer and Winter ICAP Demand Curves and the amount of Installed Capacity available in the NYCA, and (ii) multiplying that forecasted cost per megawatt-year by the sum of the megawatt impact. For Variant 2, the ISO measured the cost impact of a solution for each planning year by: (i) forecasting the cost per megawatt-year of Installed Capacity under the assumption that the solution is in place, based on the latest available Summer and Winter ICAP Demand Curves and the amount of Installed Capacity available in the NYCA; (ii) subtracting that forecasted cost per megawatt-year from the forecasted cost per megawatt-year of Installed Capacity calculated in Variant 1 (without the solution in place); and (iii) multiplying that difference by fifty percent (50%) of the assumed amount of NYCA Installed Capacity available. The ICAP cost metrics are indicative measures of the additional potential benefits resulting from the implementation of a CARIS solution. The metrics are not precise determinants of future capacity prices and are calculated for the purpose of providing additional information.

The two variants for savings calculations can be better defined and understood through the ICAP Demand Curve diagram below, Figure 32.

**Figure 32: CARIS ICAP Demand Curve**



The MW Impact calculation from the first step described above uses the GE-MARS base case for LOLE calculations, which is based upon the 2019-2028 Comprehensive Reliability Plan (CRP). Version 3.22.6 of MARS was used for this analysis. Updates were made to capacity resources contained in the production cost simulation base case to match the CRP assumptions. A series of project cases were created to simulate transmission, generation, demand response, and energy efficiency projects. Each type of project was modeled with different changes to the MARS topology to accurately represent the effect of the project on the system.

To simulate the three transmission project cases, the following changes to interface transfer limits were made, as indicated in Figure 33.

**Figure 33: MARS Interface Modifications for Transmission Solution ICAP Calculations (MW)**

| Incremental Change          |                       |                                     |                        |
|-----------------------------|-----------------------|-------------------------------------|------------------------|
| MARS Interface              | Study 1: Central East | Study 2: Central East-Knickerbocker | Study 3: Volney-Scriba |
| Central East MARS(E-F)      | 350.00                | 350.00                              | -                      |
| Central East Group(E-F&E-G) | 300.00                | 300.00                              | -                      |
| F-G                         | 100.00                | 150.00                              | -                      |
| UPNY-SENY                   | 100.00                | 150.00                              | -                      |
| Oswego Export               | -                     | -                                   | 200.00                 |

To simulate the generation project cases, capacity was added downstream of the congested element, as indicated in Figure 34.

**Figure 34: MARS Capacity Additions for Generation Solution ICAP Calculations**

| Study                               | Generator Bus Location | # Units | Unit Size (MW) | Total Capacity Addition (MW) |
|-------------------------------------|------------------------|---------|----------------|------------------------------|
| Study 1: Central East               | New Scotland           | 1       | 340            | 340                          |
| Study 2: Central East-Knickerbocker | Pleasant Valley        | 1       | 340            | 340                          |
| Study 3: Volney-Scriba              | Volney                 | 1       | 340            | 340                          |

Energy efficiency project cases were modeled by reducing the load forecast downstream of the congested element, as indicated in Figure 35.

**Figure 35: MARS Load Reductions for Energy Efficiency Solution ICAP Calculations (MW)**

| Zone & Load Reduction (MW) | Study 1: Central East | Study 2: Central East-Knickerbocker | Study 3: Volney-Scriba |
|----------------------------|-----------------------|-------------------------------------|------------------------|
| F                          | 100                   | 100                                 | 100                    |
| G                          | 100                   | 100                                 | 100                    |
| J                          | 200                   | 200                                 | -                      |

The demand response project cases were created by adding SCRs downstream of the congested element, as indicated in Figure 36.

**Figure 36: MARS SCR Capacity Additions for Demand Response Solution ICAP Calculations (MW)**

| Zone & SCR Addition Amount (MW) | Study 1: Central East | Study 2: Central East-Knickerbocker | Study 3: Volney-Scriba |
|---------------------------------|-----------------------|-------------------------------------|------------------------|
| F                               | 100                   | 100                                 | 100                    |
| G                               | 100                   | 100                                 | 100                    |
| J                               | 200                   | 200                                 | -                      |

After the base case and project cases were simulated and LOLE values determined, capacity was removed from each NYISO Zone in the each project case, based on the zonal total capacity ratio, until the base case LOLE was reached. The resultant amount of capacity removed is equivalent to the MW Impact of that project case. The MW Impact results for each of the project cases, for the 2028 study year are presented in

Figure 37.



**Figure 37: MARS SCR Capacity Additions for Demand Response Solution ICAP Calculations**

| Study                               | Solution          | MW Impact (MW) |     |    |      |
|-------------------------------------|-------------------|----------------|-----|----|------|
|                                     |                   | J              | G-J | K  | NYCA |
| Study 1: Central East               | Transmission      | -              | -   | -  | -    |
|                                     | Generation        | 54             | 81  | 29 | 220  |
|                                     | Energy Efficiency | 142            | 212 | 77 | 574  |
|                                     | Demand Response   | 122            | 182 | 66 | 493  |
| Study 2: Central East-Knickerbocker | Transmission      | -              | -   | -  | -    |
|                                     | Generation        | 54             | 81  | 29 | 220  |
|                                     | Energy Efficiency | 142            | 212 | 77 | 574  |
|                                     | Demand Response   | 122            | 182 | 66 | 493  |
| Study 3: Volney Scriba              | Transmission      | -              | -   | -  | -    |
|                                     | Generation        | 54             | 81  | 29 | 220  |
|                                     | Energy Efficiency | 36             | 54  | 19 | 145  |
|                                     | Demand Response   | 30             | 44  | 16 | 120  |

Variant #1 of the ICAP savings calculation can now be determined by simply multiplying the MW impact values in the table above with the pre-project capacity price of the demand curve for the corresponding study year. The MW impact values are also used to calculate the post-project capacity price for Variant #2, which is then subtracted from the pre-project price and multiplied by 50% of the projected available capacity for the four capacity zones in that year. The results of these calculations for all 10 years of the CARIS study are contained in

Figure **38** and Figure 39 below.

The two ICAP cost variants are indicative of a range of the potential benefits to load resulting from the implementation of a CARIS solution. The metrics are not precise determinants of future capacity prices and are calculated for the purpose of providing additional information. The results of the metric calculations are in

Figure **38** and Figure 39 below.

**Figure 38: ICAP Costs Savings - Variant 1**

| CARIS 2019 ICAP Variant #1 Savings (2019 \$M) |                   |               |      |      |      |      |      |      |      |      |      |      |               |     |
|---|-------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|-----|
| Study   | Solution          | Capacity Zone | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 10 Year Total |     |
| Study 1: Central East                         | Transmission      | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   |                   | G-I:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   |                   | J:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   |                   | K:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   | Total:            | 0             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   | Generation        | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 1    | 1    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2             | 19  |
|   |                   | J:            | 5    | 5    | 6    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 4             | 46  |
|   |                   | K:            | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 1   |
|   | Total:            | 7             | 6    | 9    | 8    | 7    | 7    | 6    | 6    | 6    | 6    | 5    | 66            |     |
|   | Energy Efficiency | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 2    | 2    | 7    | 7    | 6    | 6    | 5    | 5    | 5    | 5    | 4             | 50  |
|   |                   | J:            | 13   | 13   | 15   | 14   | 12   | 12   | 11   | 11   | 10   | 10   | 9             | 120 |
|   |                   | K:            | 2    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 4   |
|   | Total:            | 17            | 17   | 22   | 21   | 18   | 17   | 17   | 16   | 16   | 15   | 14   | 173           |     |
|   | Demand Response   | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
| G-I:  |                   | 2             | 2    | 6    | 6    | 5    | 5    | 5    | 4    | 4    | 4    | 4    | 43            |     |
| J:  |                   | 11            | 11   | 13   | 12   | 11   | 10   | 10   | 9    | 8    | 8    | 8    | 103           |     |
| K:  |                   | 2             | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 3             |     |
| Total:  | 15                | 14            | 19   | 18   | 16   | 15   | 14   | 14   | 14   | 13   | 12   | 149  |               |     |
| Study 2: Central East-Knickerbocker           | Transmission      | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   |                   | G-I:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | J:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | K:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   | Total:            | 0             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   | Generation        | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 1    | 1    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2             | 19  |
|   |                   | J:            | 5    | 5    | 6    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 4             | 46  |
|   |                   | K:            | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 1   |
|   | Total:            | 7             | 6    | 9    | 8    | 7    | 7    | 6    | 6    | 6    | 6    | 5    | 66            |     |
|   | Energy Efficiency | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 2    | 2    | 7    | 7    | 6    | 6    | 5    | 5    | 5    | 5    | 4             | 50  |
|   |                   | J:            | 13   | 13   | 15   | 14   | 12   | 12   | 11   | 11   | 10   | 10   | 9             | 120 |
|   |                   | K:            | 2    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 4   |
|   | Total:            | 17            | 17   | 22   | 21   | 18   | 17   | 17   | 16   | 16   | 15   | 14   | 173           |     |
|   | Demand Response   | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
| G-I:  |                   | 2             | 2    | 6    | 6    | 5    | 5    | 5    | 4    | 4    | 4    | 4    | 43            |     |
| J:  |                   | 11            | 11   | 13   | 12   | 11   | 10   | 10   | 9    | 8    | 8    | 8    | 103           |     |
| K:  |                   | 2             | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 3             |     |
| Total:  | 15                | 14            | 19   | 18   | 16   | 15   | 14   | 14   | 14   | 13   | 12   | 149  |               |     |
| Study 3: Volney Scriba                        | Transmission      | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   |                   | G-I:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | J:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | K:            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   | Total:            | 0             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             |     |
|   | Generation        | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 1    | 1    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2             | 19  |
|   |                   | J:            | 5    | 5    | 6    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 4             | 46  |
|   |                   | K:            | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 1   |
|   | Total:            | 7             | 6    | 9    | 8    | 7    | 7    | 6    | 6    | 6    | 6    | 5    | 66            |     |
|   | Energy Efficiency | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
|   |                   | G-I:          | 1    | 1    | 2    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | 1             | 13  |
|   |                   | J:            | 3    | 3    | 4    | 4    | 3    | 3    | 3    | 3    | 2    | 2    | 2             | 30  |
|   |                   | K:            | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 1   |
|   | Total:            | 4             | 4    | 6    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 3    | 44            |     |
|   | Demand Response   | ROS:          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0             | 0   |
| G-I:  |                   | 0             | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 10            |     |
| J:  |                   | 3             | 3    | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 25            |     |
| K:  |                   | 0             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1             |     |
| Total:  | 4                 | 3             | 5    | 4    | 4    | 4    | 3    | 3    | 3    | 3    | 3    | 36   |               |     |

**Figure 39: ICAP Costs Savings - Variant 2**

| CARIS 2019 ICAP Variant #2 Savings (2019 \$M) |                   |               |            |            |            |            |            |            |            |            |            |              |               |     |
|---|-------------------|---------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|---------------|-----|
| Study   | Solution          | Capacity Zone | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028         | 10 Year Total |     |
| Study 1: Central East                         | Transmission      | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | G-I:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | J:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | K:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   | Total:            | <b>0</b>      | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>     | <b>0</b>      |     |
|   | Generation        | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 11         | 10         | 17         | 16         | 15         | 15         | 14         | 13         | 13         | 12           | 12            | 136 |
|   |                   | J:            | 46         | 44         | 40         | 38         | 34         | 33         | 31         | 31         | 30         | 29           | 29            | 356 |
|   |                   | K:            | 9          | 9          | 9          | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 32  |
|   | Total:            | <b>66</b>     | <b>63</b>  | <b>65</b>  | <b>59</b>  | <b>50</b>  | <b>48</b>  | <b>45</b>  | <b>45</b>  | <b>43</b>  | <b>41</b>  | <b>41</b>    | <b>524</b>    |     |
|   | Energy Efficiency | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 28         | 27         | 44         | 42         | 40         | 38         | 36         | 35         | 33         | 32           | 32            | 356 |
|   |                   | J:            | 120        | 114        | 103        | 98         | 90         | 86         | 82         | 79         | 77         | 74           | 74            | 924 |
|   |                   | K:            | 24         | 23         | 13         | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 65  |
|   | Total:            | <b>173</b>    | <b>165</b> | <b>160</b> | <b>145</b> | <b>130</b> | <b>124</b> | <b>118</b> | <b>114</b> | <b>110</b> | <b>106</b> | <b>106</b>   | <b>1,345</b>  |     |
|   | Demand Response   | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
| G-I:  |                   | 24            | 23         | 38         | 36         | 34         | 33         | 31         | 30         | 29         | 27         | 27           | 305           |     |
| J:  |                   | 103           | 98         | 89         | 85         | 77         | 74         | 70         | 68         | 66         | 64         | 64           | 794           |     |
| K:  |                   | 21            | 20         | 13         | 5          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 58            |     |
| Total:  | <b>148</b>        | <b>142</b>    | <b>139</b> | <b>125</b> | <b>112</b> | <b>107</b> | <b>102</b> | <b>98</b>  | <b>95</b>  | <b>91</b>  | <b>91</b>  | <b>1,158</b> |               |     |
| Study 2: Central East-Knickerbocker           | Transmission      | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | G-I:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | J:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | K:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   | Total:            | <b>0</b>      | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>     | <b>0</b>      |     |
|   | Generation        | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 11         | 10         | 17         | 16         | 15         | 15         | 14         | 13         | 13         | 12           | 12            | 136 |
|   |                   | J:            | 46         | 44         | 40         | 38         | 34         | 33         | 31         | 31         | 30         | 29           | 29            | 356 |
|   |                   | K:            | 9          | 9          | 9          | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 32  |
|   | Total:            | <b>66</b>     | <b>63</b>  | <b>65</b>  | <b>59</b>  | <b>50</b>  | <b>48</b>  | <b>45</b>  | <b>45</b>  | <b>43</b>  | <b>41</b>  | <b>41</b>    | <b>524</b>    |     |
|   | Energy Efficiency | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 28         | 27         | 44         | 42         | 40         | 38         | 36         | 35         | 33         | 32           | 32            | 356 |
|   |                   | J:            | 120        | 114        | 103        | 98         | 90         | 86         | 82         | 79         | 77         | 74           | 74            | 924 |
|   |                   | K:            | 24         | 23         | 13         | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 65  |
|   | Total:            | <b>173</b>    | <b>165</b> | <b>160</b> | <b>145</b> | <b>130</b> | <b>124</b> | <b>118</b> | <b>114</b> | <b>110</b> | <b>106</b> | <b>106</b>   | <b>1,345</b>  |     |
|   | Demand Response   | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
| G-I:  |                   | 24            | 23         | 38         | 36         | 34         | 33         | 31         | 30         | 29         | 27         | 27           | 305           |     |
| J:  |                   | 103           | 98         | 89         | 85         | 77         | 74         | 70         | 68         | 66         | 64         | 64           | 794           |     |
| K:  |                   | 21            | 20         | 13         | 5          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 58            |     |
| Total:  | <b>148</b>        | <b>142</b>    | <b>139</b> | <b>125</b> | <b>112</b> | <b>107</b> | <b>102</b> | <b>98</b>  | <b>95</b>  | <b>91</b>  | <b>91</b>  | <b>1,158</b> |               |     |
| Study 3: Volney Scriba                        | Transmission      | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | G-I:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | J:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   |                   | K:            | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             |     |
|   | Total:            | <b>0</b>      | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>   | <b>0</b>     | <b>0</b>      |     |
|   | Generation        | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 11         | 10         | 17         | 16         | 15         | 15         | 14         | 13         | 13         | 12           | 12            | 136 |
|   |                   | J:            | 46         | 44         | 40         | 38         | 34         | 33         | 31         | 31         | 30         | 29           | 29            | 356 |
|   |                   | K:            | 9          | 9          | 9          | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 32  |
|   | Total:            | <b>66</b>     | <b>63</b>  | <b>65</b>  | <b>59</b>  | <b>50</b>  | <b>48</b>  | <b>45</b>  | <b>45</b>  | <b>43</b>  | <b>41</b>  | <b>41</b>    | <b>524</b>    |     |
|   | Energy Efficiency | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
|   |                   | G-I:          | 7          | 7          | 11         | 11         | 10         | 10         | 9          | 9          | 8          | 8            | 8             | 90  |
|   |                   | J:            | 30         | 29         | 26         | 25         | 23         | 22         | 21         | 21         | 20         | 19           | 19            | 235 |
|   |                   | K:            | 6          | 6          | 6          | 5          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 23  |
|   | Total:            | <b>44</b>     | <b>42</b>  | <b>43</b>  | <b>40</b>  | <b>33</b>  | <b>31</b>  | <b>30</b>  | <b>30</b>  | <b>28</b>  | <b>27</b>  | <b>27</b>    | <b>347</b>    |     |
|   | Demand Response   | ROS:          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 0             | 0   |
| G-I:  |                   | 6             | 6          | 9          | 9          | 8          | 8          | 8          | 7          | 7          | 7          | 7            | 74            |     |
| J:  |                   | 25            | 24         | 22         | 21         | 19         | 18         | 17         | 17         | 16         | 16         | 16           | 195           |     |
| K:  |                   | 5             | 5          | 5          | 5          | 0          | 0          | 0          | 0          | 0          | 0          | 0            | 19            |     |
| Total:  | <b>36</b>         | <b>35</b>     | <b>35</b>  | <b>34</b>  | <b>27</b>  | <b>26</b>  | <b>25</b>  | <b>24</b>  | <b>23</b>  | <b>22</b>  | <b>22</b>  | <b>288</b>   |               |     |

### CARIS Base Case Metrics Results

When comparing historic values of congestion and other metrics with the projected CARIS values, it is important to note that there are significant differences in assumptions used by these tools. MAPS, unlike SCUC, did not simulate the following: (a) virtual bidding; (b) transmission outages; (c) fixed load and price-capped load; (d) production costs based on mitigated bids;(e) BPCG payments; and (f) co-optimization with ancillary services.

Figure 40 through Figure 53 below presents the summation of the NYCA zonal results for the ten-year study period (except for NYCA-wide production costs) for the base case developed in 2019 CARIS.

**Figure 40: Projected Base Case Results 2019-2028 (nominal \$M)**

| Case Summary                          | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|---------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| NYCA-Wide Production Cost (\$M)       | 2,403  | 2,740  | 3,030  | 3,287  | 3,502  | 3,728  | 3,960  | 4,148  | 4,212  | 4,484  |
| NYCA Demand Congestion (\$M)          | 986    | 838    | 827    | 655    | 387    | 338    | 219    | 235    | 268    | 322    |
| Load LBMP Payment (\$M)               | 4,509  | 4,938  | 5,286  | 5,565  | 6,126  | 6,455  | 7,072  | 7,317  | 7,529  | 7,899  |
| Generator LBMP Payment (\$M)          | 3,544  | 3,982  | 4,251  | 4,484  | 5,137  | 5,254  | 5,955  | 6,060  | 6,265  | 6,505  |
| Load Payment Losses (\$M)             | 105    | 119    | 131    | 130    | 140    | 148    | 155    | 162    | 171    | 176    |
| SO <sub>2</sub> Costs (\$M)           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.01   | 0.01   | 0.01   |
| SO <sub>2</sub> Emission (Short Tons) | 519    | 536    | 565    | 569    | 857    | 1,217  | 3,237  | 3,147  | 2,975  | 3,168  |
| CO <sub>2</sub> Costs (\$M)           | 128    | 171    | 207    | 226    | 248    | 252    | 278    | 295    | 313    | 337    |
| CO <sub>2</sub> Emission (Short Tons) | 27,527 | 29,996 | 32,373 | 33,100 | 34,065 | 32,234 | 33,366 | 33,000 | 32,710 | 32,925 |
| NO <sub>x</sub> Costs (\$M)           | 0.74   | 0.73   | 0.80   | 0.72   | 0.65   | 0.47   | 0.47   | 0.44   | 0.46   | 0.44   |
| NO <sub>x</sub> Emission (Short Tons) | 10,784 | 11,272 | 12,197 | 12,324 | 12,551 | 11,792 | 12,007 | 11,974 | 11,861 | 11,912 |
| NYCA Avg. LBMP (\$/MWh)               | 26.74  | 29.66  | 31.97  | 34.04  | 38.09  | 40.11  | 44.39  | 45.85  | 47.12  | 49.16  |

**Figure 41: Projected Base Case Production Costs (2019-2028) by Zone (nominal \$M)**

| <b>Production Cost (\$M)</b>    | <b>2019</b>   | <b>2020</b>   | <b>2021</b>   | <b>2022</b>   | <b>2023</b>   | <b>2024</b>   | <b>2025</b>   | <b>2026</b>   | <b>2027</b>   | <b>2028</b>   |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                            | 14            | 15            | 16            | 16            | 28            | 33            | 76            | 75            | 74            | 84            |
| Genesee                         | 37            | 39            | 43            | 41            | 43            | 47            | 44            | 46            | 51            | 49            |
| Central                         | 261           | 295           | 313           | 331           | 389           | 397           | 446           | 443           | 457           | 476           |
| North                           | 1             | 1             | 2             | 1             | 2             | 4             | 3             | 3             | 4             | 4             |
| Mohawk Valley                   | 1             | 1             | 1             | 1             | 1             | 2             | 2             | 1             | 1             | 2             |
| Capital                         | 449           | 473           | 552           | 594           | 633           | 637           | 699           | 716           | 733           | 774           |
| Hudson Valley                   | 132           | 264           | 324           | 339           | 371           | 359           | 392           | 386           | 410           | 439           |
| Millwood                        | 137           | 94            | 24            | 6             | 7             | 7             | 7             | 7             | 7             | 7             |
| Dunwoodie                       | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| NY City                         | 769           | 867           | 947           | 1,029         | 1,111         | 1,141         | 1,230         | 1,293         | 1,318         | 1,374         |
| Long Island                     | 293           | 315           | 334           | 348           | 362           | 371           | 390           | 401           | 412           | 429           |
| <b>NYCA Total</b>               | <b>2,095</b>  | <b>2,363</b>  | <b>2,556</b>  | <b>2,705</b>  | <b>2,946</b>  | <b>2,997</b>  | <b>3,289</b>  | <b>3,371</b>  | <b>3,468</b>  | <b>3,638</b>  |
| NYCA Imports                    | 545           | 636           | 694           | 795           | 902           | 1,012         | 1,147         | 1,178         | 1,200         | 1,280         |
| NYCA Exports                    | 236           | 259           | 220           | 213           | 347           | 281           | 477           | 402           | 455           | 433           |
| <b>NYCA + Imports - Exports</b> | <b>2,403</b>  | <b>2,740</b>  | <b>3,030</b>  | <b>3,287</b>  | <b>3,502</b>  | <b>3,728</b>  | <b>3,960</b>  | <b>4,148</b>  | <b>4,212</b>  | <b>4,484</b>  |
| Total IESO                      | 1,024         | 1,078         | 1,095         | 1,189         | 1,234         | 1,277         | 1,527         | 1,446         | 1,580         | 1,635         |
| Total PJM                       | 14,123        | 14,860        | 15,819        | 16,916        | 18,070        | 19,082        | 20,694        | 21,106        | 21,993        | 23,060        |
| Total ISONE                     | 2,296         | 2,465         | 2,570         | 2,650         | 2,805         | 2,987         | 3,173         | 3,268         | 3,406         | 3,563         |
| <b>Total System</b>             | <b>19,538</b> | <b>20,767</b> | <b>22,041</b> | <b>23,461</b> | <b>25,055</b> | <b>26,343</b> | <b>28,684</b> | <b>29,190</b> | <b>30,448</b> | <b>31,897</b> |

**Figure 42: Projected Base Case Load Payments (2019-2028) by Zone (nominal \$M)**

| <b>Load Payment (\$M)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>  | <b>2028</b>  |
|---------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                      | 409          | 427          | 443          | 454          | 534          | 552          | 626          | 640          | 658          | 683          |
| Genesee                   | 208          | 243          | 268          | 298          | 351          | 366          | 414          | 426          | 437          | 456          |
| Central                   | 376          | 426          | 458          | 496          | 575          | 614          | 685          | 706          | 723          | 752          |
| North                     | 92           | 122          | 135          | 151          | 183          | 193          | 222          | 228          | 233          | 241          |
| Mohawk Valley             | 157          | 179          | 193          | 211          | 244          | 271          | 301          | 311          | 318          | 330          |
| Capital                   | 401          | 420          | 446          | 463          | 490          | 513          | 554          | 572          | 588          | 619          |
| Hudson Valley             | 291          | 317          | 346          | 365          | 394          | 408          | 445          | 462          | 477          | 502          |
| Millwood                  | 80           | 88           | 96           | 101          | 109          | 114          | 125          | 130          | 135          | 143          |
| Dunwoodie                 | 174          | 191          | 208          | 218          | 235          | 246          | 268          | 279          | 288          | 303          |
| NY City                   | 1,604        | 1,756        | 1,883        | 1,970        | 2,117        | 2,238        | 2,435        | 2,534        | 2,620        | 2,753        |
| Long Island               | 717          | 770          | 810          | 838          | 895          | 939          | 997          | 1,027        | 1,052        | 1,117        |
| <b>NYCA Total</b>         | <b>4,509</b> | <b>4,938</b> | <b>5,286</b> | <b>5,565</b> | <b>6,126</b> | <b>6,455</b> | <b>7,072</b> | <b>7,317</b> | <b>7,529</b> | <b>7,899</b> |

**Figure 43: Projected Base Case Generator Payments (2019-2028) by Zone (nominal \$M)**

| <b>Generator Payment (\$M)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>  | <b>2028</b>  |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                           | 317          | 399          | 466          | 537          | 650          | 678          | 817          | 839          | 858          | 894          |
| Genesee                        | 102          | 122          | 146          | 151          | 179          | 202          | 213          | 219          | 243          | 235          |
| Central                        | 589          | 683          | 784          | 840          | 1,071        | 1,096        | 1,315        | 1,289        | 1,343        | 1,361        |
| North                          | 178          | 211          | 234          | 262          | 315          | 335          | 384          | 392          | 404          | 420          |
| Mohawk Valley                  | 72           | 87           | 96           | 111          | 134          | 146          | 167          | 174          | 180          | 188          |
| Capital                        | 539          | 562          | 670          | 714          | 763          | 762          | 844          | 863          | 886          | 938          |
| Hudson Valley                  | 151          | 300          | 374          | 393          | 435          | 426          | 470          | 466          | 493          | 528          |
| Millwood                       | 511          | 388          | 109          | 16           | 18           | 19           | 20           | 21           | 21           | 23           |
| Dunwoodie                      | 2            | 2            | 3            | 3            | 3            | 4            | 4            | 4            | 4            | 5            |
| NY City                        | 765          | 883          | 988          | 1,067        | 1,159        | 1,170        | 1,280        | 1,340        | 1,365        | 1,425        |
| Long Island                    | 319          | 347          | 381          | 391          | 408          | 416          | 441          | 452          | 466          | 489          |
| <b>NYCA Total</b>              | <b>3,544</b> | <b>3,982</b> | <b>4,251</b> | <b>4,484</b> | <b>5,137</b> | <b>5,254</b> | <b>5,955</b> | <b>6,060</b> | <b>6,265</b> | <b>6,505</b> |

**Figure 44: Projected Base Case Generation (2019-2028) by Zone (GWh)**

| Generation (GWh)    | 2019             | 2020             | 2021             | 2022             | 2023             | 2024             | 2025             | 2026             | 2027             | 2028             |
|---------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| West                | 17,451           | 17,766           | 18,095           | 18,144           | 18,484           | 18,611           | 19,530           | 19,520           | 19,468           | 19,578           |
| Genesee             | 5,046            | 5,092            | 5,531            | 5,120            | 5,154            | 5,603            | 5,162            | 5,183            | 5,617            | 5,213            |
| Central             | 28,925           | 29,010           | 30,188           | 29,558           | 31,926           | 30,671           | 32,421           | 31,006           | 32,081           | 31,209           |
| North               | 9,315            | 9,387            | 9,386            | 9,407            | 9,438            | 9,489            | 9,485            | 9,467            | 9,488            | 9,501            |
| Mohawk Valley       | 3,625            | 3,676            | 3,740            | 3,808            | 3,872            | 3,944            | 3,977            | 4,020            | 4,043            | 4,078            |
| Capital             | 17,215           | 16,831           | 18,866           | 19,177           | 19,464           | 18,305           | 18,866           | 18,572           | 18,653           | 18,766           |
| Hudson Valley       | 5,590            | 10,148           | 11,743           | 11,760           | 12,135           | 11,106           | 11,352           | 10,898           | 11,223           | 11,380           |
| Millwood            | 17,645           | 11,724           | 2,631            | 438              | 440              | 443              | 443              | 444              | 445              | 447              |
| Dunwoodie           | 55               | 63               | 69               | 75               | 79               | 81               | 83               | 85               | 86               | 88               |
| NY City             | 25,090           | 25,851           | 27,378           | 28,430           | 29,053           | 27,945           | 28,093           | 28,428           | 27,949           | 27,795           |
| Long Island         | 9,441            | 9,511            | 9,895            | 9,877            | 9,742            | 9,299            | 9,053            | 8,907            | 8,908            | 8,959            |
| <b>NYCA Total</b>   | <b>139,398</b>   | <b>139,060</b>   | <b>137,521</b>   | <b>135,794</b>   | <b>139,787</b>   | <b>135,497</b>   | <b>138,465</b>   | <b>136,530</b>   | <b>137,959</b>   | <b>137,014</b>   |
| Total IESO          | 154,562          | 152,749          | 147,513          | 146,915          | 131,767          | 142,699          | 130,602          | 135,682          | 134,417          | 138,873          |
| Total PJM           | 790,508          | 793,254          | 799,154          | 805,772          | 819,816          | 822,167          | 833,443          | 834,579          | 838,884          | 844,932          |
| Total ISONE         | 107,951          | 105,479          | 105,310          | 105,908          | 105,716          | 104,976          | 104,924          | 104,424          | 105,103          | 105,832          |
| Total HQ *          | 25,985           | 25,997           | 26,093           | 26,054           | 26,020           | 26,068           | 25,959           | 26,134           | 26,093           | 26,096           |
| <b>Total System</b> | <b>1,218,404</b> | <b>1,216,539</b> | <b>1,215,590</b> | <b>1,220,444</b> | <b>1,223,106</b> | <b>1,231,407</b> | <b>1,233,394</b> | <b>1,237,348</b> | <b>1,242,456</b> | <b>1,252,747</b> |

**Figure 45: Projected Base Case Loss Payments (2019-2028) by Zone (nominal \$M)**

| Loss Costs (\$M)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West              | -10        | -14        | -11        | -14        | -8         | -20        | -14        | -19        | -16        | -21        |
| Genesee           | -4         | -5         | -4         | -3         | -1         | -6         | -3         | -5         | -4         | -5         |
| Central           | 4          | 4          | 4          | 4          | 4          | 3          | 3          | 3          | 3          | 3          |
| North             | -5         | -7         | -7         | -7         | -7         | -9         | -8         | -9         | -9         | -9         |
| Mohawk Valley     | 3          | 3          | 3          | 3          | 3          | 4          | 5          | 5          | 5          | 5          |
| Capital           | 11         | 13         | 12         | 12         | 12         | 11         | 11         | 12         | 12         | 12         |
| Hudson Valley     | 10         | 12         | 13         | 13         | 13         | 15         | 15         | 16         | 16         | 17         |
| Millwood          | 3          | 3          | 4          | 4          | 4          | 5          | 5          | 5          | 5          | 5          |
| Dunwoodie         | 6          | 7          | 8          | 8          | 8          | 10         | 9          | 10         | 11         | 11         |
| NY City           | 62         | 73         | 78         | 79         | 79         | 97         | 95         | 104        | 107        | 113        |
| Long Island       | 27         | 31         | 31         | 31         | 31         | 38         | 37         | 40         | 41         | 44         |
| <b>NYCA Total</b> | <b>105</b> | <b>119</b> | <b>131</b> | <b>130</b> | <b>140</b> | <b>148</b> | <b>155</b> | <b>162</b> | <b>171</b> | <b>176</b> |

**Figure 46: Projected Base Case SO<sub>2</sub> Emissions Costs (2019-2028) by Zone (nominal \$M)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                                  | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.01        | 0.01        | 0.00        | 0.01        |
| Genesee                               | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Central                               | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| North                                 | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Mohawk Valley                         | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Capital                               | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Hudson Valley                         | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Millwood                              | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Dunwoodie                             | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| NY City                               | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| Long Island                           | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        | 0.00        |
| <b>NYCA Total</b>                     | <b>0.00</b> | <b>0.00</b> | <b>0.00</b> | <b>0.00</b> | <b>0.00</b> | <b>0.00</b> | <b>0.01</b> | <b>0.01</b> | <b>0.01</b> | <b>0.01</b> |



**Figure 47: Projected Base Case SO<sub>2</sub> Emissions (2019-2028) by Zone (Tons)**

| SO <sub>2</sub> Emissions (Tons) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024         | 2025         | 2026         | 2027         | 2028         |
|----------------------------------|------------|------------|------------|------------|------------|--------------|--------------|--------------|--------------|--------------|
| West                             | 171        | 173        | 172        | 173        | 457        | 828          | 2,848        | 2,759        | 2,588        | 2,780        |
| Genesee                          | 0          | 0          | 0          | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| Central                          | 7          | 9          | 9          | 10         | 12         | 12           | 13           | 12           | 12           | 13           |
| North                            | 0          | 0          | 0          | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| Mohawk Valley                    | 0          | 0          | 0          | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| Capital                          | 63         | 62         | 66         | 67         | 67         | 65           | 66           | 65           | 65           | 65           |
| Hudson Valley                    | 14         | 24         | 44         | 45         | 45         | 42           | 42           | 41           | 41           | 42           |
| Millwood                         | 106        | 106        | 105        | 106        | 106        | 106          | 106          | 106          | 106          | 106          |
| Dunwoodie                        | 0          | 0          | 0          | 0          | 0          | 0            | 0            | 0            | 0            | 0            |
| NY City                          | 64         | 66         | 70         | 72         | 73         | 70           | 70           | 71           | 70           | 69           |
| Long Island                      | 96         | 96         | 98         | 97         | 96         | 94           | 93           | 93           | 93           | 93           |
| <b>NYCA Total</b>                | <b>519</b> | <b>536</b> | <b>565</b> | <b>569</b> | <b>857</b> | <b>1,217</b> | <b>3,237</b> | <b>3,147</b> | <b>2,975</b> | <b>3,168</b> |

**Figure 48: Projected Base Case CO<sub>2</sub> Emissions Costs (2019-2028) by Zone (nominal \$M)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                                  | 0.7          | 0.8          | 1.0          | 1.0          | 2.4          | 3.5          | 10.7         | 11.1         | 11.1         | 12.9         |
| Genesee                               | 0.1          | 0.1          | 0.1          | 0.1          | 0.2          | 0.2          | 0.1          | 0.2          | 0.2          | 0.2          |
| Central                               | 6.6          | 10.2         | 11.2         | 13.5         | 17.2         | 18.4         | 21.0         | 22.1         | 22.6         | 25.8         |
| North                                 | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.3          | 0.2          | 0.2          | 0.3          | 0.3          |
| Mohawk Valley                         | 0.1          | 0.0          | 0.0          | 0.0          | 0.0          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          |
| Capital                               | 33.1         | 36.6         | 46.1         | 50.1         | 54.3         | 54.4         | 59.8         | 62.8         | 67.3         | 72.4         |
| Hudson Valley                         | 12.8         | 25.2         | 32.7         | 34.5         | 37.9         | 36.4         | 39.2         | 39.9         | 44.2         | 47.9         |
| Millwood                              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dunwoodie                             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| NY City                               | 53.2         | 73.6         | 87.1         | 96.3         | 104.5        | 107.2        | 114.5        | 124.4        | 130.4        | 138.2        |
| Long Island                           | 21.2         | 24.3         | 28.4         | 30.3         | 31.7         | 31.8         | 32.7         | 34.3         | 36.6         | 39.3         |
| <b>NYCA Total</b>                     | <b>127.9</b> | <b>170.9</b> | <b>206.7</b> | <b>226.0</b> | <b>248.3</b> | <b>252.2</b> | <b>278.4</b> | <b>295.1</b> | <b>312.9</b> | <b>337.2</b> |

**Figure 49: Projected Base Case CO<sub>2</sub> Emissions (2019-2028) by Zone (1,000 Tons)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|---------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                                  | 136           | 135           | 151           | 143           | 315           | 431           | 1,276         | 1,230         | 1,148         | 1,239         |
| Genesee                               | 20            | 18            | 19            | 18            | 24            | 19            | 16            | 22            | 19            | 22            |
| Central                               | 1,295         | 1,776         | 1,718         | 1,957         | 2,344         | 2,328         | 2,512         | 2,468         | 2,361         | 2,511         |
| North                                 | 13            | 9             | 14            | 11            | 14            | 32            | 27            | 19            | 29            | 31            |
| Mohawk Valley                         | 10            | 5             | 5             | 3             | 3             | 9             | 8             | 6             | 5             | 7             |
| Capital                               | 6,565         | 6,347         | 7,143         | 7,245         | 7,368         | 6,849         | 7,076         | 6,929         | 6,946         | 6,969         |
| Hudson Valley                         | 2,522         | 4,358         | 5,055         | 4,981         | 5,127         | 4,587         | 4,627         | 4,396         | 4,551         | 4,604         |
| Millwood                              | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| Dunwoodie                             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| NY City                               | 12,658        | 13,053        | 13,785        | 14,284        | 14,504        | 13,884        | 13,882        | 14,076        | 13,804        | 13,685        |
| Long Island                           | 4,307         | 4,296         | 4,483         | 4,460         | 4,367         | 4,095         | 3,941         | 3,854         | 3,848         | 3,856         |
| <b>NYCA Total</b>                     | <b>27,527</b> | <b>29,996</b> | <b>32,373</b> | <b>33,100</b> | <b>34,065</b> | <b>32,234</b> | <b>33,366</b> | <b>33,000</b> | <b>32,710</b> | <b>32,925</b> |

**Figure 50: Projected Base Case NO<sub>x</sub> Emissions Costs (2019-2028) by Zone (nominal \$M)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Genesee                               | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Central                               | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| North                                 | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Mohawk Valley                         | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Capital                               | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Hudson Valley                         | 0.2        | 0.2        | 0.2        | 0.2        | 0.2        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        |
| Millwood                              | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | 0.3        | 0.3        | 0.3        | 0.3        | 0.3        | 0.2        | 0.2        | 0.2        | 0.2        | 0.2        |
| Long Island                           | 0.2        | 0.2        | 0.2        | 0.2        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        |
| <b>NYCA Total</b>                     | <b>0.7</b> | <b>0.7</b> | <b>0.8</b> | <b>0.7</b> | <b>0.6</b> | <b>0.5</b> | <b>0.5</b> | <b>0.4</b> | <b>0.5</b> | <b>0.4</b> |

**Figure 51: Projected Base Case NO<sub>x</sub> Emissions (2019-2028) by Zone (Tons)**

| NO <sub>x</sub> Emissions (Tons) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                             | 1,006         | 1,038         | 1,051         | 1,071         | 1,177         | 1,223         | 1,626         | 1,607         | 1,568         | 1,644         |
| Genesee                          | 151           | 158           | 160           | 170           | 178           | 177           | 176           | 178           | 177           | 178           |
| Central                          | 385           | 432           | 426           | 457           | 513           | 518           | 541           | 534           | 520           | 543           |
| North                            | 33            | 36            | 34            | 33            | 35            | 48            | 45            | 39            | 41            | 45            |
| Mohawk Valley                    | 33            | 32            | 31            | 32            | 33            | 35            | 34            | 34            | 34            | 34            |
| Capital                          | 826           | 850           | 926           | 977           | 967           | 945           | 945           | 960           | 940           | 951           |
| Hudson Valley                    | 1,324         | 1,360         | 1,739         | 1,617         | 1,699         | 1,400         | 1,312         | 1,216         | 1,302         | 1,309         |
| Millwood                         | 989           | 992           | 989           | 989           | 989           | 993           | 990           | 990           | 990           | 992           |
| Dunwoodie                        | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| NY City                          | 2,945         | 3,280         | 3,654         | 3,817         | 3,844         | 3,474         | 3,446         | 3,561         | 3,435         | 3,369         |
| Long Island                      | 3,093         | 3,093         | 3,187         | 3,161         | 3,116         | 2,978         | 2,891         | 2,856         | 2,854         | 2,847         |
| <b>NYCA Total</b>                | <b>10,784</b> | <b>11,272</b> | <b>12,197</b> | <b>12,324</b> | <b>12,551</b> | <b>11,792</b> | <b>12,007</b> | <b>11,974</b> | <b>11,861</b> | <b>11,912</b> |

**Figure 52: Projected Congestion Rents (2019-2028) (nominal \$M)**

| Congestion Rent (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-----------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>NYCA Total</b>     | <b>573</b> | <b>465</b> | <b>464</b> | <b>392</b> | <b>327</b> | <b>323</b> | <b>299</b> | <b>323</b> | <b>361</b> | <b>378</b> |

**Figure 53: Projected Base Case LBMP (2019-2028) by Zone (\$/MWh)**

| LBMP (\$/MWh)                | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                         | 25.76        | 27.42        | 28.73        | 29.70        | 35.23        | 36.34        | 41.54        | 42.49        | 43.81        | 45.40        |
| Genesee                      | 20.88        | 24.61        | 27.06        | 30.09        | 35.62        | 37.07        | 42.22        | 43.36        | 44.51        | 46.27        |
| Central                      | 23.38        | 26.78        | 28.86        | 31.40        | 36.60        | 39.02        | 43.79        | 45.21        | 46.37        | 48.14        |
| North                        | 19.13        | 22.75        | 25.23        | 28.24        | 34.05        | 35.96        | 41.21        | 42.30        | 43.41        | 44.99        |
| Mohawk Valley                | 23.15        | 26.68        | 28.81        | 31.52        | 36.72        | 39.32        | 44.06        | 45.51        | 46.63        | 48.43        |
| Capital                      | 31.41        | 33.37        | 35.63        | 37.10        | 39.47        | 41.46        | 45.05        | 46.57        | 47.96        | 50.30        |
| Hudson Valley                | 29.20        | 31.97        | 34.74        | 36.65        | 39.65        | 41.65        | 45.43        | 47.09        | 48.43        | 50.73        |
| Millwood                     | 29.39        | 32.29        | 34.94        | 36.83        | 39.79        | 41.85        | 45.61        | 47.29        | 48.63        | 50.93        |
| Dunwoodie                    | 29.37        | 32.29        | 34.98        | 36.86        | 39.81        | 41.82        | 45.58        | 47.25        | 48.60        | 50.88        |
| NY City                      | 29.98        | 32.89        | 35.26        | 37.05        | 39.96        | 42.19        | 45.97        | 47.66        | 49.07        | 51.34        |
| Long Island                  | 32.46        | 35.21        | 37.42        | 38.99        | 42.13        | 44.52        | 47.89        | 49.60        | 50.88        | 53.39        |
| <b>Average LBMP (\$/MWh)</b> | <b>26.74</b> | <b>29.66</b> | <b>31.97</b> | <b>34.04</b> | <b>38.09</b> | <b>40.11</b> | <b>44.39</b> | <b>45.85</b> | <b>47.12</b> | <b>49.16</b> |

## Selection of Studies

The process for selecting the three CARIS studies occurs in two steps, as described below.

In Step 1, the top five congested elements for the fifteen-year period (both historic (5 years) and projected (10 years)) are ranked in descending order based on the calculated present value of demand congestion for further assessment. The discount rate to be used for the present value analysis shall be the current weighted average cost of capital for the NY Transmission Owners, which was 7.08% for 2019 CARIS cycle. The top congested elements are then iteratively relieved independently by relaxing their limits. This is to determine if any of the congested elements need to be grouped with other elements, depending on whether new electrically adjacent elements appear as limiting with significant congestion when a primary element is relieved.

In Step 2, the assessed element groupings are then ranked based upon the highest change in production cost as shown with the top 3 groupings selected to be studied.

Note that the procedure provides that if future system changes (*e.g.*, generation, transmission, energy efficiency or demand side additions) produce a significant declining trend in congestion over an identified congested element in later years of the study period, such element shall be excluded from the rankings. Elements with significant increasing trend in congestion could also be evaluated in addition to the top five elements. As a result, New Scotland-Knickerbocker line was included in the relaxation and grouping process.

The study selection procedures provide the NYISO with flexibility for grouping, assessing and recommending the three studies. The grouping process for each CARIS is reviewed with ESPWG. It is expected that the three groupings/elements with the most production cost savings will be selected as the three studies. The production cost savings based on modifying an existing element's transfer limit will be different than the savings achieved when applying a transmission solution because an impedance value for the line is not being introduced.

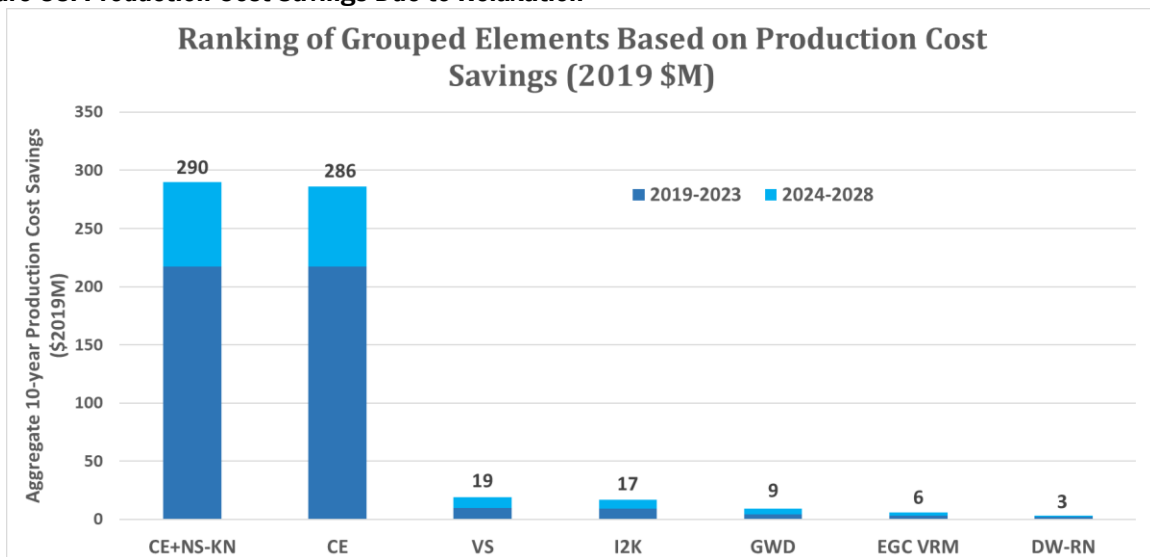
Figure 54 shows the demand congestion for the base case and the relaxation cases over the 10-year study period.

**Figure 54: Base Case and Relaxation Case Demand Congestion**

| Demand Congestion (\$2019M) | Base Case | 10 YEAR RELAXATION |                                |                             |                    |  |                    |  |
|-----------------------------|-----------|--------------------|--------------------------------|-----------------------------|--------------------|--|--------------------|--|
|                             |           | CENTRAL EAST (CE)  | DUNWOODIE TO LONG ISLAND (I2K) | DUNWOODIE TO RAINEY (DW-RN) | GREENWOOD LP (GWD) | EAST GARDEN CITY-VALLEY STREAM (EGC VRM) | VOLNEY SCRIBA (VS) | CENTRAL EAST-NEW SCOTLAND KNICKERBOCKER (CE-NS-KN) |
| CENTRAL EAST                | \$2,555   | \$0                | \$2,513                        | \$2,540                     | \$2,555            | \$2,556                                  | \$2,551            | \$0  |
| DUNWOODIE TO LONG ISLAND    | \$230     | \$220              | \$0                            | \$221                       | \$229              | \$229                                    | \$232              | \$219  |
| DUNWOODIE MOTTHAVEN         | \$83      | \$80               | \$70                           | \$0                         | \$89               | \$81                                     | \$84               | \$79   |
| GREENWOOD                   | \$67      | \$68               | \$64                           | \$67                        | \$0                | \$67                                     | \$68               | \$68   |
| VOLNEY SCRIBA               | \$51      | \$51               | \$53                           | \$52                        | \$51               | \$51                                     | \$0                | \$51   |
| EGRDNCTY 138 VALLYSTR 138 1 | \$33      | \$33               | \$30                           | \$33                        | \$33               | \$0                                      | \$33               | \$33   |
| NEW SCOTLAND KNCKRBOC       | \$16      | \$26               | \$12                           | \$17                        | \$15               | \$16                                     | \$16               | \$0  |
| LEEDS PLEASANT VALLEY       | \$9       | \$8                | \$11                           | \$12                        | \$10               | \$9                                      | \$10               | \$8  |
| MOTTHAVEN RAINEY            | \$3       | \$2                | \$2                            | \$0                         | \$4                | \$3                                      | \$3                | \$2  |

Figure 55 shows the change in production cost when the top congested elements are relieved. The NYISO presented the ranking and grouping analysis to ESPWG stakeholders and recommended three studies based upon the highest production cost savings: Central East, Central East-New Scotland-Knickerbocker, and Volney-Scriba. The recommendation was based upon these groupings meeting the NYISO's grouping and ranking guidelines.

**Figure 55: Production Cost Savings Due to Relaxation**



### Generic Solutions

The NYISO developed generic solutions for each of the three studies. The generic solutions are each added to the base case in order to determine the impact on congestion for the grouped elements in each study. It is assumed that each of the generic solutions is installed in the first study year (2019). This assumption allows for the calculation of the full ten-year production cost and

additional metrics resulting from the generic solution. The transfer limits were adjusted as necessary in the generic solution cases.

For each study, the NYISO considered whether a majority of the congestion on the grouped elements being studied could be relieved and whether diminishing returns could be realized from implementing additional blocks of solutions. The NYISO implemented transmission solutions in 1986 MVA block sizes for 345 kV, generation solutions in 340MW block sizes, energy efficiency solutions in 100 MW block sizes in Zone F-G, 200 MW in Zone J, and demand response in 100 MW block sizes in Zone F-G, 200 MW in Zone J.

Note:

- Other solutions may exist that would better alleviate the congestion on the studied elements.
- No engineering, physical feasibility study, routing study or siting study has been completed for the generic solutions. Therefore, it is unknown if the generic solutions can be physically constructed as proposed.

**Study 1: Central East**

- Transmission: 345 kV line from Edic to New Scotland, 85 Miles
- Generation: 340 MW Plant at New Scotland
- Demand Response : 100 MW in Zone F; 100 MW in Zone G; 200 MW in Zone J
- Energy Efficiency : 100 MW in Zone F; 100 MW in Zone G; 200 MW in Zone J

Figure 56 below presents the change in the number of congested hours by constraints after the generic solution has been applied. Negative values indicate a reduction in congested hours. Detailed results for all CARIS metrics, representing the change between the base case values and the values after the three generic solutions have been applied, are presented in Appendix H - Generic Solution Results - Additional Details.

**Figure 56: Change in Number of Congested Hours in Study 1 (Solution Case – Base Case)**

| Study                    | Solution              | Constraint                  | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  |
|--------------------------|-----------------------|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Study 1:<br>Central East | Transmission Solution | CENTRAL EAST                | (386) | (595) | (448) | (380) | (264) | (458) | (311) | (359) | (270) | (284) |
|                          |                       | DUNWOODIE TO LONG ISLAND    | 46    | 36    | 130   | 94    | 149   | 45    | 70    | 30    | 11    | 27    |
|                          |                       | DUNWOODIE MOTTHAVEN         | 68    | 60    | 117   | 46    | 106   | 55    | 80    | 36    | 72    | 38    |
|                          |                       | GREENWOOD                   | (63)  | (58)  | (30)  | (72)  | (82)  | (43)  | (34)  | (22)  | (7)   | 16    |
|                          |                       | VOLNEY SCRIBA               | 60    | 149   | 128   | 11    | 14    | 5     | (16)  | (7)   | (15)  | 12    |
|                          |                       | EGRDNCTY 138 VALLYSTR 138 1 | (57)  | (47)  | 4     | 22    | (31)  | (40)  | 5     | 20    | 11    | 2     |
|                          |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | 249   | 91    | 117   | 120   | 183   |
|                          |                       | LEEDS PLEASANT VALLEY       | 30    | 17    | 9     | 24    | 40    | 0     | 0     | 0     | 0     | 0     |
|                          | MOTTHAVEN RAINEY      | 149                         | 206   | 44    | 23    | 33    | 30    | 10    | 21    | 7     | 17    |       |
|                          | Generation Solution   | CENTRAL EAST                | (2)   | 102   | (41)  | 6     | (96)  | 26    | 7     | (65)  | (28)  | 18    |
|                          |                       | DUNWOODIE TO LONG ISLAND    | 62    | (72)  | 35    | 63    | 172   | 30    | 93    | 131   | 169   | 187   |
|                          |                       | DUNWOODIE MOTTHAVEN         | 3     | 62    | 55    | 47    | 79    | 136   | (4)   | 164   | 174   | 65    |
|                          |                       | GREENWOOD                   | 21    | (24)  | (3)   | 61    | (4)   | (101) | (30)  | (50)  | (33)  | 155   |
|                          |                       | VOLNEY SCRIBA               | (228) | (74)  | 142   | (136) | 25    | 9     | 17    | (75)  | 347   | (30)  |
|                          |                       | EGRDNCTY 138 VALLYSTR 138 1 | 70    | 26    | 69    | (39)  | 161   | (171) | (108) | 16    | (77)  | 11    |
|                          |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | 0     | (3)   | 40    | 7     | (6)   |
|                          |                       | LEEDS PLEASANT VALLEY       | 8     | 12    | 13    | 23    | 22    | 0     | 0     | 0     | 0     | 0     |
|                          | MOTTHAVEN RAINEY      | 61                          | 80    | 62    | 29    | 26    | 31    | (6)   | 44    | (30)  | 14    |       |
|                          | Demand Response       | CENTRAL EAST                | (4)   | (3)   | 1     | 1     | 24    | (2)   | (3)   | (5)   | (1)   | 7     |
|                          |                       | DUNWOODIE TO LONG ISLAND    | 0     | (12)  | (7)   | (1)   | 9     | 0     | 10    | 4     | 2     | (1)   |
|                          |                       | DUNWOODIE MOTTHAVEN         | (10)  | (10)  | (6)   | (5)   | 3     | 31    | (2)   | (4)   | 2     | 20    |
|                          |                       | GREENWOOD                   | 5     | (1)   | (1)   | 3     | 7     | 0     | 2     | 5     | 2     | (3)   |
|                          |                       | VOLNEY SCRIBA               | 4     | (10)  | 1     | 7     | (2)   | 0     | 1     | 0     | (2)   | 0     |
|                          |                       | EGRDNCTY 138 VALLYSTR 138 1 | (1)   | 6     | (2)   | (1)   | 4     | 5     | (7)   | 3     | 4     | 6     |
|                          |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | (1)   | 0     | 0     | 0     | 1     |
|                          |                       | LEEDS PLEASANT VALLEY       | 2     | 2     | 0     | 1     | 1     | 0     | 0     | 0     | 0     | 0     |
|                          | MOTTHAVEN RAINEY      | 11                          | 13    | 1     | 3     | 2     | 2     | 4     | (1)   | (2)   | 2     |       |
|                          | Energy Efficiency     | CENTRAL EAST                | (48)  | (28)  | (38)  | (44)  | 16    | (63)  | (24)  | (127) | (23)  | (17)  |
|                          |                       | DUNWOODIE TO LONG ISLAND    | 99    | 43    | 119   | 123   | 248   | 175   | 161   | 234   | 211   | 195   |
|                          |                       | DUNWOODIE MOTTHAVEN         | (86)  | (128) | (173) | (223) | (119) | (211) | (218) | (270) | (269) | (241) |
|                          |                       | GREENWOOD                   | (271) | (407) | (329) | (388) | (357) | (371) | (321) | (351) | (433) | (349) |
|                          |                       | VOLNEY SCRIBA               | (256) | (178) | (109) | (13)  | (42)  | (76)  | (31)  | (69)  | (79)  | (91)  |
|                          |                       | EGRDNCTY 138 VALLYSTR 138 1 | (62)  | (57)  | (56)  | (28)  | (75)  | (149) | (34)  | (30)  | (54)  | (54)  |
|                          |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | 29    | 9     | (12)  | 5     | 8     |
|                          |                       | LEEDS PLEASANT VALLEY       | 3     | (1)   | (1)   | 5     | (1)   | 0     | 0     | 0     | 0     | 0     |
|                          | MOTTHAVEN RAINEY      | 13                          | 56    | 39    | (3)   | 38    | 24    | 16    | 2     | 25    | (16)  |       |

**Study 2: Central East – New Scotland - Knickerbocker**

- Transmission: 345 kV line from Edic to Knickerbocker, 100 Miles
- Generation: 340 MW Plant at Pleasant Valley
- Demand Response : 100 MW in Zone F; 100 MW in Zone G; 200 MW in Zone J
- Energy Efficiency : 100 MW in Zone F; 100 MW in Zone G; 200 MW in Zone J



Figure 57 below presents the change in the number of congested hours by constraints after the generic solution has been applied. Negative values indicate a reduction in congested hours. Detailed results for all CARIS metrics, representing the change between the base case values and the values after the three generic solutions have been applied, are presented in Appendix H - Generic Solution Results - Additional Details.

**Figure 57: Change in Number of Congested Hours in Study 2 (Solution Case – Base Case)**

| Study  | Solution              | Constraint                  | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  |
|--|-----------------------|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Study 2: Central East - New Scotland - Knickerbocker | Transmission Solution | CENTRAL EAST                | (386) | (595) | (448) | (380) | (264) | (303) | (235) | (233) | (170) | (175) |
|  |                       | DUNWOODIE TO LONG ISLAND    | 46    | 36    | 130   | 94    | 149   | 22    | 37    | 51    | 1     | 24    |
|  |                       | DUNWOODIE MOTTHAVEN         | 68    | 60    | 117   | 46    | 106   | 49    | 32    | 41    | 51    | 42    |
|  |                       | GREENWOOD                   | (63)  | (58)  | (30)  | (72)  | (82)  | (49)  | (39)  | (14)  | (37)  | 24    |
|  |                       | VOLNEY SCRIBA               | 60    | 149   | 128   | 11    | 14    | 5     | (2)   | (7)   | (20)  | (2)   |
|  |                       | EGRDNCTY 138 VALLYSTR 138 1 | (57)  | (47)  | 4     | 22    | (31)  | (37)  | (19)  | 5     | 5     | 12    |
|  |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | (33)  | (21)  | (61)  | (37)  | (28)  |
|  |                       | LEEDS PLEASANT VALLEY       | 30    | 17    | 9     | 24    | 40    | 0     | 0     | 0     | 0     | 0     |
|  | MOTTHAVEN RAINEY      | 149                         | 206   | 44    | 23    | 33    | 39    | 10    | 17    | (1)   | 6     |       |
|  | Generation Solution   | CENTRAL EAST                | (15)  | 90    | (23)  | 53    | (87)  | 49    | 13    | (48)  | (8)   | 15    |
|  |                       | DUNWOODIE TO LONG ISLAND    | 67    | (48)  | 35    | 56    | 213   | 52    | 78    | 156   | 182   | 204   |
|  |                       | DUNWOODIE MOTTHAVEN         | (17)  | 34    | 132   | 89    | 86    | 138   | 7     | 202   | 177   | 88    |
|  |                       | GREENWOOD                   | 26    | (27)  | 0     | 65    | 5     | (109) | (25)  | (46)  | (26)  | 125   |
|  |                       | VOLNEY SCRIBA               | (201) | (66)  | 182   | (128) | 12    | 7     | 22    | (72)  | 341   | (66)  |
|  |                       | EGRDNCTY 138 VALLYSTR 138 1 | 66    | 34    | 103   | (22)  | 165   | (162) | (128) | 18    | (86)  | (3)   |
|  |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | (16)  | (4)   | (1)   | (14)  | (13)  |
|  |                       | LEEDS PLEASANT VALLEY       | (5)   | (10)  | (8)   | 1     | (7)   | 0     | 0     | 0     | 0     | 0     |
|  | MOTTHAVEN RAINEY      | 91                          | 149   | 81    | 26    | 31    | 38    | (5)   | 48    | (24)  | 16    |       |
|  | Demand Response       | CENTRAL EAST                | (4)   | (3)   | 1     | 1     | 24    | (2)   | (3)   | (5)   | (1)   | 7     |
|  |                       | DUNWOODIE TO LONG ISLAND    | 0     | (12)  | (7)   | (1)   | 9     | 0     | 10    | 4     | 2     | (1)   |
|  |                       | DUNWOODIE MOTTHAVEN         | (10)  | (10)  | (6)   | (5)   | 3     | 31    | (2)   | (4)   | 2     | 20    |
|  |                       | GREENWOOD                   | 5     | (1)   | (1)   | 3     | 7     | 0     | 2     | 5     | 2     | (3)   |
|  |                       | VOLNEY SCRIBA               | 4     | (10)  | 1     | 7     | (2)   | 0     | 1     | 0     | (2)   | 0     |
|  |                       | EGRDNCTY 138 VALLYSTR 138 1 | (1)   | 6     | (2)   | (1)   | 4     | 5     | (7)   | 3     | 4     | 6     |
|  |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | (1)   | 0     | 0     | 0     | 1     |
|  |                       | LEEDS PLEASANT VALLEY       | 2     | 2     | 0     | 1     | 1     | 0     | 0     | 0     | 0     | 0     |
|  | MOTTHAVEN RAINEY      | 11                          | 13    | 1     | 3     | 2     | 2     | 4     | (1)   | (2)   | 2     |       |
|  | Energy Efficiency     | CENTRAL EAST                | (48)  | (28)  | (38)  | (44)  | 16    | (63)  | (24)  | (127) | (23)  | (17)  |
|  |                       | DUNWOODIE TO LONG ISLAND    | 99    | 43    | 119   | 123   | 248   | 175   | 161   | 234   | 211   | 195   |
|  |                       | DUNWOODIE MOTTHAVEN         | (86)  | (128) | (173) | (223) | (119) | (211) | (218) | (270) | (269) | (241) |
|  |                       | GREENWOOD                   | (271) | (407) | (329) | (388) | (357) | (371) | (321) | (351) | (433) | (349) |
|  |                       | VOLNEY SCRIBA               | (256) | (178) | (109) | (13)  | (42)  | (76)  | (31)  | (69)  | (79)  | (91)  |
|  |                       | EGRDNCTY 138 VALLYSTR 138 1 | (62)  | (57)  | (56)  | (28)  | (75)  | (149) | (34)  | (30)  | (54)  | (54)  |
|  |                       | NEW SCOTLAND KNCKRBOC       | 0     | 0     | 0     | 0     | 0     | 29    | 9     | (12)  | 5     | 8     |
|  |                       | LEEDS PLEASANT VALLEY       | 3     | (1)   | (1)   | 5     | (1)   | 0     | 0     | 0     | 0     | 0     |
|  | MOTTHAVEN RAINEY      | 13                          | 56    | 39    | (3)   | 38    | 24    | 16    | 2     | 25    | (16)  |       |

**Study 3: Volney - Scriba**

- Transmission: 345 kV line from Volney to Scriba, 10 Miles
- Generation: 340 MW Plant at Volney
- Demand Response : 100 MW in Zone F; 100 MW in Zone G
- Energy Efficiency : 100 MW in Zone F; 100 MW in Zone G

Figure 58 below presents the change in the number of congested hours by constraint after the generic solution has been applied. Negative values indicate a reduction in congested hours. Detailed results for all CARIS metrics, representing the change between the base case values and the values after the three generic solutions have been applied, are presented in Appendix H - Generic Solution Results - Additional Details.

**Figure 58: Change in Number of Congested Hours in Study 3 (Solution Case – Base Case)**

| Study                    | Solution                    | Constraint                  | 2019                | 2020    | 2021    | 2022    | 2023    | 2024    | 2025    | 2026    | 2027    | 2028    |
|--------------------------|-----------------------------|-----------------------------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Study 3: Volney - Scriba | Transmission Solution       | CENTRAL EAST                | 23                  | 1       | 18      | 21      | 27      | 6       | 1       | (20)    | 13      | 20      |
|                          |                             | DUNWOODIE TO LONG ISLAND    | 0                   | (8)     | (2)     | (4)     | 5       | (12)    | 28      | 17      | (23)    | (21)    |
|                          |                             | DUNWOODIE MOTTHAVEN         | 5                   | (1)     | (6)     | (12)    | (9)     | (5)     | 21      | 8       | 24      | 19      |
|                          |                             | GREENWOOD                   | (5)                 | 4       | (11)    | (3)     | 5       | (1)     | (5)     | 22      | (14)    | 5       |
|                          |                             | VOLNEY SCRIBA               | (1,434)             | (1,593) | (1,224) | (1,330) | (1,444) | (1,258) | (1,334) | (1,486) | (1,798) | (1,745) |
|                          |                             | EGRDNCTY 138 VALLYSTR 138 1 | (13)                | (10)    | (20)    | 34      | 13      | (8)     | 20      | 5       | 15      | 17      |
|                          |                             | NEW SCOTLAND KNCKRBOC       | 0                   | 0       | 0       | 0       | 0       | 7       | 1       | (10)    | 1       | (4)     |
|                          |                             | LEEDS PLEASANT VALLEY       | 1                   | 1       | (1)     | 3       | 0       | 0       | 0       | 0       | 0       | 0       |
|                          |                             | MOTTHAVEN RAINEY            | 35                  | 50      | (6)     | 11      | 4       | 3       | (3)     | (4)     | 2       | 12      |
|                          |                             | CENTRAL EAST                | 102                 | 175     | 115     | 223     | 217     | 338     | 220     | 286     | 255     | 231     |
|                          | Generation Solution         | DUNWOODIE TO LONG ISLAND    | 26                  | (74)    | 35      | 41      | 174     | 30      | 54      | 93      | 138     | 151     |
|                          |                             | DUNWOODIE MOTTHAVEN         | (13)                | 46      | 37      | 10      | 52      | 69      | 31      | 170     | 130     | 39      |
|                          |                             | GREENWOOD                   | 18                  | (22)    | 5       | 46      | 7       | (125)   | (57)    | (37)    | (6)     | 122     |
|                          |                             | VOLNEY SCRIBA               | (1,018)             | (1,264) | (896)   | (1,106) | (1,289) | (1,092) | (1,286) | (1,471) | (1,768) | (1,683) |
|                          |                             | EGRDNCTY 138 VALLYSTR 138 1 | 105                 | 44      | 129     | (71)    | 149     | (155)   | (117)   | 10      | (62)    | 0       |
|                          |                             | NEW SCOTLAND KNCKRBOC       | 0                   | 0       | 0       | 0       | 0       | (2)     | 5       | 21      | (7)     | (4)     |
|                          |                             | LEEDS PLEASANT VALLEY       | 4                   | 12      | 8       | 9       | 4       | 0       | 0       | 0       | 0       | 0       |
|                          |                             | MOTTHAVEN RAINEY            | 28                  | 85      | 49      | (1)     | 29      | 15      | (14)    | 46      | (32)    | 0       |
|                          |                             | CENTRAL EAST                | (12)                | 0       | (1)     | 0       | 17      | (1)     | (3)     | (6)     | (1)     | 7       |
|                          |                             | DUNWOODIE TO LONG ISLAND    | 2                   | (3)     | (4)     | 0       | 2       | (3)     | 17      | 0       | 2       | (2)     |
|                          | Demand Response             | DUNWOODIE MOTTHAVEN         | (3)                 | 0       | 14      | 0       | (2)     | 12      | (4)     | 2       | 2       | 6       |
|                          |                             | GREENWOOD                   | 4                   | 0       | (3)     | 4       | 1       | 0       | 1       | 3       | (1)     | 0       |
|                          |                             | VOLNEY SCRIBA               | 3                   | (7)     | 1       | 5       | (2)     | 0       | 0       | 1       | (2)     | (1)     |
|                          |                             | EGRDNCTY 138 VALLYSTR 138 1 | (3)                 | 4       | 2       | (1)     | (5)     | 2       | (2)     | 1       | 0       | 6       |
|                          |                             | NEW SCOTLAND KNCKRBOC       | 0                   | 0       | 0       | 0       | 0       | 1       | 0       | 0       | 0       | 1       |
|                          |                             | LEEDS PLEASANT VALLEY       | (1)                 | 3       | 0       | 1       | 0       | 0       | 0       | 0       | 0       | 0       |
|                          |                             | MOTTHAVEN RAINEY            | 7                   | 3       | 1       | 2       | 0       | 3       | 3       | (1)     | (2)     | (1)     |
|                          |                             | CENTRAL EAST                | (46)                | (60)    | (52)    | (46)    | (19)    | (55)    | (17)    | (69)    | (24)    | 27      |
|                          |                             | DUNWOODIE TO LONG ISLAND    | 59                  | 53      | 103     | 98      | 151     | 80      | 112     | 145     | 117     | 106     |
|                          |                             | Energy Efficiency           | DUNWOODIE MOTTHAVEN | 31      | 49      | 144     | 117     | 181     | 75      | 129     | 83      | 136     |
|                          | GREENWOOD                   |                             | 17                  | (9)     | (9)     | (15)    | (26)    | (11)    | (3)     | 18      | (42)    | 20      |
|                          | VOLNEY SCRIBA               |                             | (237)               | (89)    | (47)    | (30)    | (11)    | (38)    | (10)    | (36)    | (38)    | (72)    |
|                          | EGRDNCTY 138 VALLYSTR 138 1 |                             | (25)                | (13)    | (40)    | (4)     | (61)    | (109)   | (16)    | (26)    | (17)    | (41)    |
|                          | NEW SCOTLAND KNCKRBOC       |                             | 0                   | 0       | 0       | 0       | 0       | 31      | 10      | 0       | 16      | 8       |
|                          | LEEDS PLEASANT VALLEY       |                             | 2                   | 3       | 5       | 8       | 3       | 0       | 0       | 0       | 0       | 0       |
|                          | MOTTHAVEN RAINEY            |                             | 105                 | 120     | 62      | 22      | 15      | 39      | 25      | 22      | 20      | 27      |

### Benefit/Cost Analysis

The NYISO defines generic solutions to alleviate congestion for each resource type (generation, transmission, demand response, and energy efficiency), as required by the Tariff, Attachment Y, Section 31.3.1.3.3. The costs of each solution must be estimated to report B/C ratios in CARIS Phase 1 for each generic solution. The NYISO, in consultation with its stakeholders, estimates a high, mid and low cost for each solution type in CARIS Phase 1. This establishes a broader range of costs in order to provide more useful information to developers and other interested parties. The NYISO bases the costs upon data from publicly available sources.

The Generic Solution Cost Matrix should not be utilized for purposes outside of the CARIS generic solution process. No assessment was made concerning the actual feasibility of any generic solution proposed. These estimates should not be assumed as reflective or predictive of actual projects or imply that specific facilities can necessarily be built for these generic solution estimates.

Transmission cost estimates are based on cost estimates for specific projects submitted for

consideration in the New York State PSC's AC Transmission proceeding.<sup>6</sup> The NYISO analyzed the cost data presented for the various proposed projects and developed low, mid and high cost estimates for total project costs on a per-mile basis for new 345 kV transmission facilities.

Generation costs estimates were based on available NYISO consultant estimates for developing new combined cycle units in Zones F and G provided as part of the 2016 Demand-Curve Reset process<sup>7</sup>.

Demand-response cost estimates were derived from recent utility filings with the NYPSC on Commercial System Relief Program (CSRP) costs and enrollments.<sup>8</sup>

Energy-efficiency cost estimates were derived from DPS filings on energy efficiency costs from the relevant TOs.<sup>9</sup>

The generic solutions cost matrix and assumptions for all four types of solutions are presented in Figure 59 through Figure 62 below.

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6 12-T-0502-Proceeding on Motion of the Commission to Examine Alternating Current Transmission Upgrades; 13-E-0488 –In the Matter of Alternating Current Transmission Upgrades-Comparative Proceeding

7 NYISO Staff Recommendations Initial Draft – Demand Curve Reset, August 17, 2016.

8 Case 14-E-0423 – Proceeding on Motion of the Commission to Develop Load Management Programs

9 Case 18-M-0084 – In the Matter of a Comprehensive Energy Efficiency Initiative.

**Figure 59: Transmission Cost Matrix**

| Base Case Modeling Assumptions for 2019-2028 CARIS Phase 1<br>Generic Transmission Cost Matrix<br>Order of Magnitude Unit Prices<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |           |                          |                      |                   |                             |
|---|-----------|--------------------------|----------------------|-------------------|-----------------------------|
| Cost Range  | Zone      | Transmission             |                      |                   |                             |
|   |           | Line System Voltage (kV) | Block Capacity (MVA) | Construction Type | Transmission Cost (\$/Mile) |
| High  | Zones E-G | 345                      | 1986                 | Overhead          | 7.5                         |
| Mid   | Zones E-G | 345                      | 1986                 | Overhead          | 6                           |
| Low   | Zones E-G | 345                      | 1986                 | Overhead          | 4                           |

**Assumptions:**

1. Estimates herein should not be utilized for purposes outside of the CARIS process. Also, these estimates should not be assumed as reflective or predictive of actual projects or imply that facilities can necessarily be built for these generic solution order of magnitude estimates. Estimate ranges were identified after Transmission Owner input and discussions at the ESPWG.
2. Lines constructed will be comprised of single circuit AC overhead construction.
3. The transmission line will be interconnected into an existing 345kV substation for Zones F and G.
4. The line can be permitted and constructed utilizing the shortest distance between the two selected substations.
5. The control house at the existing substations selected as the interconnection point has sufficient space for installing the new protection and communication equipment for the new line terminal.
6. Estimates include costs for material, construction labor, engineering labor, permits, testing and commissioning. The estimates do not include Allowance of Funds During Construction (AFDC).
7. The cost per mile includes a range to account for the variable land and permitting costs associated with a project such as utilizing an existing ROW, expanding an existing ROW or obtaining new ROW.

**Figure 60: Generation Cost Matrix**

| Base Case Modeling Assumptions for 2019-2028 CARIS Phase 1<br>Generic Generation Cost Matrix<br>Order of Magnitude Unit Costs<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |  |                                |                                 |
|--|--|--------------------------------|---------------------------------|
| Cost Range   | Plant Location                           | Plant Block Size Capacity (MW) | Plant Cost per Block Size (\$M) |
| High   | New Scotland (Zone F)                    | 340                            | 750                             |
| Mid  | New Scotland (Zone F)                    | 340                            | 600                             |
| Low  | New Scotland (Zone F)                    | 340                            | 450                             |
| High   | Pleasant Valley (Zone G/Dutchess County) | 340                            | 845                             |
| Mid  | Pleasant Valley (Zone G/Dutchess County) | 340                            | 675                             |
| Low  | Pleasant Valley (Zone G/Dutchess County) | 340                            | 505                             |
| High   | Volney (Zone C)                          | 340                            | 655                             |
| Mid  | Volney (Zone C)                          | 340                            | 525                             |
| Low  | Volney (Zone C)                          | 340                            | 395                             |

**Assumptions:**

1. Estimates herein should not be utilized for purposes outside of the CARIS process. Also, these estimates should not be assumed as reflective or predictive of actual projects or imply that facilities can necessarily be built for these generic solution order of magnitude estimates. Estimate ranges were identified based upon NYISO filings at FERC and Consultant estimates.
2. It is assumed the plants will be gas fired combined cycles, configured 1x1x1 Siemens SGT6-5000F(5), total generation 340 MW.

**Figure 61: Generator Cost per Unit - 2017 Price Level<sup>10</sup>**

| GENERATOR COST PER UNIT - 2016 Demand Curve Reset Cost Estimates |        |                         |                 |                     |             |                   |
|--|--------|-------------------------|-----------------|---------------------|-------------|-------------------|
| Zone   | Size   | Combined Cycle          | EPC Costs (\$M) | Non-EPC Costs (\$M) | Total (\$M) | Unit Cost (\$/kW) |
| Zone F (Capital)   | 340 MW | 1 x 1 x 1 SGT6-5000F(5) | 435             | 83                  | 518         | 1524              |
| Zone G (Hudson Valley-Dutchess)                                  | 340 MW | 1 x 1 x 1 SGT6-5000F(5) | 487             | 93                  | 580         | 1706              |
| Zone C (Central)   | 340 MW | 1 x 1 x 1 SGT6-5000F(5) | 415             | 79                  | 494         | 1453              |

**Figure 62: Demand Response and Energy Efficiency Cost Matrix**

| Base Case Modeling Assumptions for 2019-2028 CARIS Phase 1<br>Generic Demand Response and Energy Efficiency Cost Matrix<br>Order of Magnitude Unit Costs<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |      |                   |                   |
|---|------|-------------------|-------------------|
| Cost Range  | Zone | Portfolio Type    | Per-Unit (\$M/MW) |
| High  | F    | Demand Response   | 0.25              |
| Mid   | F    | Demand Response   | 0.2               |
| Low   | F    | Demand Response   | 0.15              |
| High  | G    | Demand Response   | 0.375             |
| Mid   | G    | Demand Response   | 0.3               |
| Low   | G    | Demand Response   | 0.225             |
| High  | J    | Demand Response   | 1.375             |
| Mid   | J    | Demand Response   | 1.1               |
| Low   | J    | Demand Response   | 0.825             |
| High  | F    | Energy Efficiency | 9.97              |
| Mid   | F    | Energy Efficiency | 7.98              |
| Low   | F    | Energy Efficiency | 5.98              |
| High  | G    | Energy Efficiency | 10.09             |
| Mid   | G    | Energy Efficiency | 8.08              |
| Low   | G    | Energy Efficiency | 6.06              |
| High  | J    | Energy Efficiency | 14.8              |
| Mid   | J    | Energy Efficiency | 11.9              |
| Low   | J    | Energy Efficiency | 8.9               |

*Note: Estimates herein should not be utilized for purposes outside of the CARIS process. Also, these estimates should not be assumed as reflective or predictive of actual projects or imply that facilities can necessarily be built.*

Figure 63 through Figure 67 present overnight installation costs for the generic solutions associated with each study. No verification was conducted to determine if the generic solution can be built within the generic cost estimate ranges. The generic solutions analysis is performed to provide a rough estimate of the benefit to cost opportunity based upon the assumptions contained in this report.

<sup>10</sup> Study to Establish New York Electricity Market ICAP Demand Curve Parameter, September 13, 2016, The Analysis Group, pg. 129.

**Figure 63: Generic Generation, Demand Response, and Energy Efficiency Solution Costs for Each Study**

| <b>Generic Solutions Cost Summary (\$M)</b> |                               |   |                                |
|---|-------------------------------|---|--------------------------------|
| <b>Studies</b>                              | <b>Central East (Study 1)</b> | <b>Central East-Knickerbocker (Study 2)</b> | <b>Volney-Scriba (Study 3)</b> |
| <b>GENERATION</b>                           |                               |   |                                |
| <b>Unit Siting</b>                          | New Scotland                  | Pleasant Valley                             | Volney                         |
| <b># of 340 MW Blocks</b>                   | 1                             | 1   | 1                              |
| <b>High</b>                                 | \$750                         | \$845                                       | \$655                          |
| <b>Mid</b>                                  | \$600                         | \$675                                       | \$525                          |
| <b>Low</b>                                  | \$450                         | \$505                                       | \$395                          |
| <b>DEMAND RESPONSE</b>                      |                               |   |                                |
| <b>Location (# of Blocks)</b>               | F(1), G(1), and J(2)          | F(1), G(1), and J(2)                        | F(1) and G(1)                  |
| <b>Total # 100MW Blocks</b>                 | 4                             | 4   | 2                              |
| <b>High</b>                                 | \$338                         | \$338                                       | \$63                           |
| <b>Mid</b>                                  | \$270                         | \$270                                       | \$50                           |
| <b>Low</b>                                  | \$203                         | \$203                                       | \$38                           |
| <b>ENERGY EFFICIENCY</b>                    |                               |   |                                |
| <b>Location (# of Blocks)</b>               | F(1), G(1), and J(2)          | F(1), G(1), and J(2)                        | F(1) and G(1)                  |
| <b>Total # 200MW Blocks</b>                 | 4                             | 4   | 2                              |
| <b>High</b>                                 | \$4,975                       | \$4,975                                     | \$2,006                        |
| <b>Mid</b>                                  | \$3,980                       | \$3,980                                     | \$1,605                        |
| <b>Low</b>                                  | \$2,985                       | \$2,985                                     | \$1,204                        |

**Figure 64: Generic Transmission Solution Costs for Each Study**

| <b>Generic Transmission Solution Cost Summary (\$M)</b> |                               |   |                                |
|---|-------------------------------|---|--------------------------------|
| <b>Studies</b>  | <b>Central East (study 1)</b> | <b>Central East-Knickerbocker (Study 2)</b> | <b>Volney-Scriba (Study 3)</b> |
| <b>Transmission Path</b>                                | Edic-New Scotland             | Edic-New Scotland-Knickerbocker             | Volney-Scriba                  |
| <b>Voltage</b>  | 345 kV                        | 345 kV                                      | 345 kV                         |
| <b>2019-2023</b>  |                               |   |                                |
| <b>Miles</b>  | 85                            | 85  | 10                             |
| <b>High</b>   | \$638                         | \$638                                       | \$75                           |
| <b>Mid</b>  | \$510                         | \$510                                       | \$60                           |
| <b>Low</b>  | \$340                         | \$340                                       | \$40                           |
| <b>2024-2028</b>  |                               |   |                                |
| <b>Miles</b>  | 85                            | 100   | 10                             |
| <b>High</b>   | \$638                         | \$750                                       | \$75                           |
| <b>Mid</b>  | \$510                         | \$600                                       | \$60                           |
| <b>Low</b>  | \$340                         | \$400                                       | \$40                           |



**Figure 65: Generic Solutions for Study 1: Central East**

| Generic Solution<br>Study 1: Central East<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |          |                                 |                        |
|--|----------|---------------------------------|------------------------|
| <b>Transmission Solution: Edic - New Scotland</b>  |          |                                 |                        |
| Cost Range   | Quantity | Unit Pricing (\$M)              | Total (\$M)            |
| <b>High</b>  |          |                                 |                        |
| Transmission Line (Miles)  | 85       | \$7.50                          | \$638                  |
| <b>Total High Transmission Solution Cost</b>   |          |                                 | \$638                  |
| <b>Mid</b>   |          |                                 |                        |
| Transmission Line (Miles)  | 85       | \$6.00                          | \$510                  |
| <b>Total Mid Transmission Solution Cost</b>  |          |                                 | \$510                  |
| <b>Low</b>   |          |                                 |                        |
| Transmission Line (Miles)  | 85       | \$4.00                          | \$340                  |
| <b>Total Low Transmission Solution Cost</b>  |          |                                 | \$340                  |
| <b>Generation Solution: New Scotland</b>   |          |                                 |                        |
| Cost Range   | Quantity | Unit Pricing (\$M)              | Total (\$M)            |
| <b>High</b>  |          |                                 |                        |
| Plant in Zone F (340 MW Block)   | 1        | \$750                           | \$750                  |
| <b>Total High Generation Solution Cost</b>   |          |                                 | \$750                  |
| <b>Mid</b>   |          |                                 |                        |
| Plant in Zone F (340 MW Block)   | 1        | \$600                           | \$600                  |
| <b>Total Mid Generation Solution Cost</b>  |          |                                 | \$600                  |
| <b>Low</b>   |          |                                 |                        |
| Plant in Zone F (340 MW Block)   | 1        | \$450                           | \$450                  |
| <b>Total Low Generation Solution Cost</b>  |          |                                 | \$450                  |
| <b>Demand Response Solution: Zones F, G, and J</b>   |          |                                 |                        |
| Cost Range   | Quantity | Unit Pricing (\$M/100 MW block) | Total (\$M)            |
| <b>High</b>  |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$25                            | \$25                   |
| Zone G   | 1        | \$38                            | \$38                   |
| Zone J   | 2        | \$138                           | \$275                  |
| <b>Total High Demand Response Solution Costs</b>   |          |                                 | \$338                  |
| <b>Mid</b>   |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$20                            | \$20                   |
| Zone G   | 1        | \$30                            | \$30                   |
| Zone J   | 2        | \$110                           | \$220                  |
| <b>Total Mid Demand Response Solution Costs</b>  |          |                                 | \$270                  |
| <b>Low</b>   |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$15                            | \$15                   |
| Zone G   | 1        | \$23                            | \$22.50                |
| Zone J   | 2        | \$83                            | \$165                  |
| <b>Total Low Demand Response Solution Costs</b>  |          |                                 | \$203                  |
| <b>Energy Efficiency Solution: Zones F, G, and J</b>   |          |                                 |                        |
| Cost Range   | Quantity | Unit Pricing (\$M/100 MW block) | Total (\$M)            |
| <b>High</b>  |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$997                           | \$997                  |
| Zone G   | 1        | \$1,009                         | \$1,009                |
| Zone J   | 2        | \$1,484                         | \$2,969                |
| <b>Total High Energy Efficiency Solution Costs</b>   |          |                                 | \$4,975                |
| <b>Mid</b>   |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$798                           | \$798                  |
| Zone G   | 1        | \$808                           | \$808                  |
| Zone J   | 2        | \$1,188                         | \$2,375                |
| <b>Total Mid Energy Efficiency Solution Costs</b>  |          |                                 | \$3,980                |
| <b>Low</b>   |          |                                 |                        |
|  |          |                                 | <b>(100 MW Blocks)</b> |
| Zone F   | 1        | \$598                           | \$598                  |
| Zone G   | 1        | \$606                           | \$606                  |
| Zone J   | 2        | \$891                           | \$1,781                |
| <b>Total Low Demand Response Solution Costs</b>  |          |                                 | \$2,985                |

**Figure 66: Generic Solutions for Study 2: Central East - Knickerbocker**

| Generic Solution<br>Study 2: Central East- Knickerbocker<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |                 |  |                    |
|---|-----------------|--|--------------------|
| <b>Transmission Solution: Edic - New Scotland - Knickerbocker</b>   |                 |  |                    |
| <b>2019-2023</b>  |                 |  |                    |
| <b>Cost Range</b>   | <b>Quantity</b> | <b>Unit Pricing (\$M)</b>              | <b>Total (\$M)</b> |
| <b>High</b>   |                 |  |                    |
| Transmission Line (Miles)   | 85              | \$7.50                                 | \$638              |
| <b>Total High Transmission Solution Cost</b>  |                 |  | \$638              |
| <b>Mid</b>  |                 |  |                    |
| Transmission Line (Miles)   | 85              | \$6.00                                 | \$510              |
| <b>Total Mid Transmission Solution Cost</b>   |                 |  | \$510              |
| <b>Low</b>  |                 |  |                    |
| Transmission Line (Miles)   | 85              | \$4.00                                 | \$340              |
| <b>Total Low Transmission Solution Cost</b>   |                 |  | \$340              |
| <b>2024-2028</b>  |                 |  |                    |
| <b>Cost Range</b>   | <b>Quantity</b> | <b>Unit Pricing (\$M)</b>              | <b>Total (\$M)</b> |
| <b>High</b>   |                 |  |                    |
| Transmission Line (Miles)   | 100             | \$7.50                                 | \$750              |
| <b>Total High Transmission Solution Cost</b>  |                 |  | \$750              |
| <b>Mid</b>  |                 |  |                    |
| Transmission Line (Miles)   | 100             | \$6.00                                 | \$600              |
| <b>Total Mid Transmission Solution Cost</b>   |                 |  | \$600              |
| <b>Low</b>  |                 |  |                    |
| Transmission Line (Miles)   | 100             | \$4.00                                 | \$400              |
| <b>Total Low Transmission Solution Cost</b>   |                 |  | \$400              |
| <b>Generation Solution: Pleasant Valley</b>   |                 |  |                    |
| <b>Cost Range</b>   | <b>Quantity</b> | <b>Unit Pricing (\$M)</b>              | <b>Total (\$M)</b> |
| <b>High</b>   |                 |  |                    |
| Plant in Zone G (340 MW Block)  | 1               | \$845                                  | \$845              |
| <b>Total High Generation Solution Cost</b>  |                 |  | \$845              |
| <b>Mid</b>  |                 |  |                    |
| Plant in Zone G (340 MW Block)  | 1               | \$675                                  | \$675              |
| <b>Total Mid Generation Solution Cost</b>   |                 |  | \$675              |
| <b>Low</b>  |                 |  |                    |
| Plant in Zone G (340 MW Block)  | 1               | \$505                                  | \$505              |
| <b>Total Low Generation Solution Cost</b>   |                 |  | \$505              |
| <b>Demand Response Solution: Zones F, G, and J</b>  |                 |  |                    |
| <b>Cost Range</b>   | <b>Quantity</b> | <b>Unit Pricing (\$M/100 MW block)</b> | <b>Total (\$M)</b> |
| <b>High</b>   |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$25                                   | \$25               |
| Zone G  | 1               | \$38                                   | \$38               |
| Zone J  | 2               | \$138                                  | \$275              |
| <b>Total High Demand Response Solution Costs</b>  |                 |  | \$338              |
| <b>Mid</b>  |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$20                                   | \$20               |
| Zone G  | 1               | \$30                                   | \$30               |
| Zone J  | 2               | \$110                                  | \$220              |
| <b>Total Mid Demand Response Solution Costs</b>   |                 |  | \$270              |
| <b>Low</b>  |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$15                                   | \$15               |
| Zone G  | 1               | \$23                                   | \$23               |
| Zone J  | 2               | \$83                                   | \$165              |
| <b>Total Low Demand Response Solution Costs</b>   |                 |  | \$203              |
| <b>Energy Efficiency Solution: Zones F, G, and J</b>  |                 |  |                    |
| <b>Cost Range</b>   | <b>Quantity</b> | <b>Unit Pricing (\$M/100 MW block)</b> | <b>Total (\$M)</b> |
| <b>High</b>   |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$997                                  | \$997              |
| Zone G  | 1               | \$1,009                                | \$1,009            |
| Zone J  | 2               | \$1,484                                | \$2,969            |
| <b>Total High Energy Efficiency Solution Costs</b>  |                 |  | \$4,975            |
| <b>Mid</b>  |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$798                                  | \$798              |
| Zone G  | 1               | \$808                                  | \$808              |
| Zone J  | 2               | \$1,188                                | \$2,375            |
| <b>Total Mid Energy Efficiency Solution Costs</b>   |                 |  | \$3,980            |
| <b>Low</b>  |                 |  |                    |
| <b>(100 MW Blocks)</b>  |                 |  |                    |
| Zone F  | 1               | \$598                                  | \$598              |
| Zone G  | 1               | \$606                                  | \$606              |
| Zone J  | 2               | \$891                                  | \$1,781            |
| <b>Total Low Demand Response Solution Costs</b>   |                 |  | \$2,985            |

**Figure 67: Generic Solutions for Study 3: Volney - Scriba**

| Generic Solution<br>Study 3: Volney-Scriba<br><i>(Estimates should not be assumed reflective or predictive of actual project costs)</i> |          |                                 |             |
|---|----------|---------------------------------|-------------|
| <b>Transmission Solution: Volney - Scriba</b>   |          |                                 |             |
| Cost Range  | Quantity | Unit Pricing (\$M)              | Total (\$M) |
| <b>High</b>   |          |                                 |             |
| Transmission Line (Miles)   | 10       | \$7.50                          | \$75        |
| Total High Transmission Solution Cost   |          |                                 | \$75        |
| <b>Mid</b>  |          |                                 |             |
| Transmission Line (Miles)   | 10       | \$6.00                          | \$60        |
| Total Mid Transmission Solution Cost  |          |                                 | \$60        |
| <b>Low</b>  |          |                                 |             |
| Transmission Line (Miles)   | 10       | \$4.00                          | \$40        |
| Total Low Transmission Solution Cost  |          |                                 | \$40        |
| <b>Generation Solution: Volney</b>  |          |                                 |             |
| Cost Range  | Quantity | Unit Pricing (\$M)              | Total (\$M) |
| <b>High</b>   |          |                                 |             |
| Plant in Zone C (340 MW Block)  | 1        | \$655                           | \$655       |
| Total High Generation Solution Cost   |          |                                 | \$655       |
| <b>Mid</b>  |          |                                 |             |
| Plant in Zone C (340 MW Block)  | 1        | \$525                           | \$525       |
| Total Mid Generation Solution Cost  |          |                                 | \$525       |
| <b>Low</b>  |          |                                 |             |
| Plant in Zone C (340 MW Block)  | 1        | \$395                           | \$395       |
| Total Low Generation Solution Cost  |          |                                 | \$395       |
| <b>Demand Response Solution: Zones F and G</b>  |          |                                 |             |
| Cost Range  | Quantity | Unit Pricing (\$M/100 MW block) | Total (\$M) |
| <b>High</b>   |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$25                            | \$25        |
| Zone G  | 1        | \$38                            | \$38        |
| Total High Demand Response Solution Costs   |          |                                 | \$63        |
| <b>Mid</b>  |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$20                            | \$20        |
| Zone G  | 1        | \$30                            | \$30        |
| Total Mid Demand Response Solution Costs  |          |                                 | \$50        |
| <b>Low</b>  |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$15                            | \$15        |
| Zone G  | 1        | \$23                            | \$23        |
| Total Low Demand Response Solution Costs  |          |                                 | \$38        |
| <b>Energy Efficiency Solution: Zones F and G</b>  |          |                                 |             |
| Cost Range  | Quantity | Unit Pricing (\$M/100 MW block) | Total (\$M) |
| <b>High</b>   |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$997                           | \$997       |
| Zone G  | 1        | \$1,009                         | \$1,009     |
| Total High Energy Efficiency Solution Costs   |          |                                 | \$2,006     |
| <b>Mid</b>  |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$798                           | \$798       |
| Zone G  | 1        | \$808                           | \$808       |
| Total Mid Energy Efficiency Solution Costs  |          |                                 | \$1,605     |
| <b>Low</b>  |          |                                 |             |
| (100 MW Blocks)   |          |                                 |             |
| Zone F  | 1        | \$598                           | \$598       |
| Zone G  | 1        | \$606                           | \$606       |
| Total Low Demand Response Solution Costs  |          |                                 | \$1,204     |

## **Appendix F - Economic Planning Process Manual - Congestion Assessment and Resource Integration Study (link)**

[https://www.nyiso.com/documents/20142/2924447/epp\\_caris\\_mnl.pdf/6510ece7-e0a6-7bee-e776-694abf264bae](https://www.nyiso.com/documents/20142/2924447/epp_caris_mnl.pdf/6510ece7-e0a6-7bee-e776-694abf264bae)

## Appendix G - 2018 RNA and 2019-2028 CRP Reports (link)

The 2018 RNA and 2019 – 2028 CRP reports can be found through the following links:

<https://www.nyiso.com/documents/20142/2248793/2018-Reliability-Needs-Assessment.pdf/c17f6a4a-6d22-26ee-9e28-4715af52d3c7>

<https://www.nyiso.com/documents/20142/2248481/2019-2028CRP-FinalReportJuly-2019.pdf/51b573b7-9edb-bbb9-8a87-742e9e7c3b7f>

## Appendix H - Generic Solution Results - Additional Details

The tables below present the CARIS metrics results for each of the three studies. The CARIS metrics are calculated as the change between the base case values and the change case values after each of the respective generic solutions have been added to the base case. The values are expressed in nominal \$M and are calculated as Solution minus base case. Negative values are shown in red and with brackets (except for tables showing percentage changes) and represent a reduction in costs/payments.

### Study 1: Central East

#### Generic Transmission Solution (Study 1: Central East)

PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Transmission Solution (Study 1: Central East)

| Demand Congestion (\$M) | 2019           | 2020           | 2021           | 2022           | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-------------------------|----------------|----------------|----------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                    | (8.9)          | (7.1)          | (6.9)          | (3.4)          | 1.0           | 3.2           | 1.7           | 1.9           | 1.8           | 2.1           |
| Genesee                 | 1.4            | 2.2            | 0.8            | (1.4)          | 0.5           | 1.6           | 0.9           | 1.0           | 1.0           | 1.1           |
| Central                 | (3.5)          | (3.4)          | (2.9)          | (1.7)          | (0.9)         | (1.9)         | (0.7)         | (0.6)         | (0.9)         | (1.3)         |
| North                   | (1.8)          | (2.4)          | (1.7)          | (1.3)          | (1.0)         | (0.6)         | (0.6)         | (0.6)         | (0.6)         | (0.5)         |
| Mohawk Valley           | (1.0)          | (1.1)          | (0.9)          | (0.5)          | (0.4)         | (0.8)         | (0.4)         | (0.3)         | (0.4)         | (0.6)         |
| Capital                 | (27.2)         | (27.4)         | (23.5)         | (17.2)         | (10.7)        | (13.0)        | (6.8)         | (6.9)         | (7.6)         | (10.2)        |
| Hudson Valley           | (14.0)         | (14.7)         | (13.0)         | (10.0)         | (6.6)         | (6.6)         | (3.8)         | (4.0)         | (3.9)         | (5.3)         |
| Millwood                | (4.1)          | (4.2)          | (3.8)          | (2.8)          | (1.8)         | (1.9)         | (1.1)         | (1.2)         | (1.1)         | (1.5)         |
| Dunwoodie               | (8.3)          | (8.5)          | (7.4)          | (5.7)          | (3.7)         | (3.8)         | (2.2)         | (2.3)         | (2.3)         | (3.0)         |
| NY City                 | (74.2)         | (75.1)         | (66.6)         | (50.7)         | (33.1)        | (33.8)        | (18.7)        | (20.9)        | (19.5)        | (25.6)        |
| Long Island             | (27.8)         | (28.5)         | (25.5)         | (19.6)         | (11.9)        | (12.8)        | (7.2)         | (8.1)         | (6.4)         | (9.8)         |
| <b>NYCA Total</b>       | <b>(169.4)</b> | <b>(170.1)</b> | <b>(151.4)</b> | <b>(114.3)</b> | <b>(68.5)</b> | <b>(70.2)</b> | <b>(38.9)</b> | <b>(42.2)</b> | <b>(39.9)</b> | <b>(54.5)</b> |

PROJECTED PRODUCTION COST (\$M) | Generic Transmission Solution (Study 1: Central East)

| Production Cost (\$M)           | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025       | 2026       | 2027       | 2028        |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|------------|-------------|
| West                            | 2           | 1           | 1           | 2           | 6           | 10          | 7          | 7          | 10         | 10          |
| Genesee                         | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0          | 0          | 0           |
| Central                         | 14          | 13          | 10          | 10          | 11          | 11          | 8          | 9          | 8          | 9           |
| North                           | 1           | 0           | 0           | 1           | 1           | 1           | 1          | 1          | 0          | 1           |
| Mohawk Valley                   | (0)         | 0           | 0           | 0           | 0           | 1           | 1          | 1          | 0          | 0           |
| Capital                         | (9)         | (10)        | (10)        | (11)        | (8)         | (18)        | (14)       | (17)       | (12)       | (20)        |
| Hudson Valley                   | 1           | (4)         | (2)         | (4)         | (4)         | (1)         | (1)        | 2          | (0)        | 4           |
| Millwood                        | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0          | 0          | 0           |
| Dunwoodie                       | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0          | 0          | 0           |
| NY City                         | (9)         | (10)        | (5)         | (6)         | (6)         | (4)         | (6)        | (8)        | (7)        | (7)         |
| Long Island                     | 0           | 0           | (1)         | (1)         | (2)         | (1)         | (0)        | (0)        | 0          | (0)         |
| <b>NYCA Total</b>               | <b>(0)</b>  | <b>(9)</b>  | <b>(6)</b>  | <b>(9)</b>  | <b>(1)</b>  | <b>(1)</b>  | <b>(5)</b> | <b>(5)</b> | <b>(0)</b> | <b>(3)</b>  |
| NYCA Imports                    | 3           | 9           | 10          | 12          | (1)         | (2)         | (6)        | (0)        | (3)        | (4)         |
| NYCA Exports                    | 24          | 20          | 26          | 21          | 9           | 6           | (2)        | 2          | 6          | 4           |
| <b>NYCA + Imports - Exports</b> | <b>(22)</b> | <b>(21)</b> | <b>(22)</b> | <b>(18)</b> | <b>(11)</b> | <b>(10)</b> | <b>(8)</b> | <b>(7)</b> | <b>(9)</b> | <b>(11)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Transmission Solution (Study 1: Central East)**

| Generation (GWh)  | 2019       | 2020        | 2021     | 2022        | 2023       | 2024       | 2025      | 2026      | 2027       | 2028      |
|-------------------|------------|-------------|----------|-------------|------------|------------|-----------|-----------|------------|-----------|
| West              | 54         | 24          | 38       | 48          | 161        | 214        | 174       | 152       | 235        | 207       |
| Genesee           | 12         | 6           | 6        | 4           | 2          | 1          | 0         | 1         | 3          | 1         |
| Central           | 571        | 504         | 382      | 341         | 327        | 302        | 196       | 213       | 150        | 191       |
| North             | 81         | 40          | 35       | 28          | 24         | 29         | 15        | 12        | 5          | 20        |
| Mohawk Valley     | 11         | 7           | 8        | 3           | 2          | 8          | 12        | 8         | 7          | 4         |
| Capital           | (237)      | (259)       | (246)    | (246)       | (167)      | (326)      | (207)     | (256)     | (178)      | (287)     |
| Hudson Valley     | 28         | (109)       | (33)     | (78)        | (81)       | (21)       | (21)      | 34        | (6)        | 66        |
| Millwood          | 0          | 0           | 0        | 0           | 0          | 0          | 0         | 0         | 0          | 0         |
| Dunwoodie         | 0          | 0           | 0        | 0           | 0          | 0          | 0         | 0         | 0          | 0         |
| NY City           | (308)      | (315)       | (151)    | (170)       | (117)      | (80)       | (95)      | (139)     | (109)      | (101)     |
| Long Island       | (2)        | 6           | (33)     | (15)        | (39)       | (15)       | (8)       | (6)       | 0          | (4)       |
| <b>NYCA Total</b> | <b>209</b> | <b>(96)</b> | <b>6</b> | <b>(85)</b> | <b>113</b> | <b>113</b> | <b>66</b> | <b>21</b> | <b>107</b> | <b>97</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Transmission Solution (Study 1: Central East)**

| Net Imports (GWh) | 2019         | 2020      | 2021        | 2022      | 2023         | 2024        | 2025        | 2026       | 2027        | 2028        |
|-------------------|--------------|-----------|-------------|-----------|--------------|-------------|-------------|------------|-------------|-------------|
| PJM - NYISO       | 335          | 327       | 428         | 362       | 127          | 30          | (50)        | 50         | 32          | (60)        |
| LINDEN VFT        | (103)        | (115)     | (71)        | (68)      | (40)         | (31)        | (20)        | (22)       | (14)        | (14)        |
| NEPTUNE           | (47)         | (55)      | (29)        | (37)      | (19)         | (3)         | (8)         | 10         | 8           | 3           |
| HTP               | (57)         | (36)      | (71)        | (54)      | (53)         | (39)        | (37)        | (49)       | (37)        | (34)        |
| ISONE - NYISO     | (818)        | (644)     | (730)       | (579)     | (334)        | (196)       | (78)        | (120)      | (149)       | (87)        |
| CROSS SOUND CABLE | 26           | 23        | 15          | 21        | (7)          | 7           | (12)        | (5)        | (11)        | (0)         |
| NORTHPORT NORWALK | 7            | 2         | 1           | (7)       | (8)          | (5)         | (2)         | (6)        | (5)         | (8)         |
| IESO - NYISO      | 440          | 586       | 433         | 439       | 214          | 138         | 153         | 138        | 87          | 117         |
| HQ - NYISO CHAT   | (0)          | (1)       | 0           | (0)       | 0            | (0)         | (0)         | 0          | 0           | 0           |
| HQ - NYISO CEDARS | 2            | 3         | 0           | (0)       | 0            | 0           | (0)         | (0)        | 0           | 0           |
| <b>TOTAL</b>      | <b>(215)</b> | <b>90</b> | <b>(24)</b> | <b>77</b> | <b>(121)</b> | <b>(99)</b> | <b>(54)</b> | <b>(4)</b> | <b>(89)</b> | <b>(85)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Transmission Solution (Study 1: Central East)**

| Generator Payment (\$M) | 2019      | 2020      | 2021      | 2022      | 2023      | 2024      | 2025      | 2026     | 2027      | 2028      |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| West                    | 21        | 17        | 15        | 12        | 15        | 14        | 11        | 10       | 13        | 14        |
| Genesee                 | 5         | 6         | 5         | 3         | 2         | 2         | 1         | 1        | 1         | 1         |
| Central                 | 42        | 42        | 35        | 32        | 26        | 27        | 21        | 20       | 18        | 21        |
| North                   | 15        | 16        | 13        | 11        | 7         | 7         | 4         | 4        | 4         | 5         |
| Mohawk Valley           | 5         | 6         | 5         | 4         | 3         | 3         | 2         | 2        | 2         | 2         |
| Capital                 | (19)      | (19)      | (20)      | (18)      | (14)      | (24)      | (17)      | (19)     | (17)      | (26)      |
| Hudson Valley           | 1         | (5)       | (2)       | (5)       | (4)       | (1)       | (1)       | 1        | (1)       | 4         |
| Millwood                | (2)       | (2)       | (1)       | (0)       | (0)       | (0)       | (0)       | (0)      | (0)       | (0)       |
| Dunwoodie               | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)      | (0)       | (0)       |
| NY City                 | (13)      | (13)      | (11)      | (11)      | (10)      | (8)       | (7)       | (10)     | (9)       | (10)      |
| Long Island             | (0)       | 0         | (3)       | (2)       | (3)       | (1)       | (1)       | (1)      | (1)       | (2)       |
| <b>NYCA Total</b>       | <b>54</b> | <b>48</b> | <b>36</b> | <b>27</b> | <b>21</b> | <b>18</b> | <b>15</b> | <b>9</b> | <b>10</b> | <b>10</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Transmission Solution (Study 1: Central East)**

| Load Payment (\$M) | 2019      | 2020      | 2021      | 2022      | 2023     | 2024     | 2025     | 2026     | 2027       | 2028       |
|--------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|------------|------------|
| West               | 9         | 11        | 8         | 8         | 5        | 3        | 2        | 2        | 2          | 2          |
| Genesee            | 11        | 10        | 8         | 6         | 4        | 3        | 2        | 2        | 1          | 2          |
| Central            | 17        | 18        | 15        | 12        | 7        | 6        | 4        | 4        | 3          | 4          |
| North              | 8         | 10        | 8         | 6         | 4        | 3        | 2        | 2        | 2          | 2          |
| Mohawk Valley      | 11        | 11        | 10        | 8         | 7        | 5        | 4        | 4        | 4          | 4          |
| Capital            | (12)      | (12)      | (11)      | (8)       | (7)      | (6)      | (3)      | (3)      | (4)        | (6)        |
| Hudson Valley      | (2)       | (2)       | (3)       | (2)       | (2)      | (2)      | (1)      | (2)      | (2)        | (2)        |
| Millwood           | (0)       | (0)       | (1)       | (0)       | (1)      | (0)      | (0)      | (0)      | (0)        | (0)        |
| Dunwoodie          | (1)       | (1)       | (1)       | (1)       | (1)      | (1)      | (0)      | (1)      | (1)        | (1)        |
| NY City            | (8)       | (6)       | (11)      | (8)       | (9)      | (6)      | (2)      | (4)      | (5)        | (7)        |
| Long Island        | (1)       | (0)       | (3)       | (2)       | (2)      | (2)      | (1)      | (2)      | (1)        | (3)        |
| <b>NYCA Total</b>  | <b>32</b> | <b>38</b> | <b>19</b> | <b>19</b> | <b>5</b> | <b>4</b> | <b>6</b> | <b>3</b> | <b>(2)</b> | <b>(3)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Transmission Solution (Study 1: Central East)**

| Average LBMP (\$/MWh) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                  | 0.65        | 0.77        | 0.60        | 0.54        | 0.34        | 0.21        | 0.12        | 0.10        | 0.08        | 0.14        |
| Genesee               | 1.09        | 1.04        | 0.85        | 0.62        | 0.37        | 0.29        | 0.16        | 0.15        | 0.12        | 0.19        |
| Central               | 1.08        | 1.12        | 0.93        | 0.73        | 0.40        | 0.38        | 0.24        | 0.24        | 0.20        | 0.26        |
| North                 | 1.60        | 1.72        | 1.38        | 1.04        | 0.63        | 0.59        | 0.39        | 0.39        | 0.37        | 0.43        |
| Mohawk Valley         | 1.20        | 1.23        | 1.03        | 0.81        | 0.45        | 0.43        | 0.28        | 0.28        | 0.24        | 0.31        |
| Capital               | (0.82)      | (0.81)      | (0.76)      | (0.55)      | (0.39)      | (0.48)      | (0.21)      | (0.24)      | (0.34)      | (0.44)      |
| Hudson Valley         | (0.14)      | (0.18)      | (0.24)      | (0.20)      | (0.21)      | (0.16)      | (0.09)      | (0.10)      | (0.15)      | (0.20)      |
| Millwood              | (0.16)      | (0.17)      | (0.23)      | (0.18)      | (0.19)      | (0.15)      | (0.09)      | (0.10)      | (0.15)      | (0.18)      |
| Dunwoodie             | (0.15)      | (0.16)      | (0.22)      | (0.17)      | (0.19)      | (0.15)      | (0.08)      | (0.10)      | (0.14)      | (0.18)      |
| NY City               | (0.15)      | (0.14)      | (0.21)      | (0.17)      | (0.17)      | (0.12)      | (0.05)      | (0.08)      | (0.12)      | (0.14)      |
| Long Island           | (0.05)      | (0.03)      | (0.13)      | (0.12)      | (0.11)      | (0.10)      | (0.05)      | (0.08)      | (0.07)      | (0.14)      |
| <b>Average</b>        | <b>0.38</b> | <b>0.40</b> | <b>0.27</b> | <b>0.21</b> | <b>0.09</b> | <b>0.07</b> | <b>0.06</b> | <b>0.04</b> | <b>0.00</b> | <b>0.01</b> |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Transmission Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions (Tons) | 2019      | 2020     | 2021     | 2022      | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|----------------------------------|-----------|----------|----------|-----------|------------|------------|------------|------------|------------|------------|
| West                             | 14        | 1        | 1        | 44        | 239        | 390        | 272        | 234        | 496        | 383        |
| Genesee                          | 0         | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0          | 0          |
| Central                          | 1         | 1        | 1        | 1         | 1          | 1          | 0          | 0          | 0          | 0          |
| North                            | 0         | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0          | 0          |
| Mohawk Valley                    | (0)       | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0          | 0          |
| Capital                          | (1)       | (1)      | (1)      | (1)       | (0)        | (1)        | (0)        | (1)        | (0)        | (1)        |
| Hudson Valley                    | (0)       | (0)      | 0        | (0)       | (0)        | (0)        | (0)        | 0          | (0)        | 0          |
| Millwood                         | 0         | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                        | 0         | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                          | (1)       | (1)      | (1)      | (0)       | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                      | (0)       | 0        | (1)      | 0         | (0)        | (0)        | (0)        | (0)        | 0          | (0)        |
| <b>NYCA Total</b>                | <b>14</b> | <b>0</b> | <b>0</b> | <b>44</b> | <b>239</b> | <b>390</b> | <b>272</b> | <b>234</b> | <b>496</b> | <b>383</b> |



**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Transmission Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019     | 2020       | 2021       | 2022     | 2023     | 2024     | 2025     | 2026     | 2027     | 2028     |
|---------------------------------------|----------|------------|------------|----------|----------|----------|----------|----------|----------|----------|
| West                                  | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Genesee                               | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Central                               | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| North                                 | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Mohawk Valley                         | (0)      | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Capital                               | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      |
| Hudson Valley                         | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)      | 0        | (0)      | 0        |
| Millwood                              | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Dunwoodie                             | 0        | 0          | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| NY City                               | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      |
| Long Island                           | (0)      | 0          | (0)        | 0        | (0)      | (0)      | (0)      | (0)      | 0        | (0)      |
| <b>NYCA Total</b>                     | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Transmission Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions (Tons) | 2019      | 2020        | 2021        | 2022     | 2023      | 2024       | 2025      | 2026      | 2027       | 2028      |
|----------------------------------|-----------|-------------|-------------|----------|-----------|------------|-----------|-----------|------------|-----------|
| West                             | 23        | 13          | 18          | 31       | 53        | 103        | 57        | 60        | 107        | 82        |
| Genesee                          | 10        | 5           | 6           | 3        | 0         | 1          | 0         | 0         | 0          | 0         |
| Central                          | 38        | 31          | 27          | 23       | 22        | 21         | 16        | 17        | 15         | 14        |
| North                            | 11        | 8           | 8           | 5        | 7         | 8          | 4         | 8         | 2          | 1         |
| Mohawk Valley                    | 1         | 1           | 2           | 1        | 0         | 2          | 2         | 2         | 1          | 1         |
| Capital                          | (17)      | (13)        | (12)        | (11)     | (8)       | (12)       | (8)       | (9)       | (7)        | (9)       |
| Hudson Valley                    | (10)      | (9)         | (10)        | (2)      | (4)       | (4)        | (10)      | 7         | 2          | 4         |
| Millwood                         | 0         | 0           | 0           | 0        | 0         | 0          | 0         | 0         | 0          | 0         |
| Dunwoodie                        | 0         | 0           | 0           | 0        | 0         | 0          | 0         | 0         | 0          | 0         |
| NY City                          | (43)      | (67)        | (55)        | (41)     | (17)      | (5)        | (24)      | (29)      | (10)       | (12)      |
| Long Island                      | (1)       | (2)         | (13)        | (7)      | (13)      | (5)        | (1)       | (2)       | (1)        | (3)       |
| <b>NYCA Total</b>                | <b>12</b> | <b>(31)</b> | <b>(28)</b> | <b>2</b> | <b>41</b> | <b>108</b> | <b>36</b> | <b>55</b> | <b>109</b> | <b>78</b> |

**PROJECTED NO<sub>x</sub> EMISSION COSTS (\$M) | Generic Transmission Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025     | 2026       | 2027     | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|----------|------------|----------|------------|
| West                                  | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| Genesee                               | 0          | 0          | 0          | 0          | 0          | 0          | (0)      | 0          | 0        | 0          |
| Central                               | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| North                                 | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| Mohawk Valley                         | (0)        | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| Capital                               | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)      | (0)        | (0)      | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0        | 0          | (0)      | (0)        |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)      | (0)        | (0)      | (0)        |
| Long Island                           | 0          | 0          | (0)        | 0          | (0)        | (0)        | (0)      | (0)        | (0)      | (0)        |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>(0)</b> | <b>0</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Transmission Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019       | 2020         | 2021        | 2022        | 2023      | 2024       | 2025      | 2026      | 2027       | 2028       |
|---------------------------------------|------------|--------------|-------------|-------------|-----------|------------|-----------|-----------|------------|------------|
| West                                  | 24         | 11           | 14          | 33          | 126       | 183        | 136       | 124       | 216        | 177        |
| Genesee                               | 1          | 1            | 0           | 1           | 1         | 1          | 0         | 1         | 2          | 1          |
| Central                               | 214        | 194          | 146         | 136         | 135       | 124        | 83        | 89        | 64         | 79         |
| North                                 | 8          | 5            | 6           | 8           | 11        | 13         | 7         | 6         | 3          | 10         |
| Mohawk Valley                         | (1)        | 0            | 2           | 1           | 1         | 4          | 6         | 4         | 3          | 2          |
| Capital                               | (105)      | (113)        | (105)       | (107)       | (68)      | (129)      | (85)      | (107)     | (70)       | (116)      |
| Hudson Valley                         | 5          | (47)         | (18)        | (33)        | (34)      | (10)       | (13)      | 16        | (3)        | 28         |
| Millwood                              | 0          | 0            | 0           | 0           | 0         | 0          | 0         | 0         | 0          | 0          |
| Dunwoodie                             | 0          | 0            | 0           | 0           | 0         | 0          | 0         | 0         | 0          | 0          |
| NY City                               | (149)      | (159)        | (84)        | (85)        | (59)      | (34)       | (48)      | (74)      | (51)       | (48)       |
| Long Island                           | (1)        | 5            | (18)        | (7)         | (21)      | (9)        | (4)       | (3)       | 1          | (1)        |
| <b>NYCA Total</b>                     | <b>(4)</b> | <b>(102)</b> | <b>(57)</b> | <b>(51)</b> | <b>92</b> | <b>143</b> | <b>82</b> | <b>56</b> | <b>164</b> | <b>131</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Transmission Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020         | 2021         | 2022         | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|--------------|--------------|--------------|------------|------------|------------|------------|------------|------------|
| West                                  | 0.1        | 0.1          | 0.1          | 0.2          | 0.9        | 1.4        | 1.1        | 1.1        | 2.0        | 1.8        |
| Genesee                               | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Central                               | 1.0        | 1.1          | 0.9          | 0.9          | 1.0        | 0.9        | 0.7        | 0.8        | 0.6        | 0.8        |
| North                                 | 0.0        | 0.0          | 0.0          | 0.1          | 0.1        | 0.1        | 0.1        | 0.1        | 0.0        | 0.1        |
| Mohawk Valley                         | (0.0)      | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.1        | 0.0        | 0.0        | 0.0        |
| Capital                               | (0.5)      | (0.6)        | (0.6)        | (0.7)        | (0.5)      | (1.0)      | (0.7)      | (1.0)      | (0.7)      | (1.2)      |
| Hudson Valley                         | 0.0        | (0.3)        | (0.1)        | (0.2)        | (0.3)      | (0.1)      | (0.1)      | 0.2        | (0.0)      | 0.3        |
| Millwood                              | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | (0.5)      | (0.9)        | (0.5)        | (0.6)        | (0.4)      | (0.2)      | (0.4)      | (0.6)      | (0.5)      | (0.5)      |
| Long Island                           | (0.0)      | 0.0          | (0.1)        | (0.0)        | (0.2)      | (0.1)      | (0.0)      | (0.0)      | 0.0        | (0.0)      |
| <b>NYCA Total</b>                     | <b>0.2</b> | <b>(0.6)</b> | <b>(0.3)</b> | <b>(0.3)</b> | <b>0.7</b> | <b>1.1</b> | <b>0.7</b> | <b>0.5</b> | <b>1.5</b> | <b>1.3</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Transmission Solution (Study 1: Central East)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West              | (2.0)        | (2.2)        | (1.7)        | (1.5)        | (1.1)        | (1.7)        | (1.3)        | (1.6)        | (1.3)        | (1.6)        |
| Genesee           | (0.8)        | (1.0)        | (0.8)        | (0.6)        | (0.5)        | (0.8)        | (0.7)        | (0.8)        | (0.7)        | (0.8)        |
| Central           | (0.3)        | (0.5)        | (0.4)        | (0.4)        | (0.5)        | (0.6)        | (0.5)        | (0.6)        | (0.5)        | (0.5)        |
| North             | (0.4)        | (0.5)        | (0.4)        | (0.3)        | (0.1)        | (0.2)        | (0.1)        | (0.2)        | (0.1)        | (0.2)        |
| Mohawk Valley     | 0.3          | 0.3          | 0.2          | 0.2          | 0.2          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          |
| Capital           | 0.0          | (0.0)        | (0.2)        | (0.4)        | (0.5)        | (0.2)        | (0.2)        | (0.3)        | (0.4)        | (0.3)        |
| Hudson Valley     | 0.1          | 0.1          | (0.1)        | (0.2)        | (0.3)        | (0.1)        | (0.2)        | (0.2)        | (0.3)        | (0.3)        |
| Millwood          | 0.1          | 0.0          | (0.0)        | (0.0)        | (0.1)        | 0.0          | (0.0)        | (0.0)        | (0.1)        | (0.1)        |
| Dunwoodie         | 0.1          | 0.1          | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        |
| NY City           | 1.5          | 1.2          | 0.1          | (0.5)        | (1.0)        | 0.3          | (0.4)        | (0.2)        | (1.1)        | (0.9)        |
| Long Island       | 0.8          | 0.6          | 0.3          | (0.0)        | (0.2)        | 0.3          | (0.1)        | (0.0)        | (0.4)        | (0.3)        |
| <b>NYCA Total</b> | <b>(0.7)</b> | <b>(1.9)</b> | <b>(3.0)</b> | <b>(3.8)</b> | <b>(4.2)</b> | <b>(3.0)</b> | <b>(3.4)</b> | <b>(3.8)</b> | <b>(5.0)</b> | <b>(4.9)</b> |

**Generic Generation Solution (Study 1: Central East)**

**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Generation Solution (Study 1: Central East)**

| Demand Congestion (\$M) | 2019          | 2020        | 2021       | 2022       | 2023          | 2024       | 2025       | 2026         | 2027       | 2028        |
|-------------------------|---------------|-------------|------------|------------|---------------|------------|------------|--------------|------------|-------------|
| West                    | (0.2)         | 0.4         | 0.5        | (0.1)      | 0.2           | 0.1        | (0.0)      | (0.3)        | (0.6)      | (0.2)       |
| Genesee                 | 0.2           | (0.1)       | 0.2        | (0.0)      | 0.1           | 0.1        | 0.0        | (0.2)        | (0.3)      | (0.0)       |
| Central                 | (0.8)         | (0.0)       | 0.2        | (0.8)      | (0.5)         | (0.2)      | 0.1        | (0.5)        | 0.5        | 0.1         |
| North                   | 0.1           | (0.2)       | (0.2)      | 0.0        | 0.2           | 0.2        | (0.2)      | 0.1          | (0.1)      | 0.0         |
| Mohawk Valley           | (0.1)         | 0.0         | (0.0)      | (0.3)      | (0.3)         | (0.1)      | 0.0        | (0.2)        | 0.1        | 0.1         |
| Capital                 | (2.9)         | 1.0         | (0.2)      | (1.5)      | (3.0)         | (0.6)      | 0.5        | (1.1)        | (0.8)      | 0.9         |
| Hudson Valley           | (1.4)         | 1.0         | 0.6        | 0.1        | (1.0)         | 0.1        | 0.5        | (0.6)        | 0.8        | 1.0         |
| Millwood                | (0.4)         | 0.4         | 0.1        | (0.0)      | (0.3)         | 0.0        | 0.1        | (0.1)        | 0.0        | 0.1         |
| Dunwoodie               | (0.8)         | 0.8         | 0.3        | 0.1        | (0.5)         | (0.0)      | 0.2        | (0.3)        | 0.0        | 0.3         |
| NY City                 | (7.5)         | 8.1         | 6.4        | 2.6        | (1.5)         | 3.5        | 2.0        | 2.3          | 4.2        | 8.4         |
| Long Island             | (0.7)         | 3.5         | 1.7        | 2.6        | (5.5)         | 4.6        | 2.4        | 0.7          | 1.5        | 4.2         |
| <b>NYCA Total</b>       | <b>(14.5)</b> | <b>14.8</b> | <b>9.6</b> | <b>2.7</b> | <b>(12.1)</b> | <b>7.8</b> | <b>5.5</b> | <b>(0.2)</b> | <b>5.5</b> | <b>14.9</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Generation Solution (Study 1: Central East)**

| Production Cost (\$M)           | 2019       | 2020       | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                            | (0)        | (1)        | (1)         | (1)         | (1)         | 1           | (2)         | (1)         | (1)         | (1)         |
| Genesee                         | (0)        | (0)        | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Central                         | (2)        | (0)        | (5)         | (0)         | (8)         | (3)         | (12)        | (6)         | (5)         | (7)         |
| North                           | 0          | (0)        | (0)         | (0)         | 1           | 0           | (0)         | 1           | (0)         | 0           |
| Mohawk Valley                   | (0)        | (0)        | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                         | 8          | 10         | 20          | 22          | 27          | 27          | 28          | 31          | 36          | 31          |
| Hudson Valley                   | 1          | (2)        | (4)         | (6)         | (6)         | (5)         | (11)        | 9           | (1)         | (11)        |
| Millwood                        | 0          | (0)        | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           |
| Dunwoodie                       | 0          | 0          | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                         | (2)        | (11)       | (14)        | (19)        | (5)         | (5)         | 9           | (16)        | (20)        | (8)         |
| Long Island                     | (0)        | 4          | 1           | (0)         | (2)         | (2)         | (0)         | (1)         | (5)         | (4)         |
| <b>NYCA Total</b>               | <b>5</b>   | <b>1</b>   | <b>(3)</b>  | <b>(5)</b>  | <b>5</b>    | <b>12</b>   | <b>13</b>   | <b>16</b>   | <b>4</b>    | <b>(0)</b>  |
| <b>NYCA Imports</b>             | <b>(3)</b> | <b>(4)</b> | <b>(6)</b>  | <b>(7)</b>  | <b>(7)</b>  | <b>(12)</b> | <b>(20)</b> | <b>(18)</b> | <b>(14)</b> | <b>(20)</b> |
| <b>NYCA Exports</b>             | <b>4</b>   | <b>4</b>   | <b>4</b>    | <b>6</b>    | <b>12</b>   | <b>12</b>   | <b>3</b>    | <b>12</b>   | <b>12</b>   | <b>11</b>   |
| <b>NYCA + Imports - Exports</b> | <b>(2)</b> | <b>(7)</b> | <b>(13)</b> | <b>(18)</b> | <b>(14)</b> | <b>(12)</b> | <b>(10)</b> | <b>(15)</b> | <b>(22)</b> | <b>(31)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Generation Solution (Study 1: Central East)**

| Generation (GWh)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West              | 9          | (2)        | (11)       | (39)       | (23)       | 36         | (11)       | (8)        | (9)        | 19         |
| Genesee           | (3)        | (6)        | (3)        | (4)        | (4)        | (8)        | (2)        | (7)        | (1)        | (11)       |
| Central           | (89)       | (29)       | (207)      | 3          | (242)      | (94)       | (317)      | (151)      | (119)      | (138)      |
| North             | 3          | 2          | (11)       | (1)        | 11         | 3          | (2)        | 11         | (8)        | 0          |
| Mohawk Valley     | 0          | 0          | 0          | (1)        | 1          | (5)        | (1)        | (2)        | (0)        | (3)        |
| Capital           | 365        | 429        | 742        | 829        | 1,073      | 1,035      | 1,174      | 984        | 1,114      | 1,076      |
| Hudson Valley     | 30         | (74)       | (124)      | (144)      | (148)      | (139)      | (219)      | 175        | (37)       | (247)      |
| Millwood          | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | (0)        | 0          |
| Dunwoodie         | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City           | (123)      | (166)      | (205)      | (268)      | (173)      | (217)      | 4          | (336)      | (303)      | 98         |
| Long Island       | (11)       | 45         | 34         | (9)        | (37)       | (26)       | (2)        | (16)       | (51)       | (59)       |
| <b>NYCA Total</b> | <b>181</b> | <b>198</b> | <b>214</b> | <b>367</b> | <b>460</b> | <b>587</b> | <b>626</b> | <b>650</b> | <b>586</b> | <b>735</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Generation Solution (Study 1: Central East)**

| Net Imports (GWh) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| PJM - NYISO       | (47)         | (60)         | (46)         | (103)        | (76)         | (203)        | (311)        | (240)        | (173)        | (383)        |
| LINDEN VFT        | (24)         | 19           | 4            | (7)          | (9)          | (3)          | (13)         | 1            | (20)         | (10)         |
| NEPTUNE           | (1)          | (0)          | (37)         | (13)         | (8)          | (39)         | (76)         | (42)         | (51)         | (39)         |
| HTP               | (20)         | 5            | 16           | (2)          | 2            | 13           | (6)          | (13)         | 1            | 3            |
| ISONE - NYISO     | (92)         | (87)         | (122)        | (180)        | (306)        | (298)        | (105)        | (238)        | (244)        | (166)        |
| CROSS SOUND CABLE | 9            | (3)          | (22)         | 9            | (34)         | 18           | (4)          | (18)         | (3)          | 10           |
| NORTHPORT NORWALK | 5            | 0            | 1            | (2)          | (1)          | 0            | (8)          | 5            | 10           | 3            |
| IESO - NYISO      | (13)         | (71)         | (16)         | (68)         | (29)         | (75)         | (106)        | (109)        | (109)        | (156)        |
| HQ - NYISO CHAT   | (0)          | (0)          | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| HQ - NYISO CEDARS | 0            | 1            | (0)          | (0)          | (0)          | (0)          | (0)          | 0            | 0            | 0            |
| <b>TOTAL</b>      | <b>(182)</b> | <b>(197)</b> | <b>(220)</b> | <b>(365)</b> | <b>(460)</b> | <b>(587)</b> | <b>(630)</b> | <b>(653)</b> | <b>(589)</b> | <b>(738)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Generation Solution (Study 1: Central East)**

| Generator Payment (\$M) | 2019     | 2020     | 2021        | 2022       | 2023       | 2024       | 2025     | 2026      | 2027        | 2028      |
|-------------------------|----------|----------|-------------|------------|------------|------------|----------|-----------|-------------|-----------|
| West                    | 0        | (2)      | (4)         | (4)        | (3)        | (3)        | (3)      | (2)       | (5)         | (3)       |
| Genesee                 | (0)      | (1)      | (1)         | (1)        | (1)        | (2)        | (1)      | (1)       | (1)         | (2)       |
| Central                 | 6        | (0)      | (14)        | 4          | (10)       | (11)       | (16)     | (7)       | (25)        | (11)      |
| North                   | (0)      | (1)      | (2)         | (2)        | (1)        | (3)        | (1)      | (1)       | (3)         | (2)       |
| Mohawk Valley           | (0)      | (0)      | (1)         | (1)        | (0)        | (1)        | (1)      | (1)       | (1)         | (1)       |
| Capital                 | 8        | 14       | 22          | 25         | 31         | 33         | 41       | 38        | 43          | 43        |
| Hudson Valley           | 0        | (3)      | (6)         | (8)        | (8)        | (6)        | (13)     | 8         | (3)         | (14)      |
| Millwood                | (2)      | 0        | (0)         | 0          | (1)        | (0)        | 0        | 0         | 1           | (0)       |
| Dunwoodie               | (0)      | (0)      | (0)         | (0)        | (0)        | (0)        | (0)      | (0)       | (0)         | (0)       |
| NY City                 | (7)      | (8)      | (14)        | (17)       | (8)        | (12)       | 1        | (18)      | (19)        | 11        |
| Long Island             | (1)      | 3        | (2)         | (1)        | (2)        | (1)        | (0)      | (0)       | (5)         | (4)       |
| <b>NYCA Total</b>       | <b>4</b> | <b>2</b> | <b>(21)</b> | <b>(4)</b> | <b>(4)</b> | <b>(7)</b> | <b>8</b> | <b>15</b> | <b>(18)</b> | <b>17</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Generation Solution (Study 1: Central East)**

| Load Payment (\$M) | 2019        | 2020       | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|--------------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West               | 0           | (1)        | (2)         | (2)         | (1)         | (4)         | (2)         | (2)         | (3)         | (3)         |
| Genesee            | (0)         | (1)        | (2)         | (2)         | (1)         | (3)         | (1)         | (1)         | (2)         | (2)         |
| Central            | (0)         | (2)        | (3)         | (3)         | (2)         | (4)         | (2)         | (3)         | (4)         | (3)         |
| North              | 0           | (0)        | (1)         | (1)         | (1)         | (2)         | (1)         | (1)         | (1)         | (1)         |
| Mohawk Valley      | (0)         | (1)        | (1)         | (1)         | (1)         | (2)         | (1)         | (1)         | (2)         | (2)         |
| Capital            | (3)         | (1)        | (3)         | (4)         | (5)         | (4)         | (2)         | (3)         | (4)         | (2)         |
| Hudson Valley      | (1)         | (0)        | (2)         | (2)         | (2)         | (2)         | (1)         | (2)         | (2)         | (1)         |
| Millwood           | (0)         | (0)        | (1)         | (0)         | (1)         | (1)         | (0)         | (1)         | (1)         | (1)         |
| Dunwoodie          | (1)         | (0)        | (1)         | (1)         | (1)         | (2)         | (1)         | (1)         | (1)         | (1)         |
| NY City            | (7)         | 0          | (8)         | (7)         | (9)         | (10)        | (6)         | (5)         | (9)         | (5)         |
| Long Island        | (1)         | 0          | (4)         | (2)         | (8)         | (1)         | (1)         | (3)         | (4)         | (1)         |
| <b>NYCA Total</b>  | <b>(13)</b> | <b>(7)</b> | <b>(29)</b> | <b>(25)</b> | <b>(32)</b> | <b>(35)</b> | <b>(18)</b> | <b>(24)</b> | <b>(32)</b> | <b>(22)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Generation Solution (Study 1: Central East)**

| Average LBMP (\$/MWh) | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| West                  | 0.00   | (0.08) | (0.13) | (0.11) | (0.08) | (0.25) | (0.10) | (0.11) | (0.18) | (0.16) |
| Genesee               | 0.00   | (0.11) | (0.15) | (0.12) | (0.09) | (0.27) | (0.12) | (0.13) | (0.21) | (0.19) |
| Central               | (0.02) | (0.12) | (0.16) | (0.17) | (0.11) | (0.28) | (0.12) | (0.19) | (0.22) | (0.19) |
| North                 | 0.00   | (0.08) | (0.13) | (0.12) | (0.12) | (0.31) | (0.11) | (0.18) | (0.24) | (0.21) |
| Mohawk Valley         | 0.01   | (0.12) | (0.18) | (0.16) | (0.13) | (0.29) | (0.14) | (0.20) | (0.26) | (0.21) |
| Capital               | (0.19) | (0.04) | (0.22) | (0.25) | (0.32) | (0.33) | (0.14) | (0.26) | (0.33) | (0.17) |
| Hudson Valley         | (0.10) | (0.03) | (0.14) | (0.15) | (0.20) | (0.27) | (0.11) | (0.21) | (0.20) | (0.14) |
| Millwood              | (0.10) | (0.01) | (0.15) | (0.15) | (0.20) | (0.27) | (0.11) | (0.20) | (0.23) | (0.17) |
| Dunwoodie             | (0.10) | (0.01) | (0.15) | (0.14) | (0.19) | (0.27) | (0.11) | (0.20) | (0.24) | (0.17) |
| NY City               | (0.11) | 0.01   | (0.10) | (0.11) | (0.14) | (0.22) | (0.11) | (0.11) | (0.17) | (0.09) |
| Long Island           | (0.02) | 0.01   | (0.16) | (0.05) | (0.38) | (0.06) | (0.05) | (0.13) | (0.18) | (0.03) |
| Average               | (0.06) | (0.05) | (0.15) | (0.14) | (0.18) | (0.26) | (0.11) | (0.18) | (0.22) | (0.16) |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Generation Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions (Tons) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                             | 1    | (0)  | 1    | (0)  | (23) | 102  | (7)  | (60) | (20) | 33   |
| Genesee                          | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Central                          | (0)  | (0)  | (0)  | (0)  | (1)  | (0)  | (1)  | (0)  | (0)  | (0)  |
| North                            | (0)  | (0)  | (0)  | (0)  | 0    | 0    | (0)  | 0    | (0)  | (0)  |
| Mohawk Valley                    | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  |
| Capital                          | 27   | 35   | 47   | 58   | 69   | 72   | 75   | 68   | 75   | 74   |
| Hudson Valley                    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (1)  | 0    | (0)  | (1)  |
| Millwood                         | 0    | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | 0    |
| Dunwoodie                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                          | (0)  | (1)  | (1)  | (1)  | (0)  | (1)  | 0    | (1)  | (1)  | 0    |
| Long Island                      | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| NYCA Total                       | 27   | 35   | 46   | 56   | 44   | 173  | 67   | 8    | 54   | 105  |

**PROJECTED SO2 EMISSION COSTS (\$M) | Generic Generation Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                                  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | 0    |
| Genesee                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Central                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| North                                 | (0)  | (0)  | (0)  | (0)  | 0    | 0    | (0)  | 0    | (0)  | (0)  |
| Mohawk Valley                         | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  |
| Capital                               | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Hudson Valley                         | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  |
| Millwood                              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | 0    |
| Long Island                           | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| NYCA Total                            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |

**PROJECTED NOX EMISSIONS (Tons) | Generic Generation Solution (Study 1: Central East)**

| <b>NO<sub>x</sub> Emissions (Tons)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                                   | (1)         | (7)         | (11)        | (17)        | (25)        | 19          | (14)        | (3)         | (4)         | (9)         |
| Genesee                                | (0)         | (2)         | 0           | 0           | (0)         | (1)         | (0)         | (1)         | (0)         | (1)         |
| Central                                | (5)         | (3)         | (12)        | (5)         | (14)        | (12)        | (17)        | (10)        | (8)         | (13)        |
| North                                  | 3           | (4)         | (1)         | 1           | 5           | 0           | (0)         | 3           | (0)         | (0)         |
| Mohawk Valley                          | 1           | (0)         | 1           | (0)         | 0           | (1)         | 0           | (1)         | (0)         | (1)         |
| Capital                                | 101         | 98          | 136         | 165         | 241         | 206         | 217         | 185         | 220         | 206         |
| Hudson Valley                          | 13          | (28)        | (58)        | (50)        | (69)        | (57)        | (62)        | 3           | (49)        | (54)        |
| Millwood                               | 0           | (0)         | (1)         | (1)         | 0           | (2)         | (1)         | 0           | (2)         | 1           |
| Dunwoodie                              | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                | (15)        | (63)        | (55)        | (46)        | (113)       | (49)        | 53          | (71)        | (59)        | 3           |
| Long Island                            | (0)         | 34          | 7           | (1)         | (25)        | (13)        | 5           | (11)        | (14)        | (10)        |
| <b>NYCA Total</b>                      | <b>96</b>   | <b>24</b>   | <b>3</b>    | <b>47</b>   | <b>(1)</b>  | <b>89</b>   | <b>180</b>  | <b>94</b>   | <b>82</b>   | <b>123</b>  |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Generation Solution (Study 1: Central East)**

| <b>NO<sub>x</sub> Emissions Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Genesee                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Central                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| North                                       | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Mohawk Valley                               | (0)         | (0)         | (0)         | 0           | 0           | (0)         | 0           | (0)         | (0)         | (0)         |
| Capital                                     | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Hudson Valley                               | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         |
| Long Island                                 | (0)         | (0)         | 0           | 0           | (0)         | (0)         | 0           | (0)         | (0)         | (0)         |
| <b>NYCA Total</b>                           | <b>0</b>    | <b>(0)</b>  | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Generation Solution (Study 1: Central East)**

| <b>CO<sub>2</sub> Emissions (1000 Tons)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | (2)         | (11)        | (14)        | (22)        | (28)        | 26          | (18)        | (23)        | (18)        | (1)         |
| Genesee                                     | (1)         | (3)         | (2)         | (2)         | (2)         | (3)         | (1)         | (3)         | (1)         | (5)         |
| Central                                     | (44)        | (12)        | (84)        | (5)         | (101)       | (43)        | (130)       | (63)        | (50)        | (62)        |
| North                                       | (0)         | (1)         | (3)         | (1)         | 5           | 2           | (1)         | 5           | (4)         | (0)         |
| Mohawk Valley                               | (1)         | (1)         | (0)         | (0)         | 1           | (2)         | (0)         | (1)         | (0)         | (2)         |
| Capital                                     | 146         | 177         | 299         | 333         | 442         | 421         | 468         | 395         | 454         | 432         |
| Hudson Valley                               | 16          | (39)        | (75)        | (79)        | (90)        | (79)        | (114)       | 71          | (37)        | (121)       |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (56)        | (94)        | (123)       | (153)       | (96)        | (111)       | 39          | (190)       | (164)       | 43          |
| Long Island                                 | (6)         | 39          | 19          | (3)         | (24)        | (16)        | (3)         | (11)        | (29)        | (30)        |
| <b>NYCA Total</b>                           | <b>51</b>   | <b>56</b>   | <b>17</b>   | <b>68</b>   | <b>106</b>  | <b>194</b>  | <b>241</b>  | <b>180</b>  | <b>153</b>  | <b>254</b>  |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Generation Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0.0)      | (0.1)      | (0.1)      | (0.2)      | (0.2)      | 0.2        | (0.2)      | (0.2)      | (0.2)      | (0.0)      |
| Genesee                               | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.1)      |
| Central                               | (0.2)      | (0.1)      | (0.5)      | (0.1)      | (0.7)      | (0.3)      | (1.1)      | (0.6)      | (0.5)      | (0.7)      |
| North                                 | (0.0)      | (0.0)      | (0.0)      | (0.0)      | 0.0        | 0.0        | (0.0)      | 0.0        | (0.0)      | (0.0)      |
| Mohawk Valley                         | (0.0)      | (0.0)      | (0.0)      | (0.0)      | 0.0        | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      |
| Capital                               | 0.7        | 1.0        | 2.0        | 2.3        | 3.2        | 3.3        | 3.9        | 3.6        | 4.4        | 4.5        |
| Hudson Valley                         | 0.1        | (0.2)      | (0.5)      | (0.6)      | (0.7)      | (0.6)      | (1.0)      | 0.7        | (0.4)      | (1.3)      |
| Millwood                              | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | (0.1)      | (0.6)      | (0.7)      | (1.0)      | (0.6)      | (0.8)      | 0.4        | (1.7)      | (1.5)      | 0.5        |
| Long Island                           | (0.0)      | 0.2        | 0.1        | (0.0)      | (0.1)      | (0.1)      | (0.1)      | (0.1)      | (0.2)      | (0.3)      |
| <b>NYCA Total</b>                     | <b>0.4</b> | <b>0.3</b> | <b>0.2</b> | <b>0.5</b> | <b>0.9</b> | <b>1.6</b> | <b>2.0</b> | <b>1.7</b> | <b>1.5</b> | <b>2.6</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Generation Solution (Study 1: Central East)**

| Loss Costs (\$M)  | 2019       | 2020       | 2021         | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------|------------|------------|--------------|------------|------------|------------|------------|------------|------------|------------|
| West              | 0.0        | 0.3        | 0.5          | 0.4        | 0.4        | 0.7        | 0.7        | 0.6        | 0.8        | 0.9        |
| Genesee           | 0.0        | 0.1        | 0.2          | 0.1        | 0.2        | 0.3        | 0.4        | 0.3        | 0.3        | 0.4        |
| Central           | 0.1        | 0.0        | 0.1          | 0.1        | 0.2        | 0.2        | 0.4        | 0.3        | 0.3        | 0.4        |
| North             | (0.0)      | 0.0        | 0.1          | 0.1        | 0.0        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        |
| Mohawk Valley     | 0.0        | (0.0)      | (0.0)        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Capital           | (0.0)      | (0.1)      | (0.3)        | (0.0)      | (0.1)      | (0.1)      | (0.3)      | (0.0)      | (0.2)      | (0.1)      |
| Hudson Valley     | 0.1        | 0.0        | (0.1)        | 0.2        | 0.1        | 0.2        | 0.1        | 0.2        | 0.3        | 0.2        |
| Millwood          | 0.0        | 0.0        | (0.0)        | 0.1        | 0.0        | 0.1        | 0.0        | 0.1        | 0.1        | 0.0        |
| Dunwoodie         | 0.1        | 0.0        | (0.0)        | 0.1        | 0.1        | 0.2        | 0.1        | 0.2        | 0.2        | 0.1        |
| NY City           | 0.6        | 0.3        | (0.4)        | 1.2        | 0.8        | 1.6        | 0.6        | 2.0        | 2.3        | 1.0        |
| Long Island       | 0.3        | 0.0        | (0.2)        | 0.4        | 0.4        | 0.7        | 0.2        | 0.6        | 0.8        | 0.5        |
| <b>NYCA Total</b> | <b>1.1</b> | <b>0.7</b> | <b>(0.2)</b> | <b>2.6</b> | <b>2.0</b> | <b>3.9</b> | <b>2.2</b> | <b>4.3</b> | <b>5.1</b> | <b>3.5</b> |

**Generic Demand Response Solution (Study 1: Central East)**

**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| Demand Congestion (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025       | 2026         | 2027         | 2028         |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------|--------------|--------------|--------------|
| West                    | (0.1)        | (0.0)        | (1.5)        | 0.1          | 0.0          | 0.1          | (0.0)      | 0.1          | (0.0)        | (0.0)        |
| Genesee                 | (0.0)        | (0.0)        | 0.1          | 0.1          | 0.0          | 0.0          | 0.0        | 0.0          | (0.0)        | (0.0)        |
| Central                 | 0.2          | (0.1)        | (0.2)        | (0.0)        | (0.0)        | (0.0)        | (0.0)      | (0.1)        | (0.0)        | 0.0          |
| North                   | (0.0)        | (0.0)        | (0.1)        | (0.1)        | 0.0          | (0.0)        | (0.1)      | (0.0)        | (0.0)        | 0.0          |
| Mohawk Valley           | 0.1          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)      | (0.0)        | (0.0)        | 0.0          |
| Capital                 | 0.2          | 0.0          | 0.1          | 0.1          | (0.2)        | (0.0)        | 0.3        | 0.0          | 0.2          | 0.2          |
| Hudson Valley           | (0.2)        | (0.3)        | (0.6)        | (0.4)        | (0.4)        | 0.0          | (0.1)      | (0.2)        | (0.1)        | (0.2)        |
| Millwood                | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | 0.0          |
| Dunwoodie               | (0.1)        | (0.3)        | (0.3)        | (0.2)        | (0.2)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | 0.0          |
| NY City                 | (0.6)        | (3.2)        | (3.3)        | (2.4)        | (1.6)        | (0.4)        | 0.4        | (2.0)        | (1.4)        | (1.6)        |
| Long Island             | (0.1)        | (0.7)        | (1.1)        | (0.2)        | (0.1)        | 0.1          | 0.5        | (0.1)        | 0.4          | 0.2          |
| <b>NYCA Total</b>       | <b>(0.6)</b> | <b>(4.8)</b> | <b>(7.0)</b> | <b>(3.3)</b> | <b>(2.5)</b> | <b>(0.3)</b> | <b>1.1</b> | <b>(2.4)</b> | <b>(1.2)</b> | <b>(1.3)</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| Production Cost (\$M)           | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                            | (0)        | (0)        | (0)        | (0)        | 1          | 0          | 0          | (1)        | 0          | 0          |
| Genesee                         | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | 0          | 0          |
| Central                         | (0)        | 0          | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        |
| North                           | (0)        | 0          | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley                   | (0)        | (0)        | 0          | 0          | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| Capital                         | (0)        | (0)        | (0)        | (0)        | (1)        | 0          | 0          | 0          | (0)        | (0)        |
| Hudson Valley                   | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | 0          | (0)        |
| Millwood                        | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                       | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                         | (1)        | (1)        | (1)        | (0)        | (1)        | (2)        | (1)        | (0)        | (1)        | (2)        |
| Long Island                     | (0)        | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>               | <b>(2)</b> | <b>(1)</b> | <b>(1)</b> | <b>(1)</b> | <b>(2)</b> | <b>(2)</b> | <b>(1)</b> | <b>(2)</b> | <b>(1)</b> | <b>(2)</b> |
| NYCA Imports                    | 0          | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (0)        | (1)        | (0)        |
| NYCA Exports                    | (0)        | 0          | 0          | 1          | 0          | (0)        | 0          | 0          | 1          | (0)        |
| <b>NYCA + Imports - Exports</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(3)</b> | <b>(3)</b> | <b>(2)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Demand Response Solution (Study 1: Central East)**

| Generation (GWh)  | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025       | 2026        | 2027        | 2028        |
|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|
| West              | (2)         | (1)         | (2)         | (5)         | 15          | 1           | (1)        | (18)        | (1)         | 7           |
| Genesee           | (0)         | 0           | 0           | (0)         | 0           | (0)         | (0)        | (0)         | 0           | 0           |
| Central           | (16)        | 1           | (3)         | (0)         | (5)         | (1)         | 6          | (2)         | (0)         | 0           |
| North             | 1           | 1           | (0)         | (0)         | (1)         | (1)         | (4)        | (2)         | (1)         | (1)         |
| Mohawk Valley     | (0)         | (0)         | 1           | 1           | (1)         | 0           | (1)        | (1)         | (1)         | (1)         |
| Capital           | 3           | (4)         | (5)         | (1)         | (14)        | 2           | 9          | 2           | (4)         | (6)         |
| Hudson Valley     | (2)         | 7           | (3)         | (8)         | 7           | 0           | (4)        | (2)         | 2           | (8)         |
| Millwood          | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           |
| Dunwoodie         | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           |
| NY City           | (36)        | (22)        | (17)        | (2)         | (22)        | (30)        | (13)       | (7)         | (10)        | (38)        |
| Long Island       | (1)         | 2           | 2           | (1)         | (6)         | 2           | (2)        | (0)         | (2)         | 0           |
| <b>NYCA Total</b> | <b>(53)</b> | <b>(16)</b> | <b>(26)</b> | <b>(17)</b> | <b>(26)</b> | <b>(27)</b> | <b>(9)</b> | <b>(30)</b> | <b>(16)</b> | <b>(45)</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Demand Response Solution (Study 1: Central East)**

| Net Imports (GWh) | 2019      | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026       | 2027        | 2028     |
|-------------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|----------|
| PJM - NYISO       | 2         | (9)         | 2           | (20)        | (14)        | (3)         | (23)        | 0          | (11)        | 2        |
| LINDEN VFT        | 0         | (3)         | (0)         | (3)         | (2)         | 3           | (2)         | (1)        | (7)         | 3        |
| NEPTUNE           | 0         | 0           | (0)         | (2)         | (4)         | 0           | (1)         | (5)        | (2)         | (0)      |
| HTP               | 4         | (1)         | (1)         | (3)         | 1           | (0)         | (0)         | (0)        | 2           | 2        |
| ISONE - NYISO     | 10        | (8)         | (7)         | 5           | 10          | (9)         | 5           | 2          | (3)         | 1        |
| CROSS SOUND CABLE | (1)       | (1)         | (1)         | (1)         | 4           | 0           | (0)         | 1          | 1           | 0        |
| NORTHPORT NORWALK | (1)       | 0           | (2)         | (1)         | (2)         | (1)         | (1)         | 1          | 0           | (2)      |
| IESO - NYISO      | 1         | (4)         | (5)         | 3           | (5)         | (4)         | (8)         | (7)        | (3)         | (0)      |
| HQ - NYISO CHAT   | (0)       | 0           | 0           | (0)         | 0           | 0           | (0)         | 0          | 0           | 0        |
| HQ - NYISO CEDARS | (0)       | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | (0)      |
| <b>TOTAL</b>      | <b>15</b> | <b>(24)</b> | <b>(14)</b> | <b>(23)</b> | <b>(13)</b> | <b>(13)</b> | <b>(31)</b> | <b>(9)</b> | <b>(23)</b> | <b>6</b> |



**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| Generator Payment (\$M) | 2019       | 2020       | 2021        | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------------|------------|------------|-------------|------------|------------|------------|------------|------------|------------|------------|
| West                    | (0)        | (0)        | (1)         | (0)        | 1          | (0)        | (0)        | (1)        | (0)        | 0          |
| Genesee                 | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central                 | (1)        | 0          | (1)         | (0)        | (1)        | (0)        | (0)        | 0          | (0)        | (0)        |
| North                   | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley           | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                 | (1)        | (1)        | (2)         | (1)        | (1)        | 0          | (0)        | 0          | (1)        | (0)        |
| Hudson Valley           | (1)        | (0)        | (2)         | (1)        | 0          | (0)        | (1)        | (1)        | (0)        | (0)        |
| Millwood                | (1)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie               | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| NY City                 | (3)        | (4)        | (7)         | (3)        | (2)        | (2)        | (2)        | (2)        | (2)        | (3)        |
| Long Island             | (1)        | (1)        | (2)         | (1)        | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>       | <b>(7)</b> | <b>(6)</b> | <b>(15)</b> | <b>(6)</b> | <b>(4)</b> | <b>(3)</b> | <b>(4)</b> | <b>(4)</b> | <b>(5)</b> | <b>(4)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| Load Payment (\$M) | 2019       | 2020        | 2021        | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|--------------------|------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|
| West               | (1)        | (0)         | (2)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Genesee            | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central            | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| North              | (0)        | (0)         | (0)         | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley      | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital            | (1)        | (1)         | (1)         | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        |
| Hudson Valley      | (1)        | (1)         | (2)         | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        |
| Millwood           | (0)        | (0)         | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie          | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| NY City            | (3)        | (5)         | (10)        | (5)        | (3)        | (2)        | (3)        | (4)        | (5)        | (3)        |
| Long Island        | (1)        | (1)         | (4)         | (1)        | (0)        | (0)        | (0)        | (1)        | (0)        | 0          |
| <b>NYCA Total</b>  | <b>(8)</b> | <b>(10)</b> | <b>(23)</b> | <b>(9)</b> | <b>(5)</b> | <b>(4)</b> | <b>(6)</b> | <b>(7)</b> | <b>(8)</b> | <b>(5)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Demand Response Solution (Study 1: Central East)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | (0.03)        | (0.01)        | (0.12)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        | (0.02)        | (0.01)        |
| Genesee               | (0.02)        | (0.01)        | (0.04)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        | (0.02)        | (0.01)        |
| Central               | (0.02)        | (0.02)        | (0.06)        | (0.02)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        |
| North                 | (0.02)        | (0.01)        | (0.03)        | 0.01          | (0.02)        | (0.00)        | (0.01)        | (0.00)        | (0.02)        | (0.01)        |
| Mohawk Valley         | (0.02)        | (0.01)        | (0.05)        | (0.02)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        |
| Capital               | (0.01)        | (0.01)        | (0.05)        | (0.01)        | (0.03)        | (0.01)        | (0.01)        | (0.01)        | (0.01)        | 0.01          |
| Hudson Valley         | (0.03)        | (0.03)        | (0.08)        | (0.03)        | (0.03)        | (0.00)        | (0.02)        | (0.02)        | (0.03)        | (0.01)        |
| Millwood              | (0.03)        | (0.04)        | (0.08)        | (0.03)        | (0.03)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        |
| Dunwoodie             | (0.03)        | (0.04)        | (0.08)        | (0.04)        | (0.03)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        |
| NY City               | (0.02)        | (0.04)        | (0.08)        | (0.04)        | (0.03)        | (0.01)        | (0.01)        | (0.03)        | (0.03)        | (0.02)        |
| Long Island           | (0.02)        | (0.03)        | (0.08)        | (0.02)        | (0.01)        | (0.01)        | (0.01)        | (0.02)        | (0.01)        | 0.00          |
| <b>Average</b>        | <b>(0.02)</b> | <b>(0.02)</b> | <b>(0.07)</b> | <b>(0.02)</b> | <b>(0.02)</b> | <b>(0.01)</b> | <b>(0.02)</b> | <b>(0.01)</b> | <b>(0.02)</b> | <b>(0.01)</b> |

**PROJECTED SO<sub>2</sub> EMISSIONS (Tons) | Generic Demand Response Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions (Tons) | 2019       | 2020       | 2021       | 2022       | 2023      | 2024     | 2025       | 2026        | 2027       | 2028     |
|----------------------------------|------------|------------|------------|------------|-----------|----------|------------|-------------|------------|----------|
| West                             | 0          | (0)        | (0)        | (0)        | 50        | 2        | 0          | (46)        | (2)        | 8        |
| Genesee                          | (0)        | 0          | (0)        | (0)        | 0         | (0)      | (0)        | (0)         | 0          | 0        |
| Central                          | (0)        | 0          | (0)        | 0          | (0)       | (0)      | 0          | (0)         | (0)        | 0        |
| North                            | (0)        | 0          | 0          | (0)        | (0)       | (0)      | (0)        | (0)         | (0)        | (0)      |
| Mohawk Valley                    | (0)        | (0)        | 0          | 0          | (0)       | 0        | (0)        | (0)         | (0)        | (0)      |
| Capital                          | 0          | (0)        | (0)        | (0)        | (0)       | (0)      | 0          | (0)         | (0)        | (0)      |
| Hudson Valley                    | (0)        | (0)        | (1)        | (0)        | 0         | 0        | 0          | 0           | 0          | (0)      |
| Millwood                         | 0          | 0          | 0          | 0          | 0         | 0        | 0          | 0           | 0          | 0        |
| Dunwoodie                        | 0          | 0          | 0          | 0          | 0         | 0        | 0          | 0           | 0          | 0        |
| NY City                          | (0)        | (0)        | (1)        | (0)        | (0)       | (0)      | (0)        | (0)         | (0)        | (0)      |
| Long Island                      | (0)        | (0)        | (1)        | (0)        | (0)       | 0        | (0)        | (0)         | (0)        | 0        |
| <b>NYCA Total</b>                | <b>(1)</b> | <b>(1)</b> | <b>(3)</b> | <b>(0)</b> | <b>50</b> | <b>2</b> | <b>(0)</b> | <b>(46)</b> | <b>(3)</b> | <b>7</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023     | 2024     | 2025       | 2026       | 2027       | 2028     |
|---------------------------------------|------------|------------|------------|------------|----------|----------|------------|------------|------------|----------|
| West                                  | 0          | (0)        | (0)        | (0)        | 0        | 0        | 0          | (0)        | (0)        | 0        |
| Genesee                               | (0)        | 0          | (0)        | (0)        | 0        | (0)      | (0)        | (0)        | 0          | 0        |
| Central                               | (0)        | 0          | (0)        | 0          | (0)      | (0)      | 0          | (0)        | (0)        | 0        |
| North                                 | (0)        | 0          | 0          | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Mohawk Valley                         | (0)        | (0)        | 0          | 0          | (0)      | 0        | (0)        | (0)        | (0)        | (0)      |
| Capital                               | 0          | (0)        | (0)        | (0)        | (0)      | (0)      | 0          | (0)        | (0)        | (0)      |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | 0        | 0        | 0          | 0          | 0          | (0)      |
| Millwood                              | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Long Island                           | (0)        | 0          | (0)        | (0)        | (0)      | 0        | (0)        | (0)        | (0)        | 0        |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Demand Response Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions (Tons) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                             | 1           | (1)         | (0)         | (2)         | 4           | 1           | (0)         | (10)        | 1           | 8           |
| Genesee                          | (0)         | 0           | 0           | 0           | 0           | (0)         | (0)         | (0)         | 0           | 0           |
| Central                          | (1)         | (0)         | (0)         | (0)         | (1)         | (0)         | 0           | (0)         | (0)         | 0           |
| North                            | 0           | 0           | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         |
| Mohawk Valley                    | (0)         | (0)         | 0           | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                          | (1)         | (0)         | (1)         | (1)         | (1)         | (1)         | 0           | (0)         | (0)         | (1)         |
| Hudson Valley                    | (2)         | (2)         | (6)         | (7)         | 1           | (0)         | (0)         | 1           | (2)         | (2)         |
| Millwood                         | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                        | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                          | (16)        | (20)        | (24)        | (13)        | (17)        | (20)        | (19)        | (14)        | (17)        | (25)        |
| Long Island                      | 1           | (1)         | (2)         | (1)         | (3)         | 1           | 0           | (1)         | (1)         | 1           |
| <b>NYCA Total</b>                | <b>(20)</b> | <b>(25)</b> | <b>(32)</b> | <b>(24)</b> | <b>(17)</b> | <b>(20)</b> | <b>(20)</b> | <b>(26)</b> | <b>(20)</b> | <b>(19)</b> |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | 0          | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | 0          |
| Genesee                               | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          | 0          |
| Central                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | 0          |
| North                                 | (0)        | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley                         | (0)        | (0)        | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                           | 0          | (0)        | (0)        | (0)        | (0)        | 0          | 0          | (0)        | (0)        | 0          |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Demand Response Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019        | 2020        | 2021        | 2022        | 2023       | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|
| West                                  | 1           | (0)         | (0)         | (1)         | 18         | 1           | 0           | (18)        | (0)         | 5           |
| Genesee                               | (0)         | 0           | (0)         | (0)         | 0          | (0)         | (0)         | (0)         | 0           | 0           |
| Central                               | (6)         | 0           | (1)         | 0           | (3)        | (0)         | 2           | (1)         | (0)         | 0           |
| North                                 | (0)         | 0           | 0           | (0)         | (0)        | (1)         | (2)         | (1)         | (1)         | (0)         |
| Mohawk Valley                         | (0)         | (0)         | 0           | 0           | (0)        | 0           | (0)         | (0)         | (0)         | (0)         |
| Capital                               | 0           | (3)         | (3)         | (1)         | (6)        | (1)         | 3           | (0)         | (2)         | (4)         |
| Hudson Valley                         | (2)         | 2           | (3)         | (5)         | 3          | (0)         | (3)         | (0)         | (1)         | (4)         |
| Millwood                              | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                             | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| NY City                               | (19)        | (14)        | (13)        | (3)         | (14)       | (19)        | (10)        | (5)         | (7)         | (24)        |
| Long Island                           | (0)         | 1           | 1           | (0)         | (4)        | 1           | (1)         | (0)         | (1)         | 0           |
| <b>NYCA Total</b>                     | <b>(28)</b> | <b>(14)</b> | <b>(20)</b> | <b>(11)</b> | <b>(6)</b> | <b>(18)</b> | <b>(11)</b> | <b>(26)</b> | <b>(13)</b> | <b>(27)</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                                  | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.1          | 0.0          | 0.0          | (0.2)        | (0.0)        | 0.1          |
| Genesee                               | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          |
| Central                               | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        |
| North                                 | (0.0)        | 0.0          | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Mohawk Valley                         | (0.0)        | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Capital                               | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        |
| Hudson Valley                         | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Millwood                              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dunwoodie                             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| NY City                               | (0.1)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.0)        | (0.0)        | (0.2)        |
| Long Island                           | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| <b>NYCA Total</b>                     | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.2)</b> | <b>(0.1)</b> | <b>(0.2)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Demand Response Solution (Study 1: Central East)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West              | 0.0          | 0.0          | 0.0          | 0.0          | 0.1          | 0.0          | 0.1          | 0.1          | 0.0          | (0.0)        |
| Genesee           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)        | 0.0          | 0.0          | 0.0          | (0.0)        |
| Central           | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)        |
| North             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mohawk Valley     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| Capital           | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.0)        |
| Hudson Valley     | (0.0)        | (0.0)        | (0.1)        | (0.0)        | (0.0)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        |
| Millwood          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Dunwoodie         | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| NY City           | (0.2)        | (0.2)        | (0.5)        | (0.2)        | (0.2)        | (0.1)        | (0.3)        | (0.3)        | (0.2)        | (0.1)        |
| Long Island       | (0.1)        | (0.1)        | (0.2)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | 0.0          |
| <b>NYCA Total</b> | <b>(0.4)</b> | <b>(0.3)</b> | <b>(0.9)</b> | <b>(0.4)</b> | <b>(0.2)</b> | <b>(0.2)</b> | <b>(0.3)</b> | <b>(0.4)</b> | <b>(0.4)</b> | <b>(0.2)</b> |

**Generic Energy Efficiency Solution (Study 1: Central East)**
**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Demand Congestion (\$M) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025         | 2026          | 2027          | 2028          |
|-------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|
| West                    | 1.7           | 0.1           | 2.4           | 0.6           | (0.4)         | (0.9)         | (0.9)        | (0.7)         | (1.6)         | (0.6)         |
| Genesee                 | (0.1)         | (0.1)         | (0.0)         | 0.3           | (0.2)         | (0.3)         | (0.3)        | (0.3)         | (0.7)         | (0.2)         |
| Central                 | (0.1)         | (0.5)         | (0.2)         | (0.4)         | (0.2)         | (0.4)         | 0.0          | (0.7)         | (0.4)         | (0.2)         |
| North                   | 0.1           | 0.2           | 0.3           | (0.1)         | 0.1           | 0.1           | 0.2          | (0.0)         | (0.0)         | (0.0)         |
| Mohawk Valley           | (0.0)         | (0.2)         | (0.2)         | (0.2)         | (0.1)         | (0.3)         | (0.1)        | (0.4)         | (0.2)         | (0.1)         |
| Capital                 | (9.5)         | (7.9)         | (8.6)         | (6.9)         | (3.9)         | (3.6)         | (1.4)        | (3.1)         | (1.9)         | (2.5)         |
| Hudson Valley           | (7.1)         | (6.3)         | (7.2)         | (6.7)         | (4.1)         | (2.7)         | (1.6)        | (3.0)         | (1.9)         | (2.8)         |
| Millwood                | (0.4)         | (0.6)         | (0.6)         | (0.7)         | (0.6)         | (0.3)         | (0.2)        | (0.6)         | (0.2)         | (0.3)         |
| Dunwoodie               | (0.9)         | (1.2)         | (1.3)         | (1.6)         | (1.2)         | (0.6)         | (0.3)        | (1.2)         | (0.4)         | (0.6)         |
| NY City                 | (24.1)        | (24.5)        | (25.8)        | (24.8)        | (16.7)        | (13.0)        | (7.3)        | (17.1)        | (9.7)         | (11.2)        |
| Long Island             | 2.4           | 0.8           | 1.2           | 0.0           | 1.1           | 3.7           | 5.0          | 1.3           | 4.4           | 3.3           |
| <b>NYCA Total</b>       | <b>(38.0)</b> | <b>(40.3)</b> | <b>(40.1)</b> | <b>(40.5)</b> | <b>(26.3)</b> | <b>(18.4)</b> | <b>(6.9)</b> | <b>(25.9)</b> | <b>(12.6)</b> | <b>(15.3)</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Production Cost (\$M)           | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                            | (0)          | (1)          | (1)          | (1)          | (1)          | 0            | (2)          | (4)          | (4)          | (1)          |
| Genesee                         | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| Central                         | (5)          | (4)          | (5)          | (5)          | (6)          | (7)          | (11)         | (6)          | (8)          | (9)          |
| North                           | 0            | 0            | (0)          | (0)          | (0)          | 0            | (0)          | (0)          | (0)          | (0)          |
| Mohawk Valley                   | (0)          | (0)          | (0)          | 0            | (0)          | 0            | (0)          | (0)          | 0            | (0)          |
| Capital                         | (26)         | (26)         | (21)         | (23)         | (28)         | (30)         | (29)         | (33)         | (34)         | (37)         |
| Hudson Valley                   | (7)          | (16)         | (17)         | (22)         | (18)         | (21)         | (19)         | (18)         | (22)         | (22)         |
| Millwood                        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                       | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                         | (32)         | (36)         | (32)         | (35)         | (38)         | (35)         | (40)         | (43)         | (42)         | (40)         |
| Long Island                     | (2)          | (1)          | (3)          | (3)          | (3)          | (2)          | (3)          | (3)          | (2)          | (3)          |
| <b>NYCA Total</b>               | <b>(72)</b>  | <b>(84)</b>  | <b>(79)</b>  | <b>(88)</b>  | <b>(96)</b>  | <b>(96)</b>  | <b>(104)</b> | <b>(107)</b> | <b>(112)</b> | <b>(112)</b> |
| NYCA Imports                    | (12)         | (11)         | (17)         | (19)         | (21)         | (23)         | (29)         | (30)         | (28)         | (34)         |
| NYCA Exports                    | 21           | 18           | 25           | 20           | 20           | 25           | 24           | 27           | 30           | 30           |
| <b>NYCA + Imports - Exports</b> | <b>(104)</b> | <b>(113)</b> | <b>(121)</b> | <b>(127)</b> | <b>(137)</b> | <b>(144)</b> | <b>(157)</b> | <b>(165)</b> | <b>(169)</b> | <b>(175)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Generation (GWh)  | 2019           | 2020           | 2021           | 2022           | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| West              | 6              | (15)           | (4)            | (15)           | (13)           | 14             | (14)           | (61)           | (44)           | (16)           |
| Genesee           | (3)            | (3)            | (4)            | (4)            | (8)            | (5)            | (4)            | (6)            | (4)            | (4)            |
| Central           | (239)          | (171)          | (208)          | (183)          | (204)          | (219)          | (296)          | (157)          | (212)          | (221)          |
| North             | 2              | (1)            | (6)            | (3)            | (2)            | 0              | 0              | (4)            | (1)            | (2)            |
| Mohawk Valley     | (1)            | 0              | (2)            | (1)            | (1)            | 2              | (1)            | (3)            | 0              | (3)            |
| Capital           | (926)          | (826)          | (687)          | (658)          | (751)          | (754)          | (668)          | (709)          | (709)          | (733)          |
| Hudson Valley     | (253)          | (503)          | (519)          | (625)          | (463)          | (533)          | (421)          | (378)          | (479)          | (459)          |
| Millwood          | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| Dunwoodie         | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| NY City           | (1,020)        | (1,056)        | (918)          | (944)          | (940)          | (807)          | (830)          | (884)          | (806)          | (731)          |
| Long Island       | (47)           | (37)           | (66)           | (60)           | (65)           | (40)           | (52)           | (53)           | (45)           | (45)           |
| <b>NYCA Total</b> | <b>(2,481)</b> | <b>(2,613)</b> | <b>(2,413)</b> | <b>(2,493)</b> | <b>(2,447)</b> | <b>(2,341)</b> | <b>(2,286)</b> | <b>(2,255)</b> | <b>(2,299)</b> | <b>(2,214)</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Net Imports (GWh) | 2019           | 2020         | 2021           | 2022         | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|-------------------|----------------|--------------|----------------|--------------|----------------|----------------|----------------|----------------|----------------|----------------|
| PJM - NYISO       | (248)          | (295)        | (342)          | (408)        | (349)          | (347)          | (499)          | (434)          | (388)          | (534)          |
| LINDEN VFT        | (94)           | (84)         | (75)           | (64)         | (71)           | (57)           | (60)           | (72)           | (60)           | (63)           |
| NEPTUNE           | (32)           | (48)         | (80)           | (56)         | (107)          | (95)           | (82)           | (82)           | (90)           | (72)           |
| HTP               | (46)           | (23)         | (53)           | (30)         | (21)           | (33)           | (28)           | (40)           | (46)           | (42)           |
| ISONE - NYISO     | (553)          | (427)        | (537)          | (463)        | (427)          | (545)          | (404)          | (450)          | (478)          | (406)          |
| CROSS SOUND CABLE | 9              | 15           | 36             | 17           | 7              | 18             | 1              | 6              | (0)            | 10             |
| NORTHPORT NORWALK | 14             | 21           | 18             | 8            | 5              | 15             | 8              | 12             | 5              | (1)            |
| IESO - NYISO      | (61)           | (44)         | (49)           | (2)          | (80)           | (116)          | (139)          | (179)          | (140)          | (178)          |
| HQ - NYISO CHAT   | (0)            | (0)          | (0)            | (0)          | 0              | 0              | 0              | 0              | 0              | 0              |
| HQ - NYISO CEDARS | 1              | (0)          | (2)            | (0)          | 0              | (0)            | 0              | (0)            | (0)            | (0)            |
| <b>TOTAL</b>      | <b>(1,011)</b> | <b>(887)</b> | <b>(1,082)</b> | <b>(999)</b> | <b>(1,043)</b> | <b>(1,160)</b> | <b>(1,205)</b> | <b>(1,239)</b> | <b>(1,197)</b> | <b>(1,286)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Generator Payment (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                    | (3)          | (3)          | (4)          | (3)          | (3)          | (4)          | (7)          | (6)          | (8)          | (6)          |
| Genesee                 | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (2)          | (1)          | (2)          | (2)          |
| Central                 | (5)          | (1)          | (7)          | (8)          | (10)         | (14)         | (19)         | (10)         | (16)         | (15)         |
| North                   | (2)          | (2)          | (2)          | (2)          | (2)          | (3)          | (3)          | (3)          | (3)          | (3)          |
| Mohawk Valley           | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (1)          | (2)          | (2)          |
| Capital                 | (34)         | (33)         | (30)         | (30)         | (36)         | (38)         | (38)         | (41)         | (42)         | (43)         |
| Hudson Valley           | (8)          | (19)         | (20)         | (25)         | (21)         | (24)         | (23)         | (21)         | (26)         | (25)         |
| Millwood                | (7)          | (4)          | (2)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| Dunwoodie               | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| NY City                 | (41)         | (46)         | (46)         | (49)         | (49)         | (47)         | (52)         | (56)         | (55)         | (53)         |
| Long Island             | (3)          | (3)          | (5)          | (5)          | (4)          | (3)          | (4)          | (5)          | (5)          | (4)          |
| <b>NYCA Total</b>       | <b>(104)</b> | <b>(114)</b> | <b>(117)</b> | <b>(124)</b> | <b>(128)</b> | <b>(136)</b> | <b>(150)</b> | <b>(143)</b> | <b>(157)</b> | <b>(151)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Load Payment (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West               | (1)          | (2)          | (0)          | (2)          | (2)          | (3)          | (4)          | (2)          | (4)          | (3)          |
| Genesee            | (2)          | (2)          | (2)          | (2)          | (2)          | (3)          | (3)          | (2)          | (3)          | (3)          |
| Central            | (3)          | (3)          | (4)          | (3)          | (3)          | (5)          | (6)          | (5)          | (7)          | (5)          |
| North              | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (2)          | (1)          | (2)          | (2)          |
| Mohawk Valley      | (2)          | (1)          | (2)          | (2)          | (2)          | (3)          | (3)          | (2)          | (3)          | (2)          |
| Capital            | (32)         | (34)         | (37)         | (38)         | (39)         | (42)         | (45)         | (47)         | (48)         | (49)         |
| Hudson Valley      | (28)         | (30)         | (33)         | (35)         | (37)         | (38)         | (42)         | (43)         | (45)         | (46)         |
| Millwood           | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          |
| Dunwoodie          | (2)          | (2)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          |
| NY City            | (76)         | (82)         | (89)         | (93)         | (93)         | (101)        | (107)        | (114)        | (117)        | (117)        |
| Long Island        | (3)          | (4)          | (4)          | (5)          | (3)          | (3)          | (4)          | (5)          | (5)          | (4)          |
| <b>NYCA Total</b>  | <b>(152)</b> | <b>(164)</b> | <b>(176)</b> | <b>(185)</b> | <b>(186)</b> | <b>(204)</b> | <b>(220)</b> | <b>(226)</b> | <b>(238)</b> | <b>(236)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | (0.09)        | (0.14)        | (0.05)        | (0.12)        | (0.15)        | (0.23)        | (0.27)        | (0.18)        | (0.26)        | (0.23)        |
| Genesee               | (0.19)        | (0.14)        | (0.19)        | (0.14)        | (0.17)        | (0.27)        | (0.31)        | (0.22)        | (0.31)        | (0.27)        |
| Central               | (0.21)        | (0.19)        | (0.21)        | (0.20)        | (0.21)        | (0.33)        | (0.35)        | (0.31)        | (0.42)        | (0.31)        |
| North                 | (0.22)        | (0.19)        | (0.24)        | (0.16)        | (0.21)        | (0.32)        | (0.38)        | (0.25)        | (0.39)        | (0.29)        |
| Mohawk Valley         | (0.22)        | (0.20)        | (0.24)        | (0.23)        | (0.23)        | (0.36)        | (0.39)        | (0.34)        | (0.45)        | (0.34)        |
| Capital               | (0.40)        | (0.39)        | (0.46)        | (0.46)        | (0.43)        | (0.52)        | (0.50)        | (0.55)        | (0.57)        | (0.49)        |
| Hudson Valley         | (0.39)        | (0.37)        | (0.46)        | (0.49)        | (0.44)        | (0.50)        | (0.52)        | (0.55)        | (0.57)        | (0.53)        |
| Millwood              | (0.36)        | (0.36)        | (0.43)        | (0.45)        | (0.40)        | (0.47)        | (0.47)        | (0.50)        | (0.52)        | (0.47)        |
| Dunwoodie             | (0.37)        | (0.36)        | (0.44)        | (0.46)        | (0.41)        | (0.47)        | (0.47)        | (0.50)        | (0.52)        | (0.47)        |
| NY City               | (0.43)        | (0.43)        | (0.49)        | (0.50)        | (0.44)        | (0.54)        | (0.53)        | (0.58)        | (0.59)        | (0.52)        |
| Long Island           | (0.13)        | (0.14)        | (0.16)        | (0.22)        | (0.16)        | (0.20)        | (0.20)        | (0.26)        | (0.26)        | (0.23)        |
| <b>Average</b>        | <b>(0.27)</b> | <b>(0.26)</b> | <b>(0.31)</b> | <b>(0.31)</b> | <b>(0.30)</b> | <b>(0.38)</b> | <b>(0.40)</b> | <b>(0.38)</b> | <b>(0.44)</b> | <b>(0.38)</b> |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions (Tons) | 2019       | 2020       | 2021       | 2022       | 2023      | 2024      | 2025        | 2026         | 2027        | 2028      |
|----------------------------------|------------|------------|------------|------------|-----------|-----------|-------------|--------------|-------------|-----------|
| West                             | 0          | (0)        | (0)        | (0)        | 21        | 61        | (19)        | (121)        | (61)        | 25        |
| Genesee                          | (0)        | (0)        | (0)        | (0)        | (0)       | (0)       | (0)         | (0)          | (0)         | (0)       |
| Central                          | (0)        | (0)        | (0)        | (0)        | (0)       | (0)       | (1)         | (0)          | (0)         | (0)       |
| North                            | 0          | 0          | (0)        | (0)        | (0)       | 0         | 0           | (0)          | (0)         | (0)       |
| Mohawk Valley                    | (0)        | 0          | (0)        | 0          | (0)       | 0         | (0)         | (0)          | 0           | (0)       |
| Capital                          | (2)        | (2)        | (1)        | (1)        | (1)       | (2)       | (1)         | (1)          | (1)         | (2)       |
| Hudson Valley                    | (1)        | (1)        | (1)        | (2)        | (1)       | (1)       | (1)         | (1)          | (1)         | (1)       |
| Millwood                         | 0          | 0          | 0          | 0          | 0         | 0         | 0           | 0            | 0           | 0         |
| Dunwoodie                        | 0          | 0          | 0          | 0          | 0         | 0         | 0           | 0            | 0           | 0         |
| NY City                          | (3)        | (3)        | (3)        | (3)        | (3)       | (2)       | (2)         | (2)          | (2)         | (2)       |
| Long Island                      | (0)        | (0)        | (1)        | (0)        | (0)       | (0)       | (0)         | (0)          | (0)         | (0)       |
| <b>NYCA Total</b>                | <b>(6)</b> | <b>(7)</b> | <b>(7)</b> | <b>(6)</b> | <b>15</b> | <b>56</b> | <b>(24)</b> | <b>(126)</b> | <b>(66)</b> | <b>19</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023     | 2024     | 2025       | 2026       | 2027       | 2028     |
|---------------------------------------|------------|------------|------------|------------|----------|----------|------------|------------|------------|----------|
| West                                  | (0)        | (0)        | (0)        | (0)        | 0        | 0        | (0)        | (0)        | (0)        | 0        |
| Genesee                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Central                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| North                                 | 0          | 0          | (0)        | (0)        | (0)      | 0        | 0          | (0)        | (0)        | (0)      |
| Mohawk Valley                         | (0)        | 0          | (0)        | 0          | (0)      | 0        | (0)        | (0)        | 0          | (0)      |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Millwood                              | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Long Island                           | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions (Tons) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                             | 0            | (12)         | (4)          | (10)         | (10)         | 17           | (1)          | (36)         | (26)         | 0            |
| Genesee                          | (1)          | (1)          | (1)          | (0)          | (1)          | (0)          | (0)          | (1)          | (0)          | (1)          |
| Central                          | (13)         | (9)          | (11)         | (10)         | (12)         | (13)         | (18)         | (10)         | (13)         | (15)         |
| North                            | 4            | 3            | 2            | 1            | 0            | 4            | (3)          | 7            | 1            | 1            |
| Mohawk Valley                    | (0)          | (0)          | (0)          | 0            | (0)          | 0            | (0)          | (1)          | (0)          | (1)          |
| Capital                          | (41)         | (38)         | (36)         | (40)         | (49)         | (49)         | (37)         | (43)         | (37)         | (47)         |
| Hudson Valley                    | (109)        | (73)         | (120)        | (96)         | (96)         | (73)         | (77)         | (61)         | (69)         | (86)         |
| Millwood                         | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                          | (196)        | (254)        | (250)        | (270)        | (310)        | (210)        | (247)        | (240)        | (227)        | (205)        |
| Long Island                      | (15)         | (14)         | (25)         | (18)         | (24)         | (13)         | (13)         | (17)         | (13)         | (13)         |
| <b>NYCA Total</b>                | <b>(372)</b> | <b>(399)</b> | <b>(445)</b> | <b>(443)</b> | <b>(501)</b> | <b>(336)</b> | <b>(396)</b> | <b>(401)</b> | <b>(385)</b> | <b>(365)</b> |

**PROJECTED NO<sub>x</sub> EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Genesee                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| North                                 | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)        |
| Mohawk Valley                         | (0)        | 0          | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                           | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Energy Efficiency Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019           | 2020           | 2021           | 2022           | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|---------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| West                                  | (2)            | (15)           | (9)            | (14)           | (12)           | 13             | (18)           | (62)           | (45)           | (10)           |
| Genesee                               | (1)            | (1)            | (2)            | (2)            | (4)            | (2)            | (2)            | (3)            | (2)            | (2)            |
| Central                               | (98)           | (70)           | (85)           | (74)           | (85)           | (91)           | (123)          | (66)           | (89)           | (93)           |
| North                                 | 1              | 1              | (1)            | (1)            | (1)            | 0              | 0              | (2)            | (0)            | (1)            |
| Mohawk Valley                         | (1)            | 0              | (0)            | 0              | (0)            | 1              | (0)            | (1)            | 0              | (1)            |
| Capital                               | (364)          | (329)          | (269)          | (277)          | (297)          | (310)          | (267)          | (295)          | (291)          | (304)          |
| Hudson Valley                         | (145)          | (233)          | (260)          | (291)          | (224)          | (241)          | (200)          | (173)          | (219)          | (219)          |
| Millwood                              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| Dunwoodie                             | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| NY City                               | (505)          | (544)          | (477)          | (489)          | (500)          | (413)          | (436)          | (461)          | (420)          | (376)          |
| Long Island                           | (28)           | (18)           | (37)           | (33)           | (35)           | (22)           | (28)           | (29)           | (23)           | (23)           |
| <b>NYCA Total</b>                     | <b>(1,142)</b> | <b>(1,209)</b> | <b>(1,141)</b> | <b>(1,180)</b> | <b>(1,157)</b> | <b>(1,065)</b> | <b>(1,073)</b> | <b>(1,092)</b> | <b>(1,090)</b> | <b>(1,028)</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027          | 2028          |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|
| West                                  | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | 0.1          | (0.2)        | (0.6)        | (0.5)         | (0.1)         |
| Genesee                               | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)         | (0.0)         |
| Central                               | (0.5)        | (0.4)        | (0.5)        | (0.5)        | (0.6)        | (0.7)        | (1.0)        | (0.6)        | (0.8)         | (1.0)         |
| North                                 | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)         | (0.0)         |
| Mohawk Valley                         | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0           | (0.0)         |
| Capital                               | (1.8)        | (1.8)        | (1.6)        | (1.8)        | (2.1)        | (2.4)        | (2.2)        | (2.6)        | (2.7)         | (3.0)         |
| Hudson Valley                         | (0.7)        | (1.3)        | (1.7)        | (2.0)        | (1.7)        | (1.9)        | (1.7)        | (1.6)        | (2.1)         | (2.3)         |
| Millwood                              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0           | 0.0           |
| Dunwoodie                             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0           | 0.0           |
| NY City                               | (1.9)        | (2.9)        | (2.8)        | (3.1)        | (3.4)        | (3.0)        | (3.4)        | (3.8)        | (3.8)         | (3.6)         |
| Long Island                           | (0.1)        | (0.1)        | (0.2)        | (0.2)        | (0.2)        | (0.2)        | (0.2)        | (0.3)        | (0.2)         | (0.2)         |
| <b>NYCA Total</b>                     | <b>(5.0)</b> | <b>(6.6)</b> | <b>(7.0)</b> | <b>(7.8)</b> | <b>(8.2)</b> | <b>(8.1)</b> | <b>(8.7)</b> | <b>(9.5)</b> | <b>(10.2)</b> | <b>(10.3)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Energy Efficiency Solution (Study 1: Central East)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027          | 2028          |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|
| West              | 0.3          | 0.3          | 0.5          | 0.5          | 0.4          | 0.5          | 0.7          | 0.8          | 0.7           | 0.8           |
| Genesee           | 0.1          | 0.1          | 0.2          | 0.2          | 0.2          | 0.2          | 0.3          | 0.3          | 0.3           | 0.3           |
| Central           | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.2          | 0.2          | 0.2          | 0.2           | 0.3           |
| North             | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1           | 0.1           |
| Mohawk Valley     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.1)         | (0.1)         |
| Capital           | (1.5)        | (1.7)        | (1.8)        | (1.9)        | (2.0)        | (1.6)        | (1.9)        | (1.9)        | (2.0)         | (2.0)         |
| Hudson Valley     | (1.2)        | (1.3)        | (1.5)        | (1.5)        | (1.5)        | (1.8)        | (1.8)        | (1.9)        | (2.0)         | (2.1)         |
| Millwood          | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)         | (0.1)         |
| Dunwoodie         | (0.2)        | (0.1)        | (0.2)        | (0.2)        | (0.1)        | (0.2)        | (0.3)        | (0.2)        | (0.3)         | (0.3)         |
| NY City           | (3.8)        | (3.7)        | (4.4)        | (4.5)        | (4.3)        | (5.8)        | (6.0)        | (6.0)        | (6.5)         | (7.0)         |
| Long Island       | (0.5)        | (0.3)        | (0.4)        | (0.4)        | (0.3)        | (0.6)        | (0.7)        | (0.5)        | (0.7)         | (0.8)         |
| <b>NYCA Total</b> | <b>(6.7)</b> | <b>(6.6)</b> | <b>(7.5)</b> | <b>(7.6)</b> | <b>(7.5)</b> | <b>(9.2)</b> | <b>(9.5)</b> | <b>(9.2)</b> | <b>(10.1)</b> | <b>(10.7)</b> |



## Study 2: Central East – Knickerbocker – New Scotland

### Generic Transmission Solution (Study 2: Central East – Knickerbocker – New Scotland)

PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Transmission Solution (Study 2: Central East - Knickerbocker - New Scotland)

| Demand Congestion (\$M) | 2019    | 2020    | 2021    | 2022    | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-------------------------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|
| West                    | (8.9)   | (7.1)   | (6.9)   | (3.4)   | 1.0    | 3.4    | 2.0    | 2.5    | 2.3    | 2.4    |
| Genesee                 | 1.4     | 2.2     | 0.8     | (1.4)   | 0.5    | 1.7    | 1.1    | 1.3    | 1.2    | 1.2    |
| Central                 | (3.5)   | (3.4)   | (2.9)   | (1.7)   | (0.9)  | (1.2)  | (0.2)  | (0.1)  | (0.3)  | (0.7)  |
| North                   | (1.8)   | (2.4)   | (1.7)   | (1.3)   | (1.0)  | (0.7)  | (0.8)  | (0.8)  | (0.7)  | (0.7)  |
| Mohawk Valley           | (1.0)   | (1.1)   | (0.9)   | (0.5)   | (0.4)  | (0.5)  | (0.2)  | (0.1)  | (0.2)  | (0.4)  |
| Capital                 | (27.2)  | (27.4)  | (23.5)  | (17.2)  | (10.7) | (10.1) | (5.4)  | (4.9)  | (5.5)  | (7.6)  |
| Hudson Valley           | (14.0)  | (14.7)  | (13.0)  | (10.0)  | (6.6)  | (6.3)  | (3.7)  | (3.8)  | (3.8)  | (5.2)  |
| Millwood                | (4.1)   | (4.2)   | (3.8)   | (2.8)   | (1.8)  | (1.9)  | (1.1)  | (1.1)  | (1.1)  | (1.6)  |
| Dunwoodie               | (8.3)   | (8.5)   | (7.4)   | (5.7)   | (3.7)  | (3.7)  | (2.2)  | (2.3)  | (2.3)  | (3.1)  |
| NY City                 | (74.2)  | (75.1)  | (66.6)  | (50.7)  | (33.1) | (33.5) | (20.3) | (21.2) | (20.8) | (29.0) |
| Long Island             | (27.8)  | (28.5)  | (25.5)  | (19.6)  | (11.9) | (12.6) | (7.3)  | (7.9)  | (7.3)  | (11.1) |
| NYCA Total              | (169.4) | (170.1) | (151.4) | (114.3) | (68.5) | (65.3) | (38.2) | (38.5) | (38.6) | (55.8) |

PROJECTED PRODUCTION COST (\$M) | Generic Transmission Solution (Study 2: Central East - Knickerbocker - New Scotland)

| Production Cost (\$M)    | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|
| West                     | 2    | 1    | 1    | 2    | 6    | 10   | 7    | 8    | 11   | 13   |
| Genesee                  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Central                  | 14   | 13   | 10   | 10   | 11   | 12   | 8    | 10   | 8    | 8    |
| North                    | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| Mohawk Valley            | (0)  | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| Capital                  | (9)  | (10) | (10) | (11) | (8)  | (12) | (11) | (10) | (9)  | (13) |
| Hudson Valley            | 1    | (4)  | (2)  | (4)  | (4)  | (1)  | (2)  | (1)  | (3)  | (2)  |
| Millwood                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                  | (9)  | (10) | (5)  | (6)  | (6)  | (4)  | (4)  | (7)  | (6)  | (5)  |
| Long Island              | 0    | 0    | (1)  | (1)  | (2)  | (0)  | 0    | 0    | 0    | (0)  |
| NYCA Total               | (0)  | (9)  | (6)  | (9)  | (1)  | 6    | (0)  | 2    | 4    | 2    |
| NYCA Imports             | 3    | 9    | 10   | 12   | (1)  | (2)  | (5)  | (1)  | (3)  | (3)  |
| NYCA Exports             | 24   | 20   | 26   | 21   | 9    | 14   | 3    | 9    | 10   | 10   |
| NYCA + Imports - Exports | (22) | (21) | (22) | (18) | (11) | (10) | (9)  | (8)  | (10) | (11) |

PROJECTED NYCA GENERATION (GWh) | Generic Transmission Solution (Study 2: Central East - Knickerbocker - New Scotland)

| Generation (GWh) | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| West             | 54    | 24    | 38    | 48    | 161   | 212   | 184   | 155   | 249   | 249   |
| Genesee          | 12    | 6     | 6     | 4     | 2     | 1     | 0     | 1     | 6     | 1     |
| Central          | 571   | 504   | 382   | 341   | 327   | 312   | 194   | 241   | 156   | 171   |
| North            | 81    | 40    | 35    | 28    | 24    | 33    | 19    | 13    | 16    | 18    |
| Mohawk Valley    | 11    | 7     | 8     | 3     | 2     | 12    | 11    | 11    | 7     | 7     |
| Capital          | (237) | (259) | (246) | (246) | (167) | (227) | (175) | (171) | (137) | (181) |
| Hudson Valley    | 28    | (109) | (33)  | (78)  | (81)  | (26)  | (51)  | (9)   | (44)  | (28)  |
| Millwood         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Dunwoodie        | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| NY City          | (308) | (315) | (151) | (170) | (117) | (95)  | (62)  | (129) | (92)  | (77)  |
| Long Island      | (2)   | 6     | (33)  | (15)  | (39)  | (3)   | (2)   | 1     | 3     | (3)   |
| NYCA Total       | 209   | (96)  | 6     | (85)  | 113   | 218   | 119   | 112   | 163   | 158   |

**PROJECTED NET IMPORTS (GWh) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| Net Imports (GWh) | 2019         | 2020      | 2021        | 2022      | 2023         | 2024         | 2025         | 2026        | 2027         | 2028         |
|-------------------|--------------|-----------|-------------|-----------|--------------|--------------|--------------|-------------|--------------|--------------|
| PJM - NYISO       | 335          | 327       | 428         | 362       | 127          | 51           | (36)         | 57          | 35           | (49)         |
| LINDEN VFT        | (103)        | (115)     | (71)        | (68)      | (40)         | (28)         | (17)         | (31)        | (15)         | (16)         |
| NEPTUNE           | (47)         | (55)      | (29)        | (37)      | (19)         | 0            | 0            | 3           | 7            | (3)          |
| HTP               | (57)         | (36)      | (71)        | (54)      | (53)         | (38)         | (38)         | (44)        | (40)         | (36)         |
| ISONE - NYISO     | (818)        | (644)     | (730)       | (579)     | (334)        | (325)        | (147)        | (214)       | (218)        | (157)        |
| CROSS SOUND CABLE | 26           | 23        | 15          | 21        | (7)          | 3            | (10)         | (3)         | (8)          | 10           |
| NORTHPORT NORWALK | 7            | 2         | 1           | (7)       | (8)          | (12)         | (9)          | (10)        | (13)         | (7)          |
| IESO - NYISO      | 440          | 586       | 433         | 439       | 214          | 147          | 152          | 150         | 107          | 116          |
| HQ - NYISO CHAT   | (0)          | (1)       | 0           | (0)       | 0            | 0            | 0            | 0           | 0            | (0)          |
| HQ - NYISO CEDARS | 2            | 3         | 0           | (0)       | 0            | 0            | (0)          | (0)         | 0            | 0            |
| <b>TOTAL</b>      | <b>(215)</b> | <b>90</b> | <b>(24)</b> | <b>77</b> | <b>(121)</b> | <b>(201)</b> | <b>(105)</b> | <b>(92)</b> | <b>(144)</b> | <b>(143)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| Generator Payment (\$M) | 2019      | 2020      | 2021      | 2022      | 2023      | 2024      | 2025      | 2026      | 2027      | 2028      |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| West                    | 21        | 17        | 15        | 12        | 15        | 14        | 12        | 11        | 14        | 17        |
| Genesee                 | 5         | 6         | 5         | 3         | 2         | 2         | 1         | 1         | 1         | 1         |
| Central                 | 42        | 42        | 35        | 32        | 26        | 27        | 21        | 23        | 18        | 22        |
| North                   | 15        | 16        | 13        | 11        | 7         | 7         | 5         | 5         | 5         | 6         |
| Mohawk Valley           | 5         | 6         | 5         | 4         | 3         | 3         | 2         | 3         | 2         | 3         |
| Capital                 | (19)      | (19)      | (20)      | (18)      | (14)      | (15)      | (11)      | (9)       | (11)      | (14)      |
| Hudson Valley           | 1         | (5)       | (2)       | (5)       | (4)       | (1)       | (2)       | (2)       | (3)       | (2)       |
| Millwood                | (2)       | (2)       | (1)       | (0)       | (0)       | (0)       | (0)       | 0         | 0         | (0)       |
| Dunwoodie               | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       |
| NY City                 | (13)      | (13)      | (11)      | (11)      | (10)      | (6)       | (4)       | (7)       | (8)       | (8)       |
| Long Island             | (0)       | 0         | (3)       | (2)       | (3)       | (0)       | 0         | 0         | (0)       | (2)       |
| <b>NYCA Total</b>       | <b>54</b> | <b>48</b> | <b>36</b> | <b>27</b> | <b>21</b> | <b>30</b> | <b>24</b> | <b>25</b> | <b>17</b> | <b>23</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| Load Payment (\$M) | 2019      | 2020      | 2021      | 2022      | 2023     | 2024      | 2025      | 2026      | 2027     | 2028     |
|--------------------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|----------|----------|
| West               | 9         | 11        | 8         | 8         | 5        | 3         | 2         | 2         | 1        | 3        |
| Genesee            | 11        | 10        | 8         | 6         | 4        | 3         | 2         | 2         | 1        | 2        |
| Central            | 17        | 18        | 15        | 12        | 7        | 7         | 5         | 5         | 4        | 6        |
| North              | 8         | 10        | 8         | 6         | 4        | 4         | 3         | 3         | 2        | 3        |
| Mohawk Valley      | 11        | 11        | 10        | 8         | 7        | 5         | 4         | 5         | 4        | 5        |
| Capital            | (12)      | (12)      | (11)      | (8)       | (7)      | (3)       | (1)       | 0         | (2)      | (2)      |
| Hudson Valley      | (2)       | (2)       | (3)       | (2)       | (2)      | (2)       | (2)       | (2)       | (3)      | (3)      |
| Millwood           | (0)       | (0)       | (1)       | (0)       | (1)      | (0)       | (0)       | (0)       | (0)      | (0)      |
| Dunwoodie          | (1)       | (1)       | (1)       | (1)       | (1)      | (0)       | (0)       | (0)       | (1)      | (1)      |
| NY City            | (8)       | (6)       | (11)      | (8)       | (9)      | (3)       | (0)       | 0         | (4)      | (5)      |
| Long Island        | (1)       | (0)       | (3)       | (2)       | (2)      | (1)       | 0         | 0         | (1)      | (2)      |
| <b>NYCA Total</b>  | <b>32</b> | <b>38</b> | <b>19</b> | <b>19</b> | <b>5</b> | <b>13</b> | <b>14</b> | <b>15</b> | <b>3</b> | <b>7</b> |

**PROJECTED LBMP (\$/MWh) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| Average LBMP (\$/MWh) | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| West                  | 0.65   | 0.77   | 0.60   | 0.54   | 0.34   | 0.20   | 0.13   | 0.10   | 0.05   | 0.16   |
| Genesee               | 1.09   | 1.04   | 0.85   | 0.62   | 0.37   | 0.28   | 0.18   | 0.17   | 0.10   | 0.22   |
| Central               | 1.08   | 1.12   | 0.93   | 0.73   | 0.40   | 0.42   | 0.30   | 0.32   | 0.23   | 0.34   |
| North                 | 1.60   | 1.72   | 1.38   | 1.04   | 0.63   | 0.62   | 0.47   | 0.47   | 0.39   | 0.51   |
| Mohawk Valley         | 1.20   | 1.23   | 1.03   | 0.81   | 0.45   | 0.47   | 0.33   | 0.36   | 0.27   | 0.38   |
| Capital               | (0.82) | (0.81) | (0.76) | (0.55) | (0.39) | (0.27) | (0.09) | (0.06) | (0.19) | (0.22) |
| Hudson Valley         | (0.14) | (0.18) | (0.24) | (0.20) | (0.21) | (0.10) | (0.03) | (0.01) | (0.11) | (0.12) |
| Millwood              | (0.16) | (0.17) | (0.23) | (0.18) | (0.19) | (0.10) | (0.03) | (0.02) | (0.11) | (0.12) |
| Dunwoodie             | (0.15) | (0.16) | (0.22) | (0.17) | (0.19) | (0.10) | (0.03) | (0.02) | (0.11) | (0.11) |
| NY City               | (0.15) | (0.14) | (0.21) | (0.17) | (0.17) | (0.08) | (0.02) | (0.01) | (0.10) | (0.11) |
| Long Island           | (0.05) | (0.03) | (0.13) | (0.12) | (0.11) | (0.05) | 0.01   | 0.01   | (0.07) | (0.11) |
| Average               | 0.38   | 0.40   | 0.27   | 0.21   | 0.09   | 0.12   | 0.11   | 0.12   | 0.03   | 0.08   |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions (Tons) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                             | 14   | 1    | 1    | 44   | 239  | 416  | 311  | 227  | 500  | 438  |
| Genesee                          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Central                          | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 1    | 0    | 0    |
| North                            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mohawk Valley                    | (0)  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Capital                          | (1)  | (1)  | (1)  | (1)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                    | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Millwood                         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                          | (1)  | (1)  | (1)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island                      | (0)  | 0    | (1)  | 0    | (0)  | (0)  | (0)  | (0)  | 0    | 0    |
| NYCA Total                       | 14   | 0    | 0    | 44   | 239  | 416  | 311  | 227  | 500  | 438  |

**PROJECTED SO2 EMISSION COSTS (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                                  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Genesee                               | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Central                               | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| North                                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mohawk Valley                         | (0)  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Capital                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                         | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Millwood                              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island                           | (0)  | 0    | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | 0    | 0    |
| NYCA Total                            | 0    | (0)  | (0)  | 0    | 0    | 0    | 0    | 0    | 0    | 0    |

**PROJECTED NOX EMISSIONS (Tons) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| NO <sub>x</sub> Emissions (Tons) | 2019      | 2020        | 2021        | 2022     | 2023      | 2024       | 2025      | 2026      | 2027       | 2028       |
|----------------------------------|-----------|-------------|-------------|----------|-----------|------------|-----------|-----------|------------|------------|
| West                             | 23        | 13          | 18          | 31       | 53        | 116        | 60        | 64        | 114        | 104        |
| Genesee                          | 10        | 5           | 6           | 3        | 0         | 0          | 0         | 0         | 1          | 0          |
| Central                          | 38        | 31          | 27          | 23       | 22        | 24         | 16        | 20        | 16         | 14         |
| North                            | 11        | 8           | 8           | 5        | 7         | 5          | 6         | 4         | 5          | 2          |
| Mohawk Valley                    | 1         | 1           | 2           | 1        | 0         | 3          | 2         | 3         | 1          | 1          |
| Capital                          | (17)      | (13)        | (12)        | (11)     | (8)       | (8)        | (5)       | (5)       | (5)        | (6)        |
| Hudson Valley                    | (10)      | (9)         | (10)        | (2)      | (4)       | (1)        | (10)      | 3         | 5          | (0)        |
| Millwood                         | 0         | 0           | 0           | 0        | 0         | 0          | 0         | 0         | 0          | 0          |
| Dunwoodie                        | 0         | 0           | 0           | 0        | 0         | 0          | 0         | 0         | 0          | 0          |
| NY City                          | (43)      | (67)        | (55)        | (41)     | (17)      | (10)       | (15)      | (29)      | (13)       | (9)        |
| Long Island                      | (1)       | (2)         | (13)        | (7)      | (13)      | (1)        | (0)       | (1)       | 0          | (2)        |
| <b>NYCA Total</b>                | <b>12</b> | <b>(31)</b> | <b>(28)</b> | <b>2</b> | <b>41</b> | <b>129</b> | <b>53</b> | <b>59</b> | <b>124</b> | <b>104</b> |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025     | 2026       | 2027     | 2028     |
|---------------------------------------|------------|------------|------------|------------|------------|------------|----------|------------|----------|----------|
| West                                  | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0        |
| Genesee                               | 0          | 0          | 0          | 0          | 0          | 0          | (0)      | 0          | 0        | 0        |
| Central                               | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0        |
| North                                 | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0        |
| Mohawk Valley                         | (0)        | 0          | 0          | 0          | 0          | 0          | 0        | 0          | (0)      | 0        |
| Capital                               | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)      | (0)        | (0)      | (0)      |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0        | 0          | (0)      | (0)      |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0        |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0        | 0          | 0        | 0        |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)      | (0)        | (0)      | (0)      |
| Long Island                           | 0          | 0          | (0)        | 0          | (0)        | (0)        | 0        | (0)        | 0        | (0)      |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>(0)</b> | <b>0</b> | <b>0</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019       | 2020         | 2021        | 2022        | 2023      | 2024       | 2025       | 2026      | 2027       | 2028       |
|---------------------------------------|------------|--------------|-------------|-------------|-----------|------------|------------|-----------|------------|------------|
| West                                  | 24         | 11           | 14          | 33          | 126       | 189        | 149        | 124       | 225        | 210        |
| Genesee                               | 1          | 1            | 0           | 1           | 1         | 0          | 0          | 1         | 3          | 1          |
| Central                               | 214        | 194          | 146         | 136         | 135       | 129        | 82         | 101       | 67         | 72         |
| North                                 | 8          | 5            | 6           | 8           | 11        | 15         | 9          | 6         | 8          | 9          |
| Mohawk Valley                         | (1)        | 0            | 2           | 1           | 1         | 6          | 5          | 5         | 4          | 4          |
| Capital                               | (105)      | (113)        | (105)       | (107)       | (68)      | (91)       | (73)       | (72)      | (53)       | (75)       |
| Hudson Valley                         | 5          | (47)         | (18)        | (33)        | (34)      | (12)       | (25)       | (3)       | (17)       | (11)       |
| Millwood                              | 0          | 0            | 0           | 0           | 0         | 0          | 0          | 0         | 0          | 0          |
| Dunwoodie                             | 0          | 0            | 0           | 0           | 0         | 0          | 0          | 0         | 0          | 0          |
| NY City                               | (149)      | (159)        | (84)        | (85)        | (59)      | (41)       | (30)       | (67)      | (45)       | (35)       |
| Long Island                           | (1)        | 5            | (18)        | (7)         | (21)      | (2)        | (1)        | (0)       | 3          | 0          |
| <b>NYCA Total</b>                     | <b>(4)</b> | <b>(102)</b> | <b>(57)</b> | <b>(51)</b> | <b>92</b> | <b>194</b> | <b>117</b> | <b>94</b> | <b>194</b> | <b>173</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020         | 2021         | 2022         | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|--------------|--------------|--------------|------------|------------|------------|------------|------------|------------|
| West                                  | 0.1        | 0.1          | 0.1          | 0.2          | 0.9        | 1.5        | 1.2        | 1.1        | 2.1        | 2.2        |
| Genesee                               | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Central                               | 1.0        | 1.1          | 0.9          | 0.9          | 1.0        | 1.0        | 0.7        | 0.9        | 0.6        | 0.7        |
| North                                 | 0.0        | 0.0          | 0.0          | 0.1          | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        |
| Mohawk Valley                         | (0.0)      | 0.0          | 0.0          | 0.0          | 0.0        | 0.1        | 0.1        | 0.1        | 0.0        | 0.0        |
| Capital                               | (0.5)      | (0.6)        | (0.6)        | (0.7)        | (0.5)      | (0.7)      | (0.6)      | (0.7)      | (0.5)      | (0.8)      |
| Hudson Valley                         | 0.0        | (0.3)        | (0.1)        | (0.2)        | (0.3)      | (0.1)      | (0.2)      | (0.0)      | (0.2)      | (0.1)      |
| Millwood                              | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0        | 0.0          | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | (0.5)      | (0.9)        | (0.5)        | (0.6)        | (0.4)      | (0.3)      | (0.2)      | (0.6)      | (0.4)      | (0.3)      |
| Long Island                           | (0.0)      | 0.0          | (0.1)        | (0.0)        | (0.2)      | (0.0)      | (0.0)      | (0.0)      | 0.0        | 0.0        |
| <b>NYCA Total</b>                     | <b>0.2</b> | <b>(0.6)</b> | <b>(0.3)</b> | <b>(0.3)</b> | <b>0.7</b> | <b>1.5</b> | <b>0.9</b> | <b>0.9</b> | <b>1.8</b> | <b>1.8</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Transmission Solutino (Study 2: Central East - Knickerbocker - New Scotland)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West              | (2.0)        | (2.2)        | (1.7)        | (1.5)        | (1.1)        | (1.7)        | (1.3)        | (1.6)        | (1.4)        | (1.7)        |
| Genesee           | (0.8)        | (1.0)        | (0.8)        | (0.6)        | (0.5)        | (0.8)        | (0.6)        | (0.7)        | (0.7)        | (0.8)        |
| Central           | (0.3)        | (0.5)        | (0.4)        | (0.4)        | (0.5)        | (0.5)        | (0.5)        | (0.5)        | (0.5)        | (0.5)        |
| North             | (0.4)        | (0.5)        | (0.4)        | (0.3)        | (0.1)        | (0.2)        | (0.1)        | (0.2)        | (0.1)        | (0.2)        |
| Mohawk Valley     | 0.3          | 0.3          | 0.2          | 0.2          | 0.2          | 0.1          | 0.1          | 0.1          | 0.1          | 0.2          |
| Capital           | 0.0          | (0.0)        | (0.2)        | (0.4)        | (0.5)        | (0.2)        | (0.3)        | (0.4)        | (0.5)        | (0.4)        |
| Hudson Valley     | 0.1          | 0.1          | (0.1)        | (0.2)        | (0.3)        | 0.1          | (0.0)        | 0.0          | (0.1)        | (0.0)        |
| Millwood          | 0.1          | 0.0          | (0.0)        | (0.0)        | (0.1)        | 0.1          | 0.0          | 0.1          | 0.0          | 0.0          |
| Dunwoodie         | 0.1          | 0.1          | (0.0)        | (0.1)        | (0.1)        | 0.2          | 0.1          | 0.1          | 0.1          | 0.1          |
| NY City           | 1.5          | 1.2          | 0.1          | (0.5)        | (1.0)        | 1.7          | 1.0          | 1.5          | 0.7          | 1.1          |
| Long Island       | 0.8          | 0.6          | 0.3          | (0.0)        | (0.2)        | 0.9          | 0.5          | 0.6          | 0.4          | 0.5          |
| <b>NYCA Total</b> | <b>(0.7)</b> | <b>(1.9)</b> | <b>(3.0)</b> | <b>(3.8)</b> | <b>(4.2)</b> | <b>(0.5)</b> | <b>(1.0)</b> | <b>(0.9)</b> | <b>(1.9)</b> | <b>(1.7)</b> |

**Generic Generation Solution (Study 2: Central East – Knickerbocker – New Scotland)**
**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Demand Congestion (\$M) | 2019          | 2020        | 2021       | 2022         | 2023          | 2024        | 2025       | 2026         | 2027       | 2028        |
|-------------------------|---------------|-------------|------------|--------------|---------------|-------------|------------|--------------|------------|-------------|
| West                    | (0.3)         | 0.4         | (0.2)      | (0.1)        | 0.1           | (0.3)       | (0.2)      | 0.0          | (0.5)      | (0.2)       |
| Genesee                 | 0.2           | (0.2)       | 0.3        | (0.0)        | 0.1           | (0.1)       | (0.1)      | 0.0          | (0.2)      | (0.0)       |
| Central                 | (0.6)         | 0.2         | 0.2        | (0.7)        | (0.5)         | 0.2         | 0.2        | (0.4)        | 0.7        | 0.1         |
| North                   | 0.1           | (0.2)       | (0.2)      | 0.0          | 0.2           | 0.1         | (0.0)      | (0.0)        | (0.2)      | 0.0         |
| Mohawk Valley           | (0.1)         | 0.0         | 0.0        | (0.2)        | (0.3)         | 0.0         | 0.1        | (0.1)        | 0.1        | 0.0         |
| Capital                 | (2.1)         | 1.2         | 0.1        | (1.1)        | (3.3)         | 1.0         | 1.0        | (0.6)        | 0.2        | 1.0         |
| Hudson Valley           | (1.5)         | 0.4         | (0.2)      | (1.1)        | (2.4)         | 0.5         | 0.1        | (1.0)        | (0.0)      | (0.2)       |
| Millwood                | (0.4)         | 0.2         | (0.1)      | (0.3)        | (0.7)         | 0.2         | 0.1        | (0.2)        | (0.0)      | (0.0)       |
| Dunwoodie               | (0.8)         | 0.6         | (0.3)      | (0.6)        | (1.4)         | 0.3         | 0.1        | (0.4)        | (0.0)      | (0.0)       |
| NY City                 | (8.0)         | 6.4         | 3.7        | (3.0)        | (9.4)         | 6.7         | 2.6        | 0.5          | 3.8        | 5.8         |
| Long Island             | (1.4)         | 3.4         | 0.1        | 0.7          | (8.8)         | 5.4         | 2.6        | 0.6          | 2.1        | 3.9         |
| <b>NYCA Total</b>       | <b>(14.9)</b> | <b>12.5</b> | <b>3.5</b> | <b>(6.5)</b> | <b>(26.3)</b> | <b>14.0</b> | <b>6.5</b> | <b>(1.6)</b> | <b>5.9</b> | <b>10.3</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Production Cost (\$M)           | 2019       | 2020       | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                            | 0          | (1)        | (1)         | (1)         | (3)         | 1           | (2)         | (2)         | (2)         | (0)         |
| Genesee                         | (0)        | (0)        | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (1)         |
| Central                         | (2)        | (0)        | (4)         | 2           | (5)         | (3)         | (12)        | (5)         | (4)         | (7)         |
| North                           | (0)        | (0)        | (0)         | (0)         | 1           | 0           | (0)         | 0           | (0)         | (0)         |
| Mohawk Valley                   | (0)        | 0          | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | 0           | (0)         |
| Capital                         | (2)        | (4)        | 1           | (2)         | (6)         | (9)         | (8)         | (7)         | (8)         | (12)        |
| Hudson Valley                   | 9          | 12         | 16          | 17          | 25          | 29          | 27          | 47          | 41          | 36          |
| Millwood                        | 0          | (0)        | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           |
| Dunwoodie                       | 0          | 0          | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                         | (2)        | (13)       | (18)        | (20)        | (8)         | (5)         | 7           | (17)        | (21)        | (11)        |
| Long Island                     | (0)        | 3          | 1           | (0)         | (2)         | (2)         | (0)         | (1)         | (5)         | (5)         |
| <b>NYCA Total</b>               | <b>3</b>   | <b>(2)</b> | <b>(5)</b>  | <b>(5)</b>  | <b>2</b>    | <b>11</b>   | <b>12</b>   | <b>14</b>   | <b>1</b>    | <b>(0)</b>  |
| NYCA Imports                    | (2)        | (3)        | (7)         | (7)         | (7)         | (13)        | (19)        | (18)        | (13)        | (20)        |
| NYCA Exports                    | 3          | 3          | 3           | 6           | 10          | 10          | 5           | 12          | 12          | 12          |
| <b>NYCA + Imports - Exports</b> | <b>(2)</b> | <b>(8)</b> | <b>(15)</b> | <b>(19)</b> | <b>(15)</b> | <b>(12)</b> | <b>(11)</b> | <b>(16)</b> | <b>(24)</b> | <b>(32)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generation (GWh)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West              | 11         | (3)        | 0          | (30)       | (30)       | 45         | (3)        | (22)       | (21)       | 27         |
| Genesee           | (3)        | (5)        | (3)        | (1)        | (3)        | (8)        | (1)        | (8)        | (3)        | (13)       |
| Central           | (83)       | (38)       | (169)      | 62         | (171)      | (69)       | (320)      | (134)      | (114)      | (145)      |
| North             | (2)        | 2          | (7)        | (2)        | 13         | 4          | (1)        | 4          | (9)        | (1)        |
| Mohawk Valley     | (1)        | 1          | (0)        | (1)        | 1          | (5)        | (1)        | (3)        | 1          | (3)        |
| Capital           | (67)       | (196)      | (96)       | (199)      | (186)      | (270)      | (152)      | (224)      | (260)      | (275)      |
| Hudson Valley     | 447        | 639        | 779        | 868        | 1,099      | 1,118      | 1,149      | 1,429      | 1,389      | 1,212      |
| Millwood          | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | (0)        | 0          |
| Dunwoodie         | 0          | 0          | (0)        | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City           | (124)      | (237)      | (311)      | (314)      | (249)      | (227)      | (43)       | (371)      | (340)      | 28         |
| Long Island       | (12)       | 33         | 32         | (17)       | (43)       | (24)       | (6)        | (13)       | (66)       | (76)       |
| <b>NYCA Total</b> | <b>166</b> | <b>195</b> | <b>224</b> | <b>366</b> | <b>430</b> | <b>563</b> | <b>622</b> | <b>659</b> | <b>577</b> | <b>755</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Net Imports (GWh) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| PJM - NYISO       | (48)         | (83)         | (103)        | (127)        | (90)         | (220)        | (326)        | (270)        | (201)        | (421)        |
| LINDEN VFT        | (31)         | 13           | 0            | (12)         | (19)         | (2)          | (13)         | 0            | (21)         | (11)         |
| NEPTUNE           | (14)         | (5)          | (43)         | (10)         | (21)         | (50)         | (75)         | (47)         | (49)         | (41)         |
| HTP               | (2)          | (0)          | 27           | (6)          | (5)          | 10           | (2)          | (10)         | (4)          | 0            |
| ISONE - NYISO     | (90)         | (69)         | (57)         | (144)        | (256)        | (258)        | (85)         | (220)        | (202)        | (149)        |
| CROSS SOUND CABLE | 12           | 2            | (26)         | 0            | (37)         | 16           | (2)          | (24)         | 3            | 20           |
| NORTHPORT NORWALK | 11           | 6            | (8)          | (8)          | (3)          | 4            | (8)          | 1            | 11           | 5            |
| IESO - NYISO      | (4)          | (60)         | (22)         | (59)         | (0)          | (65)         | (116)        | (95)         | (116)        | (165)        |
| HQ - NYISO CHAT   | (0)          | (0)          | (0)          | (0)          | 0            | (0)          | 0            | 0            | 0            | 0            |
| HQ - NYISO CEDARS | (1)          | 1            | (0)          | (0)          | 0            | (0)          | (0)          | 0            | 0            | 0            |
| <b>TOTAL</b>      | <b>(167)</b> | <b>(194)</b> | <b>(231)</b> | <b>(365)</b> | <b>(433)</b> | <b>(566)</b> | <b>(628)</b> | <b>(665)</b> | <b>(580)</b> | <b>(762)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generator Payment (\$M) | 2019     | 2020       | 2021        | 2022     | 2023     | 2024       | 2025      | 2026      | 2027        | 2028      |
|-------------------------|----------|------------|-------------|----------|----------|------------|-----------|-----------|-------------|-----------|
| West                    | 1        | (1)        | (3)         | (2)      | (1)      | (2)        | (2)       | (2)       | (5)         | (2)       |
| Genesee                 | (0)      | (1)        | (1)         | (0)      | 0        | (2)        | (1)       | (1)       | (1)         | (2)       |
| Central                 | 5        | (0)        | (14)        | 6        | (5)      | (10)       | (16)      | (4)       | (24)        | (10)      |
| North                   | 0        | (1)        | (1)         | (1)      | 1        | (2)        | (1)       | (1)       | (2)         | (2)       |
| Mohawk Valley           | 0        | (0)        | (1)         | (0)      | 0        | (1)        | (0)       | (0)       | (0)         | (1)       |
| Capital                 | (4)      | (5)        | (4)         | (5)      | (11)     | (12)       | (9)       | (10)      | (13)        | (15)      |
| Hudson Valley           | 12       | 17         | 23          | 26       | 36       | 40         | 41        | 60        | 56          | 51        |
| Millwood                | (1)      | (0)        | (0)         | 0        | (1)      | (0)        | 0         | 0         | 1           | (0)       |
| Dunwoodie               | (0)      | (0)        | (0)         | (0)      | (0)      | (0)        | (0)       | (0)       | (0)         | (0)       |
| NY City                 | (7)      | (12)       | (19)        | (19)     | (12)     | (11)       | (1)       | (20)      | (21)        | 5         |
| Long Island             | (2)      | 2          | (2)         | (1)      | (3)      | (1)        | (1)       | 0         | (6)         | (5)       |
| <b>NYCA Total</b>       | <b>4</b> | <b>(1)</b> | <b>(22)</b> | <b>3</b> | <b>5</b> | <b>(1)</b> | <b>12</b> | <b>23</b> | <b>(14)</b> | <b>19</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Load Payment (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West               | 0           | (1)         | (3)         | (1)         | 0           | (3)         | (1)         | (1)         | (2)         | (2)         |
| Genesee            | 0           | (1)         | (2)         | (1)         | 0           | (2)         | (1)         | (1)         | (2)         | (2)         |
| Central            | 0           | (2)         | (3)         | (2)         | 0           | (4)         | (1)         | (2)         | (3)         | (3)         |
| North              | 0           | (0)         | (1)         | (0)         | 0           | (1)         | (0)         | (0)         | (1)         | (1)         |
| Mohawk Valley      | 0           | (1)         | (1)         | (1)         | (0)         | (2)         | (1)         | (1)         | (1)         | (1)         |
| Capital            | (2)         | (0)         | (3)         | (2)         | (3)         | (2)         | (1)         | (1)         | (3)         | (2)         |
| Hudson Valley      | (1)         | (1)         | (3)         | (2)         | (3)         | (2)         | (1)         | (2)         | (3)         | (3)         |
| Millwood           | (0)         | (0)         | (1)         | (1)         | (1)         | (1)         | (0)         | (1)         | (1)         | (1)         |
| Dunwoodie          | (1)         | (0)         | (2)         | (1)         | (2)         | (1)         | (1)         | (1)         | (2)         | (2)         |
| NY City            | (6)         | (2)         | (10)        | (9)         | (11)        | (8)         | (7)         | (6)         | (10)        | (10)        |
| Long Island        | (1)         | (0)         | (6)         | (2)         | (9)         | (0)         | (1)         | (2)         | (3)         | (2)         |
| <b>NYCA Total</b>  | <b>(10)</b> | <b>(10)</b> | <b>(33)</b> | <b>(21)</b> | <b>(26)</b> | <b>(27)</b> | <b>(16)</b> | <b>(17)</b> | <b>(29)</b> | <b>(29)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | 0.01          | (0.08)        | (0.15)        | (0.05)        | 0.03          | (0.21)        | (0.07)        | (0.07)        | (0.15)        | (0.15)        |
| Genesee               | 0.01          | (0.10)        | (0.13)        | (0.06)        | 0.04          | (0.23)        | (0.08)        | (0.07)        | (0.17)        | (0.17)        |
| Central               | 0.00          | (0.11)        | (0.14)        | (0.09)        | 0.01          | (0.24)        | (0.08)        | (0.10)        | (0.16)        | (0.18)        |
| North                 | 0.02          | (0.07)        | (0.11)        | (0.05)        | 0.01          | (0.27)        | (0.09)        | (0.08)        | (0.17)        | (0.18)        |
| Mohawk Valley         | 0.02          | (0.11)        | (0.16)        | (0.08)        | 0.00          | (0.25)        | (0.10)        | (0.11)        | (0.20)        | (0.19)        |
| Capital               | (0.11)        | (0.02)        | (0.16)        | (0.14)        | (0.21)        | (0.16)        | (0.05)        | (0.12)        | (0.20)        | (0.12)        |
| Hudson Valley         | (0.08)        | (0.08)        | (0.20)        | (0.17)        | (0.21)        | (0.23)        | (0.13)        | (0.20)        | (0.24)        | (0.25)        |
| Millwood              | (0.08)        | (0.05)        | (0.21)        | (0.17)        | (0.22)        | (0.24)        | (0.13)        | (0.19)        | (0.26)        | (0.25)        |
| Dunwoodie             | (0.08)        | (0.05)        | (0.21)        | (0.17)        | (0.22)        | (0.23)        | (0.13)        | (0.19)        | (0.25)        | (0.25)        |
| NY City               | (0.09)        | (0.02)        | (0.12)        | (0.12)        | (0.16)        | (0.18)        | (0.11)        | (0.11)        | (0.18)        | (0.16)        |
| Long Island           | (0.02)        | 0.00          | (0.20)        | (0.05)        | (0.41)        | (0.03)        | (0.06)        | (0.11)        | (0.16)        | (0.08)        |
| <b>Average</b>        | <b>(0.04)</b> | <b>(0.06)</b> | <b>(0.16)</b> | <b>(0.10)</b> | <b>(0.12)</b> | <b>(0.21)</b> | <b>(0.09)</b> | <b>(0.12)</b> | <b>(0.20)</b> | <b>(0.18)</b> |

**PROJECTED SO<sub>2</sub> EMISSIONS (Tons) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions (Tons) | 2019      | 2020      | 2021      | 2022      | 2023       | 2024       | 2025      | 2026        | 2027      | 2028       |
|----------------------------------|-----------|-----------|-----------|-----------|------------|------------|-----------|-------------|-----------|------------|
| West                             | 0         | (0)       | 1         | (0)       | (66)       | 104        | (4)       | (81)        | (62)      | 77         |
| Genesee                          | (0)       | (0)       | (0)       | (0)       | (0)        | (0)        | (0)       | (0)         | (0)       | (0)        |
| Central                          | (0)       | (0)       | (0)       | 0         | (0)        | (0)        | (1)       | (0)         | (0)       | (0)        |
| North                            | (0)       | (0)       | (0)       | (0)       | 0          | 0          | (0)       | 0           | (0)       | (0)        |
| Mohawk Valley                    | (0)       | 0         | (0)       | (0)       | 0          | (0)        | (0)       | (0)         | 0         | (0)        |
| Capital                          | (0)       | (0)       | (0)       | (0)       | (0)        | (1)        | (0)       | (0)         | (1)       | (1)        |
| Hudson Valley                    | 24        | 40        | 49        | 57        | 67         | 68         | 77        | 70          | 79        | 79         |
| Millwood                         | 0         | (0)       | (0)       | (0)       | 0          | (0)        | (0)       | (0)         | (0)       | 0          |
| Dunwoodie                        | 0         | 0         | 0         | 0         | 0          | 0          | 0         | 0           | 0         | 0          |
| NY City                          | (0)       | (1)       | (1)       | (1)       | (1)        | (1)        | 0         | (1)         | (1)       | 0          |
| Long Island                      | (0)       | 0         | (1)       | 0         | (0)        | (0)        | (0)       | (0)         | (0)       | (0)        |
| <b>NYCA Total</b>                | <b>23</b> | <b>38</b> | <b>47</b> | <b>56</b> | <b>(1)</b> | <b>170</b> | <b>72</b> | <b>(12)</b> | <b>14</b> | <b>156</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019     | 2020     | 2021     | 2022     | 2023       | 2024     | 2025     | 2026       | 2027     | 2028     |
|---------------------------------------|----------|----------|----------|----------|------------|----------|----------|------------|----------|----------|
| West                                  | 0        | (0)      | (0)      | (0)      | (0)        | 0        | (0)      | (0)        | (0)      | 0        |
| Genesee                               | (0)      | (0)      | (0)      | (0)      | (0)        | (0)      | (0)      | (0)        | (0)      | (0)      |
| Central                               | (0)      | (0)      | (0)      | 0        | (0)        | (0)      | (0)      | (0)        | (0)      | (0)      |
| North                                 | (0)      | (0)      | (0)      | (0)      | 0          | 0        | (0)      | 0          | (0)      | (0)      |
| Mohawk Valley                         | (0)      | 0        | (0)      | (0)      | 0          | (0)      | (0)      | (0)        | 0        | (0)      |
| Capital                               | (0)      | (0)      | (0)      | (0)      | (0)        | (0)      | (0)      | (0)        | (0)      | (0)      |
| Hudson Valley                         | 0        | 0        | 0        | 0        | 0          | 0        | 0        | 0          | 0        | 0        |
| Millwood                              | 0        | 0        | 0        | 0        | 0          | 0        | 0        | 0          | 0        | 0        |
| Dunwoodie                             | 0        | 0        | 0        | 0        | 0          | 0        | 0        | 0          | 0        | 0        |
| NY City                               | (0)      | (0)      | (0)      | (0)      | (0)        | (0)      | 0        | (0)        | (0)      | 0        |
| Long Island                           | (0)      | 0        | (0)      | 0        | (0)        | (0)      | (0)      | (0)        | (0)      | (0)      |
| <b>NYCA Total</b>                     | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>0</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| NO <sub>x</sub> Emissions (Tons) | 2019      | 2020     | 2021        | 2022     | 2023        | 2024      | 2025       | 2026      | 2027      | 2028      |
|----------------------------------|-----------|----------|-------------|----------|-------------|-----------|------------|-----------|-----------|-----------|
| West                             | 1         | (7)      | (4)         | (18)     | (27)        | 23        | (15)       | (7)       | (15)      | (11)      |
| Genesee                          | 0         | (1)      | 0           | 0        | (0)         | (1)       | (0)        | (1)       | (0)       | (1)       |
| Central                          | (4)       | (5)      | (10)        | (0)      | (10)        | (11)      | (17)       | (10)      | (8)       | (14)      |
| North                            | 4         | (2)      | (2)         | 1        | 5           | 0         | (2)        | 1         | (0)       | (1)       |
| Mohawk Valley                    | 1         | 0        | 0           | (1)      | 0           | (1)       | 0          | (1)       | (0)       | (1)       |
| Capital                          | 15        | (18)     | (15)        | (20)     | 15          | (28)      | (24)       | (37)      | (29)      | (35)      |
| Hudson Valley                    | 80        | 86       | 80          | 106      | 142         | 160       | 180        | 225       | 197       | 191       |
| Millwood                         | 0         | (0)      | (1)         | (1)      | 0           | (2)       | (1)        | 0         | (2)       | 1         |
| Dunwoodie                        | 0         | 0        | 0           | 0        | 0           | 0         | 0          | 0         | 0         | 0         |
| NY City                          | (20)      | (82)     | (91)        | (64)     | (134)       | (53)      | 42         | (92)      | (68)      | (18)      |
| Long Island                      | (2)       | 29       | 4           | (4)      | (27)        | (13)      | 4          | (10)      | (22)      | (15)      |
| <b>NYCA Total</b>                | <b>75</b> | <b>0</b> | <b>(38)</b> | <b>0</b> | <b>(37)</b> | <b>74</b> | <b>168</b> | <b>69</b> | <b>54</b> | <b>96</b> |



**PROJECTED NOX EMISSION COSTS (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>NO<sub>x</sub> Emissions Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Genesee                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Central                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| North                                       | (0)         | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         |
| Mohawk Valley                               | (0)         | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Hudson Valley                               | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         |
| Long Island                                 | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         |
| <b>NYCA Total</b>                           | <b>(0)</b>  | <b>(0)</b>  | <b>0</b>    | <b>0</b>    | <b>(0)</b>  | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>(0)</b>  |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>CO<sub>2</sub> Emissions (1000 Tons)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | 1           | (12)        | (9)         | (21)        | (44)        | 28          | (15)        | (33)        | (37)        | 12          |
| Genesee                                     | (2)         | (2)         | (2)         | (1)         | (2)         | (4)         | (0)         | (4)         | (1)         | (6)         |
| Central                                     | (41)        | (16)        | (68)        | 20          | (72)        | (33)        | (131)       | (56)        | (48)        | (65)        |
| North                                       | (1)         | (1)         | (2)         | (2)         | 6           | 2           | (0)         | 1           | (4)         | (1)         |
| Mohawk Valley                               | (1)         | 0           | (1)         | (1)         | 0           | (2)         | (0)         | (1)         | 1           | (2)         |
| Capital                                     | (37)        | (85)        | (48)        | (91)        | (83)        | (120)       | (79)        | (103)       | (116)       | (127)       |
| Hudson Valley                               | 184         | 251         | 289         | 327         | 423         | 441         | 450         | 589         | 549         | 477         |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (58)        | (133)       | (181)       | (178)       | (136)       | (116)       | 12          | (209)       | (181)       | 8           |
| Long Island                                 | (7)         | 31          | 18          | (8)         | (28)        | (15)        | (5)         | (9)         | (37)        | (40)        |
| <b>NYCA Total</b>                           | <b>40</b>   | <b>34</b>   | <b>(4)</b>  | <b>45</b>   | <b>65</b>   | <b>182</b>  | <b>231</b>  | <b>174</b>  | <b>124</b>  | <b>258</b>  |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>CO<sub>2</sub> Emissions Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | 0.0         | (0.1)       | (0.1)       | (0.1)       | (0.3)       | 0.2         | (0.1)       | (0.3)       | (0.3)       | 0.1         |
| Genesee                                     | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.1)       |
| Central                                     | (0.2)       | (0.1)       | (0.4)       | 0.1         | (0.5)       | (0.3)       | (1.1)       | (0.5)       | (0.5)       | (0.7)       |
| North                                       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | 0.1         | 0.0         | (0.0)       | 0.0         | (0.0)       | (0.0)       |
| Mohawk Valley                               | (0.0)       | 0.0         | (0.0)       | (0.0)       | 0.0         | (0.0)       | (0.0)       | (0.0)       | 0.0         | (0.0)       |
| Capital                                     | (0.2)       | (0.5)       | (0.3)       | (0.6)       | (0.6)       | (0.9)       | (0.7)       | (0.9)       | (1.1)       | (1.2)       |
| Hudson Valley                               | 0.9         | 1.4         | 1.9         | 2.2         | 3.1         | 3.4         | 3.7         | 5.3         | 5.2         | 4.8         |
| Millwood                                    | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| Dunwoodie                                   | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| NY City                                     | (0.2)       | (0.8)       | (1.1)       | (1.1)       | (0.9)       | (0.8)       | 0.2         | (1.8)       | (1.7)       | 0.2         |
| Long Island                                 | (0.0)       | 0.1         | 0.1         | (0.1)       | (0.2)       | (0.1)       | (0.1)       | (0.1)       | (0.3)       | (0.4)       |
| <b>NYCA Total</b>                           | <b>0.3</b>  | <b>0.2</b>  | <b>0.1</b>  | <b>0.4</b>  | <b>0.6</b>  | <b>1.5</b>  | <b>1.9</b>  | <b>1.7</b>  | <b>1.2</b>  | <b>2.6</b>  |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Generation Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West              | (0.1)        | 0.2          | 0.3          | 0.1          | 0.1          | 0.4          | 0.4          | 0.3          | 0.4          | 0.5          |
| Genesee           | (0.0)        | 0.1          | 0.1          | 0.0          | 0.1          | 0.1          | 0.2          | 0.1          | 0.2          | 0.2          |
| Central           | 0.0          | (0.0)        | (0.0)        | 0.0          | 0.1          | 0.1          | 0.2          | 0.1          | 0.1          | 0.2          |
| North             | (0.0)        | 0.0          | 0.1          | 0.0          | (0.0)        | 0.1          | 0.0          | 0.0          | 0.1          | 0.1          |
| Mohawk Valley     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Capital           | 0.0          | (0.0)        | (0.2)        | 0.1          | 0.1          | 0.0          | (0.1)        | 0.1          | (0.0)        | 0.0          |
| Hudson Valley     | (0.0)        | (0.2)        | (0.3)        | (0.1)        | (0.3)        | (0.3)        | (0.5)        | (0.4)        | (0.4)        | (0.5)        |
| Millwood          | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.2)        | (0.1)        | (0.1)        | (0.2)        |
| Dunwoodie         | (0.0)        | (0.1)        | (0.2)        | (0.1)        | (0.2)        | (0.2)        | (0.3)        | (0.2)        | (0.3)        | (0.3)        |
| NY City           | 0.0          | (0.9)        | (1.7)        | (0.5)        | (1.3)        | (1.8)        | (3.1)        | (1.5)        | (1.8)        | (3.1)        |
| Long Island       | 0.0          | (0.5)        | (0.8)        | (0.2)        | (0.5)        | (0.7)        | (1.2)        | (0.8)        | (0.7)        | (1.1)        |
| <b>NYCA Total</b> | <b>(0.1)</b> | <b>(1.5)</b> | <b>(2.8)</b> | <b>(0.6)</b> | <b>(2.1)</b> | <b>(2.5)</b> | <b>(4.7)</b> | <b>(2.4)</b> | <b>(2.6)</b> | <b>(4.4)</b> |

**Generic Demand Response Solution (Study 2: Central East)**
**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Demand Congestion (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025       | 2026         | 2027         | 2028         |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------|--------------|--------------|--------------|
| West                    | (0.1)        | (0.0)        | (1.5)        | 0.1          | 0.0          | 0.1          | (0.0)      | 0.1          | (0.0)        | (0.0)        |
| Genesee                 | (0.0)        | (0.0)        | 0.1          | 0.1          | 0.0          | 0.0          | 0.0        | 0.0          | (0.0)        | (0.0)        |
| Central                 | 0.2          | (0.1)        | (0.2)        | (0.0)        | (0.0)        | (0.0)        | (0.0)      | (0.1)        | (0.0)        | 0.0          |
| North                   | (0.0)        | (0.0)        | (0.1)        | (0.1)        | 0.0          | (0.0)        | (0.1)      | (0.0)        | (0.0)        | 0.0          |
| Mohawk Valley           | 0.1          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)      | (0.0)        | (0.0)        | 0.0          |
| Capital                 | 0.2          | 0.0          | 0.1          | 0.1          | (0.2)        | (0.0)        | 0.3        | 0.0          | 0.2          | 0.2          |
| Hudson Valley           | (0.2)        | (0.3)        | (0.6)        | (0.4)        | (0.4)        | 0.0          | (0.1)      | (0.2)        | (0.1)        | (0.2)        |
| Millwood                | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | 0.0          |
| Dunwoodie               | (0.1)        | (0.3)        | (0.3)        | (0.2)        | (0.2)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | 0.0          |
| NY City                 | (0.6)        | (3.2)        | (3.3)        | (2.4)        | (1.6)        | (0.4)        | 0.4        | (2.0)        | (1.4)        | (1.6)        |
| Long Island             | (0.1)        | (0.7)        | (1.1)        | (0.2)        | (0.1)        | 0.1          | 0.5        | (0.1)        | 0.4          | 0.2          |
| <b>NYCA Total</b>       | <b>(0.6)</b> | <b>(4.8)</b> | <b>(7.0)</b> | <b>(3.3)</b> | <b>(2.5)</b> | <b>(0.3)</b> | <b>1.1</b> | <b>(2.4)</b> | <b>(1.2)</b> | <b>(1.3)</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Production Cost (\$M)           | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                            | (0)        | (0)        | (0)        | (0)        | 1          | 0          | 0          | (1)        | 0          | 0          |
| Genesee                         | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | 0          | 0          |
| Central                         | (0)        | 0          | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        |
| North                           | (0)        | 0          | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley                   | (0)        | (0)        | 0          | 0          | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| Capital                         | (0)        | (0)        | (0)        | (0)        | (1)        | 0          | 0          | 0          | (0)        | (0)        |
| Hudson Valley                   | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | 0          | (0)        |
| Millwood                        | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                       | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                         | (1)        | (1)        | (1)        | (0)        | (1)        | (2)        | (1)        | (0)        | (1)        | (2)        |
| Long Island                     | (0)        | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>               | <b>(2)</b> | <b>(1)</b> | <b>(1)</b> | <b>(1)</b> | <b>(2)</b> | <b>(2)</b> | <b>(1)</b> | <b>(2)</b> | <b>(1)</b> | <b>(2)</b> |
| NYCA Imports                    | 0          | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (0)        | (1)        | (0)        |
| NYCA Exports                    | (0)        | 0          | 0          | 1          | 0          | (0)        | 0          | 0          | 1          | (0)        |
| <b>NYCA + Imports - Exports</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(2)</b> | <b>(3)</b> | <b>(3)</b> | <b>(2)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generation (GWh)  | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025       | 2026        | 2027        | 2028        |
|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|
| West              | (2)         | (1)         | (2)         | (5)         | 15          | 1           | (1)        | (18)        | (1)         | 7           |
| Genesee           | (0)         | 0           | 0           | (0)         | 0           | (0)         | (0)        | (0)         | 0           | 0           |
| Central           | (16)        | 1           | (3)         | (0)         | (5)         | (1)         | 6          | (2)         | (0)         | 0           |
| North             | 1           | 1           | (0)         | (0)         | (1)         | (1)         | (4)        | (2)         | (1)         | (1)         |
| Mohawk Valley     | (0)         | (0)         | 1           | 1           | (1)         | 0           | (1)        | (1)         | (1)         | (1)         |
| Capital           | 3           | (4)         | (5)         | (1)         | (14)        | 2           | 9          | 2           | (4)         | (6)         |
| Hudson Valley     | (2)         | 7           | (3)         | (8)         | 7           | 0           | (4)        | (2)         | 2           | (8)         |
| Millwood          | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           |
| Dunwoodie         | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           |
| NY City           | (36)        | (22)        | (17)        | (2)         | (22)        | (30)        | (13)       | (7)         | (10)        | (38)        |
| Long Island       | (1)         | 2           | 2           | (1)         | (6)         | 2           | (2)        | (0)         | (2)         | 0           |
| <b>NYCA Total</b> | <b>(53)</b> | <b>(16)</b> | <b>(26)</b> | <b>(17)</b> | <b>(26)</b> | <b>(27)</b> | <b>(9)</b> | <b>(30)</b> | <b>(16)</b> | <b>(45)</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Net Imports (GWh) | 2019      | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026       | 2027        | 2028     |
|-------------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|----------|
| PJM - NYISO       | 2         | (9)         | 2           | (20)        | (14)        | (3)         | (23)        | 0          | (11)        | 2        |
| LINDEN VFT        | 0         | (3)         | (0)         | (3)         | (2)         | 3           | (2)         | (1)        | (7)         | 3        |
| NEPTUNE           | 0         | 0           | (0)         | (2)         | (4)         | 0           | (1)         | (5)        | (2)         | (0)      |
| HTP               | 4         | (1)         | (1)         | (3)         | 1           | (0)         | (0)         | (0)        | 2           | 2        |
| ISONE - NYISO     | 10        | (8)         | (7)         | 5           | 10          | (9)         | 5           | 2          | (3)         | 1        |
| CROSS SOUND CABLE | (1)       | (1)         | (1)         | (1)         | 4           | 0           | (0)         | 1          | 1           | 0        |
| NORTHPORT NORWALK | (1)       | 0           | (2)         | (1)         | (2)         | (1)         | (1)         | 1          | 0           | (2)      |
| IESO - NYISO      | 1         | (4)         | (5)         | 3           | (5)         | (4)         | (8)         | (7)        | (3)         | (0)      |
| HQ - NYISO CHAT   | (0)       | 0           | 0           | (0)         | 0           | 0           | (0)         | 0          | 0           | 0        |
| HQ - NYISO CEDARS | (0)       | 0           | 0           | 0           | 0           | 0           | 0           | 0          | 0           | (0)      |
| <b>TOTAL</b>      | <b>15</b> | <b>(24)</b> | <b>(14)</b> | <b>(23)</b> | <b>(13)</b> | <b>(13)</b> | <b>(31)</b> | <b>(9)</b> | <b>(23)</b> | <b>6</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generator Payment (\$M) | 2019       | 2020       | 2021        | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------------|------------|------------|-------------|------------|------------|------------|------------|------------|------------|------------|
| West                    | (0)        | (0)        | (1)         | (0)        | 1          | (0)        | (0)        | (1)        | (0)        | 0          |
| Genesee                 | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central                 | (1)        | 0          | (1)         | (0)        | (1)        | (0)        | (0)        | 0          | (0)        | (0)        |
| North                   | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley           | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                 | (1)        | (1)        | (2)         | (1)        | (1)        | 0          | (0)        | 0          | (1)        | (0)        |
| Hudson Valley           | (1)        | (0)        | (2)         | (1)        | 0          | (0)        | (1)        | (1)        | (0)        | (0)        |
| Millwood                | (1)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie               | (0)        | (0)        | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| NY City                 | (3)        | (4)        | (7)         | (3)        | (2)        | (2)        | (2)        | (2)        | (2)        | (3)        |
| Long Island             | (1)        | (1)        | (2)         | (1)        | (0)        | 0          | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>       | <b>(7)</b> | <b>(6)</b> | <b>(15)</b> | <b>(6)</b> | <b>(4)</b> | <b>(3)</b> | <b>(4)</b> | <b>(4)</b> | <b>(5)</b> | <b>(4)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Load Payment (\$M) | 2019       | 2020        | 2021        | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|--------------------|------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|
| West               | (1)        | (0)         | (2)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Genesee            | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central            | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| North              | (0)        | (0)         | (0)         | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley      | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital            | (1)        | (1)         | (1)         | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        |
| Hudson Valley      | (1)        | (1)         | (2)         | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        | (1)        |
| Millwood           | (0)        | (0)         | (0)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie          | (0)        | (0)         | (1)         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| NY City            | (3)        | (5)         | (10)        | (5)        | (3)        | (2)        | (3)        | (4)        | (5)        | (3)        |
| Long Island        | (1)        | (1)         | (4)         | (1)        | (0)        | (0)        | (0)        | (1)        | (0)        | 0          |
| <b>NYCA Total</b>  | <b>(8)</b> | <b>(10)</b> | <b>(23)</b> | <b>(9)</b> | <b>(5)</b> | <b>(4)</b> | <b>(6)</b> | <b>(7)</b> | <b>(8)</b> | <b>(5)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | (0.03)        | (0.01)        | (0.12)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        | (0.02)        | (0.01)        |
| Genesee               | (0.02)        | (0.01)        | (0.04)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        | (0.02)        | (0.01)        |
| Central               | (0.02)        | (0.02)        | (0.06)        | (0.02)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        |
| North                 | (0.02)        | (0.01)        | (0.03)        | 0.01          | (0.02)        | (0.00)        | (0.01)        | (0.00)        | (0.02)        | (0.01)        |
| Mohawk Valley         | (0.02)        | (0.01)        | (0.05)        | (0.02)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.01)        |
| Capital               | (0.01)        | (0.01)        | (0.05)        | (0.01)        | (0.03)        | (0.01)        | (0.01)        | (0.01)        | (0.01)        | 0.01          |
| Hudson Valley         | (0.03)        | (0.03)        | (0.08)        | (0.03)        | (0.03)        | (0.00)        | (0.02)        | (0.02)        | (0.03)        | (0.01)        |
| Millwood              | (0.03)        | (0.04)        | (0.08)        | (0.03)        | (0.03)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        |
| Dunwoodie             | (0.03)        | (0.04)        | (0.08)        | (0.04)        | (0.03)        | (0.01)        | (0.02)        | (0.01)        | (0.02)        | (0.00)        |
| NY City               | (0.02)        | (0.04)        | (0.08)        | (0.04)        | (0.03)        | (0.01)        | (0.01)        | (0.03)        | (0.03)        | (0.02)        |
| Long Island           | (0.02)        | (0.03)        | (0.08)        | (0.02)        | (0.01)        | (0.01)        | (0.01)        | (0.02)        | (0.01)        | 0.00          |
| <b>Average</b>        | <b>(0.02)</b> | <b>(0.02)</b> | <b>(0.07)</b> | <b>(0.02)</b> | <b>(0.02)</b> | <b>(0.01)</b> | <b>(0.02)</b> | <b>(0.01)</b> | <b>(0.02)</b> | <b>(0.01)</b> |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions (Tons) | 2019       | 2020       | 2021       | 2022       | 2023      | 2024     | 2025       | 2026        | 2027       | 2028     |
|----------------------------------|------------|------------|------------|------------|-----------|----------|------------|-------------|------------|----------|
| West                             | 0          | (0)        | (0)        | (0)        | 50        | 2        | 0          | (46)        | (2)        | 8        |
| Genesee                          | (0)        | 0          | (0)        | (0)        | 0         | (0)      | (0)        | (0)         | 0          | 0        |
| Central                          | (0)        | 0          | (0)        | 0          | (0)       | (0)      | 0          | (0)         | (0)        | 0        |
| North                            | (0)        | 0          | 0          | (0)        | (0)       | (0)      | (0)        | (0)         | (0)        | (0)      |
| Mohawk Valley                    | (0)        | (0)        | 0          | 0          | (0)       | 0        | (0)        | (0)         | (0)        | (0)      |
| Capital                          | 0          | (0)        | (0)        | (0)        | (0)       | (0)      | 0          | (0)         | (0)        | (0)      |
| Hudson Valley                    | (0)        | (0)        | (1)        | (0)        | 0         | 0        | 0          | 0           | 0          | (0)      |
| Millwood                         | 0          | 0          | 0          | 0          | 0         | 0        | 0          | 0           | 0          | 0        |
| Dunwoodie                        | 0          | 0          | 0          | 0          | 0         | 0        | 0          | 0           | 0          | 0        |
| NY City                          | (0)        | (0)        | (1)        | (0)        | (0)       | (0)      | (0)        | (0)         | (0)        | (0)      |
| Long Island                      | (0)        | (0)        | (1)        | (0)        | (0)       | 0        | (0)        | (0)         | (0)        | 0        |
| <b>NYCA Total</b>                | <b>(1)</b> | <b>(1)</b> | <b>(3)</b> | <b>(0)</b> | <b>50</b> | <b>2</b> | <b>(0)</b> | <b>(46)</b> | <b>(3)</b> | <b>7</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023     | 2024     | 2025       | 2026       | 2027       | 2028     |
|---------------------------------------|------------|------------|------------|------------|----------|----------|------------|------------|------------|----------|
| West                                  | 0          | (0)        | (0)        | (0)        | 0        | 0        | 0          | (0)        | (0)        | 0        |
| Genesee                               | (0)        | 0          | (0)        | (0)        | 0        | (0)      | (0)        | (0)        | 0          | 0        |
| Central                               | (0)        | 0          | (0)        | 0          | (0)      | (0)      | 0          | (0)        | (0)        | 0        |
| North                                 | (0)        | 0          | 0          | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Mohawk Valley                         | (0)        | (0)        | 0          | 0          | (0)      | 0        | (0)        | (0)        | (0)        | (0)      |
| Capital                               | 0          | (0)        | (0)        | (0)        | (0)      | (0)      | 0          | (0)        | (0)        | (0)      |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | 0        | 0        | 0          | 0          | 0          | (0)      |
| Millwood                              | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Long Island                           | (0)        | 0          | (0)        | (0)        | (0)      | 0        | (0)        | (0)        | (0)        | 0        |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| NO <sub>x</sub> Emissions (Tons) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                             | 1           | (1)         | (0)         | (2)         | 4           | 1           | (0)         | (10)        | 1           | 8           |
| Genesee                          | (0)         | 0           | 0           | 0           | 0           | (0)         | (0)         | (0)         | 0           | 0           |
| Central                          | (1)         | (0)         | (0)         | (0)         | (1)         | (0)         | 0           | (0)         | (0)         | 0           |
| North                            | 0           | 0           | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         |
| Mohawk Valley                    | (0)         | (0)         | 0           | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                          | (1)         | (0)         | (1)         | (1)         | (1)         | (1)         | 0           | (0)         | (0)         | (1)         |
| Hudson Valley                    | (2)         | (2)         | (6)         | (7)         | 1           | (0)         | (0)         | 1           | (2)         | (2)         |
| Millwood                         | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                        | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                          | (16)        | (20)        | (24)        | (13)        | (17)        | (20)        | (19)        | (14)        | (17)        | (25)        |
| Long Island                      | 1           | (1)         | (2)         | (1)         | (3)         | 1           | 0           | (1)         | (1)         | 1           |
| <b>NYCA Total</b>                | <b>(20)</b> | <b>(25)</b> | <b>(32)</b> | <b>(24)</b> | <b>(17)</b> | <b>(20)</b> | <b>(20)</b> | <b>(26)</b> | <b>(20)</b> | <b>(19)</b> |

**PROJECTED NO<sub>x</sub> EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | 0          | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | 0          |
| Genesee                               | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          | 0          |
| Central                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | 0          |
| North                                 | (0)        | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley                         | (0)        | (0)        | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | (0)        | (0)        |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                           | 0          | (0)        | (0)        | (0)        | (0)        | 0          | 0          | (0)        | (0)        | 0          |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019        | 2020        | 2021        | 2022        | 2023       | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|
| West                                  | 1           | (0)         | (0)         | (1)         | 18         | 1           | 0           | (18)        | (0)         | 5           |
| Genesee                               | (0)         | 0           | (0)         | (0)         | 0          | (0)         | (0)         | (0)         | 0           | 0           |
| Central                               | (6)         | 0           | (1)         | 0           | (3)        | (0)         | 2           | (1)         | (0)         | 0           |
| North                                 | (0)         | 0           | 0           | (0)         | (0)        | (1)         | (2)         | (1)         | (1)         | (0)         |
| Mohawk Valley                         | (0)         | (0)         | 0           | 0           | (0)        | 0           | (0)         | (0)         | (0)         | (0)         |
| Capital                               | 0           | (3)         | (3)         | (1)         | (6)        | (1)         | 3           | (0)         | (2)         | (4)         |
| Hudson Valley                         | (2)         | 2           | (3)         | (5)         | 3          | (0)         | (3)         | (0)         | (1)         | (4)         |
| Millwood                              | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                             | 0           | 0           | 0           | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| NY City                               | (19)        | (14)        | (13)        | (3)         | (14)       | (19)        | (10)        | (5)         | (7)         | (24)        |
| Long Island                           | (0)         | 1           | 1           | (0)         | (4)        | 1           | (1)         | (0)         | (1)         | 0           |
| <b>NYCA Total</b>                     | <b>(28)</b> | <b>(14)</b> | <b>(20)</b> | <b>(11)</b> | <b>(6)</b> | <b>(18)</b> | <b>(11)</b> | <b>(26)</b> | <b>(13)</b> | <b>(27)</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                                  | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.1          | 0.0          | 0.0          | (0.2)        | (0.0)        | 0.1          |
| Genesee                               | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          |
| Central                               | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        |
| North                                 | (0.0)        | 0.0          | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Mohawk Valley                         | (0.0)        | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Capital                               | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        |
| Hudson Valley                         | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Millwood                              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dunwoodie                             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| NY City                               | (0.1)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.0)        | (0.0)        | (0.2)        |
| Long Island                           | (0.0)        | 0.0          | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| <b>NYCA Total</b>                     | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.1)</b> | <b>(0.2)</b> | <b>(0.1)</b> | <b>(0.2)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Demand Response Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West              | 0.0          | 0.0          | 0.0          | 0.0          | 0.1          | 0.0          | 0.1          | 0.1          | 0.0          | (0.0)        |
| Genesee           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)        | 0.0          | 0.0          | 0.0          | (0.0)        |
| Central           | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)        |
| North             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mohawk Valley     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| Capital           | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.0)        |
| Hudson Valley     | (0.0)        | (0.0)        | (0.1)        | (0.0)        | (0.0)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.0)        |
| Millwood          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Dunwoodie         | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| NY City           | (0.2)        | (0.2)        | (0.5)        | (0.2)        | (0.2)        | (0.1)        | (0.3)        | (0.3)        | (0.2)        | (0.1)        |
| Long Island       | (0.1)        | (0.1)        | (0.2)        | (0.1)        | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | 0.0          |
| <b>NYCA Total</b> | <b>(0.4)</b> | <b>(0.3)</b> | <b>(0.9)</b> | <b>(0.4)</b> | <b>(0.2)</b> | <b>(0.2)</b> | <b>(0.3)</b> | <b>(0.4)</b> | <b>(0.4)</b> | <b>(0.2)</b> |

**Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Demand Congestion (\$M) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025         | 2026          | 2027          | 2028          |
|-------------------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|
| West                    | 1.7           | 0.1           | 2.4           | 0.6           | (0.4)         | (0.9)         | (0.9)        | (0.7)         | (1.6)         | (0.6)         |
| Genesee                 | (0.1)         | (0.1)         | (0.0)         | 0.3           | (0.2)         | (0.3)         | (0.3)        | (0.3)         | (0.7)         | (0.2)         |
| Central                 | (0.1)         | (0.5)         | (0.2)         | (0.4)         | (0.2)         | (0.4)         | 0.0          | (0.7)         | (0.4)         | (0.2)         |
| North                   | 0.1           | 0.2           | 0.3           | (0.1)         | 0.1           | 0.1           | 0.2          | (0.0)         | (0.0)         | (0.0)         |
| Mohawk Valley           | (0.0)         | (0.2)         | (0.2)         | (0.2)         | (0.1)         | (0.3)         | (0.1)        | (0.4)         | (0.2)         | (0.1)         |
| Capital                 | (9.5)         | (7.9)         | (8.6)         | (6.9)         | (3.9)         | (3.6)         | (1.4)        | (3.1)         | (1.9)         | (2.5)         |
| Hudson Valley           | (7.1)         | (6.3)         | (7.2)         | (6.7)         | (4.1)         | (2.7)         | (1.6)        | (3.0)         | (1.9)         | (2.8)         |
| Millwood                | (0.4)         | (0.6)         | (0.6)         | (0.7)         | (0.6)         | (0.3)         | (0.2)        | (0.6)         | (0.2)         | (0.3)         |
| Dunwoodie               | (0.9)         | (1.2)         | (1.3)         | (1.6)         | (1.2)         | (0.6)         | (0.3)        | (1.2)         | (0.4)         | (0.6)         |
| NY City                 | (24.1)        | (24.5)        | (25.8)        | (24.8)        | (16.7)        | (13.0)        | (7.3)        | (17.1)        | (9.7)         | (11.2)        |
| Long Island             | 2.4           | 0.8           | 1.2           | 0.0           | 1.1           | 3.7           | 5.0          | 1.3           | 4.4           | 3.3           |
| <b>NYCA Total</b>       | <b>(38.0)</b> | <b>(40.3)</b> | <b>(40.1)</b> | <b>(40.5)</b> | <b>(26.3)</b> | <b>(18.4)</b> | <b>(6.9)</b> | <b>(25.9)</b> | <b>(12.6)</b> | <b>(15.3)</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Production Cost (\$M)           | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                            | (0)          | (1)          | (1)          | (1)          | (1)          | 0            | (2)          | (4)          | (4)          | (1)          |
| Genesee                         | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| Central                         | (5)          | (4)          | (5)          | (5)          | (6)          | (7)          | (11)         | (6)          | (8)          | (9)          |
| North                           | 0            | 0            | (0)          | (0)          | (0)          | 0            | (0)          | (0)          | (0)          | (0)          |
| Mohawk Valley                   | (0)          | (0)          | (0)          | 0            | (0)          | 0            | (0)          | (0)          | 0            | (0)          |
| Capital                         | (26)         | (26)         | (21)         | (23)         | (28)         | (30)         | (29)         | (33)         | (34)         | (37)         |
| Hudson Valley                   | (7)          | (16)         | (17)         | (22)         | (18)         | (21)         | (19)         | (18)         | (22)         | (22)         |
| Millwood                        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                       | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                         | (32)         | (36)         | (32)         | (35)         | (38)         | (35)         | (40)         | (43)         | (42)         | (40)         |
| Long Island                     | (2)          | (1)          | (3)          | (3)          | (3)          | (2)          | (3)          | (3)          | (2)          | (3)          |
| <b>NYCA Total</b>               | <b>(72)</b>  | <b>(84)</b>  | <b>(79)</b>  | <b>(88)</b>  | <b>(96)</b>  | <b>(96)</b>  | <b>(104)</b> | <b>(107)</b> | <b>(112)</b> | <b>(112)</b> |
| <b>NYCA Imports</b>             | <b>(12)</b>  | <b>(11)</b>  | <b>(17)</b>  | <b>(19)</b>  | <b>(21)</b>  | <b>(23)</b>  | <b>(29)</b>  | <b>(30)</b>  | <b>(28)</b>  | <b>(34)</b>  |
| <b>NYCA Exports</b>             | <b>21</b>    | <b>18</b>    | <b>25</b>    | <b>20</b>    | <b>20</b>    | <b>25</b>    | <b>24</b>    | <b>27</b>    | <b>30</b>    | <b>30</b>    |
| <b>NYCA + Imports - Exports</b> | <b>(104)</b> | <b>(113)</b> | <b>(121)</b> | <b>(127)</b> | <b>(137)</b> | <b>(144)</b> | <b>(157)</b> | <b>(165)</b> | <b>(169)</b> | <b>(175)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generation (GWh)  | 2019           | 2020           | 2021           | 2022           | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| West              | 6              | (15)           | (4)            | (15)           | (13)           | 14             | (14)           | (61)           | (44)           | (16)           |
| Genesee           | (3)            | (3)            | (4)            | (4)            | (8)            | (5)            | (4)            | (6)            | (4)            | (4)            |
| Central           | (239)          | (171)          | (208)          | (183)          | (204)          | (219)          | (296)          | (157)          | (212)          | (221)          |
| North             | 2              | (1)            | (6)            | (3)            | (2)            | 0              | 0              | (4)            | (1)            | (2)            |
| Mohawk Valley     | (1)            | 0              | (2)            | (1)            | (1)            | 2              | (1)            | (3)            | 0              | (3)            |
| Capital           | (926)          | (826)          | (687)          | (658)          | (751)          | (754)          | (668)          | (709)          | (709)          | (733)          |
| Hudson Valley     | (253)          | (503)          | (519)          | (625)          | (463)          | (533)          | (421)          | (378)          | (479)          | (459)          |
| Millwood          | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| Dunwoodie         | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| NY City           | (1,020)        | (1,056)        | (918)          | (944)          | (940)          | (807)          | (830)          | (884)          | (806)          | (731)          |
| Long Island       | (47)           | (37)           | (66)           | (60)           | (65)           | (40)           | (52)           | (53)           | (45)           | (45)           |
| <b>NYCA Total</b> | <b>(2,481)</b> | <b>(2,613)</b> | <b>(2,413)</b> | <b>(2,493)</b> | <b>(2,447)</b> | <b>(2,341)</b> | <b>(2,286)</b> | <b>(2,255)</b> | <b>(2,299)</b> | <b>(2,214)</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Net Imports (GWh) | 2019           | 2020         | 2021           | 2022         | 2023           | 2024           | 2025           | 2026           | 2027           | 2028           |
|-------------------|----------------|--------------|----------------|--------------|----------------|----------------|----------------|----------------|----------------|----------------|
| PJM - NYISO       | (248)          | (295)        | (342)          | (408)        | (349)          | (347)          | (499)          | (434)          | (388)          | (534)          |
| LINDEN VFT        | (94)           | (84)         | (75)           | (64)         | (71)           | (57)           | (60)           | (72)           | (60)           | (63)           |
| NEPTUNE           | (32)           | (48)         | (80)           | (56)         | (107)          | (95)           | (82)           | (82)           | (90)           | (72)           |
| HTP               | (46)           | (23)         | (53)           | (30)         | (21)           | (33)           | (28)           | (40)           | (46)           | (42)           |
| ISONE - NYISO     | (553)          | (427)        | (537)          | (463)        | (427)          | (545)          | (404)          | (450)          | (478)          | (406)          |
| CROSS SOUND CABLE | 9              | 15           | 36             | 17           | 7              | 18             | 1              | 6              | (0)            | 10             |
| NORTHPORT NORWALK | 14             | 21           | 18             | 8            | 5              | 15             | 8              | 12             | 5              | (1)            |
| IESO - NYISO      | (61)           | (44)         | (49)           | (2)          | (80)           | (116)          | (139)          | (179)          | (140)          | (178)          |
| HQ - NYISO CHAT   | (0)            | (0)          | (0)            | (0)          | 0              | 0              | 0              | 0              | 0              | 0              |
| HQ - NYISO CEDARS | 1              | (0)          | (2)            | (0)          | 0              | (0)            | 0              | (0)            | (0)            | (0)            |
| <b>TOTAL</b>      | <b>(1,011)</b> | <b>(887)</b> | <b>(1,082)</b> | <b>(999)</b> | <b>(1,043)</b> | <b>(1,160)</b> | <b>(1,205)</b> | <b>(1,239)</b> | <b>(1,197)</b> | <b>(1,286)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Generator Payment (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                    | (3)          | (3)          | (4)          | (3)          | (3)          | (4)          | (7)          | (6)          | (8)          | (6)          |
| Genesee                 | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (2)          | (1)          | (2)          | (2)          |
| Central                 | (5)          | (1)          | (7)          | (8)          | (10)         | (14)         | (19)         | (10)         | (16)         | (15)         |
| North                   | (2)          | (2)          | (2)          | (2)          | (2)          | (3)          | (3)          | (3)          | (3)          | (3)          |
| Mohawk Valley           | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (1)          | (2)          | (2)          |
| Capital                 | (34)         | (33)         | (30)         | (30)         | (36)         | (38)         | (38)         | (41)         | (42)         | (43)         |
| Hudson Valley           | (8)          | (19)         | (20)         | (25)         | (21)         | (24)         | (23)         | (21)         | (26)         | (25)         |
| Millwood                | (7)          | (4)          | (2)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| Dunwoodie               | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| NY City                 | (41)         | (46)         | (46)         | (49)         | (49)         | (47)         | (52)         | (56)         | (55)         | (53)         |
| Long Island             | (3)          | (3)          | (5)          | (5)          | (4)          | (3)          | (4)          | (5)          | (5)          | (4)          |
| <b>NYCA Total</b>       | <b>(104)</b> | <b>(114)</b> | <b>(117)</b> | <b>(124)</b> | <b>(128)</b> | <b>(136)</b> | <b>(150)</b> | <b>(143)</b> | <b>(157)</b> | <b>(151)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Load Payment (\$M) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West               | (1)          | (2)          | (0)          | (2)          | (2)          | (3)          | (4)          | (2)          | (4)          | (3)          |
| Genesee            | (2)          | (2)          | (2)          | (2)          | (2)          | (3)          | (3)          | (2)          | (3)          | (3)          |
| Central            | (3)          | (3)          | (4)          | (3)          | (3)          | (5)          | (6)          | (5)          | (7)          | (5)          |
| North              | (1)          | (1)          | (1)          | (1)          | (1)          | (2)          | (2)          | (1)          | (2)          | (2)          |
| Mohawk Valley      | (2)          | (1)          | (2)          | (2)          | (2)          | (3)          | (3)          | (2)          | (3)          | (2)          |
| Capital            | (32)         | (34)         | (37)         | (38)         | (39)         | (42)         | (45)         | (47)         | (48)         | (49)         |
| Hudson Valley      | (28)         | (30)         | (33)         | (35)         | (37)         | (38)         | (42)         | (43)         | (45)         | (46)         |
| Millwood           | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          | (1)          |
| Dunwoodie          | (2)          | (2)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          | (3)          |
| NY City            | (76)         | (82)         | (89)         | (93)         | (93)         | (101)        | (107)        | (114)        | (117)        | (117)        |
| Long Island        | (3)          | (4)          | (4)          | (5)          | (3)          | (3)          | (4)          | (5)          | (5)          | (4)          |
| <b>NYCA Total</b>  | <b>(152)</b> | <b>(164)</b> | <b>(176)</b> | <b>(185)</b> | <b>(186)</b> | <b>(204)</b> | <b>(220)</b> | <b>(226)</b> | <b>(238)</b> | <b>(236)</b> |



**PROJECTED LBMP (\$/MWh) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| Average LBMP (\$/MWh) | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| West                  | (0.09) | (0.14) | (0.05) | (0.12) | (0.15) | (0.23) | (0.27) | (0.18) | (0.26) | (0.23) |
| Genesee               | (0.19) | (0.14) | (0.19) | (0.14) | (0.17) | (0.27) | (0.31) | (0.22) | (0.31) | (0.27) |
| Central               | (0.21) | (0.19) | (0.21) | (0.20) | (0.21) | (0.33) | (0.35) | (0.31) | (0.42) | (0.31) |
| North                 | (0.22) | (0.19) | (0.24) | (0.16) | (0.21) | (0.32) | (0.38) | (0.25) | (0.39) | (0.29) |
| Mohawk Valley         | (0.22) | (0.20) | (0.24) | (0.23) | (0.23) | (0.36) | (0.39) | (0.34) | (0.45) | (0.34) |
| Capital               | (0.40) | (0.39) | (0.46) | (0.46) | (0.43) | (0.52) | (0.50) | (0.55) | (0.57) | (0.49) |
| Hudson Valley         | (0.39) | (0.37) | (0.46) | (0.49) | (0.44) | (0.50) | (0.52) | (0.55) | (0.57) | (0.53) |
| Millwood              | (0.36) | (0.36) | (0.43) | (0.45) | (0.40) | (0.47) | (0.47) | (0.50) | (0.52) | (0.47) |
| Dunwoodie             | (0.37) | (0.36) | (0.44) | (0.46) | (0.41) | (0.47) | (0.47) | (0.50) | (0.52) | (0.47) |
| NY City               | (0.43) | (0.43) | (0.49) | (0.50) | (0.44) | (0.54) | (0.53) | (0.58) | (0.59) | (0.52) |
| Long Island           | (0.13) | (0.14) | (0.16) | (0.22) | (0.16) | (0.20) | (0.20) | (0.26) | (0.26) | (0.23) |
| Average               | (0.27) | (0.26) | (0.31) | (0.31) | (0.30) | (0.38) | (0.40) | (0.38) | (0.44) | (0.38) |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions (Tons) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026  | 2027 | 2028 |
|----------------------------------|------|------|------|------|------|------|------|-------|------|------|
| West                             | 0    | (0)  | (0)  | (0)  | 21   | 61   | (19) | (121) | (61) | 25   |
| Genesee                          | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)   | (0)  | (0)  |
| Central                          | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (1)  | (0)   | (0)  | (0)  |
| North                            | 0    | 0    | (0)  | (0)  | (0)  | 0    | 0    | (0)   | (0)  | (0)  |
| Mohawk Valley                    | (0)  | 0    | (0)  | 0    | (0)  | 0    | (0)  | (0)   | 0    | (0)  |
| Capital                          | (2)  | (2)  | (1)  | (1)  | (1)  | (2)  | (1)  | (1)   | (1)  | (2)  |
| Hudson Valley                    | (1)  | (1)  | (1)  | (2)  | (1)  | (1)  | (1)  | (1)   | (1)  | (1)  |
| Millwood                         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0    | 0    |
| Dunwoodie                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0    | 0    |
| NY City                          | (3)  | (3)  | (3)  | (3)  | (3)  | (2)  | (2)  | (2)   | (2)  | (2)  |
| Long Island                      | (0)  | (0)  | (1)  | (0)  | (0)  | (0)  | (0)  | (0)   | (0)  | (0)  |
| NYCA Total                       | (6)  | (7)  | (7)  | (6)  | 15   | 56   | (24) | (126) | (66) | 19   |

**PROJECTED SO2 EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                                  | (0)  | (0)  | (0)  | (0)  | 0    | 0    | (0)  | (0)  | (0)  | 0    |
| Genesee                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Central                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| North                                 | 0    | 0    | (0)  | (0)  | (0)  | 0    | 0    | (0)  | (0)  | (0)  |
| Mohawk Valley                         | (0)  | 0    | (0)  | 0    | (0)  | 0    | (0)  | (0)  | 0    | (0)  |
| Capital                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                         | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Millwood                              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island                           | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| NYCA Total                            | (0)  | (0)  | (0)  | (0)  | 0    | 0    | (0)  | (0)  | (0)  | 0    |

**PROJECTED NOX EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>NO<sub>x</sub> Emissions (Tons)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>  | <b>2028</b>  |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                                   | 0            | (12)         | (4)          | (10)         | (10)         | 17           | (1)          | (36)         | (26)         | 0            |
| Genesee                                | (1)          | (1)          | (1)          | (0)          | (1)          | (0)          | (0)          | (1)          | (0)          | (1)          |
| Central                                | (13)         | (9)          | (11)         | (10)         | (12)         | (13)         | (18)         | (10)         | (13)         | (15)         |
| North                                  | 4            | 3            | 2            | 1            | 0            | 4            | (3)          | 7            | 1            | 1            |
| Mohawk Valley                          | (0)          | (0)          | (0)          | 0            | (0)          | 0            | (0)          | (1)          | (0)          | (1)          |
| Capital                                | (41)         | (38)         | (36)         | (40)         | (49)         | (49)         | (37)         | (43)         | (37)         | (47)         |
| Hudson Valley                          | (109)        | (73)         | (120)        | (96)         | (96)         | (73)         | (77)         | (61)         | (69)         | (86)         |
| Millwood                               | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                              | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                                | (196)        | (254)        | (250)        | (270)        | (310)        | (210)        | (247)        | (240)        | (227)        | (205)        |
| Long Island                            | (15)         | (14)         | (25)         | (18)         | (24)         | (13)         | (13)         | (17)         | (13)         | (13)         |
| <b>NYCA Total</b>                      | <b>(372)</b> | <b>(399)</b> | <b>(445)</b> | <b>(443)</b> | <b>(501)</b> | <b>(336)</b> | <b>(396)</b> | <b>(401)</b> | <b>(385)</b> | <b>(365)</b> |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>NO<sub>x</sub> Emissions Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Genesee                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Central                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| North                                       | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         | (0)         |
| Mohawk Valley                               | (0)         | 0           | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Hudson Valley                               | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Long Island                                 | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| <b>NYCA Total</b>                           | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>CO<sub>2</sub> Emissions (1000 Tons)</b> | <b>2019</b>    | <b>2020</b>    | <b>2021</b>    | <b>2022</b>    | <b>2023</b>    | <b>2024</b>    | <b>2025</b>    | <b>2026</b>    | <b>2027</b>    | <b>2028</b>    |
|---|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| West  | (2)            | (15)           | (9)            | (14)           | (12)           | 13             | (18)           | (62)           | (45)           | (10)           |
| Genesee                                     | (1)            | (1)            | (2)            | (2)            | (4)            | (2)            | (2)            | (3)            | (2)            | (2)            |
| Central                                     | (98)           | (70)           | (85)           | (74)           | (85)           | (91)           | (123)          | (66)           | (89)           | (93)           |
| North                                       | 1              | 1              | (1)            | (1)            | (1)            | 0              | 0              | (2)            | (0)            | (1)            |
| Mohawk Valley                               | (1)            | 0              | (0)            | 0              | (0)            | 1              | (0)            | (1)            | 0              | (1)            |
| Capital                                     | (364)          | (329)          | (269)          | (277)          | (297)          | (310)          | (267)          | (295)          | (291)          | (304)          |
| Hudson Valley                               | (145)          | (233)          | (260)          | (291)          | (224)          | (241)          | (200)          | (173)          | (219)          | (219)          |
| Millwood                                    | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| Dunwoodie                                   | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| NY City                                     | (505)          | (544)          | (477)          | (489)          | (500)          | (413)          | (436)          | (461)          | (420)          | (376)          |
| Long Island                                 | (28)           | (18)           | (37)           | (33)           | (35)           | (22)           | (28)           | (29)           | (23)           | (23)           |
| <b>NYCA Total</b>                           | <b>(1,142)</b> | <b>(1,209)</b> | <b>(1,141)</b> | <b>(1,180)</b> | <b>(1,157)</b> | <b>(1,065)</b> | <b>(1,073)</b> | <b>(1,092)</b> | <b>(1,090)</b> | <b>(1,028)</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>CO<sub>2</sub> Emissions Costs (\$M)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>   | <b>2028</b>   |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|
| West  | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | 0.1          | (0.2)        | (0.6)        | (0.5)         | (0.1)         |
| Genesee                                     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)         | (0.0)         |
| Central                                     | (0.5)        | (0.4)        | (0.5)        | (0.5)        | (0.6)        | (0.7)        | (1.0)        | (0.6)        | (0.8)         | (1.0)         |
| North                                       | 0.0          | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)         | (0.0)         |
| Mohawk Valley                               | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        | (0.0)        | 0.0           | (0.0)         |
| Capital                                     | (1.8)        | (1.8)        | (1.6)        | (1.8)        | (2.1)        | (2.4)        | (2.2)        | (2.6)        | (2.7)         | (3.0)         |
| Hudson Valley                               | (0.7)        | (1.3)        | (1.7)        | (2.0)        | (1.7)        | (1.9)        | (1.7)        | (1.6)        | (2.1)         | (2.3)         |
| Millwood                                    | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0           | 0.0           |
| Dunwoodie                                   | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0           | 0.0           |
| NY City                                     | (1.9)        | (2.9)        | (2.8)        | (3.1)        | (3.4)        | (3.0)        | (3.4)        | (3.8)        | (3.8)         | (3.6)         |
| Long Island                                 | (0.1)        | (0.1)        | (0.2)        | (0.2)        | (0.2)        | (0.2)        | (0.2)        | (0.3)        | (0.2)         | (0.2)         |
| <b>NYCA Total</b>                           | <b>(5.0)</b> | <b>(6.6)</b> | <b>(7.0)</b> | <b>(7.8)</b> | <b>(8.2)</b> | <b>(8.1)</b> | <b>(8.7)</b> | <b>(9.5)</b> | <b>(10.2)</b> | <b>(10.3)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Energy Efficiency Solution (Study 2: Central East - Knickerbocker - New Scotland)**

| <b>Loss Costs (\$M)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>   | <b>2028</b>   |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|
| West                    | 0.3          | 0.3          | 0.5          | 0.5          | 0.4          | 0.5          | 0.7          | 0.8          | 0.7           | 0.8           |
| Genesee                 | 0.1          | 0.1          | 0.2          | 0.2          | 0.2          | 0.2          | 0.3          | 0.3          | 0.3           | 0.3           |
| Central                 | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.2          | 0.2          | 0.2          | 0.2           | 0.3           |
| North                   | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1          | 0.1           | 0.1           |
| Mohawk Valley           | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.1)        | (0.1)        | (0.0)        | (0.1)         | (0.1)         |
| Capital                 | (1.5)        | (1.7)        | (1.8)        | (1.9)        | (2.0)        | (1.6)        | (1.9)        | (1.9)        | (2.0)         | (2.0)         |
| Hudson Valley           | (1.2)        | (1.3)        | (1.5)        | (1.5)        | (1.5)        | (1.8)        | (1.8)        | (1.9)        | (2.0)         | (2.1)         |
| Millwood                | (0.1)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)         | (0.1)         |
| Dunwoodie               | (0.2)        | (0.1)        | (0.2)        | (0.2)        | (0.1)        | (0.2)        | (0.3)        | (0.2)        | (0.3)         | (0.3)         |
| NY City                 | (3.8)        | (3.7)        | (4.4)        | (4.5)        | (4.3)        | (5.8)        | (6.0)        | (6.0)        | (6.5)         | (7.0)         |
| Long Island             | (0.5)        | (0.3)        | (0.4)        | (0.4)        | (0.3)        | (0.6)        | (0.7)        | (0.5)        | (0.7)         | (0.8)         |
| <b>NYCA Total</b>       | <b>(6.7)</b> | <b>(6.6)</b> | <b>(7.5)</b> | <b>(7.6)</b> | <b>(7.5)</b> | <b>(9.2)</b> | <b>(9.5)</b> | <b>(9.2)</b> | <b>(10.1)</b> | <b>(10.7)</b> |

### Study 3: Volney – Scriba

#### Generic Transmission Solution (Study 3: Volney – Scriba)

PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)

| Demand Congestion (\$M) | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| West                    | 0.5   | 0.7   | 0.3   | 0.0   | 0.5   | 0.5   | 0.1   | 0.8   | 0.4   | 0.8   |
| Genesee                 | 0.5   | 0.4   | (0.2) | (0.0) | 0.3   | 0.3   | 0.1   | 0.4   | 0.2   | 0.4   |
| Central                 | (2.5) | (3.3) | (2.8) | (3.0) | (3.3) | (3.4) | (3.4) | (4.4) | (5.2) | (5.2) |
| North                   | 0.1   | (0.0) | 0.0   | 0.1   | 0.1   | 0.2   | (0.1) | 0.1   | 0.2   | 0.1   |
| Mohawk Valley           | (0.5) | (0.7) | (0.5) | (0.6) | (0.6) | (0.7) | (0.7) | (0.9) | (1.0) | (1.0) |
| Capital                 | 0.6   | (0.8) | 1.0   | 1.5   | (0.0) | 0.1   | 0.1   | (0.4) | (0.0) | 0.4   |
| Hudson Valley           | 0.3   | (0.1) | 0.7   | 1.1   | 0.4   | 0.0   | 0.0   | (0.5) | (0.1) | (0.0) |
| Millwood                | 0.1   | (0.0) | 0.2   | 0.3   | 0.1   | (0.0) | 0.0   | (0.2) | (0.0) | 0.0   |
| Dunwoodie               | 0.2   | (0.1) | 0.4   | 0.6   | 0.3   | (0.0) | (0.0) | (0.3) | (0.1) | (0.0) |
| NY City                 | 2.4   | 0.9   | 3.8   | 6.5   | 2.5   | 0.3   | 1.0   | (1.3) | (0.3) | 0.7   |
| Long Island             | 1.4   | 0.1   | 1.8   | 3.1   | 1.1   | 0.7   | 0.8   | (1.3) | 0.6   | 0.0   |
| NYCA Total              | 3.1   | (2.9) | 4.7   | 9.6   | 1.3   | (2.0) | (2.0) | (8.0) | (5.5) | (3.8) |

PROJECTED PRODUCTION COST (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)

| Production Cost (\$M)    | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|
| West                     | (0)  | (1)  | (1)  | (1)  | 0    | 0    | (0)  | (2)  | 0    | 1    |
| Genesee                  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  |
| Central                  | 3    | 6    | 5    | 6    | 5    | 4    | 5    | 7    | 6    | 6    |
| North                    | (0)  | (0)  | (0)  | 0    | 0    | 0    | (0)  | (0)  | (0)  | 0    |
| Mohawk Valley            | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  |
| Capital                  | (2)  | (0)  | (1)  | (1)  | (2)  | 1    | (1)  | (1)  | (1)  | (0)  |
| Hudson Valley            | (1)  | (2)  | (2)  | (1)  | (2)  | (2)  | 0    | 1    | (1)  | (1)  |
| Millwood                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                  | (1)  | (3)  | (1)  | (2)  | (1)  | (1)  | (1)  | (2)  | (2)  | (2)  |
| Long Island              | 0    | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | 0    | 1    |
| NYCA Total               | (1)  | 1    | 1    | 1    | 0    | 2    | 2    | 2    | 2    | 5    |
| NYCA Imports             | (1)  | (1)  | (1)  | (2)  | (1)  | (1)  | (4)  | (3)  | (3)  | (4)  |
| NYCA Exports             | 1    | 3    | 2    | 2    | 2    | 3    | 2    | 2    | 3    | 3    |
| NYCA + Imports - Exports | (2)  | (3)  | (3)  | (3)  | (3)  | (2)  | (4)  | (3)  | (3)  | (3)  |

PROJECTED NYCA GENERATION (GWh) | Generic Transmission Solution (Study 3: Volney - Scriba)

| Generation (GWh) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|------------------|------|------|------|------|------|------|------|------|------|------|
| West             | (2)  | (22) | (19) | (29) | 1    | 0    | 24   | (34) | 7    | 27   |
| Genesee          | (1)  | (2)  | (2)  | (6)  | (6)  | (2)  | (1)  | (0)  | (0)  | (1)  |
| Central          | 173  | 304  | 244  | 244  | 217  | 161  | 169  | 219  | 204  | 200  |
| North            | (2)  | 0    | (4)  | 3    | 2    | 1    | (1)  | (5)  | (1)  | 3    |
| Mohawk Valley    | (3)  | (0)  | (1)  | (1)  | (1)  | (2)  | 1    | (3)  | (2)  | (3)  |
| Capital          | (54) | (28) | (22) | (48) | (51) | 4    | (20) | (23) | (34) | (22) |
| Hudson Valley    | (30) | (61) | (58) | (25) | (48) | (36) | 2    | 13   | (25) | (20) |
| Millwood         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | (0)  |
| Dunwoodie        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | (0)  |
| NY City          | (28) | (80) | (32) | (45) | (33) | (20) | (20) | (48) | (48) | (44) |
| Long Island      | (0)  | (3)  | (4)  | 4    | (11) | (7)  | (6)  | (9)  | 2    | 12   |
| NYCA Total       | 52   | 108  | 103  | 97   | 72   | 98   | 147  | 110  | 104  | 152  |

**PROJECTED NET IMPORTS (GWh) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| Net Imports (GWh) | 2019        | 2020         | 2021         | 2022        | 2023        | 2024        | 2025         | 2026         | 2027         | 2028         |
|-------------------|-------------|--------------|--------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PJM - NYISO       | (19)        | (59)         | (31)         | (64)        | (20)        | (58)        | (90)         | (80)         | (77)         | (87)         |
| LINDEN VFT        | 3           | 9            | 1            | 4           | 0           | 9           | (9)          | 0            | 4            | 14           |
| NEPTUNE           | (4)         | (4)          | 6            | 5           | 2           | 21          | 6            | 10           | 4            | 6            |
| HTP               | 3           | (2)          | 8            | 1           | 3           | 6           | (10)         | (9)          | (4)          | (8)          |
| ISONE - NYISO     | (12)        | (46)         | (54)         | (18)        | (24)        | (38)        | (17)         | (11)         | 17           | (16)         |
| CROSS SOUND CABLE | (5)         | 2            | (2)          | (4)         | (2)         | (2)         | (1)          | (2)          | 6            | 4            |
| NORTHPORT NORWALK | 2           | 3            | 0            | (5)         | (0)         | (6)         | (2)          | (1)          | (2)          | (11)         |
| IESO - NYISO      | (19)        | (8)          | (31)         | (15)        | (26)        | (25)        | (24)         | (13)         | (49)         | (49)         |
| HQ - NYISO CHAT   | (0)         | 0            | 0            | (0)         | 0           | (0)         | (0)          | 0            | 0            | 0            |
| HQ - NYISO CEDARS | (0)         | 0            | (0)          | (0)         | 0           | 0           | (0)          | 0            | 0            | (0)          |
| <b>TOTAL</b>      | <b>(50)</b> | <b>(105)</b> | <b>(102)</b> | <b>(96)</b> | <b>(68)</b> | <b>(93)</b> | <b>(147)</b> | <b>(106)</b> | <b>(102)</b> | <b>(148)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| Generator Payment (\$M) | 2019      | 2020      | 2021      | 2022      | 2023      | 2024      | 2025      | 2026      | 2027      | 2028      |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| West                    | (3)       | (2)       | (3)       | (3)       | (1)       | (1)       | (0)       | (1)       | (0)       | 0         |
| Genesee                 | (0)       | (0)       | (1)       | (1)       | (1)       | (0)       | (0)       | 0         | (0)       | (0)       |
| Central                 | 40        | 55        | 49        | 53        | 57        | 58        | 57        | 77        | 90        | 91        |
| North                   | (1)       | (0)       | (1)       | (1)       | (1)       | (1)       | (0)       | (0)       | (1)       | (0)       |
| Mohawk Valley           | (1)       | (0)       | (1)       | (1)       | (1)       | (1)       | (1)       | (0)       | (1)       | (1)       |
| Capital                 | (2)       | (2)       | (1)       | (2)       | (3)       | (0)       | (2)       | (1)       | (2)       | 0         |
| Hudson Valley           | (1)       | (3)       | (3)       | (1)       | (2)       | (2)       | (0)       | 0         | (2)       | (1)       |
| Millwood                | (0)       | (0)       | 0         | (0)       | (0)       | (0)       | (0)       | 0         | (0)       | (0)       |
| Dunwoodie               | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | 0         | (0)       | (0)       |
| NY City                 | (1)       | (3)       | (3)       | (2)       | (1)       | (2)       | (2)       | (1)       | (3)       | (2)       |
| Long Island             | 0         | (0)       | (1)       | 0         | (0)       | (0)       | (0)       | (0)       | 0         | 0         |
| <b>NYCA Total</b>       | <b>32</b> | <b>44</b> | <b>37</b> | <b>42</b> | <b>47</b> | <b>51</b> | <b>51</b> | <b>74</b> | <b>81</b> | <b>87</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| Load Payment (\$M) | 2019       | 2020       | 2021        | 2022        | 2023       | 2024        | 2025        | 2026       | 2027        | 2028       |
|--------------------|------------|------------|-------------|-------------|------------|-------------|-------------|------------|-------------|------------|
| West               | (0)        | 0          | (1)         | (2)         | (1)        | (1)         | (1)         | (0)        | (1)         | (1)        |
| Genesee            | (1)        | (1)        | (1)         | (1)         | (1)        | (1)         | (1)         | 0          | (1)         | (1)        |
| Central            | (3)        | (4)        | (4)         | (5)         | (4)        | (4)         | (4)         | (4)        | (6)         | (5)        |
| North              | (0)        | (0)        | (0)         | (1)         | (0)        | (0)         | (0)         | 0          | (0)         | (0)        |
| Mohawk Valley      | (1)        | (1)        | (1)         | (2)         | (1)        | (1)         | (1)         | (1)        | (1)         | (1)        |
| Capital            | (0)        | (1)        | (0)         | (0)         | (1)        | (0)         | (1)         | 0          | (0)         | 0          |
| Hudson Valley      | (0)        | (0)        | (0)         | (0)         | (0)        | (0)         | (1)         | 0          | (0)         | (0)        |
| Millwood           | (0)        | (0)        | (0)         | (0)         | (0)        | (0)         | (0)         | 0          | (0)         | (0)        |
| Dunwoodie          | (0)        | (0)        | (0)         | (0)         | (0)        | (0)         | (0)         | 0          | (0)         | (0)        |
| NY City            | (0)        | (1)        | (2)         | (1)         | (0)        | (2)         | (3)         | 2          | (1)         | 1          |
| Long Island        | 0          | (1)        | (1)         | 0           | 0          | (0)         | (1)         | (0)        | (0)         | (0)        |
| <b>NYCA Total</b>  | <b>(7)</b> | <b>(8)</b> | <b>(12)</b> | <b>(12)</b> | <b>(9)</b> | <b>(11)</b> | <b>(13)</b> | <b>(1)</b> | <b>(11)</b> | <b>(8)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| Average LBMP (\$/MWh) | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| West                  | (0.02) | 0.03   | (0.05) | (0.10) | (0.09) | (0.06) | (0.07) | 0.00   | (0.04) | (0.06) |
| Genesee               | (0.09) | (0.05) | (0.09) | (0.11) | (0.08) | (0.06) | (0.08) | 0.01   | (0.04) | (0.06) |
| Central               | (0.19) | (0.19) | (0.24) | (0.29) | (0.25) | (0.23) | (0.26) | (0.20) | (0.32) | (0.31) |
| North                 | (0.07) | (0.01) | (0.08) | (0.13) | (0.08) | (0.07) | (0.05) | 0.03   | (0.07) | (0.04) |
| Mohawk Valley         | (0.12) | (0.10) | (0.15) | (0.20) | (0.15) | (0.12) | (0.16) | (0.06) | (0.16) | (0.14) |
| Capital               | 0.00   | (0.07) | (0.00) | (0.02) | (0.05) | (0.03) | (0.05) | 0.03   | (0.03) | 0.02   |
| Hudson Valley         | (0.01) | (0.03) | (0.01) | (0.02) | (0.02) | (0.03) | (0.06) | 0.02   | (0.02) | (0.00) |
| Millwood              | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.03) | (0.06) | 0.02   | (0.02) | 0.00   |
| Dunwoodie             | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.03) | (0.06) | 0.02   | (0.03) | 0.00   |
| NY City               | (0.00) | (0.00) | (0.02) | (0.02) | (0.01) | (0.03) | (0.05) | 0.04   | (0.02) | 0.01   |
| Long Island           | 0.01   | (0.02) | 0.00   | 0.00   | (0.01) | (0.00) | (0.03) | 0.01   | 0.00   | (0.00) |
| Average               | (0.05) | (0.04) | (0.06) | (0.09) | (0.07) | (0.06) | (0.08) | (0.01) | (0.07) | (0.05) |

**PROJECTED SO2 EMISSION COSTS (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                                  | (0)  | (0)  | (0)  | (0)  | 0    | 0    | 0    | (0)  | 0    | 0    |
| Genesee                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Central                               | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| North                                 | (0)  | (0)  | (0)  | 0    | 0    | 0    | (0)  | (0)  | (0)  | 0    |
| Mohawk Valley                         | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  |
| Capital                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                         | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  |
| Millwood                              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island                           | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | 0    | 0    |
| NYCA Total                            | (0)  | (0)  | 0    | 0    | 0    | 0    | 0    | (0)  | 0    | 0    |

**PROJECTED NOX EMISSIONS (Tons) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions (Tons) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                             | (1)  | (11) | (8)  | (9)  | (1)  | 14   | 19   | (17) | 3    | 18   |
| Genesee                          | (1)  | (0)  | (0)  | (1)  | (1)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Central                          | (0)  | 3    | 2    | 5    | 4    | (1)  | (2)  | (0)  | (1)  | (2)  |
| North                            | (1)  | (1)  | 1    | 1    | 0    | 2    | (1)  | (1)  | (0)  | 0    |
| Mohawk Valley                    | (1)  | (0)  | (1)  | (1)  | (0)  | (1)  | 0    | (1)  | (1)  | (1)  |
| Capital                          | (8)  | (6)  | (4)  | (6)  | (6)  | (5)  | (4)  | (3)  | (3)  | (6)  |
| Hudson Valley                    | (21) | (33) | (33) | (24) | (23) | (15) | (23) | 4    | (5)  | (10) |
| Millwood                         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                          | (7)  | (22) | (12) | (9)  | (19) | (9)  | (17) | (21) | (24) | (12) |
| Long Island                      | (0)  | (3)  | 0    | 4    | (4)  | (1)  | (1)  | (5)  | 1    | 3    |
| NYCA Total                       | (40) | (75) | (55) | (39) | (49) | (16) | (29) | (44) | (30) | (10) |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          |
| Genesee                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Central                               | (0)        | 0          | 0          | 0          | 0          | (0)        | (0)        | (0)        | (0)        | (0)        |
| North                                 | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | 0          | (0)        | (0)        | (0)        |
| Mohawk Valley                         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                           | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | 0          | 0          |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019        | 2020       | 2021     | 2022      | 2023     | 2024      | 2025      | 2026     | 2027      | 2028      |
|---------------------------------------|-------------|------------|----------|-----------|----------|-----------|-----------|----------|-----------|-----------|
| West                                  | (2)         | (10)       | (8)      | (10)      | 12       | 7         | 27        | (31)     | 8         | 35        |
| Genesee                               | (0)         | (1)        | (1)      | (3)       | (3)      | (1)       | (0)       | (0)      | (0)       | (0)       |
| Central                               | 56          | 106        | 86       | 87        | 77       | 55        | 59        | 79       | 71        | 68        |
| North                                 | (1)         | (0)        | (1)      | 1         | 1        | 1         | (1)       | (2)      | (1)       | 2         |
| Mohawk Valley                         | (1)         | (1)        | (1)      | (1)       | (1)      | (1)       | 0         | (2)      | (1)       | (1)       |
| Capital                               | (27)        | (16)       | (13)     | (23)      | (24)     | (1)       | (9)       | (14)     | (15)      | (13)      |
| Hudson Valley                         | (21)        | (39)       | (39)     | (21)      | (29)     | (22)      | (9)       | 7        | (13)      | (12)      |
| Millwood                              | 0           | 0          | 0        | 0         | 0        | 0         | 0         | 0        | 0         | 0         |
| Dunwoodie                             | 0           | 0          | 0        | 0         | 0        | 0         | 0         | 0        | 0         | 0         |
| NY City                               | (15)        | (44)       | (16)     | (22)      | (19)     | (11)      | (14)      | (28)     | (29)      | (23)      |
| Long Island                           | 0           | (1)        | (2)      | 4         | (6)      | (4)       | (3)       | (6)      | 1         | 8         |
| <b>NYCA Total</b>                     | <b>(11)</b> | <b>(7)</b> | <b>5</b> | <b>11</b> | <b>9</b> | <b>23</b> | <b>48</b> | <b>2</b> | <b>21</b> | <b>63</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|--------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0.0)        | (0.1)        | (0.1)      | (0.1)      | 0.1        | 0.0        | 0.2        | (0.3)      | 0.1        | 0.3        |
| Genesee                               | (0.0)        | (0.0)        | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | 0.0        | (0.0)      | (0.0)      |
| Central                               | 0.3          | 0.6          | 0.5        | 0.6        | 0.5        | 0.4        | 0.5        | 0.7        | 0.6        | 0.7        |
| North                                 | (0.0)        | (0.0)        | (0.0)      | 0.0        | 0.0        | 0.0        | (0.0)      | (0.0)      | (0.0)      | 0.0        |
| Mohawk Valley                         | (0.0)        | (0.0)        | (0.0)      | (0.0)      | (0.0)      | (0.0)      | 0.0        | (0.0)      | (0.0)      | (0.0)      |
| Capital                               | (0.1)        | (0.1)        | (0.1)      | (0.2)      | (0.2)      | 0.0        | (0.1)      | (0.1)      | (0.1)      | (0.1)      |
| Hudson Valley                         | (0.1)        | (0.2)        | (0.2)      | (0.2)      | (0.2)      | (0.2)      | (0.1)      | 0.1        | (0.1)      | (0.1)      |
| Millwood                              | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0          | 0.0          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | (0.0)        | (0.2)        | (0.1)      | (0.1)      | (0.1)      | (0.1)      | (0.1)      | (0.2)      | (0.3)      | (0.2)      |
| Long Island                           | 0.0          | (0.0)        | (0.0)      | 0.0        | (0.0)      | (0.0)      | (0.0)      | (0.1)      | 0.0        | 0.1        |
| <b>NYCA Total</b>                     | <b>(0.0)</b> | <b>(0.1)</b> | <b>0.0</b> | <b>0.1</b> | <b>0.0</b> | <b>0.2</b> | <b>0.3</b> | <b>0.0</b> | <b>0.2</b> | <b>0.6</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Transmission Solution (Study 3: Volney - Scriba)**

| Loss Costs (\$M)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West              | 0.2        | 0.1        | 0.3        | 0.4        | 0.2        | 0.1        | 0.1        | 0.1        | 0.2        | 0.1        |
| Genesee           | 0.0        | (0.0)      | 0.1        | 0.1        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Central           | (0.0)      | (0.1)      | (0.1)      | (0.0)      | (0.1)      | (0.0)      | (0.0)      | (0.1)      | (0.0)      | (0.0)      |
| North             | 0.0        | 0.0        | 0.0        | 0.1        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Mohawk Valley     | 0.0        | 0.0        | (0.0)      | (0.0)      | 0.0        | 0.0        | (0.0)      | 0.0        | 0.0        | 0.0        |
| Capital           | 0.1        | 0.2        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        | 0.2        | 0.1        | 0.2        |
| Hudson Valley     | 0.1        | 0.2        | 0.1        | 0.1        | 0.2        | 0.1        | 0.1        | 0.2        | 0.2        | 0.2        |
| Millwood          | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.1        | 0.0        | 0.1        |
| Dunwoodie         | 0.1        | 0.1        | 0.0        | 0.0        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        | 0.1        |
| NY City           | 0.5        | 1.0        | 0.4        | 0.4        | 0.9        | 0.6        | 0.7        | 1.3        | 1.1        | 1.3        |
| Long Island       | 0.2        | 0.4        | 0.2        | 0.1        | 0.4        | 0.3        | 0.3        | 0.5        | 0.4        | 0.4        |
| <b>NYCA Total</b> | <b>1.2</b> | <b>1.9</b> | <b>1.2</b> | <b>1.3</b> | <b>1.9</b> | <b>1.4</b> | <b>1.5</b> | <b>2.4</b> | <b>2.2</b> | <b>2.4</b> |

**Generic Generation Solution (Study 3: Volney - Scriba)**
**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Demand Congestion (\$M) | 2019       | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|-------------------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                    | 1.9        | 3.5         | 2.3         | 0.4         | (0.5)       | (1.3)       | (0.5)       | (2.5)       | (1.4)       | (0.8)       |
| Genesee                 | 0.6        | (0.3)       | 0.0         | 0.1         | (0.2)       | (0.7)       | (0.2)       | (1.2)       | (0.7)       | (0.3)       |
| Central                 | (2.0)      | (1.6)       | (2.1)       | (2.7)       | (2.8)       | (2.3)       | (2.6)       | (3.3)       | (4.2)       | (4.1)       |
| North                   | (0.1)      | (0.3)       | (0.3)       | (0.1)       | 0.1         | (0.0)       | (0.2)       | (0.1)       | 0.1         | 0.0         |
| Mohawk Valley           | (0.4)      | (0.2)       | (0.4)       | (0.5)       | (0.6)       | (0.2)       | (0.4)       | (0.4)       | (0.6)       | (0.6)       |
| Capital                 | 0.6        | 6.2         | 2.9         | 2.3         | 2.2         | 5.3         | 3.3         | 5.7         | 5.6         | 5.5         |
| Hudson Valley           | 0.8        | 4.3         | 2.9         | 2.9         | 2.6         | 3.6         | 2.2         | 3.5         | 4.4         | 3.7         |
| Millwood                | 0.2        | 1.2         | 0.8         | 0.8         | 0.8         | 1.0         | 0.6         | 1.0         | 1.1         | 1.0         |
| Dunwoodie               | 0.5        | 2.7         | 1.8         | 1.8         | 1.7         | 2.1         | 1.2         | 2.1         | 2.1         | 1.8         |
| NY City                 | 3.0        | 24.1        | 20.4        | 17.7        | 17.8        | 22.0        | 12.6        | 25.8        | 23.0        | 21.6        |
| Long Island             | 3.2        | 10.7        | 6.6         | 8.1         | 2.9         | 12.1        | 7.5         | 10.7        | 9.5         | 10.2        |
| <b>NYCA Total</b>       | <b>8.3</b> | <b>50.2</b> | <b>34.9</b> | <b>30.7</b> | <b>24.0</b> | <b>41.7</b> | <b>23.7</b> | <b>41.4</b> | <b>38.8</b> | <b>37.9</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Production Cost (\$M)           | 2019       | 2020       | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                            | (1)        | (2)        | (2)         | (3)         | (5)         | (2)         | (5)         | (7)         | (9)         | (8)         |
| Genesee                         | (0)        | (0)        | (0)         | (0)         | (1)         | (0)         | (0)         | (0)         | (0)         | (1)         |
| Central                         | 8          | 20         | 19          | 29          | 38          | 44          | 50          | 54          | 61          | 63          |
| North                           | (0)        | (0)        | (0)         | (0)         | (0)         | (1)         | (1)         | (0)         | (1)         | (0)         |
| Mohawk Valley                   | (0)        | (0)        | (0)         | (0)         | (0)         | (1)         | (1)         | (0)         | (0)         | (0)         |
| Capital                         | (1)        | (4)        | 2           | (1)         | (5)         | (7)         | (11)        | (6)         | (10)        | (16)        |
| Hudson Valley                   | (1)        | (5)        | (6)         | (9)         | (7)         | (10)        | (18)        | 3           | (9)         | (17)        |
| Millwood                        | 0          | (0)        | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           |
| Dunwoodie                       | 0          | 0          | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                         | (0)        | (12)       | (13)        | (15)        | (7)         | (4)         | 5           | (21)        | (22)        | (13)        |
| Long Island                     | (0)        | 4          | 1           | 0           | (1)         | (2)         | (0)         | (1)         | (5)         | (4)         |
| <b>NYCA Total</b>               | <b>4</b>   | <b>0</b>   | <b>(0)</b>  | <b>1</b>    | <b>13</b>   | <b>18</b>   | <b>19</b>   | <b>20</b>   | <b>5</b>    | <b>5</b>    |
| <b>NYCA Imports</b>             | <b>(2)</b> | <b>(6)</b> | <b>(9)</b>  | <b>(12)</b> | <b>(18)</b> | <b>(21)</b> | <b>(24)</b> | <b>(23)</b> | <b>(18)</b> | <b>(26)</b> |
| <b>NYCA Exports</b>             | <b>3</b>   | <b>3</b>   | <b>5</b>    | <b>7</b>    | <b>15</b>   | <b>14</b>   | <b>13</b>   | <b>21</b>   | <b>20</b>   | <b>19</b>   |
| <b>NYCA + Imports - Exports</b> | <b>(1)</b> | <b>(9)</b> | <b>(14)</b> | <b>(18)</b> | <b>(20)</b> | <b>(17)</b> | <b>(19)</b> | <b>(24)</b> | <b>(33)</b> | <b>(41)</b> |



**PROJECTED NYCA GENERATION (GWh) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Generation (GWh)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028         |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
| West              | (16)       | (33)       | (48)       | (74)       | (102)      | (14)       | (93)       | (166)      | (157)      | (134)        |
| Genesee           | (4)        | (10)       | (10)       | (9)        | (16)       | (11)       | (6)        | (9)        | (7)        | (14)         |
| Central           | 433        | 941        | 846        | 1,205      | 1,543      | 1,612      | 1,708      | 1,724      | 1,894      | 1,952        |
| North             | (5)        | (6)        | (15)       | (5)        | (7)        | (18)       | (11)       | (4)        | (14)       | (5)          |
| Mohawk Valley     | (6)        | (2)        | (5)        | (4)        | (2)        | (12)       | (8)        | (6)        | (4)        | (7)          |
| Capital           | (41)       | (212)      | (66)       | (188)      | (172)      | (223)      | (227)      | (226)      | (303)      | (346)        |
| Hudson Valley     | (28)       | (159)      | (175)      | (205)      | (169)      | (250)      | (362)      | 42         | (176)      | (354)        |
| Millwood          | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | 0          | (0)        | 0            |
| Dunwoodie         | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0            |
| NY City           | (91)       | (206)      | (165)      | (173)      | (207)      | (186)      | (61)       | (383)      | (336)      | 12           |
| Long Island       | (13)       | 42         | 27         | 2          | (19)       | (19)       | (5)        | (16)       | (61)       | (63)         |
| <b>NYCA Total</b> | <b>228</b> | <b>355</b> | <b>389</b> | <b>549</b> | <b>850</b> | <b>881</b> | <b>935</b> | <b>956</b> | <b>836</b> | <b>1,041</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Net Imports (GWh) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028           |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|
| PJM - NYISO       | (71)         | (124)        | (148)        | (234)        | (329)        | (418)        | (442)        | (405)        | (316)        | (556)          |
| LINDEN VFT        | (7)          | 39           | 20           | 16           | (12)         | 9            | (21)         | 0            | (28)         | (3)            |
| NEPTUNE           | 15           | (0)          | (24)         | 12           | (8)          | (30)         | (67)         | (22)         | (23)         | (17)           |
| HTP               | 9            | 9            | 34           | (3)          | (8)          | 19           | (15)         | (14)         | 3            | 16             |
| ISONE - NYISO     | (94)         | (84)         | (157)        | (161)        | (266)        | (266)        | (150)        | (219)        | (196)        | (196)          |
| CROSS SOUND CABLE | 5            | (8)          | (19)         | (2)          | (39)         | 11           | (12)         | (22)         | (5)          | 9              |
| NORTHPORT NORWALK | 6            | 7            | 6            | (8)          | (5)          | (4)          | (2)          | (3)          | 2            | (4)            |
| IESO - NYISO      | (85)         | (184)        | (101)        | (164)        | (183)        | (197)        | (222)        | (268)        | (272)        | (284)          |
| HQ - NYISO CHAT   | (0)          | (0)          | 0            | (0)          | 0            | (0)          | (0)          | 0            | 0            | 0              |
| HQ - NYISO CEDARS | (1)          | 0            | (0)          | 0            | 0            | (0)          | 0            | 0            | 0            | 0              |
| <b>TOTAL</b>      | <b>(223)</b> | <b>(346)</b> | <b>(388)</b> | <b>(545)</b> | <b>(850)</b> | <b>(876)</b> | <b>(930)</b> | <b>(952)</b> | <b>(834)</b> | <b>(1,036)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Generator Payment (\$M) | 2019      | 2020      | 2021     | 2022      | 2023      | 2024      | 2025      | 2026      | 2027      | 2028      |
|-------------------------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| West                    | (4)       | (7)       | (9)      | (9)       | (12)      | (10)      | (12)      | (18)      | (19)      | (16)      |
| Genesee                 | (1)       | (2)       | (3)      | (2)       | (3)       | (4)       | (3)       | (4)       | (4)       | (4)       |
| Central                 | 34        | 52        | 46       | 67        | 82        | 85        | 102       | 114       | 138       | 144       |
| North                   | (1)       | (3)       | (3)      | (3)       | (5)       | (6)       | (4)       | (6)       | (7)       | (6)       |
| Mohawk Valley           | (1)       | (2)       | (2)      | (2)       | (2)       | (3)       | (3)       | (4)       | (4)       | (4)       |
| Capital                 | (4)       | (4)       | (3)      | (5)       | (11)      | (11)      | (15)      | (13)      | (16)      | (19)      |
| Hudson Valley           | (2)       | (6)       | (9)      | (10)      | (9)       | (12)      | (20)      | 1         | (10)      | (19)      |
| Millwood                | (1)       | 1         | (0)      | 0         | (1)       | (0)       | 0         | 0         | 1         | (0)       |
| Dunwoodie               | (0)       | 0         | (0)      | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       | (0)       |
| NY City                 | (4)       | (9)       | (12)     | (10)      | (8)       | (11)      | (5)       | (26)      | (22)      | 5         |
| Long Island             | (1)       | 3         | (2)      | 0         | (1)       | (1)       | (1)       | (1)       | (6)       | (4)       |
| <b>NYCA Total</b>       | <b>14</b> | <b>23</b> | <b>3</b> | <b>26</b> | <b>30</b> | <b>26</b> | <b>39</b> | <b>44</b> | <b>51</b> | <b>78</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Load Payment (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West               | 0           | (2)         | (4)         | (5)         | (6)         | (8)         | (6)         | (7)         | (8)         | (7)         |
| Genesee            | (2)         | (4)         | (5)         | (4)         | (5)         | (6)         | (5)         | (6)         | (6)         | (6)         |
| Central            | (4)         | (9)         | (10)        | (9)         | (11)        | (13)        | (11)        | (16)        | (16)        | (14)        |
| North              | (0)         | (2)         | (2)         | (2)         | (3)         | (3)         | (2)         | (4)         | (4)         | (3)         |
| Mohawk Valley      | (1)         | (3)         | (4)         | (3)         | (4)         | (5)         | (4)         | (6)         | (6)         | (5)         |
| Capital            | (1)         | 1           | (3)         | (2)         | (4)         | (3)         | (3)         | (4)         | (3)         | (2)         |
| Hudson Valley      | (1)         | (0)         | (2)         | (1)         | (2)         | (3)         | (2)         | (4)         | (2)         | (2)         |
| Millwood           | (0)         | 0           | (1)         | (0)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         |
| Dunwoodie          | (0)         | 0           | (1)         | (0)         | (1)         | (2)         | (1)         | (2)         | (2)         | (1)         |
| NY City            | (5)         | 1           | (7)         | (2)         | (7)         | (10)        | (11)        | (12)        | (12)        | (8)         |
| Long Island        | (0)         | 1           | (5)         | (0)         | (7)         | (1)         | (2)         | (4)         | (4)         | (1)         |
| <b>NYCA Total</b>  | <b>(16)</b> | <b>(17)</b> | <b>(41)</b> | <b>(28)</b> | <b>(50)</b> | <b>(54)</b> | <b>(47)</b> | <b>(65)</b> | <b>(64)</b> | <b>(49)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | (0.02)        | (0.14)        | (0.22)        | (0.26)        | (0.37)        | (0.48)        | (0.35)        | (0.45)        | (0.50)        | (0.42)        |
| Genesee               | (0.18)        | (0.34)        | (0.38)        | (0.31)        | (0.44)        | (0.57)        | (0.43)        | (0.57)        | (0.61)        | (0.52)        |
| Central               | (0.24)        | (0.47)        | (0.51)        | (0.48)        | (0.65)        | (0.79)        | (0.64)        | (0.93)        | (0.97)        | (0.83)        |
| North                 | (0.10)        | (0.30)        | (0.31)        | (0.30)        | (0.47)        | (0.61)        | (0.42)        | (0.68)        | (0.68)        | (0.55)        |
| Mohawk Valley         | (0.18)        | (0.41)        | (0.45)        | (0.40)        | (0.56)        | (0.68)        | (0.53)        | (0.81)        | (0.80)        | (0.66)        |
| Capital               | (0.07)        | 0.10          | (0.18)        | (0.13)        | (0.27)        | (0.21)        | (0.19)        | (0.28)        | (0.26)        | (0.11)        |
| Hudson Valley         | (0.05)        | 0.02          | (0.14)        | (0.06)        | (0.21)        | (0.26)        | (0.20)        | (0.34)        | (0.25)        | (0.17)        |
| Millwood              | (0.05)        | 0.03          | (0.15)        | (0.07)        | (0.20)        | (0.26)        | (0.21)        | (0.33)        | (0.28)        | (0.19)        |
| Dunwoodie             | (0.04)        | 0.04          | (0.13)        | (0.05)        | (0.19)        | (0.27)        | (0.21)        | (0.33)        | (0.29)        | (0.19)        |
| NY City               | (0.07)        | 0.03          | (0.08)        | (0.03)        | (0.15)        | (0.22)        | (0.19)        | (0.23)        | (0.23)        | (0.14)        |
| Long Island           | 0.01          | 0.07          | (0.17)        | 0.01          | (0.38)        | (0.06)        | (0.09)        | (0.21)        | (0.21)        | (0.04)        |
| <b>Average</b>        | <b>(0.09)</b> | <b>(0.12)</b> | <b>(0.25)</b> | <b>(0.19)</b> | <b>(0.35)</b> | <b>(0.40)</b> | <b>(0.32)</b> | <b>(0.47)</b> | <b>(0.46)</b> | <b>(0.35)</b> |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Generation Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions (Tons) | 2019      | 2020      | 2021      | 2022      | 2023      | 2024       | 2025        | 2026         | 2027         | 2028         |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|------------|-------------|--------------|--------------|--------------|
| West                             | (0)       | (0)       | 1         | (0)       | (79)      | 46         | (122)       | (357)        | (291)        | (227)        |
| Genesee                          | (0)       | (0)       | (0)       | (0)       | (0)       | (0)        | (0)         | (0)          | (0)          | (0)          |
| Central                          | 26        | 45        | 43        | 58        | 90        | 85         | 99          | 92           | 98           | 108          |
| North                            | (0)       | (0)       | (0)       | (0)       | (0)       | (0)        | (0)         | (0)          | (0)          | (0)          |
| Mohawk Valley                    | (0)       | (0)       | (0)       | (0)       | (0)       | (0)        | (0)         | (0)          | (0)          | (0)          |
| Capital                          | (0)       | (0)       | (0)       | (0)       | (0)       | (0)        | (1)         | (0)          | (1)          | (1)          |
| Hudson Valley                    | (0)       | (0)       | (1)       | (0)       | 0         | (1)        | (1)         | 0            | (0)          | (1)          |
| Millwood                         | 0         | (0)       | (0)       | (0)       | 0         | (0)        | (0)         | (0)          | (0)          | 0            |
| Dunwoodie                        | 0         | 0         | 0         | 0         | 0         | 0          | 0           | 0            | 0            | 0            |
| NY City                          | (0)       | (1)       | (1)       | (1)       | (1)       | (0)        | (0)         | (1)          | (1)          | (0)          |
| Long Island                      | (0)       | 0         | (0)       | (0)       | (0)       | (0)        | (0)         | (0)          | (0)          | (0)          |
| <b>NYCA Total</b>                | <b>25</b> | <b>43</b> | <b>42</b> | <b>56</b> | <b>10</b> | <b>129</b> | <b>(24)</b> | <b>(267)</b> | <b>(195)</b> | <b>(121)</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019     | 2020     | 2021     | 2022     | 2023     | 2024     | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|----------|----------|----------|----------|----------|----------|------------|------------|------------|------------|
| West                                  | (0)      | (0)      | (0)      | (0)      | (0)      | 0        | (0)        | (0)        | (0)        | (0)        |
| Genesee                               | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)        | (0)        | (0)        | (0)        |
| Central                               | 0        | 0        | 0        | 0        | 0        | 0        | 0          | 0          | 0          | 0          |
| North                                 | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)        | (0)        | (0)        | (0)        |
| Mohawk Valley                         | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)        | (0)        | (0)        | (0)        |
| Capital                               | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)        | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)      | (0)      | (0)      | (0)      | 0        | (0)      | (0)        | 0          | (0)        | (0)        |
| Millwood                              | 0        | 0        | 0        | 0        | 0        | 0        | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0        | 0        | 0        | 0        | 0        | 0        | 0          | 0          | 0          | 0          |
| NY City                               | (0)      | (0)      | (0)      | (0)      | (0)      | (0)      | (0)        | (0)        | (0)        | 0          |
| Long Island                           | (0)      | 0        | (0)      | 0        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>                     | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Generation Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions (Tons) | 2019      | 2020       | 2021        | 2022      | 2023      | 2024      | 2025       | 2026      | 2027      | 2028       |
|----------------------------------|-----------|------------|-------------|-----------|-----------|-----------|------------|-----------|-----------|------------|
| West                             | (7)       | (22)       | (28)        | (32)      | (60)      | (2)       | (43)       | (64)      | (50)      | (65)       |
| Genesee                          | (2)       | (2)        | (1)         | (1)       | (2)       | (1)       | (1)        | (1)       | (1)       | (2)        |
| Central                          | 73        | 134        | 126         | 180       | 270       | 259       | 299        | 281       | 302       | 329        |
| North                            | (1)       | (5)        | (2)         | 0         | (1)       | (6)       | (5)        | (2)       | 0         | (1)        |
| Mohawk Valley                    | (0)       | (1)        | (0)         | (1)       | (1)       | (3)       | (1)        | (2)       | (2)       | (2)        |
| Capital                          | 20        | (17)       | (12)        | (22)      | 17        | (20)      | (26)       | (37)      | (28)      | (37)       |
| Hudson Valley                    | (1)       | (64)       | (80)        | (67)      | (77)      | (60)      | (60)       | (12)      | (61)      | (59)       |
| Millwood                         | 0         | (0)        | (1)         | (1)       | 0         | (2)       | (1)        | 0         | (2)       | 1          |
| Dunwoodie                        | 0         | 0          | 0           | 0         | 0         | 0         | 0          | 0         | 0         | 0          |
| NY City                          | (15)      | (66)       | (47)        | (24)      | (115)     | (57)      | 25         | (88)      | (71)      | (19)       |
| Long Island                      | (1)       | 33         | 2           | 5         | (15)      | (11)      | 6          | (8)       | (18)      | (12)       |
| <b>NYCA Total</b>                | <b>67</b> | <b>(9)</b> | <b>(43)</b> | <b>37</b> | <b>17</b> | <b>97</b> | <b>193</b> | <b>68</b> | <b>70</b> | <b>133</b> |

**PROJECTED NO<sub>x</sub> EMISSION COSTS (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021     | 2022       | 2023       | 2024     | 2025     | 2026     | 2027       | 2028       |
|---------------------------------------|------------|------------|----------|------------|------------|----------|----------|----------|------------|------------|
| West                                  | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Genesee                               | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Central                               | 0          | 0          | 0        | 0          | 0          | 0        | 0        | 0        | 0          | 0          |
| North                                 | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Mohawk Valley                         | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Capital                               | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)      | (0)        | (0)        | (0)      | (0)      | (0)      | (0)        | (0)        |
| Millwood                              | 0          | 0          | 0        | 0          | 0          | 0        | 0        | 0        | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0        | 0          | 0          | 0        | 0        | 0        | 0          | 0          |
| NY City                               | (0)        | (0)        | 0        | 0          | (0)        | (0)      | 0        | (0)      | (0)        | (0)        |
| Long Island                           | (0)        | (0)        | 0        | 0          | (0)        | (0)      | 0        | 0        | (0)        | (0)        |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Generation Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019      | 2020      | 2021      | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (7)       | (25)      | (30)      | (39)       | (80)       | (11)       | (83)       | (161)      | (150)      | (125)      |
| Genesee                               | (2)       | (5)       | (5)       | (5)        | (8)        | (5)        | (3)        | (5)        | (3)        | (7)        |
| Central                               | 160       | 367       | 331       | 473        | 606        | 638        | 677        | 683        | 750        | 773        |
| North                                 | (5)       | (3)       | (5)       | (3)        | (3)        | (8)        | (5)        | (2)        | (6)        | (3)        |
| Mohawk Valley                         | (3)       | (1)       | (2)       | (1)        | (1)        | (6)        | (4)        | (3)        | (2)        | (4)        |
| Capital                               | (24)      | (88)      | (36)      | (85)       | (77)       | (97)       | (107)      | (99)       | (132)      | (156)      |
| Hudson Valley                         | (14)      | (93)      | (109)     | (116)      | (101)      | (124)      | (171)      | 12         | (98)       | (166)      |
| Millwood                              | 0         | 0         | 0         | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0         | 0         | 0         | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (39)      | (118)     | (104)     | (103)      | (113)      | (97)       | (2)        | (215)      | (183)      | (4)        |
| Long Island                           | (8)       | 37        | 15        | 2          | (13)       | (11)       | (3)        | (9)        | (34)       | (33)       |
| <b>NYCA Total</b>                     | <b>58</b> | <b>74</b> | <b>56</b> | <b>124</b> | <b>211</b> | <b>278</b> | <b>300</b> | <b>201</b> | <b>141</b> | <b>276</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0.0)      | (0.2)      | (0.2)      | (0.3)      | (0.6)      | (0.1)      | (0.7)      | (1.4)      | (1.4)      | (1.3)      |
| Genesee                               | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.1)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.1)      |
| Central                               | 0.8        | 2.1        | 2.1        | 3.3        | 4.5        | 5.0        | 5.6        | 6.1        | 7.1        | 7.8        |
| North                                 | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.1)      | (0.0)      | (0.0)      | (0.1)      | (0.0)      |
| Mohawk Valley                         | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      | (0.1)      | (0.0)      | (0.0)      | (0.0)      | (0.0)      |
| Capital                               | (0.1)      | (0.5)      | (0.2)      | (0.6)      | (0.5)      | (0.7)      | (0.9)      | (0.9)      | (1.2)      | (1.6)      |
| Hudson Valley                         | (0.1)      | (0.5)      | (0.7)      | (0.8)      | (0.8)      | (1.0)      | (1.5)      | 0.1        | (1.0)      | (1.8)      |
| Millwood                              | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| Dunwoodie                             | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        |
| NY City                               | (0.1)      | (0.7)      | (0.6)      | (0.7)      | (0.8)      | (0.7)      | 0.1        | (1.9)      | (1.7)      | 0.0        |
| Long Island                           | (0.1)      | 0.2        | 0.1        | (0.0)      | (0.0)      | (0.1)      | (0.1)      | (0.1)      | (0.3)      | (0.3)      |
| <b>NYCA Total</b>                     | <b>0.4</b> | <b>0.4</b> | <b>0.4</b> | <b>0.9</b> | <b>1.6</b> | <b>2.2</b> | <b>2.5</b> | <b>1.9</b> | <b>1.3</b> | <b>2.8</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Generation Solution (Study 3: Volney - Scriba)**

| Loss Costs (\$M)  | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025        | 2026        | 2027        | 2028        |
|-------------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|
| West              | 0.3        | 0.9        | 0.9        | 0.8        | 1.4        | 1.6        | 1.7         | 2.3         | 2.2         | 2.0         |
| Genesee           | 0.0        | 0.1        | 0.2        | 0.1        | 0.3        | 0.3        | 0.4         | 0.7         | 0.6         | 0.4         |
| Central           | (0.1)      | (0.1)      | (0.2)      | (0.2)      | (0.1)      | (0.2)      | (0.2)       | (0.2)       | (0.2)       | (0.2)       |
| North             | 0.1        | 0.2        | 0.2        | 0.2        | 0.2        | 0.3        | 0.3         | 0.4         | 0.4         | 0.3         |
| Mohawk Valley     | (0.0)      | (0.0)      | (0.0)      | 0.0        | 0.0        | (0.0)      | 0.0         | (0.0)       | (0.0)       | 0.0         |
| Capital           | 0.1        | 0.2        | 0.1        | 0.5        | 0.6        | 0.4        | 0.6         | 0.5         | 0.6         | 0.9         |
| Hudson Valley     | 0.2        | 0.3        | 0.2        | 0.5        | 0.7        | 0.6        | 0.8         | 0.6         | 0.9         | 0.9         |
| Millwood          | 0.0        | 0.1        | 0.1        | 0.1        | 0.2        | 0.2        | 0.2         | 0.2         | 0.2         | 0.3         |
| Dunwoodie         | 0.1        | 0.2        | 0.1        | 0.3        | 0.4        | 0.4        | 0.5         | 0.5         | 0.6         | 0.6         |
| NY City           | 1.0        | 1.3        | 0.9        | 2.7        | 3.8        | 3.4        | 4.2         | 4.3         | 5.5         | 5.3         |
| Long Island       | 0.5        | 0.5        | 0.4        | 1.1        | 1.4        | 1.3        | 1.7         | 1.5         | 2.0         | 2.1         |
| <b>NYCA Total</b> | <b>2.3</b> | <b>3.4</b> | <b>3.0</b> | <b>6.2</b> | <b>8.8</b> | <b>8.2</b> | <b>10.1</b> | <b>10.8</b> | <b>12.7</b> | <b>12.6</b> |

### Generic Demand Response Solution (Study 3: Volney – Scriba)

PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)

| Demand Congestion (\$M) | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| West                    | 0.6   | 0.4   | (0.6) | (0.0) | 0.0   | 0.2   | (0.1) | 0.0   | (0.0) | (0.2) |
| Genesee                 | (0.0) | (0.0) | 0.1   | (0.0) | 0.0   | 0.1   | (0.0) | (0.0) | (0.0) | (0.1) |
| Central                 | 0.1   | (0.0) | (0.1) | (0.0) | 0.1   | (0.1) | 0.0   | (0.0) | (0.0) | 0.0   |
| North                   | 0.0   | (0.0) | (0.0) | (0.0) | 0.0   | 0.0   | (0.1) | 0.0   | (0.0) | (0.0) |
| Mohawk Valley           | 0.1   | (0.0) | (0.0) | (0.0) | 0.0   | (0.0) | (0.0) | (0.0) | (0.0) | 0.0   |
| Capital                 | (0.1) | 0.0   | 0.1   | 0.0   | 0.2   | (0.4) | 0.3   | 0.0   | 0.1   | 0.2   |
| Hudson Valley           | (0.2) | (0.2) | (0.2) | (0.2) | (0.0) | (0.2) | (0.1) | (0.2) | (0.1) | (0.3) |
| Millwood                | (0.0) | (0.0) | (0.0) | (0.0) | 0.0   | (0.1) | 0.0   | (0.0) | 0.0   | (0.0) |
| Dunwoodie               | (0.1) | (0.0) | (0.0) | (0.0) | 0.0   | (0.1) | 0.0   | (0.1) | 0.0   | (0.0) |
| NY City                 | (0.4) | (0.1) | (0.4) | (0.2) | 0.3   | (0.8) | 0.5   | (0.5) | 0.2   | 0.1   |
| Long Island             | 0.1   | 0.2   | (0.3) | 0.1   | 0.3   | (0.3) | 0.4   | (0.2) | 0.2   | 0.3   |
| NYCA Total              | 0.1   | 0.3   | (1.7) | (0.4) | 0.9   | (1.7) | 1.1   | (1.1) | 0.4   | (0.0) |

PROJECTED PRODUCTION COST (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)

| Production Cost (\$M)    | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|
| West                     | (0)  | 0    | 0    | 0    | 1    | (0)  | 0    | (1)  | 0    | (1)  |
| Genesee                  | (0)  | 0    | (0)  | 0    | 0    | 0    | 0    | (0)  | 0    | (0)  |
| Central                  | (0)  | 0    | (0)  | 0    | (0)  | (0)  | 0    | (0)  | 0    | (0)  |
| North                    | (0)  | (0)  | 0    | (0)  | 0    | 0    | (0)  | 0    | (0)  | 0    |
| Mohawk Valley            | (0)  | 0    | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Capital                  | 0    | (0)  | (0)  | 0    | (0)  | 1    | (0)  | 0    | (0)  | (0)  |
| Hudson Valley            | 0    | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | 0    |
| Millwood                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                  | (0)  | (0)  | (1)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island              | (0)  | (0)  | 0    | 0    | (0)  | 0    | (0)  | (0)  | (0)  | (0)  |
| NYCA Total               | (0)  | (0)  | (1)  | (0)  | (0)  | (0)  | (1)  | (2)  | (1)  | (1)  |
| NYCA Imports             | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | (1)  | (0)  | (0)  | (0)  |
| NYCA Exports             | 0    | 0    | (0)  | 0    | 1    | 0    | (0)  | (0)  | 0    | 0    |
| NYCA + Imports - Exports | (1)  | (1)  | (1)  | (1)  | (1)  | (1)  | (1)  | (2)  | (1)  | (2)  |

PROJECTED NYCA GENERATION (GWh) | Generic Demand Response Solution (Study 3: Volney - Scriba)

| Generation (GWh) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|------------------|------|------|------|------|------|------|------|------|------|------|
| West             | (1)  | 1    | 0    | (0)  | 18   | (6)  | 0    | (16) | (1)  | (13) |
| Genesee          | (0)  | (0)  | (0)  | 0    | 0    | (0)  | 0    | (0)  | 0    | (0)  |
| Central          | (6)  | 0    | (1)  | (0)  | (5)  | (1)  | 5    | (0)  | 1    | (1)  |
| North            | (0)  | (0)  | 1    | (1)  | 1    | 0    | (2)  | 1    | (1)  | 0    |
| Mohawk Valley    | (0)  | 0    | (0)  | (0)  | (1)  | 0    | (1)  | (0)  | (0)  | (0)  |
| Capital          | 7    | (2)  | (2)  | 1    | (9)  | 11   | (2)  | (1)  | (3)  | (1)  |
| Hudson Valley    | 1    | (3)  | (4)  | (6)  | (0)  | (4)  | (2)  | (3)  | 2    | 5    |
| Millwood         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City          | (12) | (7)  | (14) | (1)  | (2)  | (8)  | (1)  | (2)  | (3)  | (6)  |
| Long Island      | (1)  | (0)  | 3    | 0    | (1)  | 1    | (4)  | 0    | (2)  | (1)  |
| NYCA Total       | (12) | (11) | (16) | (7)  | 1    | (6)  | (5)  | (22) | (7)  | (17) |

**PROJECTED NET IMPORTS (GWh) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| Net Imports (GWh) | 2019       | 2020       | 2021       | 2022        | 2023        | 2024        | 2025        | 2026     | 2027        | 2028       |
|-------------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------|-------------|------------|
| PJM - NYISO       | (4)        | (3)        | 7          | (6)         | (9)         | (6)         | (2)         | (3)      | (7)         | (1)        |
| LINDEN VFT        | (2)        | 0          | 2          | (1)         | (1)         | 0           | (2)         | 1        | (2)         | 1          |
| NEPTUNE           | 1          | 1          | 0          | (2)         | (3)         | (0)         | 0           | (4)      | (2)         | 2          |
| HTP               | (0)        | 0          | 0          | (0)         | 3           | 0           | (5)         | 0        | 0           | 1          |
| ISONE - NYISO     | 2          | (4)        | (5)        | (1)         | (2)         | (8)         | 1           | 6        | (4)         | (8)        |
| CROSS SOUND CABLE | (1)        | (0)        | (2)        | 0           | 0           | 0           | (1)         | 1        | 0           | 0          |
| NORTHPORT NORWALK | (0)        | 1          | (2)        | (1)         | (1)         | (1)         | (1)         | 1        | 0           | (1)        |
| IESO - NYISO      | (4)        | (3)        | (5)        | (2)         | (7)         | 0           | (6)         | (1)      | 2           | 4          |
| HQ - NYISO CHAT   | (0)        | 0          | 0          | 0           | 0           | 0           | (0)         | 0        | 0           | 0          |
| HQ - NYISO CEDARS | 0          | 0          | 0          | 0           | 0           | 0           | 0           | 0        | 0           | (0)        |
| <b>TOTAL</b>      | <b>(7)</b> | <b>(9)</b> | <b>(4)</b> | <b>(13)</b> | <b>(21)</b> | <b>(14)</b> | <b>(15)</b> | <b>2</b> | <b>(13)</b> | <b>(3)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| Generator Payment (\$M) | 2019       | 2020       | 2021       | 2022       | 2023     | 2024     | 2025       | 2026       | 2027       | 2028       |
|-------------------------|------------|------------|------------|------------|----------|----------|------------|------------|------------|------------|
| West                    | (0)        | (0)        | (0)        | (0)        | 1        | (0)      | (0)        | (1)        | (0)        | (1)        |
| Genesee                 | (0)        | (0)        | (0)        | (0)        | (0)      | 0        | (0)        | 0          | (0)        | (0)        |
| Central                 | (0)        | 0          | (0)        | (1)        | (1)      | 1        | (1)        | 0          | (0)        | (0)        |
| North                   | (0)        | (0)        | (0)        | (0)        | (0)      | 0        | (0)        | 0          | (0)        | (0)        |
| Mohawk Valley           | (0)        | (0)        | (0)        | (0)        | (0)      | 0        | (0)        | (0)        | (0)        | (0)        |
| Capital                 | (0)        | (0)        | (1)        | (1)        | (0)      | 0        | (0)        | 0          | (0)        | 0          |
| Hudson Valley           | (0)        | (0)        | (1)        | (1)        | 0        | (0)      | (0)        | (0)        | (0)        | 0          |
| Millwood                | (0)        | (0)        | (0)        | (0)        | 0        | (0)      | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie               | (0)        | (0)        | (0)        | (0)        | 0        | (0)      | (0)        | (0)        | (0)        | (0)        |
| NY City                 | (1)        | (1)        | (3)        | (2)        | 0        | (1)      | (1)        | (0)        | (1)        | (1)        |
| Long Island             | (0)        | (0)        | (1)        | (0)        | 0        | 0        | (0)        | (0)        | (0)        | (0)        |
| <b>NYCA Total</b>       | <b>(2)</b> | <b>(3)</b> | <b>(8)</b> | <b>(5)</b> | <b>1</b> | <b>0</b> | <b>(4)</b> | <b>(1)</b> | <b>(2)</b> | <b>(2)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| Load Payment (\$M) | 2019       | 2020       | 2021        | 2022       | 2023     | 2024       | 2025       | 2026       | 2027       | 2028       |
|--------------------|------------|------------|-------------|------------|----------|------------|------------|------------|------------|------------|
| West               | 1          | 0          | (1)         | (0)        | (0)      | (0)        | (0)        | 0          | (0)        | 0          |
| Genesee            | (0)        | (0)        | (0)         | (0)        | 0        | 0          | (0)        | 0          | (0)        | 0          |
| Central            | 0          | (0)        | (1)         | (0)        | 0        | 0          | (0)        | 0          | (0)        | (0)        |
| North              | (0)        | (0)        | (0)         | (0)        | (0)      | 0          | (0)        | 0          | (0)        | (0)        |
| Mohawk Valley      | 0          | (0)        | (0)         | (0)        | (0)      | 0          | (0)        | 0          | (0)        | (0)        |
| Capital            | (1)        | (1)        | (1)         | (1)        | (0)      | (1)        | (1)        | (1)        | (1)        | (1)        |
| Hudson Valley      | (1)        | (1)        | (1)         | (1)        | (0)      | (1)        | (1)        | (1)        | (1)        | (1)        |
| Millwood           | (0)        | (0)        | (0)         | (0)        | 0        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Dunwoodie          | (0)        | (0)        | (0)         | (0)        | 0        | (0)        | (0)        | (0)        | (0)        | (0)        |
| NY City            | (1)        | (1)        | (4)         | (2)        | 0        | (0)        | (1)        | (0)        | (1)        | (1)        |
| Long Island        | (0)        | (0)        | (2)         | (1)        | 0        | (0)        | (0)        | (0)        | (0)        | 0          |
| <b>NYCA Total</b>  | <b>(2)</b> | <b>(4)</b> | <b>(11)</b> | <b>(7)</b> | <b>0</b> | <b>(1)</b> | <b>(5)</b> | <b>(2)</b> | <b>(4)</b> | <b>(3)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| Average LBMP (\$/MWh) | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| West                  | 0.03   | 0.01   | (0.06) | (0.02) | (0.01) | 0.00   | (0.02) | 0.01   | (0.01) | 0.00   |
| Genesee               | (0.01) | (0.01) | (0.02) | (0.02) | (0.01) | 0.01   | (0.02) | 0.01   | (0.01) | (0.00) |
| Central               | 0.00   | (0.02) | (0.04) | (0.02) | (0.01) | 0.01   | (0.03) | 0.00   | (0.01) | (0.01) |
| North                 | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | 0.01   | (0.02) | 0.00   | (0.01) | (0.01) |
| Mohawk Valley         | 0.00   | (0.01) | (0.03) | (0.02) | (0.01) | 0.01   | (0.03) | 0.00   | (0.01) | (0.01) |
| Capital               | (0.01) | (0.01) | (0.03) | (0.02) | 0.01   | (0.01) | (0.01) | (0.00) | (0.01) | 0.00   |
| Hudson Valley         | (0.02) | (0.02) | (0.03) | (0.02) | 0.00   | (0.01) | (0.03) | (0.01) | (0.02) | (0.02) |
| Millwood              | (0.01) | (0.01) | (0.03) | (0.02) | 0.00   | (0.00) | (0.02) | (0.01) | (0.01) | (0.01) |
| Dunwoodie             | (0.01) | (0.01) | (0.03) | (0.02) | 0.00   | (0.00) | (0.02) | (0.00) | (0.01) | (0.01) |
| NY City               | (0.01) | (0.01) | (0.03) | (0.02) | 0.00   | (0.00) | (0.02) | (0.01) | (0.01) | (0.01) |
| Long Island           | (0.00) | (0.01) | (0.04) | (0.02) | 0.01   | (0.00) | (0.01) | (0.01) | (0.01) | (0.00) |
| Average               | (0.00) | (0.01) | (0.03) | (0.02) | (0.00) | 0.00   | (0.02) | (0.00) | (0.01) | (0.01) |

**PROJECTED SO2 EMISSIONS (Tons) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions (Tons) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                             | 0    | 0    | 0    | 0    | 50   | (8)  | 0    | (46) | (2)  | (43) |
| Genesee                          | (0)  | 0    | (0)  | 0    | 0    | 0    | 0    | (0)  | 0    | (0)  |
| Central                          | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | 0    | (0)  |
| North                            | (0)  | (0)  | 0    | (0)  | 0    | 0    | (0)  | 0    | (0)  | 0    |
| Mohawk Valley                    | (0)  | 0    | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  |
| Capital                          | 0    | (0)  | (0)  | 0    | (0)  | 0    | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                    | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | 0    | (0)  | 0    | 0    |
| Millwood                         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                          | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  | (0)  |
| Long Island                      | (0)  | 0    | (1)  | 0    | 0    | 0    | (0)  | 0    | (0)  | (0)  |
| NYCA Total                       | (0)  | (0)  | (2)  | (0)  | 50   | (8)  | 0    | (46) | (2)  | (43) |

**PROJECTED SO2 EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|
| West                                  | (0)  | 0    | 0    | 0    | 0    | (0)  | 0    | (0)  | (0)  | (0)  |
| Genesee                               | (0)  | 0    | (0)  | 0    | 0    | 0    | 0    | (0)  | 0    | (0)  |
| Central                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | 0    | (0)  |
| North                                 | (0)  | (0)  | 0    | (0)  | 0    | 0    | (0)  | 0    | (0)  | 0    |
| Mohawk Valley                         | (0)  | 0    | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  | (0)  |
| Capital                               | 0    | (0)  | (0)  | 0    | (0)  | 0    | (0)  | (0)  | (0)  | (0)  |
| Hudson Valley                         | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | 0    | (0)  | 0    | 0    |
| Millwood                              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Dunwoodie                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NY City                               | (0)  | (0)  | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | (0)  | (0)  |
| Long Island                           | (0)  | (0)  | (0)  | 0    | 0    | 0    | (0)  | 0    | (0)  | (0)  |
| NYCA Total                            | (0)  | (0)  | (0)  | (0)  | 0    | (0)  | 0    | (0)  | (0)  | (0)  |

**PROJECTED NOX EMISSIONS (Tons) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions (Tons) | 2019       | 2020       | 2021        | 2022       | 2023     | 2024       | 2025       | 2026        | 2027       | 2028       |
|----------------------------------|------------|------------|-------------|------------|----------|------------|------------|-------------|------------|------------|
| West                             | (0)        | 0          | 1           | 0          | 6        | (5)        | (0)        | (10)        | 2          | (4)        |
| Genesee                          | 0          | 0          | 0           | (0)        | 0        | 0          | 0          | (0)         | 0          | (0)        |
| Central                          | (0)        | (0)        | (0)         | 0          | (1)      | (0)        | 0          | (0)         | (0)        | 0          |
| North                            | (0)        | (0)        | 0           | (0)        | 0        | (0)        | (0)        | 0           | 0          | 0          |
| Mohawk Valley                    | (0)        | 0          | (0)         | (0)        | (0)      | (0)        | (0)        | (0)         | (0)        | 0          |
| Capital                          | (0)        | 0          | (0)         | 0          | (1)      | (1)        | (0)        | (0)         | (0)        | (0)        |
| Hudson Valley                    | (1)        | (2)        | (3)         | (4)        | 1        | 0          | 0          | (0)         | (2)        | (0)        |
| Millwood                         | 0          | 0          | 0           | 0          | 0        | 0          | 0          | 0           | 0          | 0          |
| Dunwoodie                        | 0          | 0          | 0           | 0          | 0        | 0          | 0          | 0           | 0          | 0          |
| NY City                          | (3)        | (4)        | (11)        | (3)        | (3)      | (4)        | (7)        | (1)         | (3)        | (1)        |
| Long Island                      | 0          | (1)        | 1           | 0          | (1)      | 1          | (1)        | 0           | (1)        | 0          |
| <b>NYCA Total</b>                | <b>(3)</b> | <b>(7)</b> | <b>(12)</b> | <b>(7)</b> | <b>2</b> | <b>(9)</b> | <b>(8)</b> | <b>(12)</b> | <b>(4)</b> | <b>(4)</b> |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028       |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| West                                  | (0)        | (0)        | 0          | 0          | (0)        | (0)        | (0)        | (0)        | 0          | (0)        |
| Genesee                               | (0)        | 0          | (0)        | 0          | (0)        | 0          | 0          | (0)        | 0          | (0)        |
| Central                               | (0)        | (0)        | (0)        | 0          | (0)        | (0)        | (0)        | 0          | (0)        | (0)        |
| North                                 | 0          | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | 0          | (0)        | 0          |
| Mohawk Valley                         | (0)        | 0          | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | 0          |
| Capital                               | (0)        | 0          | (0)        | 0          | (0)        | 0          | 0          | (0)        | (0)        | (0)        |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | 0          | 0          | (0)        | (0)        | (0)        | 0          |
| Millwood                              | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        | (0)        |
| Long Island                           | 0          | (0)        | 0          | 0          | (0)        | 0          | (0)        | 0          | (0)        | 0          |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions (1000 Tons) | 2019       | 2020       | 2021        | 2022       | 2023      | 2024       | 2025       | 2026        | 2027       | 2028        |
|---------------------------------------|------------|------------|-------------|------------|-----------|------------|------------|-------------|------------|-------------|
| West                                  | (0)        | 1          | 1           | 0          | 19        | (4)        | 0          | (18)        | (0)        | (16)        |
| Genesee                               | (0)        | 0          | (0)         | 0          | 0         | 0          | 0          | (0)         | 0          | (0)         |
| Central                               | (3)        | (0)        | (0)         | (0)        | (2)       | (0)        | 2          | (0)         | 0          | (0)         |
| North                                 | (0)        | (0)        | 0           | (0)        | 0         | 0          | (1)        | 0           | (0)        | 0           |
| Mohawk Valley                         | (0)        | 0          | (0)         | (0)        | (0)       | 0          | (0)        | (0)         | (0)        | (0)         |
| Capital                               | 2          | (1)        | (1)         | 0          | (5)       | 3          | (1)        | (1)         | (2)        | (1)         |
| Hudson Valley                         | 0          | (2)        | (3)         | (4)        | 0         | (2)        | (1)        | (1)         | (1)        | 2           |
| Millwood                              | 0          | 0          | 0           | 0          | 0         | 0          | 0          | 0           | 0          | 0           |
| Dunwoodie                             | 0          | 0          | 0           | 0          | 0         | 0          | 0          | 0           | 0          | 0           |
| NY City                               | (6)        | (5)        | (9)         | (1)        | (1)       | (4)        | (1)        | (1)         | (2)        | (4)         |
| Long Island                           | (1)        | (0)        | 2           | 0          | (1)       | 1          | (3)        | 0           | (1)        | (1)         |
| <b>NYCA Total</b>                     | <b>(7)</b> | <b>(8)</b> | <b>(11)</b> | <b>(5)</b> | <b>10</b> | <b>(6)</b> | <b>(5)</b> | <b>(21)</b> | <b>(6)</b> | <b>(19)</b> |



**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| CO <sub>2</sub> Emissions Costs (\$M) | 2019         | 2020         | 2021         | 2022         | 2023       | 2024         | 2025         | 2026         | 2027         | 2028         |
|---------------------------------------|--------------|--------------|--------------|--------------|------------|--------------|--------------|--------------|--------------|--------------|
| West                                  | (0.0)        | 0.0          | 0.0          | 0.0          | 0.1        | (0.0)        | 0.0          | (0.2)        | (0.0)        | (0.2)        |
| Genesee                               | (0.0)        | 0.0          | (0.0)        | 0.0          | 0.0        | 0.0          | 0.0          | (0.0)        | 0.0          | (0.0)        |
| Central                               | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)      | (0.0)        | 0.0          | (0.0)        | 0.0          | (0.0)        |
| North                                 | (0.0)        | (0.0)        | 0.0          | (0.0)        | 0.0        | 0.0          | (0.0)        | 0.0          | (0.0)        | 0.0          |
| Mohawk Valley                         | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)      | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| Capital                               | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)      | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Hudson Valley                         | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)      | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          |
| Millwood                              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0        | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dunwoodie                             | 0.0          | 0.0          | 0.0          | 0.0          | 0.0        | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| NY City                               | (0.0)        | (0.0)        | (0.1)        | (0.0)        | (0.0)      | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        |
| Long Island                           | (0.0)        | (0.0)        | 0.0          | 0.0          | (0.0)      | 0.0          | (0.0)        | 0.0          | (0.0)        | (0.0)        |
| <b>NYCA Total</b>                     | <b>(0.0)</b> | <b>(0.0)</b> | <b>(0.1)</b> | <b>(0.0)</b> | <b>0.1</b> | <b>(0.0)</b> | <b>(0.0)</b> | <b>(0.2)</b> | <b>(0.1)</b> | <b>(0.2)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Demand Response Solution (Study 3: Volney - Scriba)**

| Loss Costs (\$M)  | 2019         | 2020         | 2021         | 2022         | 2023         | 2024       | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|------------|--------------|--------------|--------------|--------------|
| West              | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)      | 0.1          | 0.1          | 0.0          | 0.1          |
| Genesee           | 0.0          | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)      | 0.0          | 0.0          | 0.0          | 0.0          |
| Central           | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.0          | (0.0)      | 0.0          | 0.0          | 0.0          | 0.0          |
| North             | 0.0          | 0.0          | 0.0          | 0.0          | (0.0)        | (0.0)      | 0.0          | (0.0)        | 0.0          | 0.0          |
| Mohawk Valley     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | 0.0        | (0.0)        | 0.0          | (0.0)        | (0.0)        |
| Capital           | (0.0)        | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.0)      | (0.0)        | (0.0)        | (0.0)        | (0.1)        |
| Hudson Valley     | (0.0)        | (0.0)        | (0.1)        | (0.0)        | (0.0)        | (0.0)      | (0.0)        | (0.0)        | (0.0)        | (0.1)        |
| Millwood          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Dunwoodie         | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| NY City           | (0.0)        | (0.1)        | (0.2)        | (0.1)        | (0.0)        | 0.1        | (0.1)        | (0.0)        | (0.0)        | (0.1)        |
| Long Island       | 0.0          | (0.0)        | (0.1)        | (0.0)        | (0.0)        | 0.0        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| <b>NYCA Total</b> | <b>(0.1)</b> | <b>(0.2)</b> | <b>(0.4)</b> | <b>(0.2)</b> | <b>(0.1)</b> | <b>0.1</b> | <b>(0.1)</b> | <b>(0.0)</b> | <b>(0.1)</b> | <b>(0.1)</b> |

**Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

**PROJECTED DEMAND CONGESTION BY ZONE (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Demand Congestion (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024       | 2025     | 2026       | 2027       | 2028     |
|-------------------------|-------------|-------------|-------------|-------------|-------------|------------|----------|------------|------------|----------|
| West                    | 0           | (0)         | 1           | (0)         | (0)         | (0)        | (1)      | (0)        | (1)        | (1)      |
| Genesee                 | 0           | 0           | 0           | 0           | (0)         | (0)        | (0)      | (0)        | (0)        | (0)      |
| Central                 | (1)         | (1)         | (0)         | (0)         | (0)         | (0)        | (0)      | (0)        | (0)        | (0)      |
| North                   | 0           | 0           | 0           | 0           | 0           | 0          | (0)      | 0          | 0          | (0)      |
| Mohawk Valley           | (0)         | (0)         | (0)         | (0)         | (0)         | (0)        | (0)      | (0)        | (0)        | (0)      |
| Capital                 | (11)        | (9)         | (7)         | (8)         | (3)         | (3)        | (1)      | (2)        | (2)        | (2)      |
| Hudson Valley           | (7)         | (6)         | (6)         | (6)         | (3)         | (3)        | (1)      | (2)        | (2)        | (2)      |
| Millwood                | (1)         | (0)         | (0)         | (1)         | (0)         | (0)        | (0)      | (0)        | (0)        | (0)      |
| Dunwoodie               | (1)         | (1)         | (0)         | (1)         | (1)         | (1)        | (0)      | (1)        | (0)        | (0)      |
| NY City                 | (8)         | (6)         | (1)         | (9)         | (3)         | (2)        | 1        | (3)        | (1)        | 3        |
| Long Island             | (1)         | (1)         | 2           | (2)         | 1           | 1          | 3        | 0          | 2          | 3        |
| <b>NYCA Total</b>       | <b>(29)</b> | <b>(25)</b> | <b>(11)</b> | <b>(28)</b> | <b>(10)</b> | <b>(8)</b> | <b>0</b> | <b>(9)</b> | <b>(5)</b> | <b>1</b> |

**PROJECTED PRODUCTION COST (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Production Cost (\$M)           | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                            | (0)         | (1)         | (0)         | (1)         | (0)         | 0           | (1)         | (3)         | (3)         | 1           |
| Genesee                         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         |
| Central                         | (4)         | (2)         | (4)         | (3)         | (4)         | (5)         | (7)         | (3)         | (5)         | (5)         |
| North                           | 0           | 0           | 0           | (0)         | 0           | (0)         | (0)         | (0)         | 0           | (0)         |
| Mohawk Valley                   | (0)         | 0           | (0)         | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | (0)         |
| Capital                         | (18)        | (17)        | (13)        | (14)        | (17)        | (18)        | (18)        | (19)        | (21)        | (23)        |
| Hudson Valley                   | (4)         | (9)         | (9)         | (13)        | (10)        | (13)        | (10)        | (10)        | (10)        | (12)        |
| Millwood                        | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                       | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                         | (9)         | (11)        | (9)         | (12)        | (13)        | (10)        | (13)        | (17)        | (13)        | (11)        |
| Long Island                     | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         |
| <b>NYCA Total</b>               | <b>(35)</b> | <b>(41)</b> | <b>(37)</b> | <b>(43)</b> | <b>(45)</b> | <b>(46)</b> | <b>(50)</b> | <b>(53)</b> | <b>(52)</b> | <b>(50)</b> |
| NYCA Imports                    | (6)         | (6)         | (9)         | (8)         | (12)        | (12)        | (15)        | (16)        | (15)        | (21)        |
| NYCA Exports                    | 12          | 10          | 15          | 12          | 12          | 13          | 13          | 14          | 17          | 17          |
| <b>NYCA + Imports - Exports</b> | <b>(53)</b> | <b>(57)</b> | <b>(61)</b> | <b>(64)</b> | <b>(69)</b> | <b>(71)</b> | <b>(78)</b> | <b>(82)</b> | <b>(84)</b> | <b>(88)</b> |

**PROJECTED NYCA GENERATION (GWh) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Generation (GWh)  | 2019           | 2020           | 2021           | 2022           | 2023           | 2024           | 2025           | 2026           | 2027           | 2028         |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------|
| West              | 5              | (15)           | 7              | (10)           | 4              | 3              | (18)           | (39)           | (32)           | 21           |
| Genesee           | (1)            | (2)            | (1)            | (3)            | (4)            | (3)            | (3)            | (4)            | 1              | (2)          |
| Central           | (148)          | (79)           | (136)          | (93)           | (113)          | (149)          | (188)          | (69)           | (124)          | (106)        |
| North             | 2              | 4              | (1)            | (4)            | 2              | (1)            | (3)            | (4)            | (0)            | (1)          |
| Mohawk Valley     | (1)            | 2              | (1)            | (0)            | (2)            | 1              | (2)            | (1)            | (0)            | (2)          |
| Capital           | (605)          | (510)          | (406)          | (406)          | (443)          | (436)          | (407)          | (399)          | (420)          | (430)        |
| Hudson Valley     | (130)          | (287)          | (271)          | (354)          | (243)          | (318)          | (215)          | (216)          | (217)          | (242)        |
| Millwood          | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0            |
| Dunwoodie         | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0            |
| NY City           | (302)          | (337)          | (286)          | (337)          | (324)          | (232)          | (260)          | (341)          | (277)          | (205)        |
| Long Island       | (17)           | (28)           | (29)           | (31)           | (27)           | (15)           | (18)           | (17)           | (20)           | (15)         |
| <b>NYCA Total</b> | <b>(1,198)</b> | <b>(1,250)</b> | <b>(1,125)</b> | <b>(1,237)</b> | <b>(1,149)</b> | <b>(1,149)</b> | <b>(1,114)</b> | <b>(1,090)</b> | <b>(1,089)</b> | <b>(983)</b> |

**PROJECTED NET IMPORTS (GWh) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Net Imports (GWh) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| PJM - NYISO       | (118)        | (156)        | (186)        | (147)        | (159)        | (165)        | (258)        | (203)        | (214)        | (330)        |
| LINDEN VFT        | (40)         | (31)         | (31)         | (24)         | (27)         | (23)         | (22)         | (20)         | (23)         | (19)         |
| NEPTUNE           | (27)         | (31)         | (52)         | (33)         | (63)         | (31)         | (49)         | (55)         | (49)         | (41)         |
| HTP               | (9)          | (9)          | 4            | (12)         | (13)         | (15)         | (12)         | (17)         | (17)         | (29)         |
| ISONE - NYISO     | (336)        | (264)        | (360)        | (301)        | (308)        | (324)        | (218)        | (281)        | (287)        | (241)        |
| CROSS SOUND CABLE | 9            | 12           | 19           | 18           | (0)          | 3            | 7            | 4            | 1            | 16           |
| NORTHPORT NORWALK | 4            | 22           | 11           | 3            | (1)          | 2            | 3            | 12           | (1)          | (10)         |
| IESO - NYISO      | (28)         | (32)         | (26)         | (7)          | (23)         | (41)         | (78)         | (93)         | (66)         | (110)        |
| HQ - NYISO CHAT   | (0)          | (0)          | (0)          | (0)          | 0            | 0            | (0)          | 0            | 0            | 0            |
| HQ - NYISO CEDARS | (0)          | 1            | (0)          | 0            | 0            | (0)          | 0            | 0            | (0)          | (0)          |
| <b>TOTAL</b>      | <b>(546)</b> | <b>(490)</b> | <b>(621)</b> | <b>(502)</b> | <b>(594)</b> | <b>(593)</b> | <b>(628)</b> | <b>(652)</b> | <b>(655)</b> | <b>(764)</b> |

**PROJECTED GENERATOR PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Generator Payment (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West                    | (1)         | (2)         | (3)         | (1)         | (1)         | (2)         | (4)         | (3)         | (4)         | (3)         |
| Genesee                 | (0)         | (0)         | (1)         | (0)         | (1)         | (1)         | (1)         | (1)         | (1)         | (1)         |
| Central                 | 1           | 2           | (6)         | (2)         | (6)         | (8)         | (12)        | (4)         | (9)         | (11)        |
| North                   | (0)         | (0)         | (2)         | (1)         | (1)         | (1)         | (2)         | (1)         | (2)         | (2)         |
| Mohawk Valley           | (0)         | (0)         | (1)         | (0)         | (0)         | (0)         | (1)         | (0)         | (1)         | (1)         |
| Capital                 | (23)        | (22)        | (18)        | (20)        | (21)        | (22)        | (24)        | (23)        | (26)        | (28)        |
| Hudson Valley           | (4)         | (11)        | (11)        | (15)        | (11)        | (14)        | (12)        | (12)        | (12)        | (14)        |
| Millwood                | (3)         | (2)         | (1)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Dunwoodie               | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| NY City                 | (12)        | (14)        | (15)        | (18)        | (15)        | (14)        | (18)        | (21)        | (19)        | (17)        |
| Long Island             | (1)         | (1)         | (2)         | (2)         | (1)         | (1)         | (2)         | (1)         | (2)         | (2)         |
| <b>NYCA Total</b>       | <b>(44)</b> | <b>(50)</b> | <b>(60)</b> | <b>(59)</b> | <b>(57)</b> | <b>(63)</b> | <b>(76)</b> | <b>(66)</b> | <b>(77)</b> | <b>(80)</b> |

**PROJECTED LOAD PAYMENTS (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Load Payment (\$M) | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025         | 2026         | 2027         | 2028         |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| West               | (0)         | (0)         | (2)         | (1)         | (1)         | (1)         | (2)          | (1)          | (2)          | (3)          |
| Genesee            | (0)         | (0)         | (2)         | (0)         | (1)         | (1)         | (2)          | (1)          | (2)          | (2)          |
| Central            | (1)         | (1)         | (3)         | (1)         | (1)         | (2)         | (4)          | (2)          | (4)          | (5)          |
| North              | (0)         | (0)         | (1)         | (0)         | (1)         | (1)         | (1)          | (1)          | (1)          | (1)          |
| Mohawk Valley      | (0)         | (0)         | (1)         | (1)         | (1)         | (1)         | (2)          | (1)          | (2)          | (2)          |
| Capital            | (31)        | (33)        | (35)        | (37)        | (37)        | (40)        | (43)         | (44)         | (46)         | (48)         |
| Hudson Valley      | (26)        | (29)        | (31)        | (33)        | (35)        | (36)        | (40)         | (41)         | (43)         | (45)         |
| Millwood           | (1)         | (0)         | (1)         | (1)         | (0)         | (1)         | (1)          | (1)          | (1)          | (1)          |
| Dunwoodie          | (1)         | (1)         | (1)         | (2)         | (1)         | (1)         | (2)          | (1)          | (2)          | (2)          |
| NY City            | (8)         | (6)         | (11)        | (11)        | (7)         | (9)         | (12)         | (8)          | (13)         | (13)         |
| Long Island        | (1)         | (1)         | (2)         | (2)         | (0)         | (2)         | (2)          | (2)          | (3)          | (3)          |
| <b>NYCA Total</b>  | <b>(69)</b> | <b>(72)</b> | <b>(90)</b> | <b>(88)</b> | <b>(84)</b> | <b>(96)</b> | <b>(110)</b> | <b>(102)</b> | <b>(118)</b> | <b>(125)</b> |

**PROJECTED LBMP (\$/MWh) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| Average LBMP (\$/MWh) | 2019          | 2020          | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          |
|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| West                  | (0.00)        | (0.01)        | (0.10)        | (0.03)        | (0.07)        | (0.10)        | (0.15)        | (0.07)        | (0.14)        | (0.21)        |
| Genesee               | (0.04)        | (0.02)        | (0.15)        | (0.03)        | (0.08)        | (0.12)        | (0.18)        | (0.09)        | (0.17)        | (0.24)        |
| Central               | (0.04)        | (0.03)        | (0.17)        | (0.06)        | (0.09)        | (0.15)        | (0.23)        | (0.12)        | (0.24)        | (0.29)        |
| North                 | (0.02)        | (0.01)        | (0.19)        | (0.05)        | (0.12)        | (0.13)        | (0.22)        | (0.11)        | (0.22)        | (0.26)        |
| Mohawk Valley         | (0.04)        | (0.03)        | (0.19)        | (0.07)        | (0.11)        | (0.16)        | (0.24)        | (0.14)        | (0.26)        | (0.31)        |
| Capital               | (0.29)        | (0.31)        | (0.31)        | (0.36)        | (0.27)        | (0.32)        | (0.34)        | (0.31)        | (0.40)        | (0.39)        |
| Hudson Valley         | (0.21)        | (0.21)        | (0.27)        | (0.28)        | (0.21)        | (0.27)        | (0.32)        | (0.28)        | (0.36)        | (0.38)        |
| Millwood              | (0.19)        | (0.15)        | (0.23)        | (0.24)        | (0.16)        | (0.22)        | (0.26)        | (0.22)        | (0.30)        | (0.30)        |
| Dunwoodie             | (0.18)        | (0.15)        | (0.22)        | (0.23)        | (0.16)        | (0.22)        | (0.26)        | (0.21)        | (0.29)        | (0.29)        |
| NY City               | (0.16)        | (0.11)        | (0.18)        | (0.20)        | (0.13)        | (0.18)        | (0.22)        | (0.15)        | (0.24)        | (0.25)        |
| Long Island           | (0.05)        | (0.02)        | (0.08)        | (0.11)        | (0.02)        | (0.09)        | (0.10)        | (0.08)        | (0.14)        | (0.15)        |
| <b>Average</b>        | <b>(0.11)</b> | <b>(0.10)</b> | <b>(0.19)</b> | <b>(0.15)</b> | <b>(0.13)</b> | <b>(0.18)</b> | <b>(0.23)</b> | <b>(0.16)</b> | <b>(0.25)</b> | <b>(0.28)</b> |

**PROJECTED SO<sub>2</sub> EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions (Tons) | 2019       | 2020       | 2021       | 2022       | 2023      | 2024      | 2025        | 2026        | 2027        | 2028      |
|----------------------------------|------------|------------|------------|------------|-----------|-----------|-------------|-------------|-------------|-----------|
| West                             | 0          | (0)        | (0)        | (0)        | 34        | 41        | (14)        | (66)        | (60)        | 78        |
| Genesee                          | (0)        | (0)        | (0)        | (0)        | (0)       | (0)       | (0)         | (0)         | 0           | (0)       |
| Central                          | (0)        | (0)        | (0)        | (0)        | (0)       | (0)       | (0)         | (0)         | (0)         | (0)       |
| North                            | (0)        | 0          | 0          | (0)        | 0         | (0)       | (0)         | (0)         | (0)         | (0)       |
| Mohawk Valley                    | (0)        | 0          | (0)        | (0)        | (0)       | 0         | (0)         | (0)         | (0)         | (0)       |
| Capital                          | (1)        | (1)        | (1)        | (1)        | (1)       | (1)       | (1)         | (1)         | (1)         | (1)       |
| Hudson Valley                    | (1)        | (1)        | (1)        | (1)        | (1)       | (1)       | (0)         | (0)         | (0)         | (1)       |
| Millwood                         | 0          | 0          | 0          | 0          | 0         | 0         | 0           | 0           | 0           | 0         |
| Dunwoodie                        | 0          | 0          | 0          | 0          | 0         | 0         | 0           | 0           | 0           | 0         |
| NY City                          | (1)        | (1)        | (1)        | (1)        | (1)       | (1)       | (1)         | (1)         | (1)         | (1)       |
| Long Island                      | (0)        | (0)        | (0)        | (0)        | (0)       | (0)       | (0)         | (0)         | (0)         | (0)       |
| <b>NYCA Total</b>                | <b>(3)</b> | <b>(3)</b> | <b>(3)</b> | <b>(3)</b> | <b>31</b> | <b>38</b> | <b>(16)</b> | <b>(69)</b> | <b>(63)</b> | <b>76</b> |

**PROJECTED SO<sub>2</sub> EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| SO <sub>2</sub> Emissions Costs (\$M) | 2019       | 2020       | 2021       | 2022       | 2023     | 2024     | 2025       | 2026       | 2027       | 2028     |
|---------------------------------------|------------|------------|------------|------------|----------|----------|------------|------------|------------|----------|
| West                                  | (0)        | (0)        | (0)        | (0)        | 0        | 0        | (0)        | (0)        | (0)        | 0        |
| Genesee                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | 0          | (0)      |
| Central                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| North                                 | (0)        | 0          | 0          | (0)        | 0        | (0)      | (0)        | (0)        | (0)        | (0)      |
| Mohawk Valley                         | (0)        | 0          | (0)        | (0)        | (0)      | 0        | (0)        | (0)        | (0)        | (0)      |
| Capital                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Hudson Valley                         | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Millwood                              | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| Dunwoodie                             | 0          | 0          | 0          | 0          | 0        | 0        | 0          | 0          | 0          | 0        |
| NY City                               | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| Long Island                           | (0)        | (0)        | (0)        | (0)        | (0)      | (0)      | (0)        | (0)        | (0)        | (0)      |
| <b>NYCA Total</b>                     | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> | <b>0</b> | <b>(0)</b> | <b>(0)</b> | <b>(0)</b> | <b>0</b> |

**PROJECTED NO<sub>x</sub> EMISSIONS (Tons) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| NO <sub>x</sub> Emissions (Tons) | 2019         | 2020         | 2021         | 2022         | 2023         | 2024         | 2025         | 2026         | 2027         | 2028         |
|----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West                             | (0)          | (10)         | (4)          | (7)          | (4)          | 14           | (10)         | (20)         | (21)         | 18           |
| Genesee                          | (1)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | (0)          | 0            | (0)          |
| Central                          | (9)          | (4)          | (6)          | (7)          | (9)          | (9)          | (11)         | (6)          | (9)          | (9)          |
| North                            | 2            | (0)          | 1            | 1            | (0)          | 1            | (1)          | 1            | 1            | 1            |
| Mohawk Valley                    | (0)          | 0            | (0)          | 0            | (1)          | (0)          | (0)          | (0)          | (0)          | (0)          |
| Capital                          | (29)         | (24)         | (22)         | (26)         | (33)         | (29)         | (23)         | (29)         | (26)         | (28)         |
| Hudson Valley                    | (54)         | (36)         | (74)         | (57)         | (53)         | (46)         | (48)         | (42)         | (30)         | (55)         |
| Millwood                         | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                          | (37)         | (69)         | (62)         | (67)         | (99)         | (47)         | (60)         | (70)         | (65)         | (51)         |
| Long Island                      | (3)          | (9)          | (9)          | (7)          | (10)         | (2)          | (3)          | (5)          | (4)          | (4)          |
| <b>NYCA Total</b>                | <b>(131)</b> | <b>(151)</b> | <b>(177)</b> | <b>(172)</b> | <b>(209)</b> | <b>(119)</b> | <b>(157)</b> | <b>(171)</b> | <b>(154)</b> | <b>(127)</b> |

**PROJECTED NOX EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| <b>NO<sub>x</sub> Emissions Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| West  | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Genesee                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           | (0)         |
| Central                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| North                                       | (0)         | 0           | (0)         | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         |
| Mohawk Valley                               | (0)         | 0           | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Capital                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Hudson Valley                               | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Millwood                                    | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Dunwoodie                                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| NY City                                     | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         |
| Long Island                                 | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | (0)         | 0           |
| <b>NYCA Total</b>                           | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  | <b>(0)</b>  |

**PROJECTED CO2 EMISSIONS (1000 Tons) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| <b>CO<sub>2</sub> Emissions (1000 Tons)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>  | <b>2028</b>  |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West  | (2)          | (12)         | (6)          | (10)         | 3            | 5            | (17)         | (37)         | (37)         | 21           |
| Genesee                                     | (1)          | (1)          | (1)          | (1)          | (2)          | (1)          | (1)          | (2)          | 0            | (1)          |
| Central                                     | (62)         | (35)         | (57)         | (40)         | (48)         | (62)         | (78)         | (30)         | (53)         | (46)         |
| North                                       | (0)          | 0            | 0            | (1)          | 1            | (0)          | (2)          | (2)          | (0)          | (0)          |
| Mohawk Valley                               | (0)          | 0            | (0)          | (0)          | (1)          | 1            | (1)          | (1)          | (0)          | (1)          |
| Capital                                     | (248)        | (206)        | (167)        | (168)        | (178)        | (180)        | (164)        | (168)        | (173)        | (181)        |
| Hudson Valley                               | (75)         | (129)        | (141)        | (166)        | (117)        | (145)        | (106)        | (101)        | (99)         | (120)        |
| Millwood                                    | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Dunwoodie                                   | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| NY City                                     | (146)        | (174)        | (141)        | (168)        | (172)        | (115)        | (134)        | (174)        | (142)        | (103)        |
| Long Island                                 | (9)          | (15)         | (16)         | (16)         | (15)         | (7)          | (9)          | (10)         | (10)         | (6)          |
| <b>NYCA Total</b>                           | <b>(544)</b> | <b>(571)</b> | <b>(528)</b> | <b>(571)</b> | <b>(529)</b> | <b>(506)</b> | <b>(511)</b> | <b>(524)</b> | <b>(514)</b> | <b>(436)</b> |

**PROJECTED CO2 EMISSION COSTS (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| <b>CO<sub>2</sub> Emissions Costs (\$M)</b> | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>2024</b>  | <b>2025</b>  | <b>2026</b>  | <b>2027</b>  | <b>2028</b>  |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| West  | (0.0)        | (0.1)        | (0.0)        | (0.1)        | 0.0          | 0.0          | (0.1)        | (0.3)        | (0.4)        | 0.2          |
| Genesee                                     | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        | 0.0          | (0.0)        |
| Central                                     | (0.3)        | (0.2)        | (0.4)        | (0.3)        | (0.4)        | (0.5)        | (0.7)        | (0.3)        | (0.5)        | (0.5)        |
| North                                       | 0.0          | 0.0          | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Mohawk Valley                               | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | 0.0          | (0.0)        | (0.0)        | (0.0)        | (0.0)        |
| Capital                                     | (1.2)        | (1.1)        | (1.0)        | (1.1)        | (1.3)        | (1.4)        | (1.3)        | (1.5)        | (1.6)        | (1.8)        |
| Hudson Valley                               | (0.4)        | (0.7)        | (0.9)        | (1.1)        | (0.9)        | (1.2)        | (0.9)        | (0.9)        | (1.0)        | (1.3)        |
| Millwood                                    | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dunwoodie                                   | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| NY City                                     | (0.5)        | (1.0)        | (0.8)        | (1.1)        | (1.2)        | (0.8)        | (1.1)        | (1.5)        | (1.3)        | (1.0)        |
| Long Island                                 | (0.0)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        | (0.1)        |
| <b>NYCA Total</b>                           | <b>(2.5)</b> | <b>(3.2)</b> | <b>(3.3)</b> | <b>(3.8)</b> | <b>(3.8)</b> | <b>(3.9)</b> | <b>(4.2)</b> | <b>(4.6)</b> | <b>(4.9)</b> | <b>(4.4)</b> |

**PROJECTED DEMAND LOSS PAYMENT (\$M) | Generic Energy Efficiency Solution (Study 3: Volney - Scriba)**

| <b>Loss Costs (\$M)</b> | <b>2019</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>West</b>             | 0.1         | 0.0         | 0.4         | 0.2         | 0.2         | 0.3         | 0.6         | 0.5         | 0.6         | 0.7         |
| <b>Genesee</b>          | 0.1         | 0.0         | 0.2         | 0.1         | 0.1         | 0.1         | 0.3         | 0.2         | 0.3         | 0.3         |
| <b>Central</b>          | 0.1         | 0.1         | 0.1         | 0.1         | 0.2         | 0.2         | 0.2         | 0.2         | 0.2         | 0.2         |
| <b>North</b>            | 0.0         | (0.0)       | 0.1         | 0.0         | 0.0         | 0.1         | 0.1         | 0.1         | 0.1         | 0.1         |
| <b>Mohawk Valley</b>    | (0.0)       | 0.0         | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       | (0.0)       |
| <b>Capital</b>          | (1.5)       | (1.7)       | (1.9)       | (1.8)       | (2.0)       | (1.7)       | (1.9)       | (1.9)       | (2.0)       | (2.1)       |
| <b>Hudson Valley</b>    | (0.9)       | (1.1)       | (1.3)       | (1.2)       | (1.3)       | (1.5)       | (1.5)       | (1.6)       | (1.7)       | (1.8)       |
| <b>Millwood</b>         | 0.0         | 0.0         | (0.0)       | 0.0         | 0.0         | 0.0         | (0.0)       | 0.0         | 0.0         | (0.0)       |
| <b>Dunwoodie</b>        | 0.0         | 0.1         | (0.0)       | 0.1         | 0.1         | 0.0         | 0.0         | 0.1         | 0.0         | 0.0         |
| <b>NY City</b>          | 0.4         | 1.0         | 0.1         | 0.9         | 0.9         | 0.5         | 0.3         | 1.2         | 0.6         | 0.4         |
| <b>Long Island</b>      | 0.2         | 0.4         | 0.1         | 0.4         | 0.4         | 0.3         | 0.0         | 0.4         | 0.2         | 0.1         |
| <b>NYCA Total</b>       | (1.5)       | (1.1)       | (2.4)       | (1.2)       | (1.4)       | (1.7)       | (2.0)       | (0.8)       | (1.8)       | (2.0)       |

## Appendix I - Scenario Case Results

These results reflect changes in the identified metrics for 2028, only. All dollar values are presented as nominal.

### PROJECTED DEMAND CONGESTION CHANGE BY ZONE (\$M)

| Demand Congestion (\$M) | High Load   | Low Load    | High Fuel  | Low Fuel    |
|-------------------------|-------------|-------------|------------|-------------|
| West                    | 4           | (4)         | 9          | (2)         |
| Genesee                 | 1           | (2)         | 5          | (1)         |
| Central                 | (2)         | (4)         | 5          | (3)         |
| North                   | 0           | (0)         | 1          | (0)         |
| Mohawk Valley           | (1)         | (1)         | 2          | (1)         |
| Capital                 | (8)         | 3           | 22         | (8)         |
| Hudson Valley           | (6)         | (0)         | 16         | (6)         |
| Millwood                | (1)         | 1           | 4          | (2)         |
| Dunwoodie               | (2)         | 1           | 9          | (3)         |
| NY City                 | (39)        | (22)        | 97         | (31)        |
| Long Island             | 21          | (7)         | 52         | (17)        |
| <b>NYCA Total</b>       | <b>(32)</b> | <b>(35)</b> | <b>222</b> | <b>(72)</b> |

### PROJECTED PRODUCTION COST CHANGE (\$M)

| Production Cost (\$M)           | High Load  | Low Load       | High Fuel  | Low Fuel     |
|---------------------------------|------------|----------------|------------|--------------|
| West                            | (5)        | (52)           | 81         | (24)         |
| Genesee                         | 0          | (2)            | (1)        | (0)          |
| Central                         | 23         | (79)           | (29)       | (16)         |
| North                           | 1          | (2)            | 0          | 0            |
| Mohawk Valley                   | (0)        | (1)            | 0          | (0)          |
| Capital                         | 59         | (154)          | 112        | (52)         |
| Hudson Valley                   | 15         | (150)          | 3          | (1)          |
| Millwood                        | 0          | (0)            | 0          | 0            |
| Dunwoodie                       | 0          | 0              | 0          | 0            |
| NY City                         | (20)       | (192)          | 230        | (110)        |
| Long Island                     | 32         | (68)           | 52         | (22)         |
| <b>NYCA Total</b>               | <b>105</b> | <b>(701)</b>   | <b>448</b> | <b>(224)</b> |
| <b>NYCA Imports</b>             | <b>86</b>  | <b>(196)</b>   | <b>280</b> | <b>(95)</b>  |
| <b>NYCA Exports</b>             | <b>(5)</b> | <b>158</b>     | <b>41</b>  | <b>(8)</b>   |
| <b>NYCA + Imports - Exports</b> | <b>196</b> | <b>(1,055)</b> | <b>686</b> | <b>(311)</b> |

**PROJECTED NYCA GENERATION CHANGE (GWh)**

| <b>Generation (GWh)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|-------------------------|------------------|-----------------|------------------|-----------------|
| West                    | (59)             | (868)           | 1,482            | (329)           |
| Genesee                 | (1)              | (36)            | (28)             | 4               |
| Central                 | 503              | (1,921)         | (1,693)          | 191             |
| North                   | 17               | (45)            | (6)              | 13              |
| Mohawk Valley           | (4)              | (14)            | 1                | (4)             |
| Capital                 | 1,205            | (3,134)         | (1,225)          | 491             |
| Hudson Valley           | 299              | (3,208)         | (1,614)          | 911             |
| Millwood                | 0                | (0)             | 0                | 0               |
| Dunwoodie               | 0                | 0               | 0                | 0               |
| NY City                 | (1)              | (3,341)         | (1,281)          | 367             |
| Long Island             | 560              | (1,149)         | (691)            | 376             |
| <b>NYCA Total</b>       | <b>2,520</b>     | <b>(13,716)</b> | <b>(5,053)</b>   | <b>2,021</b>    |

**PROJECTED NET IMPORTS CHANGE (GWh)**

| <b>Net Imports (GWh)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|--------------------------|------------------|-----------------|------------------|-----------------|
| PJM - NYISO              | 425              | (2,527)         | 4,433            | (1,575)         |
| LINDEN VFT               | 44               | (341)           | 499              | (123)           |
| NEPTUNE                  | 299              | (920)           | 927              | (404)           |
| HTP                      | 114              | (49)            | 347              | (113)           |
| ISONE - NYISO            | 297              | (1,814)         | (1,036)          | 385             |
| CROSS SOUND CABLE        | 383              | (281)           | (142)            | 55              |
| NORTHPORT NORWALK        | 231              | (178)           | (114)            | 5               |
| IESO - NYISO             | 237              | (1,115)         | 251              | (275)           |
| HQ - NYISO CHAT          | 0                | 0               | 0                | 0               |
| HQ - NYISO CEDARS        | (0)              | 0               | 0                | 0               |
| <b>TOTAL</b>             | <b>2,029</b>     | <b>(7,223)</b>  | <b>5,166</b>     | <b>(2,045)</b>  |

**PROJECTED GENERATOR PAYMENTS CHANGE (\$M)**

| <b>Generator Payment (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|--------------------------------|------------------|-----------------|------------------|-----------------|
| West                           | 9                | (96)            | 200              | (79)            |
| Genesee                        | 4                | (16)            | 33               | (17)            |
| Central                        | 55               | (113)           | 170              | (96)            |
| North                          | 9                | (25)            | 71               | (32)            |
| Mohawk Valley                  | 3                | (12)            | 32               | (15)            |
| Capital                        | 60               | (191)           | 120              | (59)            |
| Hudson Valley                  | 13               | (170)           | 6                | (3)             |
| Millwood                       | 0                | (1)             | 5                | (2)             |
| Dunwoodie                      | (0)              | (0)             | 1                | (0)             |
| NY City                        | (13)             | (254)           | 209              | (106)           |
| Long Island                    | 43               | (88)            | 62               | (28)            |
| <b>NYCA Total</b>              | <b>183</b>       | <b>(967)</b>    | <b>908</b>       | <b>(438)</b>    |



**PROJECTED LOAD PAYMENTS CHANGE (\$M)**

| <b>Load Payment (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|---------------------------|------------------|-----------------|------------------|-----------------|
| West                      | 54               | (105)           | 92               | (48)            |
| Genesee                   | (7)              | (114)           | 67               | (34)            |
| Central                   | 6                | (161)           | 128              | (59)            |
| North                     | 6                | (23)            | 41               | (19)            |
| Mohawk Valley             | 20               | (57)            | 58               | (26)            |
| Capital                   | 30               | (106)           | 126              | (55)            |
| Hudson Valley             | 8                | (94)            | 100              | (44)            |
| Millwood                  | 17               | (17)            | 29               | (13)            |
| Dunwoodie                 | 31               | (36)            | 60               | (26)            |
| NY City                   | 10               | (541)           | 555              | (240)           |
| Long Island               | 132              | (193)           | 234              | (100)           |
| <b>NYCA Total</b>         | <b>306</b>       | <b>(1,446)</b>  | <b>1,490</b>     | <b>(664)</b>    |

**PROJECTED LBMP CHANGE (\$/MWh)**

| <b>LBMP (\$/MWh)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|----------------------|------------------|-----------------|------------------|-----------------|
| West                 | 1.00             | (2.41)          | 6.25             | (3.21)          |
| Genesee              | 0.88             | (2.82)          | 6.93             | (3.42)          |
| Central              | 0.95             | (2.85)          | 8.23             | (3.80)          |
| North                | 0.97             | (2.37)          | 7.64             | (3.51)          |
| Mohawk Valley        | 1.06             | (2.78)          | 8.59             | (3.88)          |
| Capital              | 0.49             | (1.84)          | 10.29            | (4.43)          |
| Hudson Valley        | 0.57             | (2.27)          | 10.11            | (4.42)          |
| Millwood             | 0.65             | (2.24)          | 10.11            | (4.42)          |
| Dunwoodie            | 0.64             | (2.26)          | 10.07            | (4.41)          |
| NY City              | 0.58             | (2.57)          | 10.34            | (4.46)          |
| Long Island          | 1.86             | (2.50)          | 11.04            | (4.72)          |

**PROJECTED SO<sub>2</sub> EMISSIONS CHANGE (Tons)**

| <b>SO<sub>2</sub> Emissions (Tons)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|--|------------------|-----------------|------------------|-----------------|
| West                                   | (311)            | (1,767)         | 4,245            | (1,317)         |
| Genesee                                | (0)              | (0)             | (0)              | 0               |
| Central                                | 1                | (4)             | (4)              | 0               |
| North                                  | 0                | (0)             | (0)              | 0               |
| Mohawk Valley                          | (0)              | (0)             | 0                | (0)             |
| Capital                                | 2                | (7)             | (3)              | 1               |
| Hudson Valley                          | 1                | (7)             | (4)              | 2               |
| Millwood                               | 0                | (0)             | 0                | 0               |
| Dunwoodie                              | 0                | 0               | 0                | 0               |
| NY City                                | (1)              | (10)            | (4)              | 1               |
| Long Island                            | 2                | (3)             | (2)              | 1               |
| <b>NYCA Total</b>                      | <b>(306)</b>     | <b>(1,798)</b>  | <b>4,229</b>     | <b>(1,311)</b>  |

**PROJECTED SO<sub>2</sub> EMISSION COSTS CHANGE (\$M)**

| <b>SO<sub>2</sub> Emissions Costs (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|---|------------------|-----------------|------------------|-----------------|
| West  | (0)              | (0)             | 0                | (0)             |
| Genesee                                     | (0)              | (0)             | (0)              | 0               |
| Central                                     | 0                | (0)             | (0)              | 0               |
| North                                       | 0                | (0)             | (0)              | 0               |
| Mohawk Valley                               | (0)              | (0)             | 0                | (0)             |
| Capital                                     | 0                | (0)             | (0)              | 0               |
| Hudson Valley                               | 0                | (0)             | (0)              | 0               |
| Millwood                                    | 0                | 0               | 0                | 0               |
| Dunwoodie                                   | 0                | 0               | 0                | 0               |
| NY City                                     | (0)              | (0)             | (0)              | 0               |
| Long Island                                 | 0                | (0)             | (0)              | 0               |
| <b>NYCA Total</b>                           | <b>(0)</b>       | <b>(0)</b>      | <b>0</b>         | <b>(0)</b>      |

**PROJECTED NO<sub>x</sub> EMISSIONS CHANGE (Tons)**

| <b>NO<sub>x</sub> Emissions (Tons)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|--|------------------|-----------------|------------------|-----------------|
| West                                   | (66)             | (469)           | 766              | (218)           |
| Genesee                                | (0)              | (4)             | (3)              | 1               |
| Central                                | 27               | (123)           | (99)             | 23              |
| North                                  | 5                | (9)             | (4)              | 4               |
| Mohawk Valley                          | (2)              | (3)             | 1                | (1)             |
| Capital                                | 21               | (225)           | (131)            | 19              |
| Hudson Valley                          | 12               | (498)           | (449)            | 264             |
| Millwood                               | 1                | (1)             | 0                | 0               |
| Dunwoodie                              | 0                | 0               | 0                | 0               |
| NY City                                | (341)            | (1,301)         | (433)            | 145             |
| Long Island                            | 158              | (330)           | (211)            | 119             |
| <b>NYCA Total</b>                      | <b>(184)</b>     | <b>(2,964)</b>  | <b>(563)</b>     | <b>355</b>      |

**PROJECTED NO<sub>x</sub> EMISSION COSTS CHANGE (\$M)**

| <b>NO<sub>x</sub> Emissions Costs (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|---|------------------|-----------------|------------------|-----------------|
| West  | (0)              | (0)             | 0                | (0)             |
| Genesee                                     | (0)              | (0)             | (0)              | 0               |
| Central                                     | 0                | (0)             | (0)              | 0               |
| North                                       | (0)              | (0)             | (0)              | 0               |
| Mohawk Valley                               | (0)              | (0)             | 0                | 0               |
| Capital                                     | 0                | (0)             | (0)              | 0               |
| Hudson Valley                               | 0                | (0)             | (0)              | 0               |
| Millwood                                    | 0                | 0               | 0                | 0               |
| Dunwoodie                                   | 0                | 0               | 0                | 0               |
| NY City                                     | (0)              | (0)             | (0)              | 0               |
| Long Island                                 | 0                | (0)             | (0)              | 0               |
| <b>NYCA Total</b>                           | <b>0</b>         | <b>(0)</b>      | <b>(0)</b>       | <b>0</b>        |

**PROJECTED CO<sub>2</sub> EMISSIONS CHANGE (1000 Tons)**

| <b>CO<sub>2</sub> Emissions (1000 Tons)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|---|------------------|-----------------|------------------|-----------------|
| West  | (104)            | (858)           | 1,627            | (460)           |
| Genesee                                     | (1)              | (17)            | (13)             | 2               |
| Central                                     | 206              | (801)           | (702)            | 88              |
| North                                       | 9                | (22)            | (3)              | 7               |
| Mohawk Valley                               | (2)              | (7)             | 1                | (2)             |
| Capital                                     | 457              | (1,288)         | (556)            | 224             |
| Hudson Valley                               | 122              | (1,473)         | (826)            | 476             |
| Millwood                                    | 0                | 0               | 0                | 0               |
| Dunwoodie                                   | 0                | 0               | 0                | 0               |
| NY City                                     | (115)            | (1,837)         | (706)            | 218             |
| Long Island                                 | 310              | (653)           | (395)            | 225             |
| <b>NYCA Total</b>                           | <b>882</b>       | <b>(6,956)</b>  | <b>(1,572)</b>   | <b>779</b>      |

**PROJECTED CO<sub>2</sub> EMISSION COSTS CHANGE (\$M)**

| <b>CO<sub>2</sub> Emissions Costs (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|---|------------------|-----------------|------------------|-----------------|
| West  | (1)              | (9)             | 16               | (5)             |
| Genesee                                     | (0)              | (0)             | (0)              | 0               |
| Central                                     | 2                | (8)             | (7)              | 1               |
| North                                       | 0                | (0)             | (0)              | 0               |
| Mohawk Valley                               | (0)              | (0)             | 0                | (0)             |
| Capital                                     | 4                | (13)            | (6)              | 2               |
| Hudson Valley                               | 1                | (16)            | (9)              | 5               |
| Millwood                                    | 0                | 0               | 0                | 0               |
| Dunwoodie                                   | 0                | 0               | 0                | 0               |
| NY City                                     | (1)              | (18)            | (7)              | 2               |
| Long Island                                 | 3                | (7)             | (4)              | 2               |
| <b>NYCA Total</b>                           | <b>8</b>         | <b>(71)</b>     | <b>(16)</b>      | <b>8</b>        |

**PROJECTED DEMAND LOSS PAYMENT CHANGE (\$M)**

| <b>Loss Costs (\$M)</b> | <b>High Load</b> | <b>Low Load</b> | <b>High Fuel</b> | <b>Low Fuel</b> |
|-------------------------|------------------|-----------------|------------------|-----------------|
| West                    | 1                | 0               | (21)             | 6               |
| Genesee                 | (0)              | (3)             | (8)              | 2               |
| Central                 | (0)              | (4)             | (3)              | 1               |
| North                   | (0)              | 1               | (2)              | 1               |
| Mohawk Valley           | 1                | (2)             | 1                | (0)             |
| Capital                 | 1                | (2)             | 5                | (2)             |
| Hudson Valley           | 1                | (4)             | 4                | (2)             |
| Millwood                | 1                | (1)             | 1                | (1)             |
| Dunwoodie               | 2                | (2)             | 3                | (1)             |
| NY City                 | 1                | (33)            | 30               | (13)            |
| Long Island             | 9                | (12)            | 15               | (6)             |
| <b>NYCA Total</b>       | <b>15</b>        | <b>(61)</b>     | <b>26</b>        | <b>(15)</b>     |

## Appendix J – Tie Line Import & Export

The 2028 annual net export energy, by individual NYISO tie line is provided in Figure 68 below.

Results are presented for the base case and four scenarios.

**Figure 68: Annual Net Export Energy by Tie Line**

| Annual Flow(GWh)       | Description           | From ISO | To ISO | Base Case     | Scenario Load Relaxed | Scenario Load Constrained | Base Load Relaxed | Base Load Constrained |
|------------------------|-----------------------|----------|--------|---------------|-----------------------|---------------------------|-------------------|-----------------------|
| WEST/CENTRAL to PEN    | PJM West AC Ties      | NYISO    | PJM    | (3,471)       | 4,359                 | 2,646                     | 4,986             | 2,946                 |
| HUDSON to JCP&L        | Ramapo Line           | NYISO    | PJM    | (3,472)       | (3,207)               | 68                        | (3,247)           | 195                   |
| HUDSON to PSEG         | Waldwick PARS (J & K) | NYISO    | PJM    | (1,023)       | 5,199                 | 436                       | 5,007             | 469                   |
| HUDSON to RECO         | RECO Ties             | NYISO    | PJM    | 1,493         | 1,491                 | 1,491                     | 1,491             | 1,490                 |
| NYC to PSEG            | VFT + A-PAR + HTP     | NYISO    | PJM    | (1,531)       | (1,786)               | 1,568                     | (1,838)           | 1,274                 |
| L ISLAND to JCP&L      | Neptune               | NYISO    | PJM    | (4,234)       | (576)                 | (1,763)                   | (403)             | (1,847)               |
| <b>PJM Net Imports</b> |                       |          |        | <b>12,239</b> | <b>(5,480)</b>        | <b>(4,446)</b>            | <b>(5,997)</b>    | <b>(4,526)</b>        |

| Annual Flow(GWh)        | Description      | From ISO | To ISO | Base Case      | Scenario Load Relaxed | Scenario Load Constrained | Base Load Relaxed | Base Load Constrained |
|-------------------------|------------------|----------|--------|----------------|-----------------------|---------------------------|-------------------|-----------------------|
| WEST to ONNI            | Niagara Ties     | NYISO    | IESO   | 2,810          | 5,394                 | 5,661                     | 5,874             | 6,089                 |
| NORTH to ONEAST         | St Lawrence PARs | NYISO    | IESO   | 53             | 156                   | 154                       | 155               | 158                   |
| <b>IESO Net imports</b> |                  |          |        | <b>(2,862)</b> | <b>(5,550)</b>        | <b>(5,815)</b>            | <b>(6,030)</b>    | <b>(6,247)</b>        |

| Annual Flow(GWh)                   | Description       | From ISO | To ISO | Base Case    | Scenario Load Relaxed | Scenario Load Constrained | Base Load Relaxed | Base Load Constrained |
|------------------------------------|-------------------|----------|--------|--------------|-----------------------|---------------------------|-------------------|-----------------------|
| NORTH to VT                        | PV20              | NYISO    | ISONE  | 967          | 665                   | 650                       | 657               | 636                   |
| CAPITAL to VT/WMA and HUDSON to CT | AC Freeflow Ties  | NYISO    | ISONE  | 1,646        | 6,048                 | 6,379                     | 5,242             | 5,240                 |
| L ISLAND to CT                     | Cross Sound Cable | NYISO    | ISONE  | (1,638)      | (109)                 | (910)                     | (226)             | (970)                 |
| L ISLAND to NOR                    | 1385 Line         | NYISO    | ISONE  | (439)        | 1,188                 | 300                       | 1,038             | 166                   |
| <b>ISONE Net imports</b>           |                   |          |        | <b>(536)</b> | <b>(7,791)</b>        | <b>(6,419)</b>            | <b>(6,710)</b>    | <b>(5,072)</b>        |

| Annual Flow(GWh)      | Description  | From ISO | To ISO | Base Case     | Scenario Load Relaxed | Scenario Load Constrained | Base Load Relaxed | Base Load Constrained |
|-----------------------|--------------|----------|--------|---------------|-----------------------|---------------------------|-------------------|-----------------------|
| NORTH to HQ           | Cedars       | NYISO    | HQ     | (1,009)       | (1,293)               | (1,268)                   | (1,277)           | (1,275)               |
| NORTH to HQ           | Chateaugay   | NYISO    | HQ     | (10,555)      | (10,497)              | (10,495)                  | (10,491)          | (10,482)              |
| NYC to HQ             | NYC HVDC Tie | NYISO    | HQ     | 0             | (8,012)               | (8,012)                   | (8,012)           | (8,012)               |
| <b>HQ Net imports</b> |              |          |        | <b>11,564</b> | <b>19,803</b>         | <b>19,775</b>             | <b>19,780</b>     | <b>19,769</b>         |

## Appendix K - Annualized Growth Rates for the Base, Low and High Loads

These values represent the annualized-growth rates for energy and non-coincident peaks for each NYCA Load Zone from 2017 to 2026 for the “Business as Usual” case as well as the Low and High scenarios. The energy growth rates are presented as well for the New York Control Area.

**Figure 69: Load Growth Rates for Base, Low, and High Scenarios**

| Zones         | Energy |        |        | Non-Coincident Peak |        |        |
|---------------|--------|--------|--------|---------------------|--------|--------|
|               | Low    | Base   | High   | Low                 | Base   | High   |
| West          | -2.17% | -0.71% | 0.06%  | -2.92%              | -0.82% | -0.66% |
| Genesee       | -2.58% | -0.32% | -0.22% | -3.04%              | -0.26% | -0.65% |
| Central       | -2.68% | -0.57% | -0.31% | -3.06%              | -0.78% | -0.66% |
| North         | 0.10%  | 1.08%  | 0.77%  | -1.21%              | 1.56%  | -0.53% |
| Mohawk Valley | -3.42% | -1.07% | -0.26% | -3.52%              | -1.37% | -0.31% |
| Capital       | -2.78% | -0.76% | 0.08%  | -3.07%              | -1.09% | -0.20% |
| Hudson Valley | -2.84% | -0.29% | 0.05%  | -3.34%              | -0.38% | -0.41% |
| Millwood      | -1.40% | 0.27%  | 0.99%  | -1.26%              | -0.05% | 1.16%  |
| Dunwoodie     | -1.33% | -0.03% | 0.59%  | -0.64%              | -0.02% | 1.33%  |
| NY City       | -1.76% | -0.03% | 0.04%  | -2.60%              | -0.02% | -0.78% |
| Long Island   | -2.46% | -0.57% | 0.33%  | -3.21%              | -1.13% | -0.40% |
| NYCA          | -2.16% | -0.32% | 0.08%  | N/A                 | N/A    | N/A    |

## Appendix L – 70x30 Scenario Cases

In addition to the standard scenario simulations involving changes in natural gas and energy demand forecasts, a scenario evaluating the New York “70x30” target was performed. Within this scenario, three individual sensitivities were simulated to investigate the impacts of storage, nuclear retirements, and reduced export energy. This appendix provides additional detail for the 70x30 scenario and sensitivities.

### Targeted Investigation of Energy Storage Resources

State policies, including the CLCPA, support the installation of 3,000 MW of Energy Storage Resources (ESR) in New York by 2030. As a sensitivity to the constrained scenario cases, which do not include incremental ESR, two different ESR dispatch models were used to study 3,000 MW as a distributed resource within MAPS. An additional limited case examined the inclusion of a smaller amount of ESR capacity in the generation pockets in order to minimize RE curtailment from individual collocated RE generators within the Scenario Load Constrained case.

GE-MAPS software allows ESRs (*e.g.*, pumped hydro storage) to be modeled entirely within the MAPS simulations. This method provides ESR dispatches optimizing arbitrage amongst the generators included within an initial commitment pass across each week of the simulation. The supply cost curve of these set of NYCA units and the ESR parameters were used to compute the optimal dispatch for resources in each NYCA zone. ESR in this approach were modeled as distributed resources in MAPS, and distributed to the load busses according to the ratio of annual zonal load to bus load, similar to the distributed modeling approach employed to model BTM-PV.

To augment the capabilities of the MAPS internal ESR model, an external ESR dispatch optimization algorithm was implemented using MATLAB’s Optimization Toolbox. Potential benefits of this approach include flexibility and controllability in modeling ESR to target various objectives. As an initial comparison to the MAPS internal model, an external optimization was developed with the objective of minimizing the daily net load (*i.e.*, Gross Load – RE<sub>input</sub>) deviation on a zonal basis. Input to the optimization are the zonal gross load and aggregate renewable energy profiles, and the ESR power, energy, and efficiency constraints. Resulting optimal dispatches were included in the MAPS simulations as distributed hourly resource modifiers (HRM), just as currently done with BTM-PV. MAPS may curtail ESR discharges into the transmission network if it is the most effective resource to resolve low LBMPs due to transmission constraints.

In both of these approaches, all ESR are assumed to be four-hour duration with 85% round trip charge to discharge efficiency. The full power and energy capacity are available to the ESR for charging and

discharging. The efficiency constraint is preserved upon charging by appropriately reducing the energy state of charge of the ESR. Self-discharge and other degradation losses are ignored. Results of the modeling study conducted for the NYSERDA Energy Storage Roadmap<sup>11</sup> were used to inform the zonal capacity levels of storage included in the ESR and HRM storage cases.

**Figure 70: Assumed ESR Zonal Power Capacity**

| Nameplate Capacity Distribution (MW) |     |    |     |     |     |     |     |     |     |       |     |       |
|--------------------------------------|-----|----|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|
|                                      | A   | B  | C   | D   | E   | F   | G   | H   | I   | J     | K   | NYCA  |
| ESR                                  | 150 | 90 | 120 | 180 | 120 | 240 | 100 | 100 | 100 | 1,320 | 480 | 3,000 |

An additional examination of ESR focused on using ESR to capture RE curtailments in generation pockets. Five RE generators were selected from one generation pocket, and an ESR unit was collocated with each RE unit. A dispatch profile was created for each ESR using the hourly curtailment data of each RE unit from the Scenario Load Constrained case with no ESR in the system. This approach was based on the principle that ESRs will charge whenever there is any curtailment and discharge when there is no curtailment, while respecting the power, energy, and efficiency constraints of the ESR itself. The power rating of the ESR was selected to capture approximately 75<sup>th</sup> and 50<sup>th</sup> percentile of the hourly curtailments of each RE unit. The total hours of available storage were chosen such as the curtailment of each RE unit was reduced to approximately 5% of the total input renewable energy. Resulting ESR dispatches are included in the MAPS simulations as hourly resource modifiers (HRM) collocated with the associated RE unit.

Several considerations should be taken into account when reviewing results and methods utilized in the ESR sensitivity cases. These include:

- ESR models based on arbitrage of energy or costs are significant simplifications of complex, co-optimization bidding strategies and market opportunities which may be available to ESRs (*e.g.*, provision for regulation, reserves, dual-market participation, etc.) and are a function of the assumed zonal capacity distribution.
- Results of distributed methods ignore potential locational benefits provided or anticipated for particular siting locations (*e.g.*, ESRs awarded contracts may be utilized for local rather than bulk power system needs).
- ESR dispatch must be integrated into MAPS optimization to expose the impact of operations on the surrounding power system.

<sup>11</sup> [documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={2A1BFBC9-85B4-4DAE-BCAE-164B21B0DC3D}](https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={2A1BFBC9-85B4-4DAE-BCAE-164B21B0DC3D})

- Targeted application of ESR is labor intensive and iterative process that will require further understanding and methodological development to reliably include ESR in modeling studies going forward.

For the ESR sensitivity, the NYISO examined two distributed models for storage resources in MAPS and made an initial investigation targeting RE generation curtailment at collocated generators within a generation pocket. The methodologies and differences in approaches are outlined in the assumptions section of the CARIS report. This section compares the results of the distributed MAPS internal ESR and external HRM approach is provided. Separately, results also describe the analysis of ESRs located in generation pockets.

Direct comparison between the two distributed methods for modeling ESR, the first based on utilization of MAPS' internal ESR dispatch and the second based on an external dispatch optimization developed by NYISO staff, is possible because both incorporate the same amount of storage in the same locations across all cases.



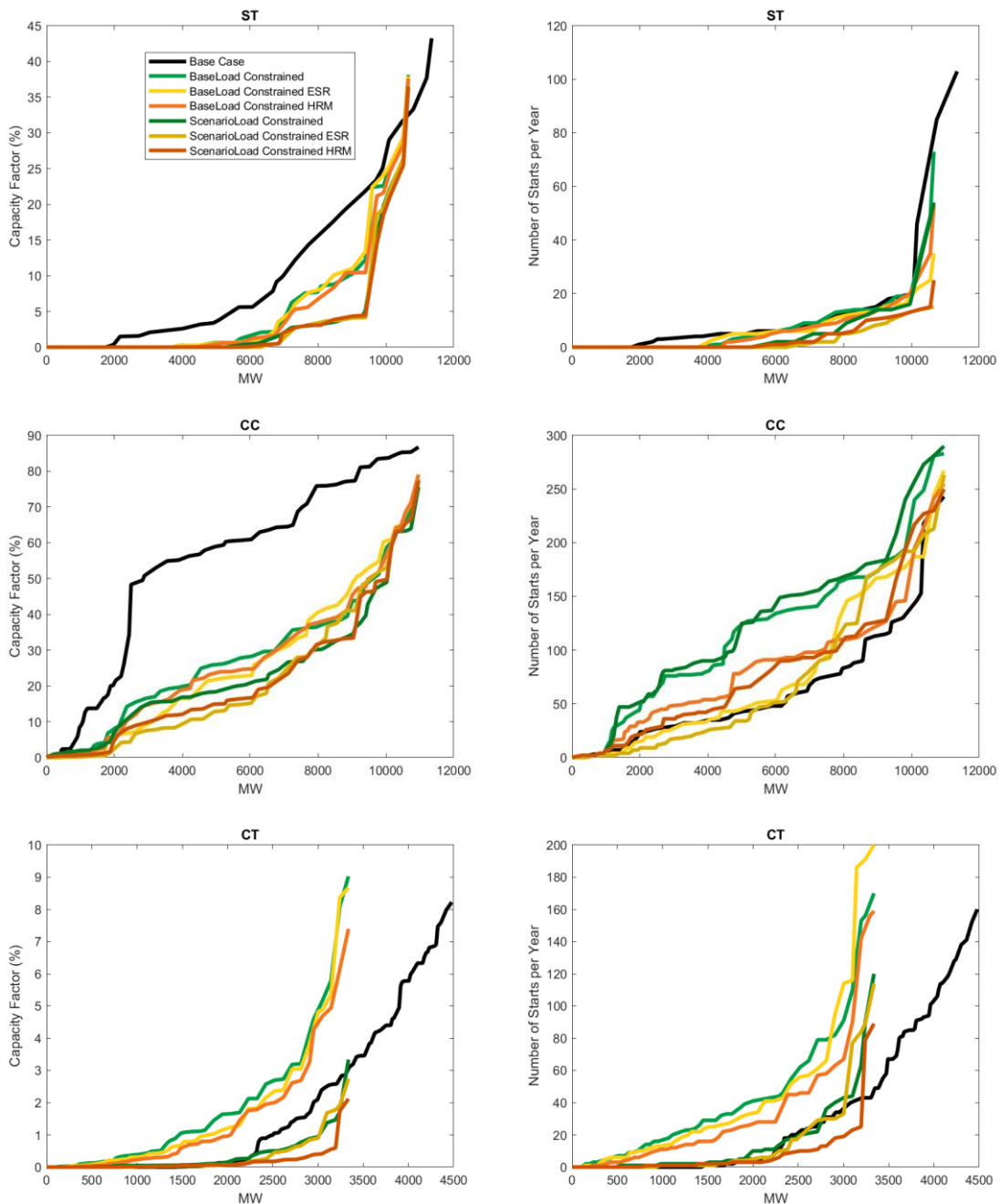
Figure 71 displays the annual energy composition of generation, net imports, curtailments, and gross load. Storage resources in the table are shown as net generation values (*i.e.*, net generation = discharge – charge), similar to the calculation of net generation for Pumped Storage resources. The primary impact of including ESR as a distributed resource in MAPS is a reduction in fossil generation, exports, and curtailments, with an observed increase in RE generation. Impacts of distributed ESR models are directionally consistent. The external optimization included as an HRM, however, shows slightly more pronounced changes from the constrained cases without ESR. It should also be noted that including ESR as internally modeled resources in MAPS will impact the output of the Pumped Storage generators more as they use the same internal ESR model approach in MAPS, which places Pumped Storage generators in direct competition with incremental MAPS ESR. These effects together with the zonal daily balancing of the HRM external dispatches explain the increased utilization of the HRM ESR resources across these cases.

**Figure 71: Energy Storage Resource Sensitivity Case Results Energy Results**

| Energy (GWh)             | ScenarioLoad<br>Constrained | ScenarioLoad<br>Constrained ESR | ScenarioLoad<br>Constrained<br>HRM | BaseLoad<br>Constrained | BaseLoad<br>Constrained ESR | BaseLoad<br>Constrained<br>HRM |
|--------------------------|-----------------------------|---------------------------------|------------------------------------|-------------------------|-----------------------------|--------------------------------|
| Nuclear                  | 27,433                      | 27,434                          | 27,434                             | 27,433                  | 27,434                      | 27,435                         |
| Other                    | 2,110                       | 2,130                           | 2,126                              | 2,102                   | 2,115                       | 2,117                          |
| Fossil                   | 28,185                      | 26,290                          | 26,294                             | 35,181                  | 33,667                      | 33,603                         |
| Hydro                    | 28,050                      | 28,123                          | 28,114                             | 28,020                  | 28,084                      | 28,091                         |
| Hydro Imports            | 19,775                      | 19,820                          | 19,808                             | 19,769                  | 19,802                      | 19,808                         |
| LBW                      | 13,290                      | 13,515                          | 13,532                             | 17,117                  | 17,322                      | 17,376                         |
| OSW                      | 21,625                      | 21,682                          | 21,743                             | 21,592                  | 21,656                      | 21,821                         |
| UPV                      | 12,666                      | 13,234                          | 13,124                             | 17,982                  | 18,256                      | 18,350                         |
| BTM-PV                   | 9,266                       | 9,287                           | 9,288                              | 9,327                   | 9,332                       | 9,329                          |
| Pumped Storage           | (822)                       | (514)                           | (630)                              | (868)                   | (562)                       | (671)                          |
| Storage                  | -                           | (613)                           | (693)                              | -                       | (604)                       | (756)                          |
| IESO Net Imports         | (5,817)                     | (5,788)                         | (5,755)                            | (6,250)                 | (6,136)                     | (6,145)                        |
| ISONE Net Imports        | (6,418)                     | (5,902)                         | (5,847)                            | (5,073)                 | (4,695)                     | (4,723)                        |
| PJM Net Imports          | (4,446)                     | (3,798)                         | (3,648)                            | (4,528)                 | (3,859)                     | (3,838)                        |
| Renewable Generation     | 104,672                     | 105,661                         | 105,609                            | 113,808                 | 114,452                     | 114,775                        |
| Curtailment              | 10,151                      | 9,174                           | 9,266                              | 14,020                  | 13,369                      | 13,097                         |
| Non-Renewable Generation | 57,728                      | 55,853                          | 55,853                             | 64,717                  | 63,215                      | 63,155                         |
| GrossLoad                | 144,897                     | 144,897                         | 144,888                            | 161,807                 | 161,811                     | 161,797                        |

Figure 72 displays the impact that the two distributed storage resource models, MAPS internal ESR and HRM external dispatch, have on fossil fleet operations. The curves show the capacity factor and number of starts per year for each unit across the NYCA fossil fleet broken out by type. Comparison of the curves for the constrained, ESR, and HRM cases at the same load level allows the impact of the storage models to be assessed. The curves clearly show that the inclusion of ESR has the least operational impacts upon the steam turbine fleet as these resources have less operational flexibility than other fossil generators. Both ESR models lead to a more efficient utilization of the fossil fleet, particularly the combined cycle fleet. This is observed in the combined cycle capacity factor graph as the ESR and HRM lines cross over the constrained case curves as unit utilization increases. As each of these ESR models have different approaches and objectives, it is not surprising that they result in different dispatch patterns over the course of the year and therefore have different impact on the operation of the fossil fleet.

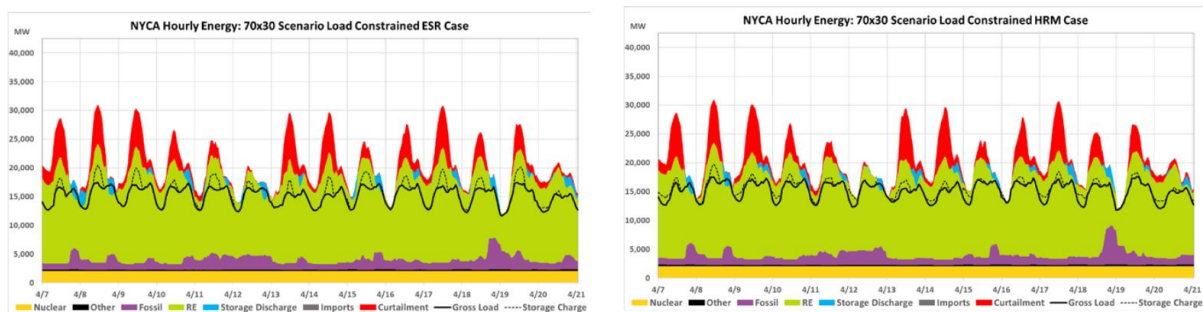
**Figure 72: Energy Storage Resource Sensitivity Cases Fossil Fleet Cumulative Capacity Curves**



Graphs over two week sample periods, as shown in Figure 73, display the impacts of different distributed ESR models on fossil, renewable, imports, and curtailments on an hourly granularity. The MAPS internal ESR model results in more coherent charging (increase in load indicate by dotted lines) and discharging (blue fill) patterns than HRM as a result of the different approaches to model storage. The MAPS ESR model objective has all the storage resources optimizing across the NYCA load and initial thermal generation commitments on a weekly basis. In contrast, the HRM results shown is actually the

aggregate result of 11 individual optimizations on the zonal daily basis as described above. This result is observable as more uniform dispatches in the HRM cases which tend to spread the ESR utilization across more hours in a day compared to the MAPS ESR results where they appear to aggregate into a certain subset of hours. Another observation visible in Figure 73 is that MAPS ESR targets peak load hours absorbing excess RE generation and dispatching primarily during the evening down ramp hours. By comparison, HRM results tends to absorb excess RE in low load and high load hours and discharges most often during the evening down ramp hours but other hours as well. It can also be observed that across the year the MAPS ESR model provides for smoother fossil fleet output profiles than the HRM approach, indicating generally lower ramping demand. This is due to the MAPS ESR model targeting the initial cost commitment curve to define the ESR dispatch while HRM looks at net load explicitly. Both models show less fossil generation during low net load periods compared to a case without ESR, as ESR typically reduces peak fossil demand levels. It was also observed for both models that some (mostly winter) hours when ESR was charging were also hours when NYCA was a net importer. This implies that the increase charging demand could increase imports in some hours relative to a case without ESR. Hourly results across each two week period is presented at the end of the 70x30 section appendix.

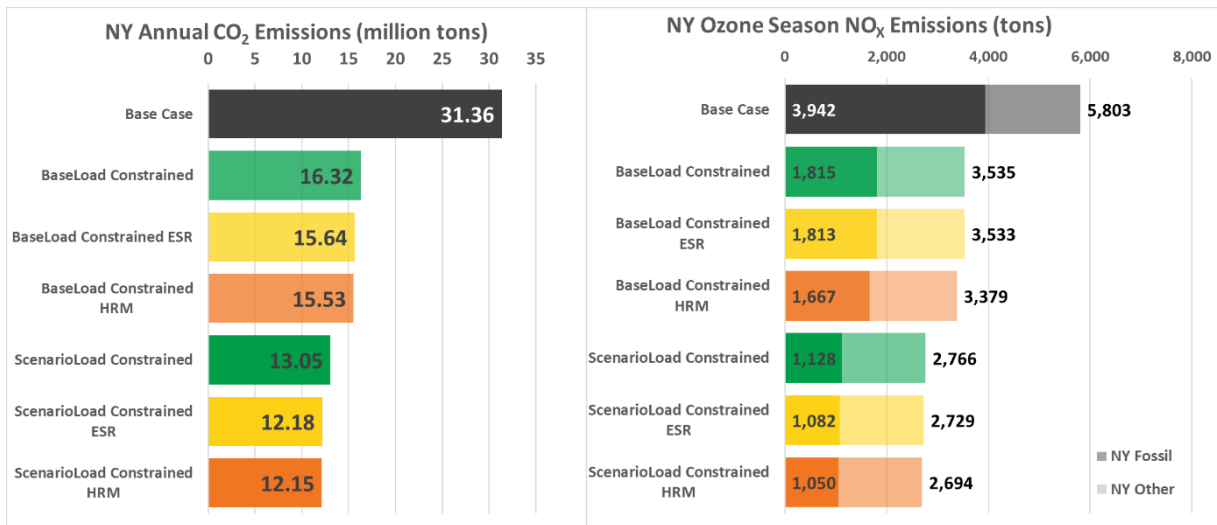
**Figure 73: Energy Storage Resource Hourly Results across a Spring Low Net Load Period**



The introduction of ESR does not inherently result in a reduction in emissions or output of fossil generators because on net ESR increase energy demand and this could be associated with increased emissions if not correctly implemented.

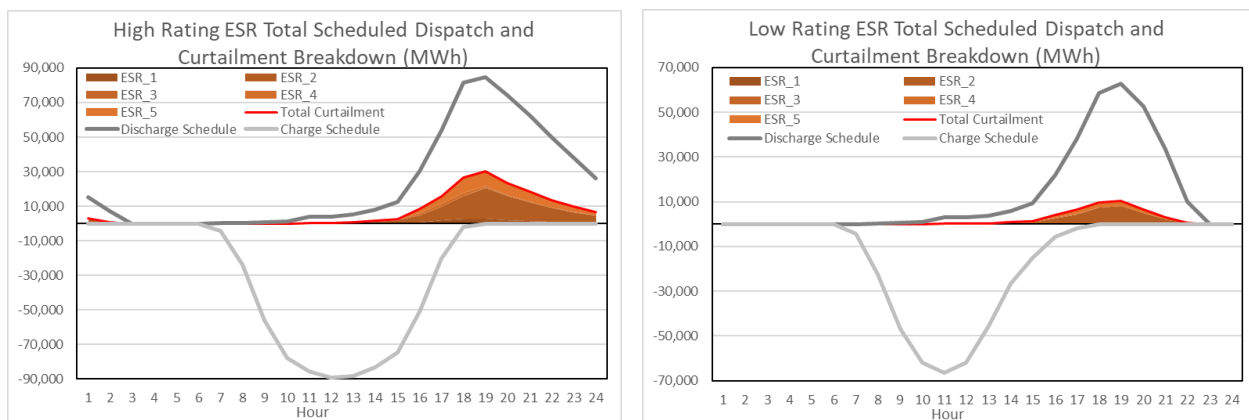
Figure **74** shows the CO<sub>2</sub> and NO<sub>x</sub> emissions of generators located in New York across the Scenario cases and the Base Case. Emissions across all scenario cases decrease substantially from the Base Case results. The additional reduction from both distributed storage models at both load levels are also shown to be relatively small, but non negligible. Again, slightly more pronounced changes occur for the HRM cases due to their increased utilization compared the MAPS ESR case results.

**Figure 74: Energy Storage Resource Sensitivity Case CO<sub>2</sub> and Ozone Season NO<sub>x</sub> Emissions Projections**



The NYISO also performed a limited targeted investigation of the capability of collocated pocket bound ESR to mitigate curtailments, and determine the amount of curtailment that can not be resolved due to inherent limitations in the existing lower voltage transmission network. Based on stakeholder feedback additional information related to the diurnal profile of pocket bound ESR input dispatch and curtailments were aggregated across each hour of the day for the entire modeled year. Input dispatches aggregated across the five ESR units and the individual aggregate curtailments are displayed in Figure 75 in both graphical and tabular form. The High Rating represents 8 hour duration storage with a power capacity approximating the 75<sup>th</sup> percentile of hourly curtailments while the Low Rating represents 4 hour duration with a power capacity approximately equal to the 50<sup>th</sup> percentile of hourly curtailment values as described in the body of the report.

**Figure 75: Pocket Bound Energy Storage Resource Sensitivity Hourly Aggregate Dispatch and Curtailment**



| Hour | High Rating  |           |                 |        |       |       |       |        |
|------|--------------|-----------|-----------------|--------|-------|-------|-------|--------|
|      | ESR Schedule |           | ESR Curtailment |        |       |       |       | Total  |
|      | Charge       | Discharge | ESR_1           | ESR_2  | ESR_3 | ESR_4 | ESR_5 |        |
| 1    | 0            | 15,266    | 163             | 2,091  | 0     | 5     | 816   | 3,075  |
| 2    | 0            | 7,107     | 4               | 657    | 0     | 0     | 133   | 794    |
| 3    | 0            | 0         | 0               | 0      | 0     | 0     | 0     | 0      |
| 4    | 0            | 0         | 0               | 0      | 0     | 0     | 0     | 0      |
| 5    | 0            | 0         | 0               | 0      | 0     | 0     | 0     | 0      |
| 6    | -132         | 0         | 0               | 0      | 0     | 0     | 0     | 0      |
| 7    | -4,453       | 54        | 0               | 0      | 0     | 0     | 0     | 0      |
| 8    | -23,974      | 354       | 0               | 0      | 0     | 0     | 0     | 0      |
| 9    | -55,975      | 655       | 0               | 0      | 0     | 0     | 0     | 0      |
| 10   | -77,793      | 1,100     | 0               | 0      | 0     | 0     | 0     | 0      |
| 11   | -85,799      | 3,849     | 0               | 320    | 0     | 0     | 101   | 421    |
| 12   | -89,203      | 3,958     | 0               | 77     | 0     | 125   | 93    | 295    |
| 13   | -88,376      | 5,317     | 112             | 318    | 0     | 161   | 112   | 703    |
| 14   | -83,389      | 7,757     | 27              | 937    | 0     | 212   | 492   | 1,668  |
| 15   | -74,612      | 12,398    | 211             | 1,453  | 0     | 362   | 690   | 2,716  |
| 16   | -51,293      | 30,079    | 607             | 3,939  | 37    | 1,391 | 2,249 | 8,224  |
| 17   | -20,139      | 53,760    | 1,640           | 7,714  | 0     | 1,843 | 4,356 | 15,552 |
| 18   | -1,853       | 81,642    | 2,790           | 13,101 | 161   | 1,887 | 8,834 | 26,774 |
| 19   | 0            | 84,706    | 2,793           | 17,615 | 405   | 952   | 8,474 | 30,239 |
| 20   | 0            | 74,250    | 1,918           | 13,984 | 155   | 525   | 6,800 | 23,383 |
| 21   | 0            | 62,275    | 1,517           | 10,914 | 0     | 389   | 5,423 | 18,243 |
| 22   | 0            | 49,860    | 845             | 8,066  | 92    | 256   | 4,197 | 13,457 |
| 23   | 0            | 37,901    | 730             | 5,787  | 0     | 115   | 3,004 | 9,636  |
| 24   | 0            | 26,139    | 794             | 3,660  | 0     | 23    | 1,911 | 6,388  |

| Hour | Low Rating   |           |                 |       |       |       |       |        |
|------|--------------|-----------|-----------------|-------|-------|-------|-------|--------|
|      | ESR Schedule |           | ESR Curtailment |       |       |       |       | Total  |
|      | Charge       | Discharge | ESR_1           | ESR_2 | ESR_3 | ESR_4 | ESR_5 |        |
| 1    | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 2    | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 3    | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 4    | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 5    | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 6    | -132         | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 7    | -4,441       | 54        | 0               | 0     | 0     | 0     | 0     | 0      |
| 8    | -22,322      | 349       | 0               | 0     | 0     | 0     | 0     | 0      |
| 9    | -46,923      | 528       | 0               | 0     | 0     | 0     | 0     | 0      |
| 10   | -61,976      | 923       | 0               | 0     | 0     | 0     | 0     | 0      |
| 11   | -66,452      | 3,148     | 0               | 205   | 0     | 0     | 78    | 283    |
| 12   | -61,933      | 3,052     | 0               | 49    | 0     | 20    | 82    | 151    |
| 13   | -45,355      | 3,925     | 0               | 182   | 0     | 55    | 45    | 282    |
| 14   | -26,683      | 5,973     | 0               | 605   | 0     | 50    | 211   | 866    |
| 15   | -15,124      | 9,290     | 59              | 877   | 0     | 79    | 294   | 1,308  |
| 16   | -5,636       | 21,824    | 84              | 2,508 | 0     | 394   | 989   | 3,975  |
| 17   | -1,884       | 38,228    | 132             | 4,246 | 0     | 305   | 1,701 | 6,383  |
| 18   | -117         | 58,757    | 161             | 7,102 | 0     | 240   | 2,329 | 9,832  |
| 19   | 0            | 62,799    | 128             | 8,100 | 0     | 8     | 2,189 | 10,425 |
| 20   | 0            | 52,567    | 327             | 4,680 | 41    | 18    | 1,637 | 6,703  |
| 21   | 0            | 33,594    | 248             | 1,843 | 23    | 38    | 1,059 | 3,211  |
| 22   | 0            | 10,109    | 10              | 310   | 0     | 0     | 417   | 737    |
| 23   | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |
| 24   | 0            | 0         | 0               | 0     | 0     | 0     | 0     | 0      |

### Nuclear Sensitivity Result Details

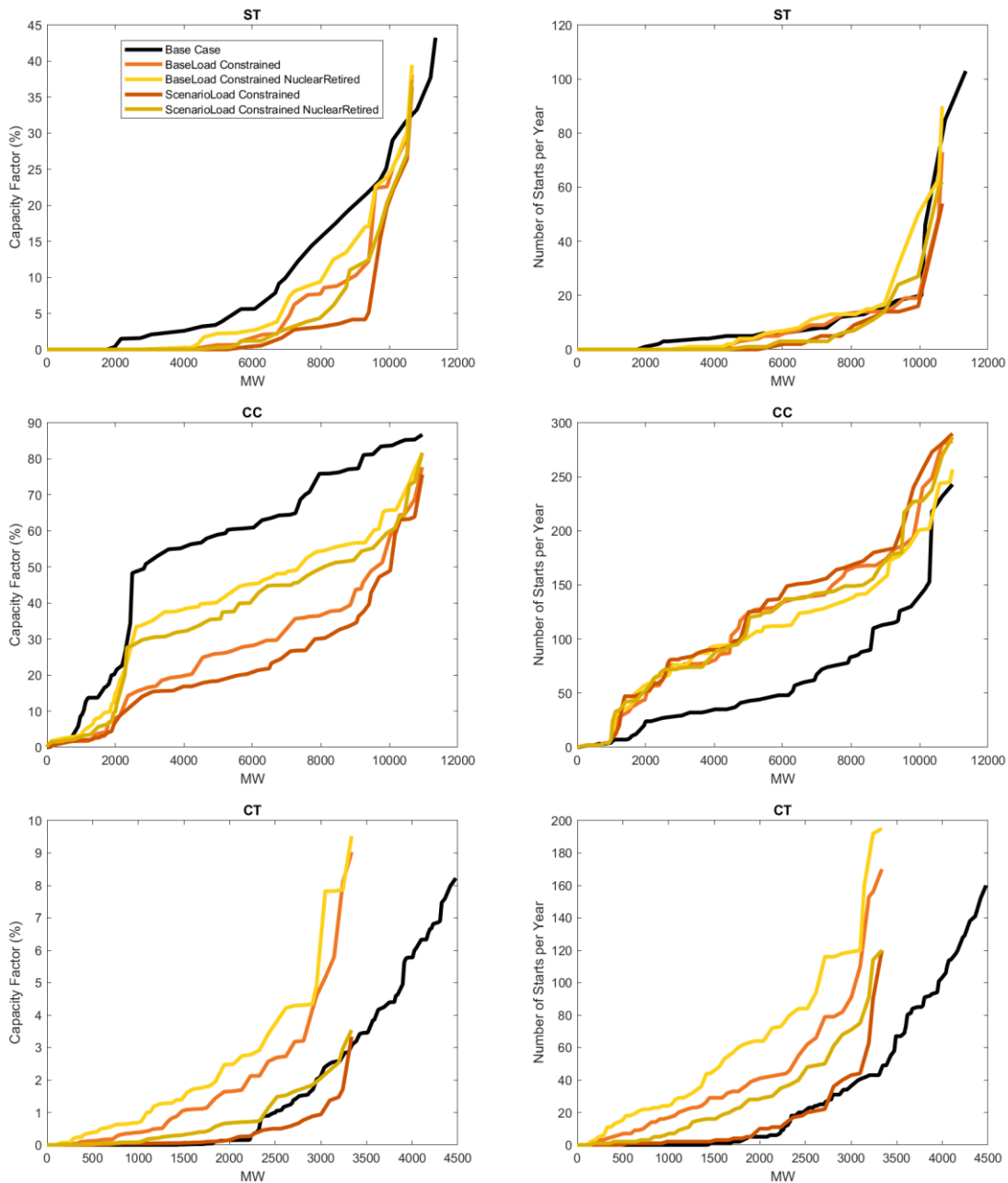
Distinctions between fossil fuel operation in cases with and without nuclear generation can be further studied from the cumulative capacity curves shown below in Figure 76. Steam turbine capacity factors are lower in scenario cases compared to the Base Case even though the number of starts remains consistent across all cases. This result can be attributed to; (i) steam units fulfilling contract and local reliability requirements by remaining on at minimum generation levels, (ii) the location of the nuclear units upstate while the majority of operating steam turbines are located downstate, and (iii) steam turbine generators' lower relative flexibility compared to other fossil generators.

Combined cycle units, which offer more flexibility in operation compared to steam turbine units, have more starts in all scenario cases. Moreover, combined cycle units operate at higher capacity factors across the board when the upstate nuclear fleet is retired. Combined cycle resources operate as marginal units filling in between renewable energy resources in the absence of nuclear generation, which produces a pronounced gap in the cumulative curves between the sensitivity cases.

Combustion turbines offer rapid response to net load variability in cases with high renewable penetration. These units have shorter minimum run time and minimum down time characteristics, which allows for very flexible operation. Similar to other fossil units, these units operate at higher capacity factors in cases with nuclear generation retired.

Across all unit types, capacity factors are higher for Base load cases compared to Scenario load cases because of the higher load levels.

**Figure 76: Nuclear Retirement Sensitivity Cases Fossil Fleet Cumulative Capacity Curves**



### Sample Interval Hourly Examples

In order to examine the system condition more closely, four two-week periods across the annual hourly simulations were reviewed that are representative of combinations of RE generation and load levels:

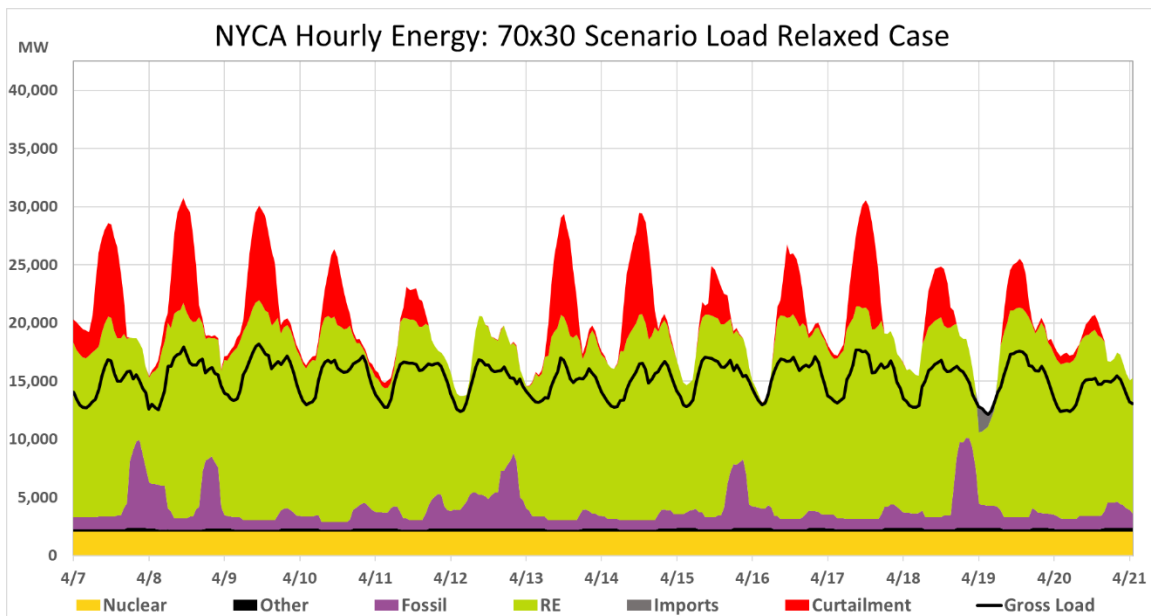
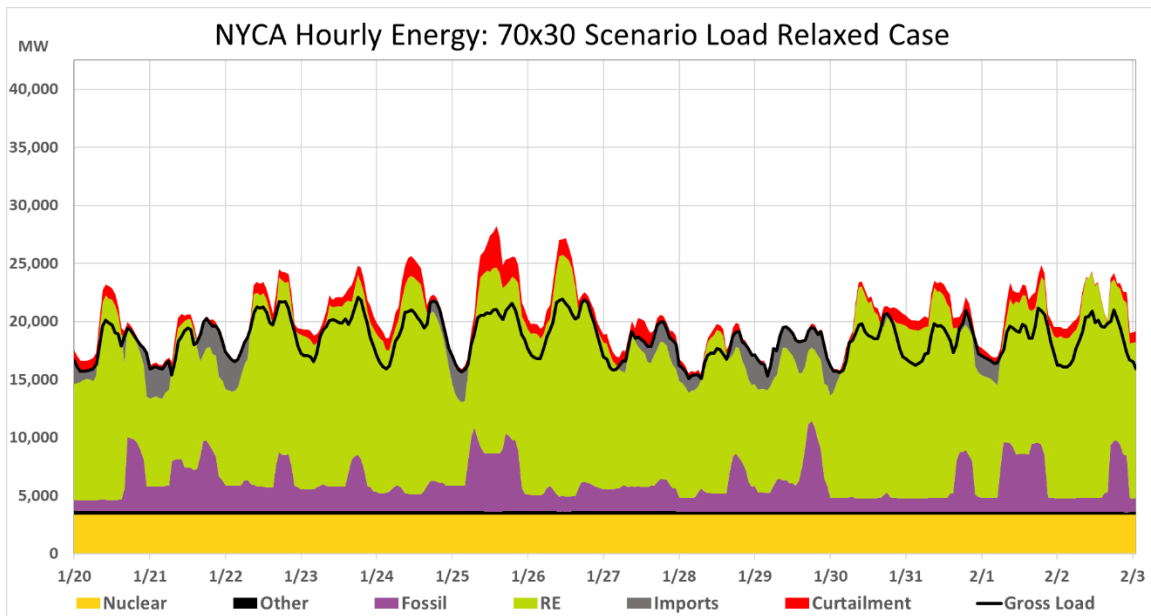
- January: during winter peak load and low renewable generation period
- April: during spring low net load period (high renewable generation during low load)

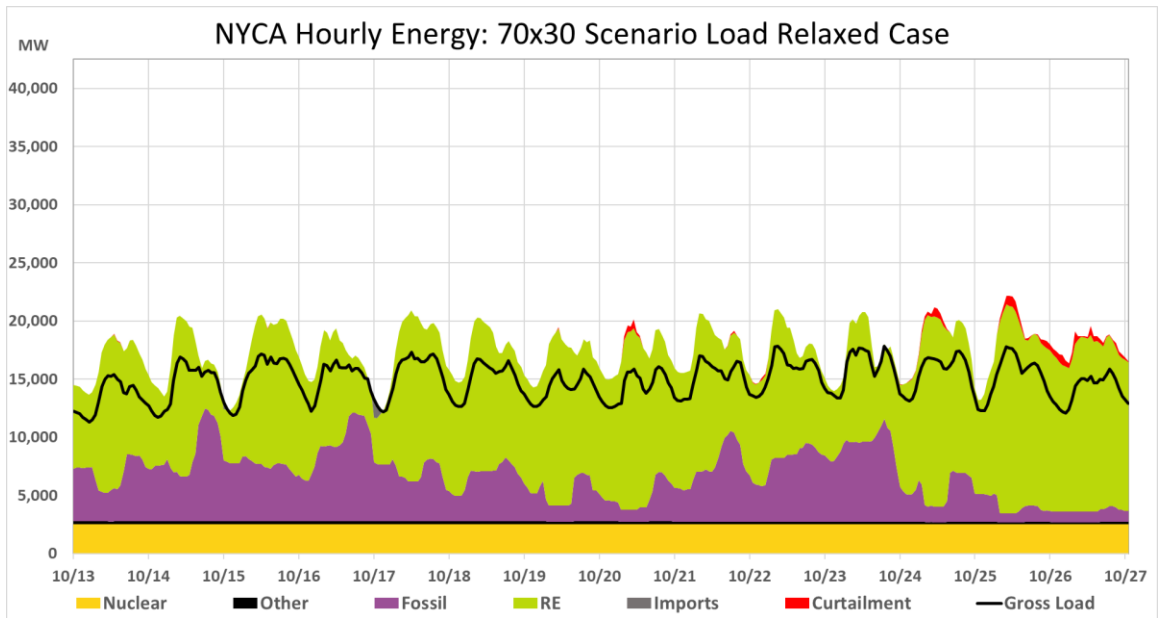
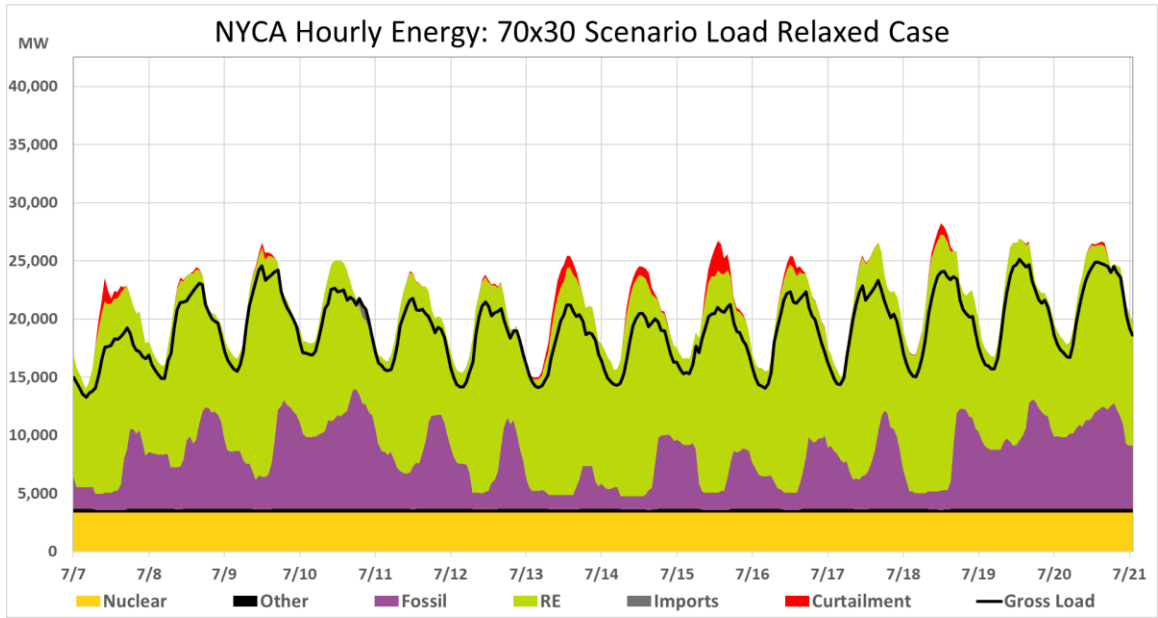


- July: during summer peak load period
- October: during fall low load and low renewable generation period

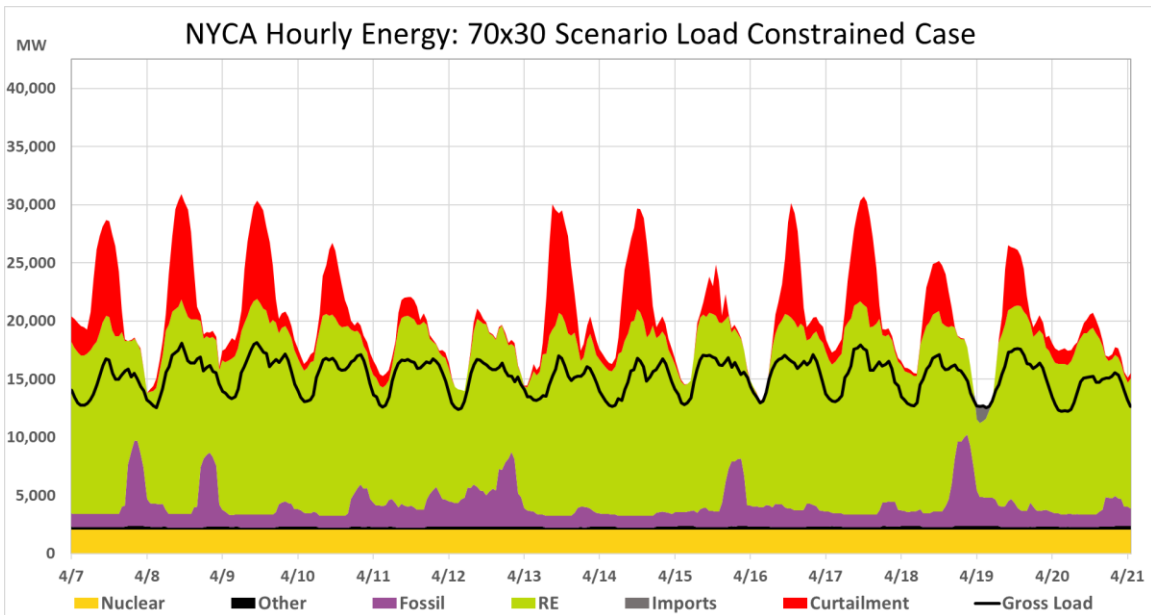
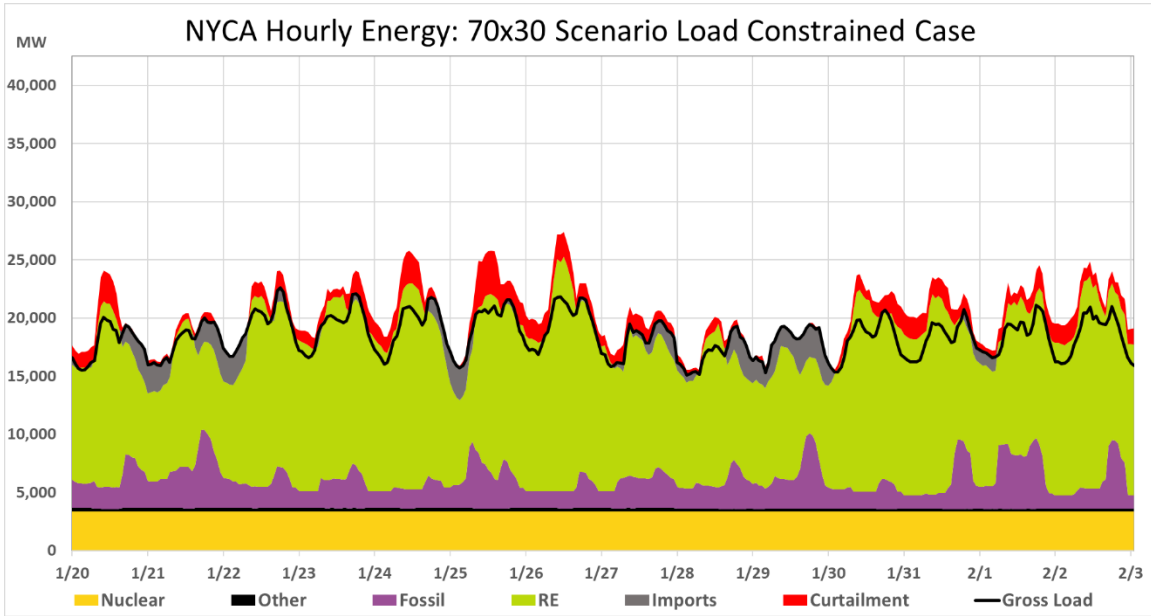
The following figures display results during these periods in the relaxed, constrained, nuclear retired, ESR, and HRM cases for both the Scenario and Base Load cases.

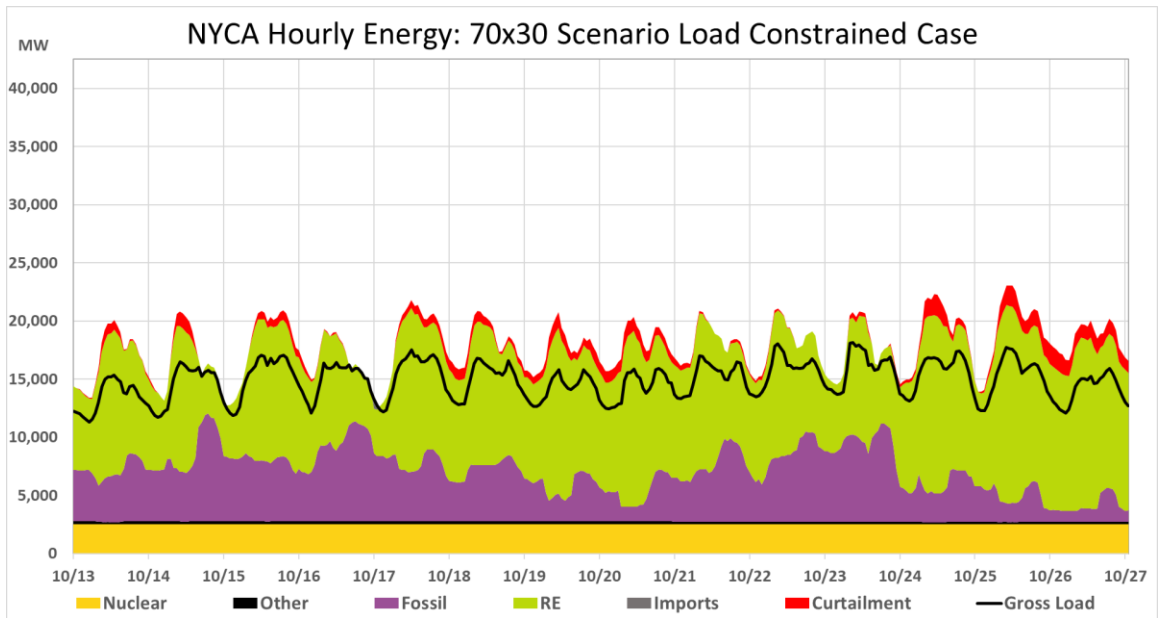
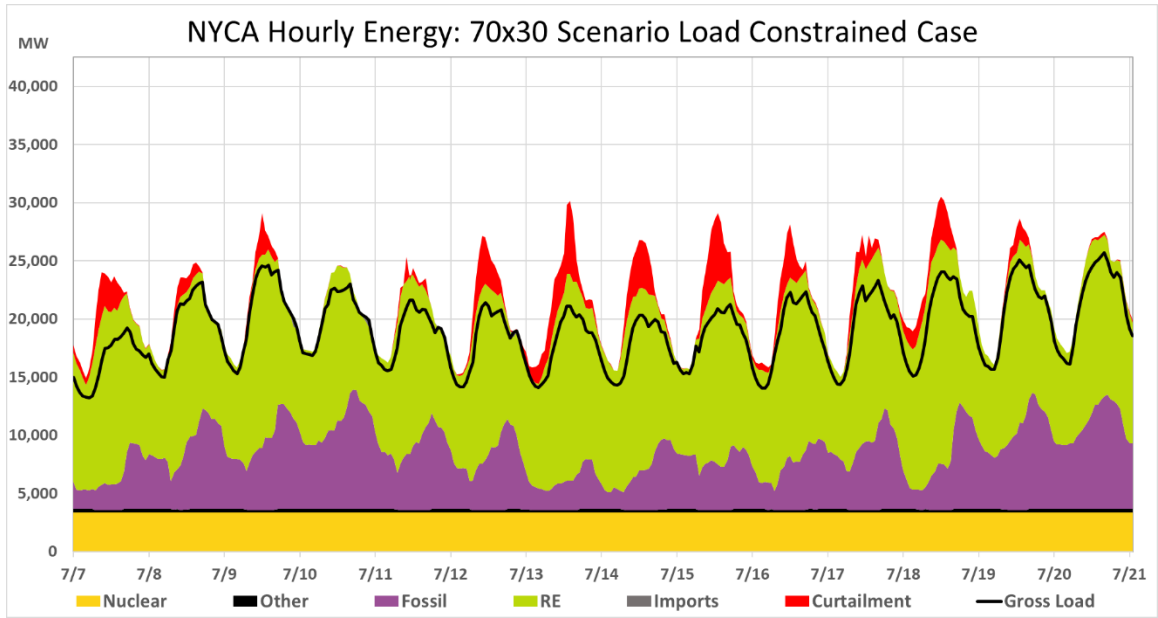
**Figure 77: Sample Interval Hourly Examples: Scenario Load Relaxed Case**



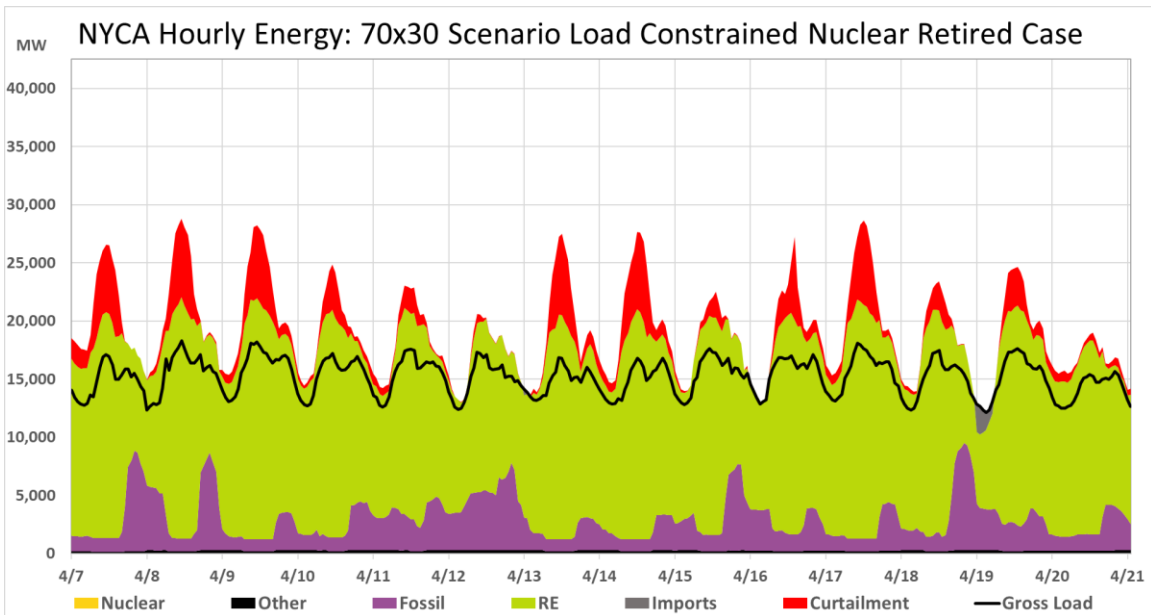
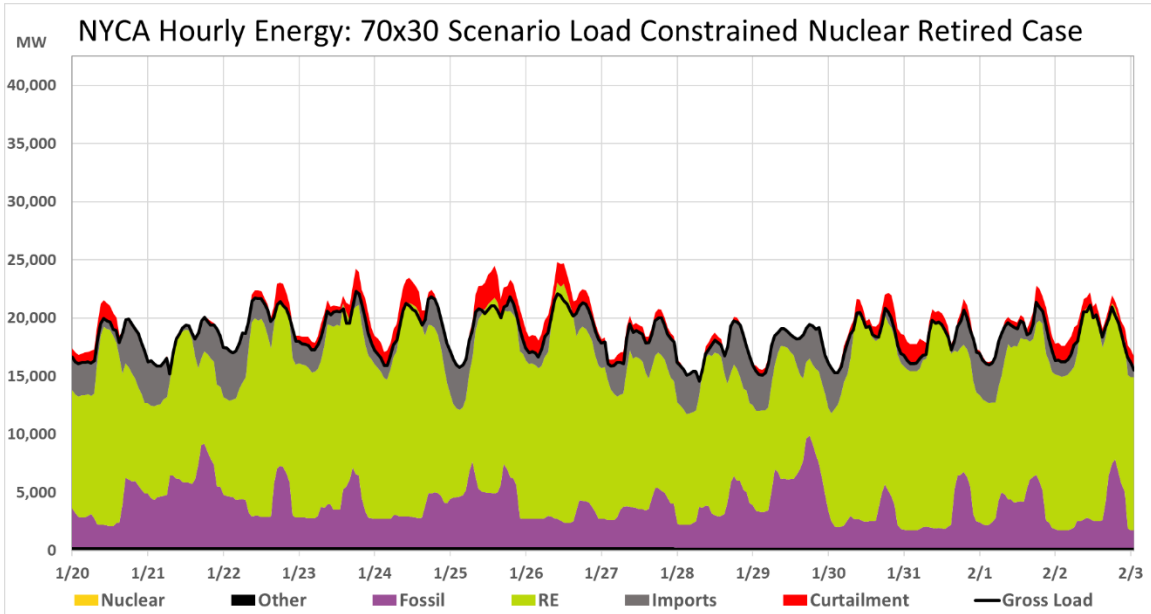


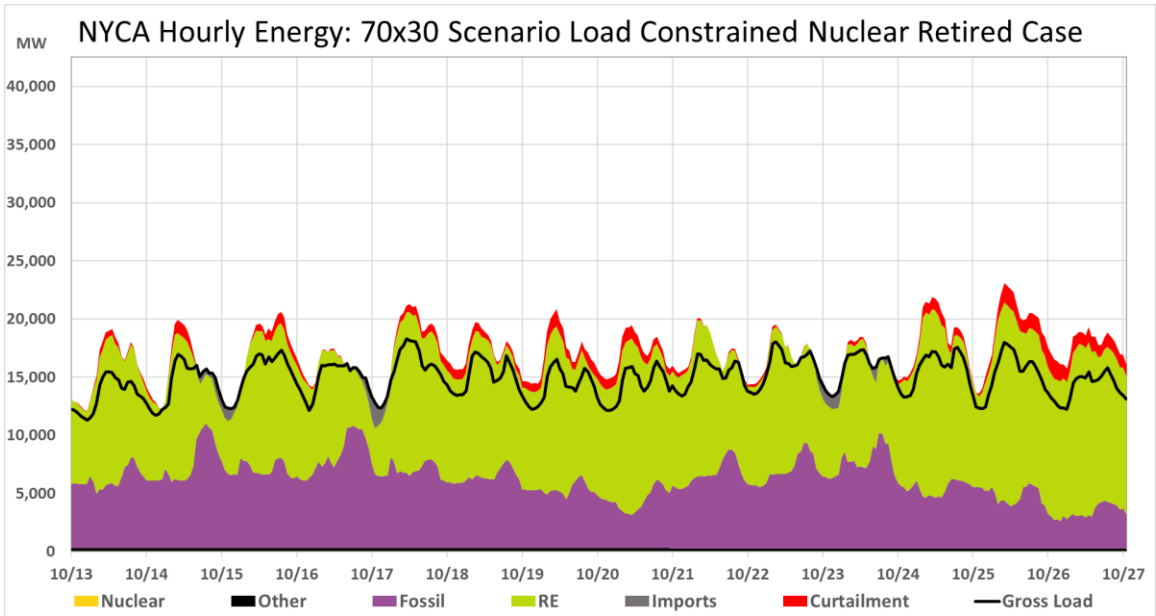
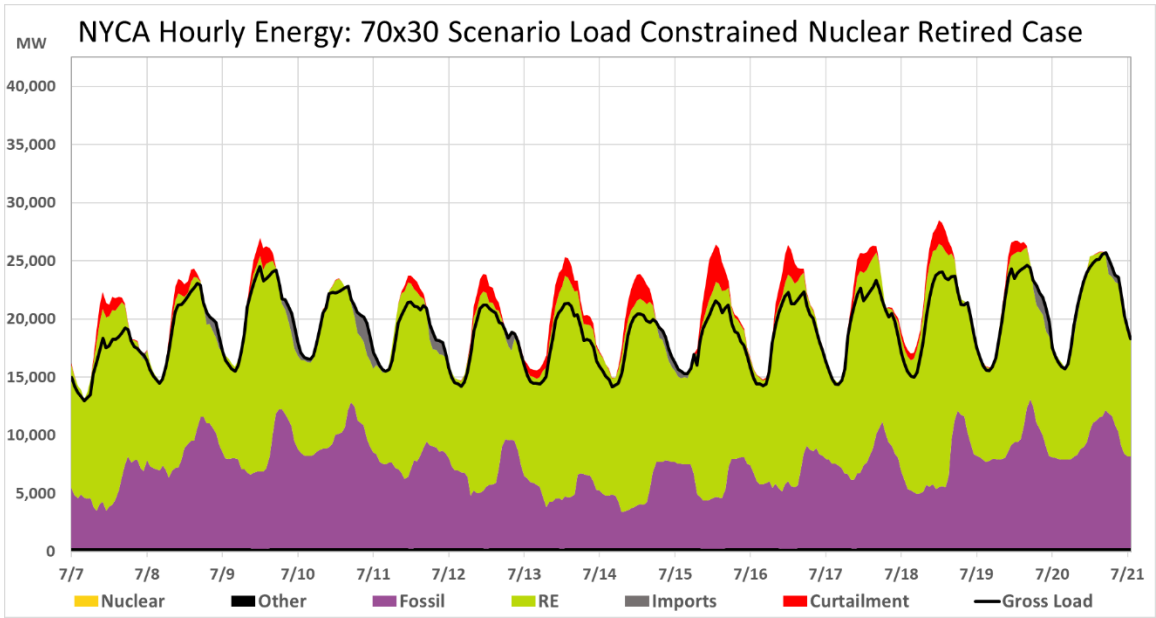
**Figure 78: Sample Interval Hourly Examples: Scenario Load Constrained Case**



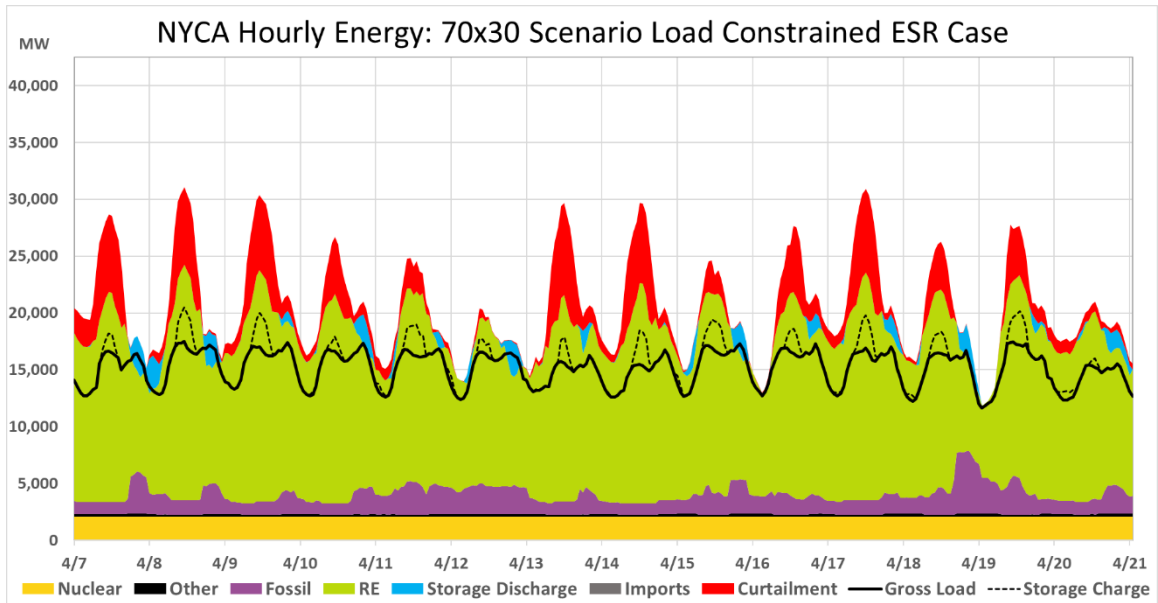
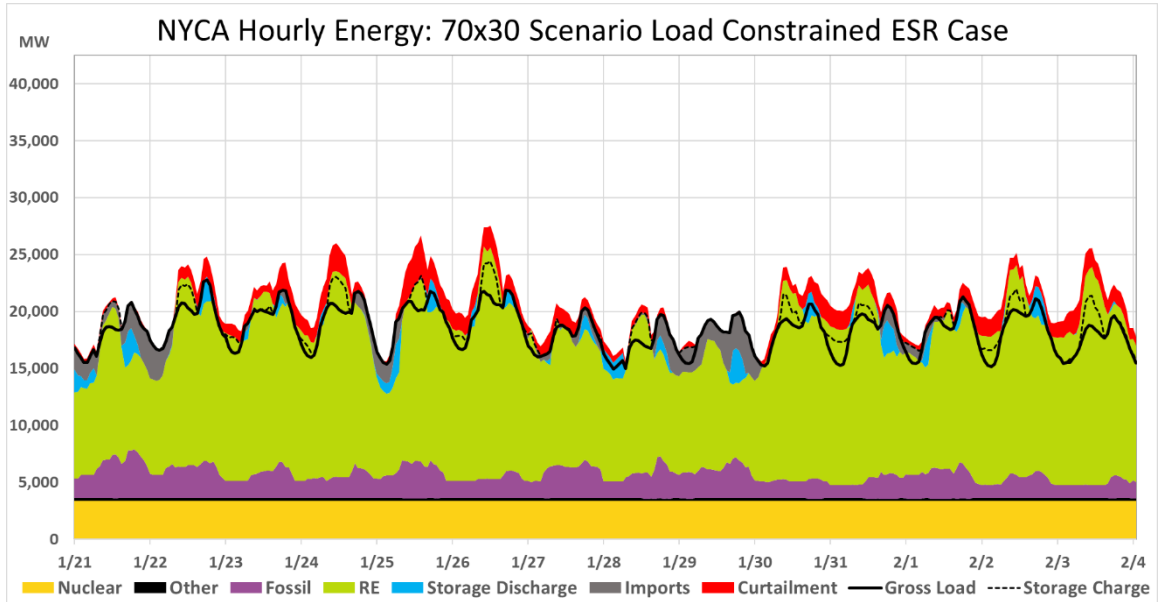


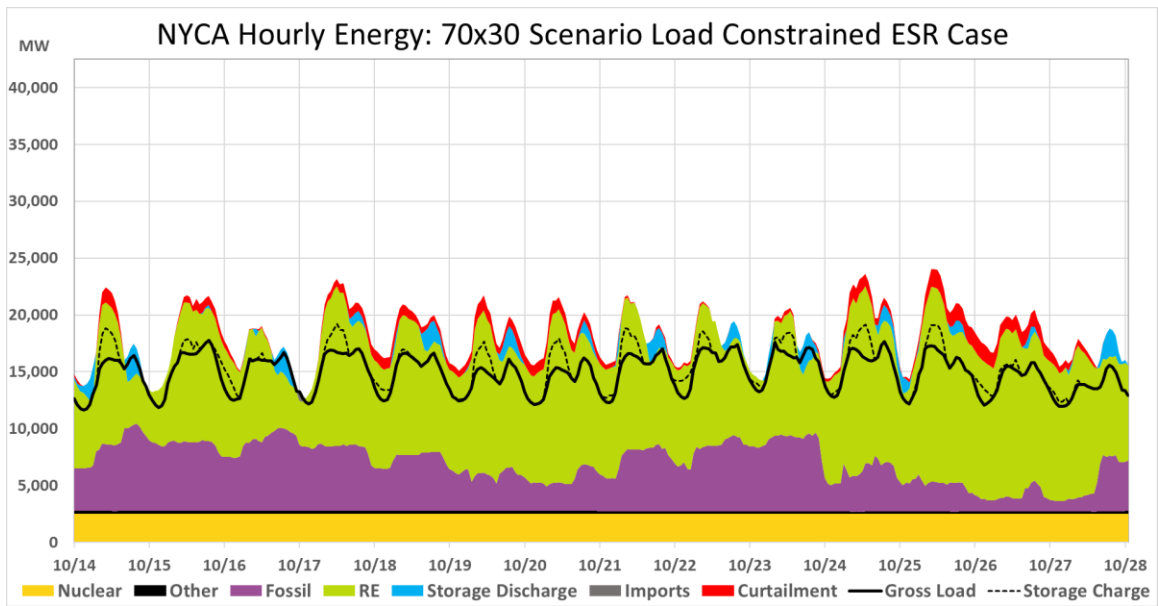
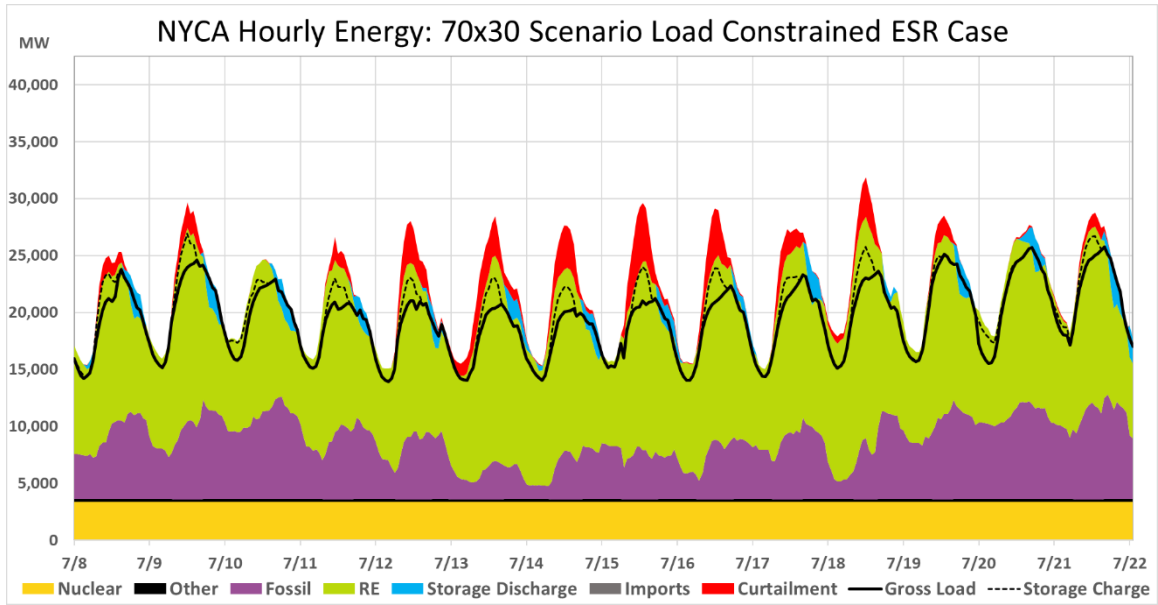
**Figure 79: Sample Interval Hourly Examples: Scenario Load Nuclear Retired Case**





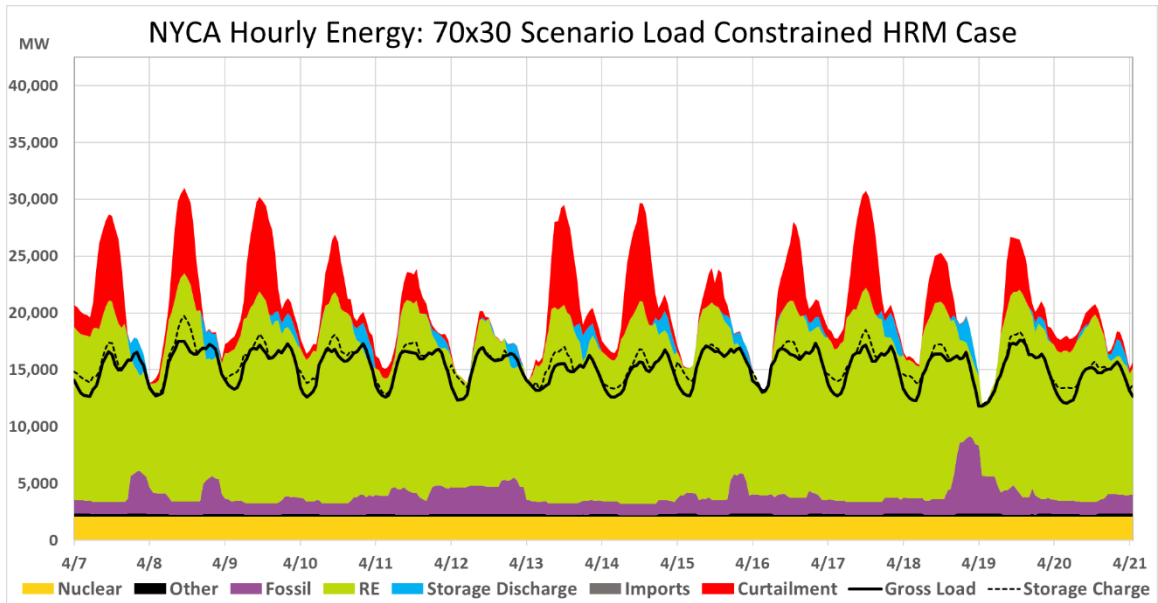
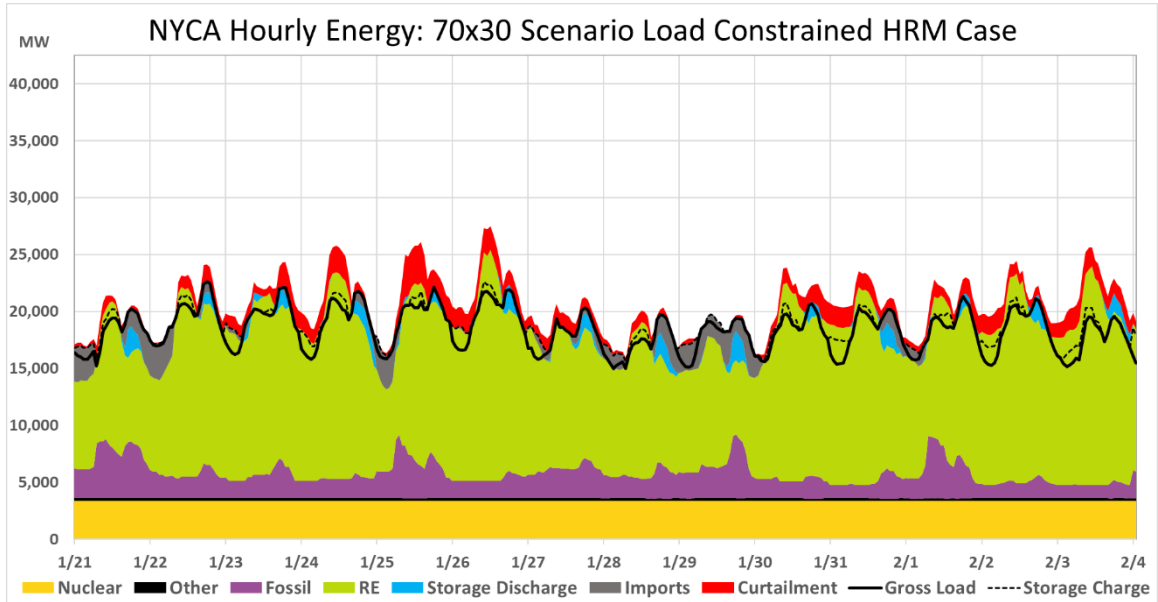
**Figure 80: Sample Interval Hourly Examples: Scenario Load ESR Case**

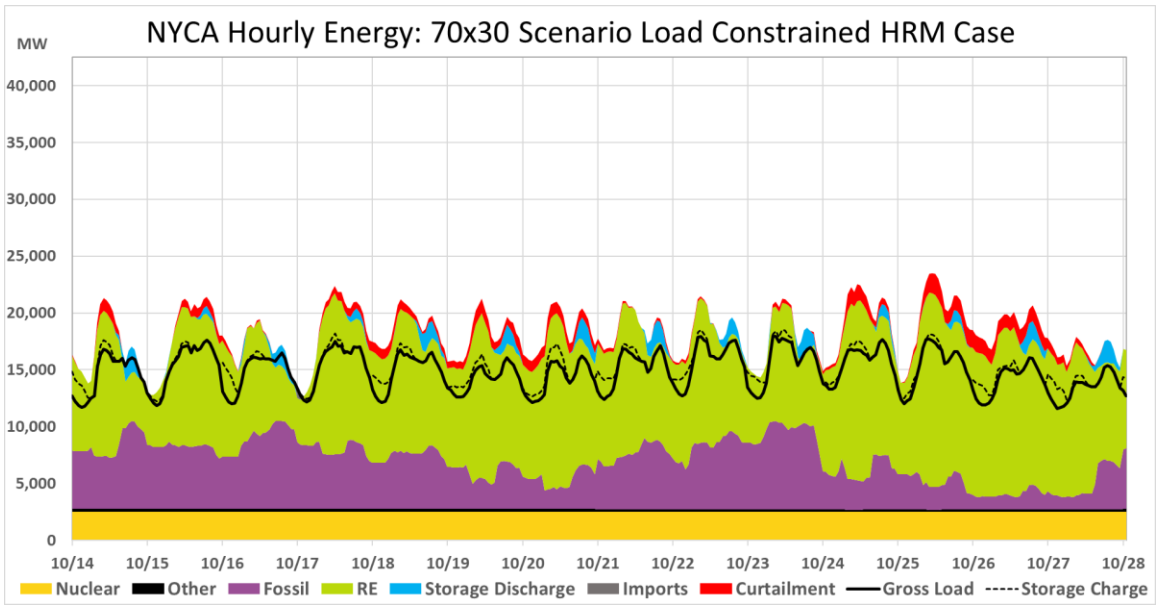
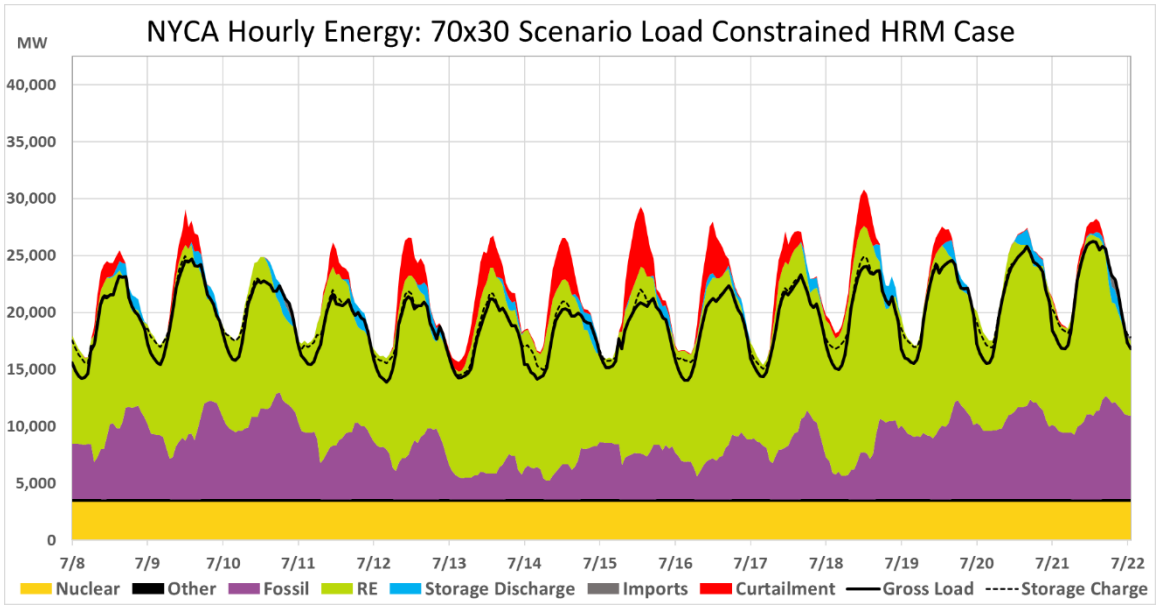




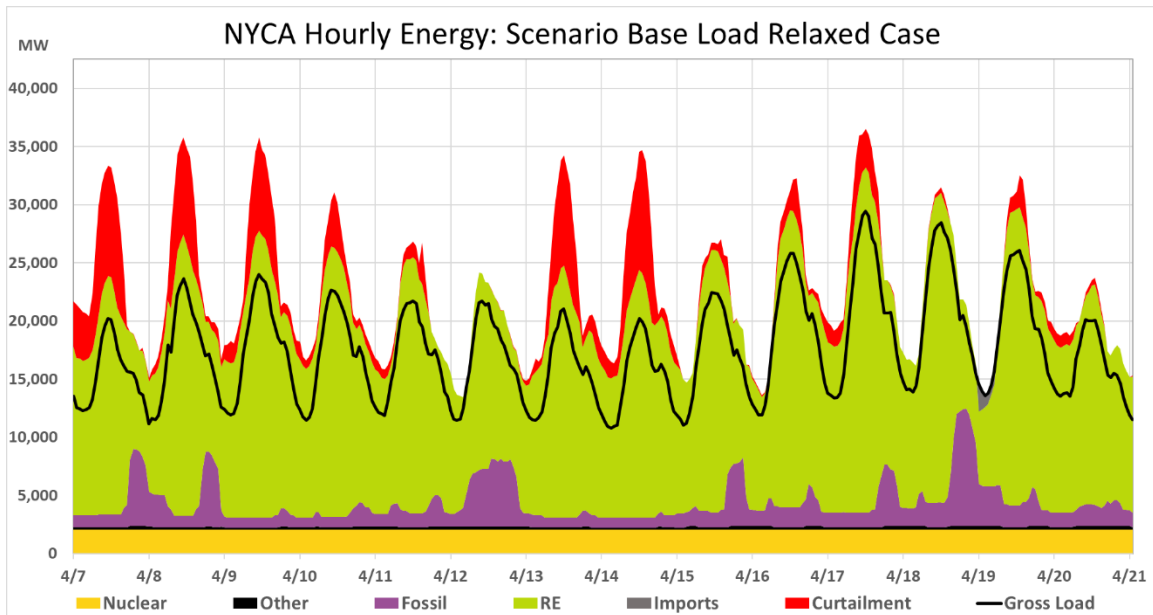
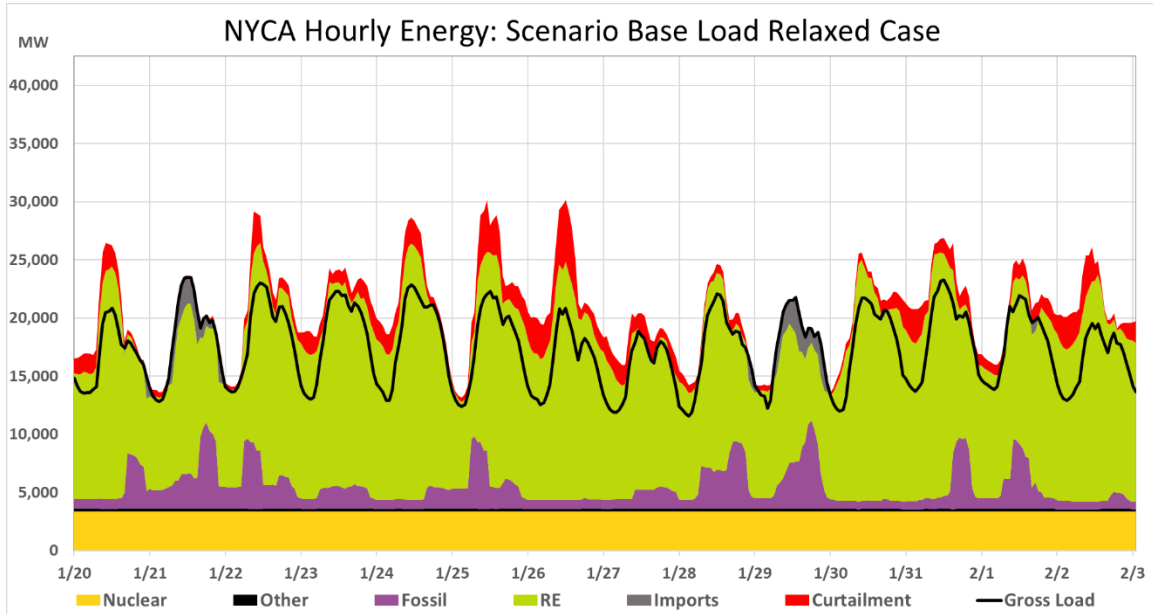


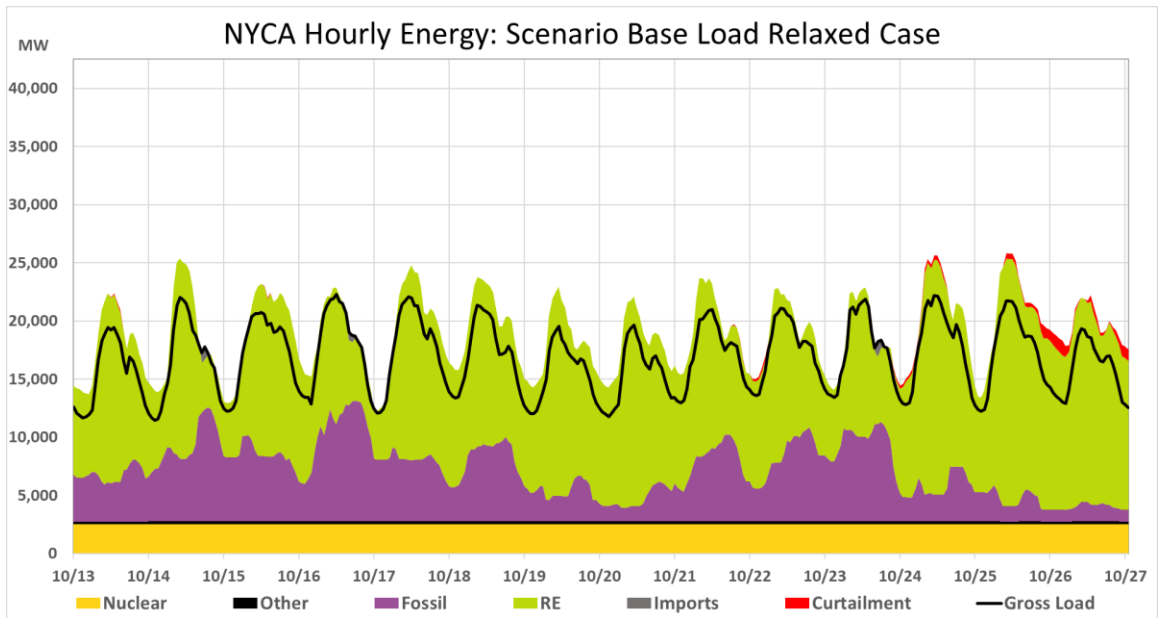
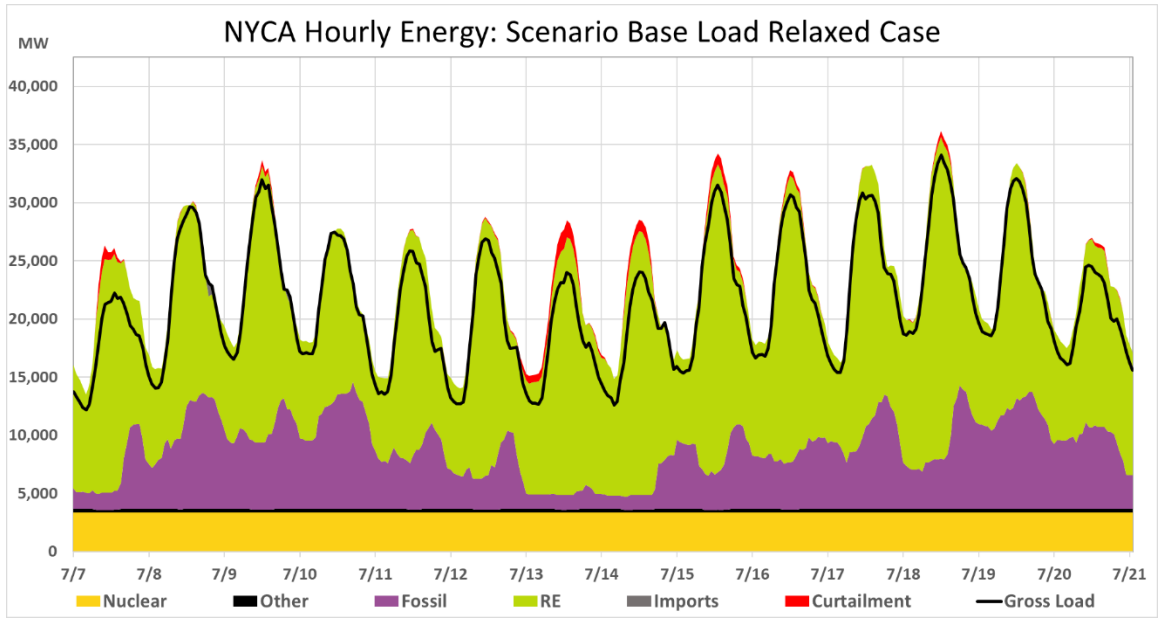
**Figure 81: Sample Interval Hourly Examples: Scenario Load HRM Case**



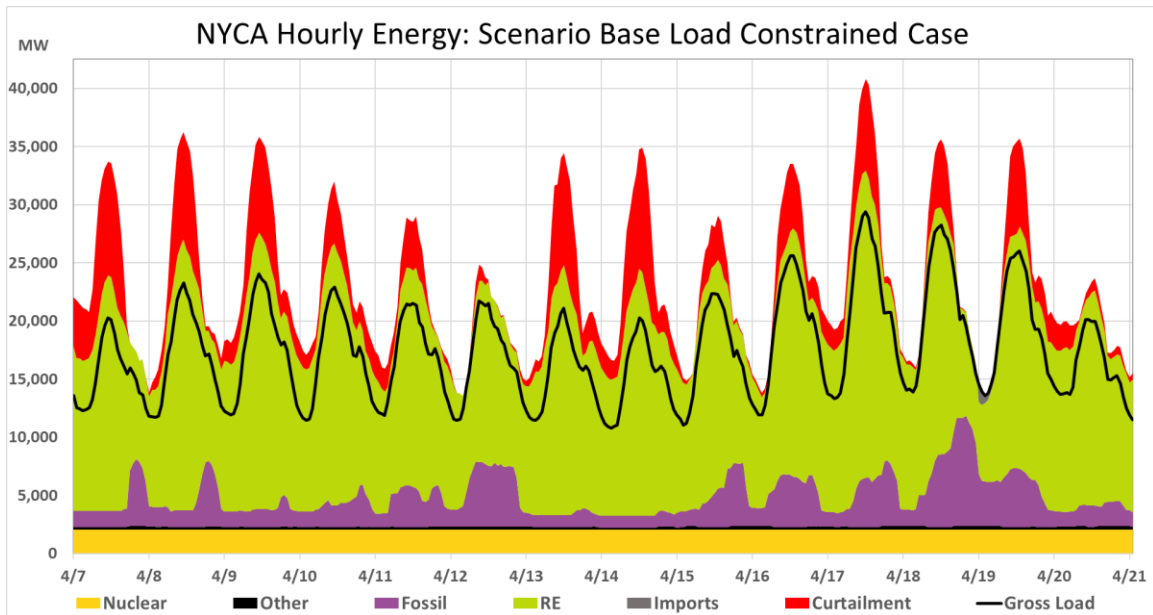
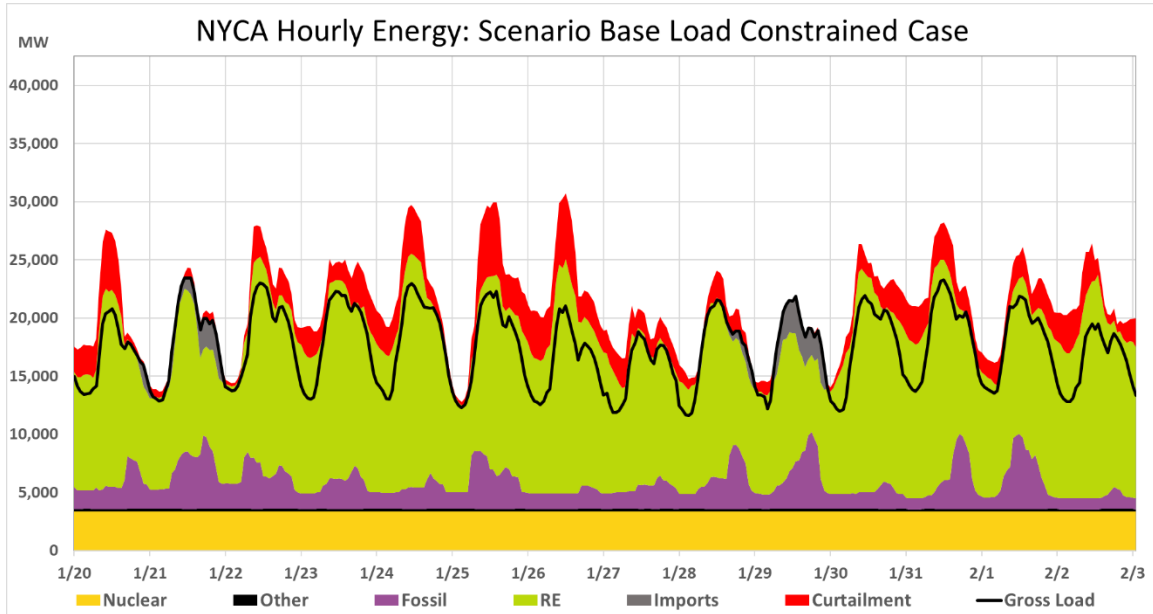


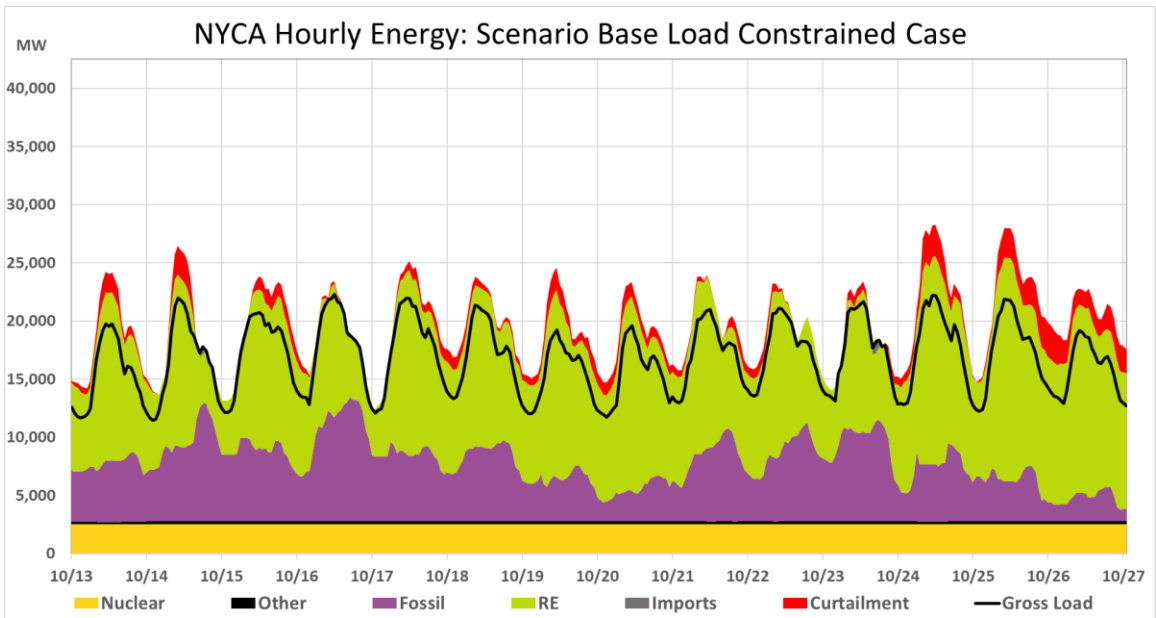
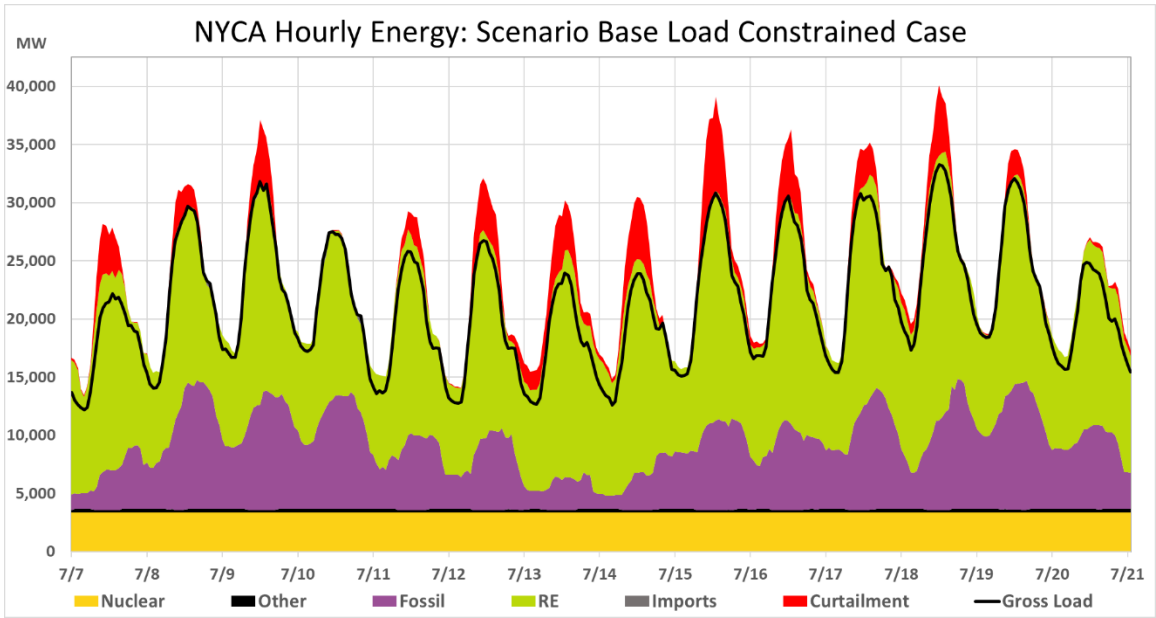
**Figure 82: Sample Interval Hourly Examples: Base Load Relaxed Case**



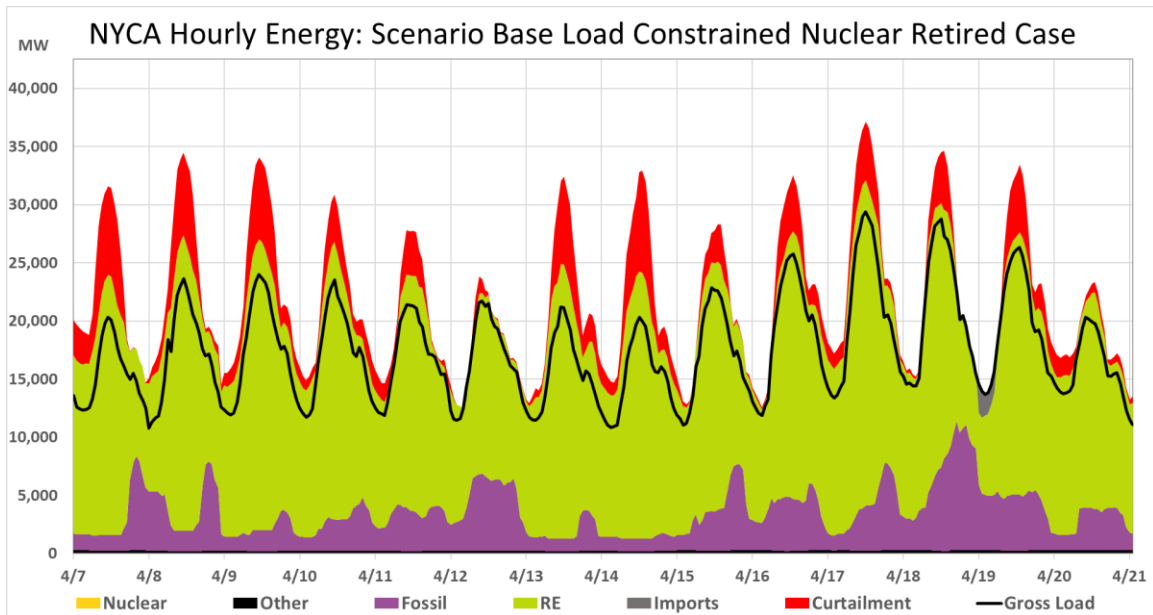
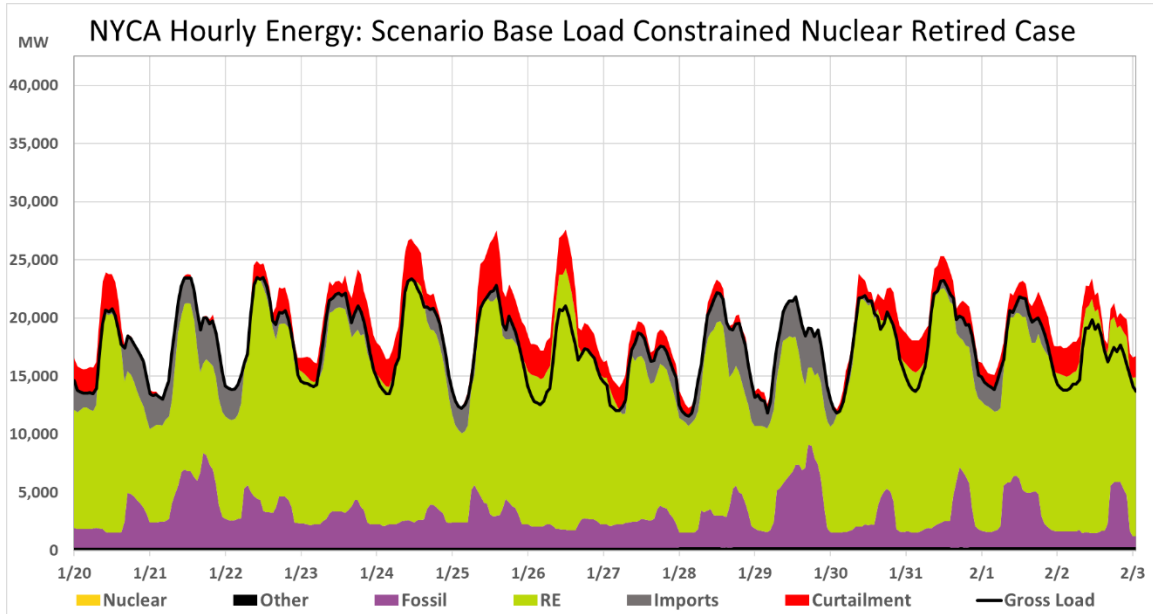


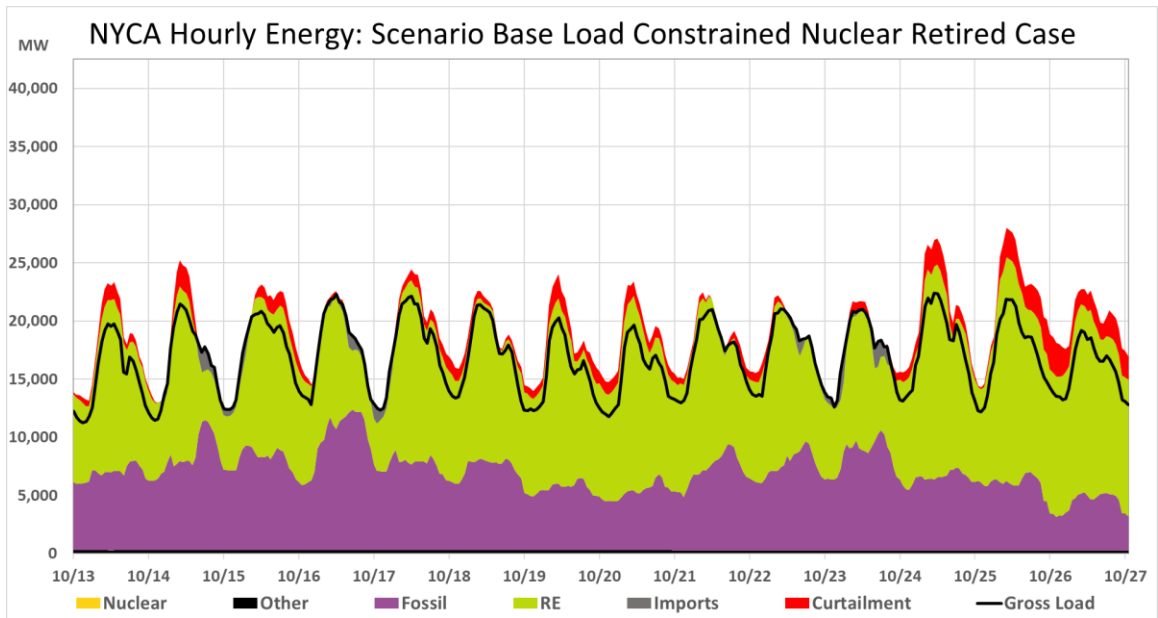
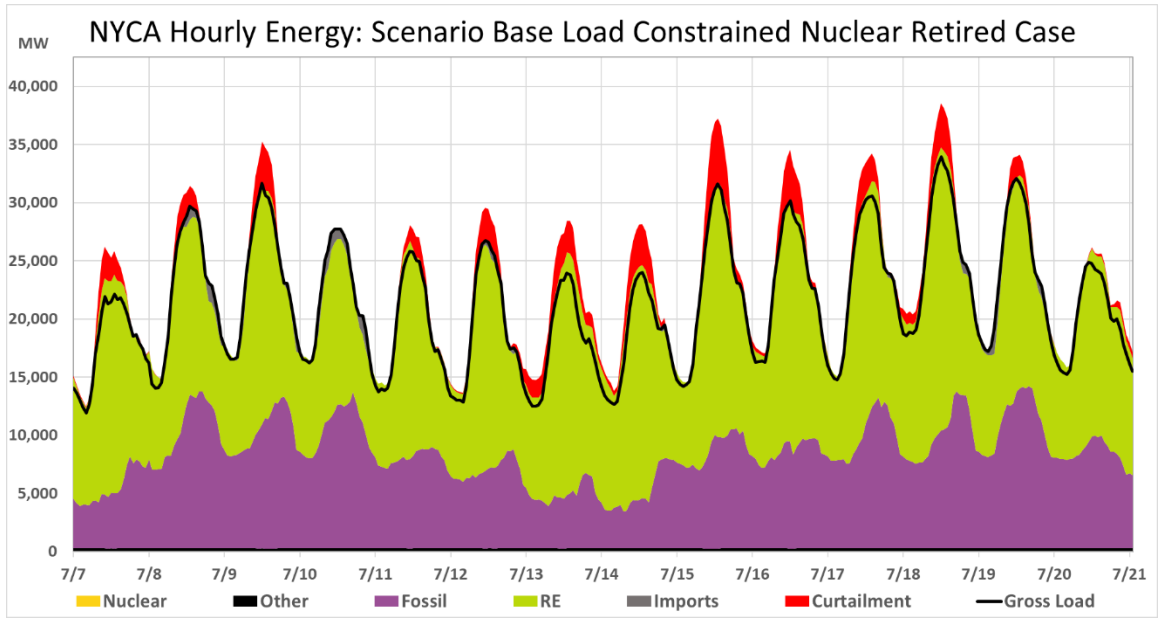
**Figure 83: Sample Interval Hourly Examples: Base Load Constrained Case**





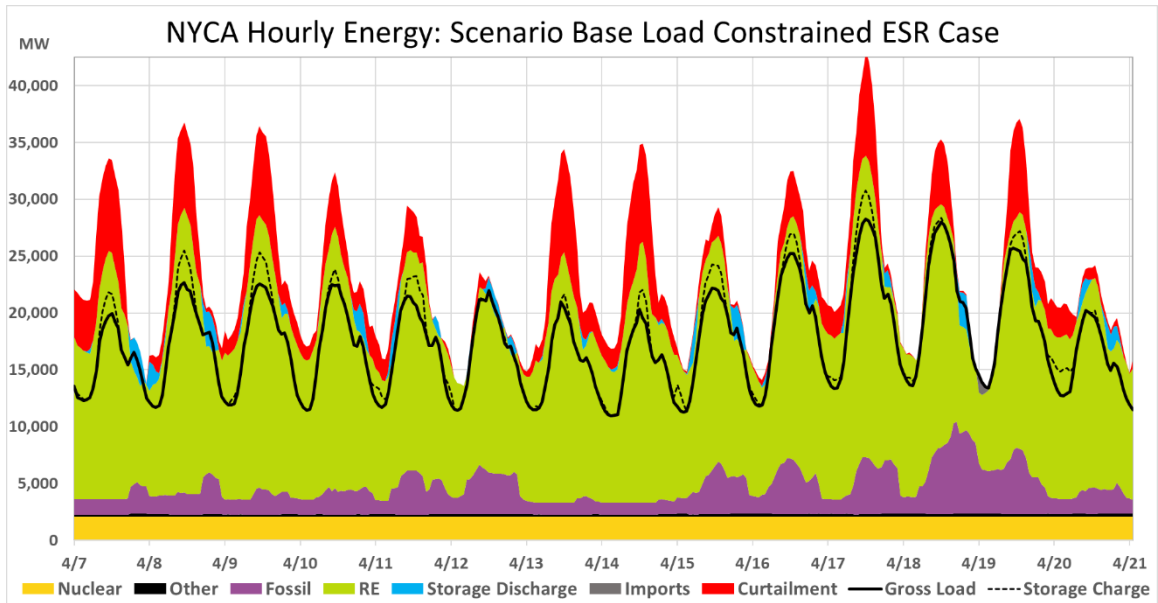
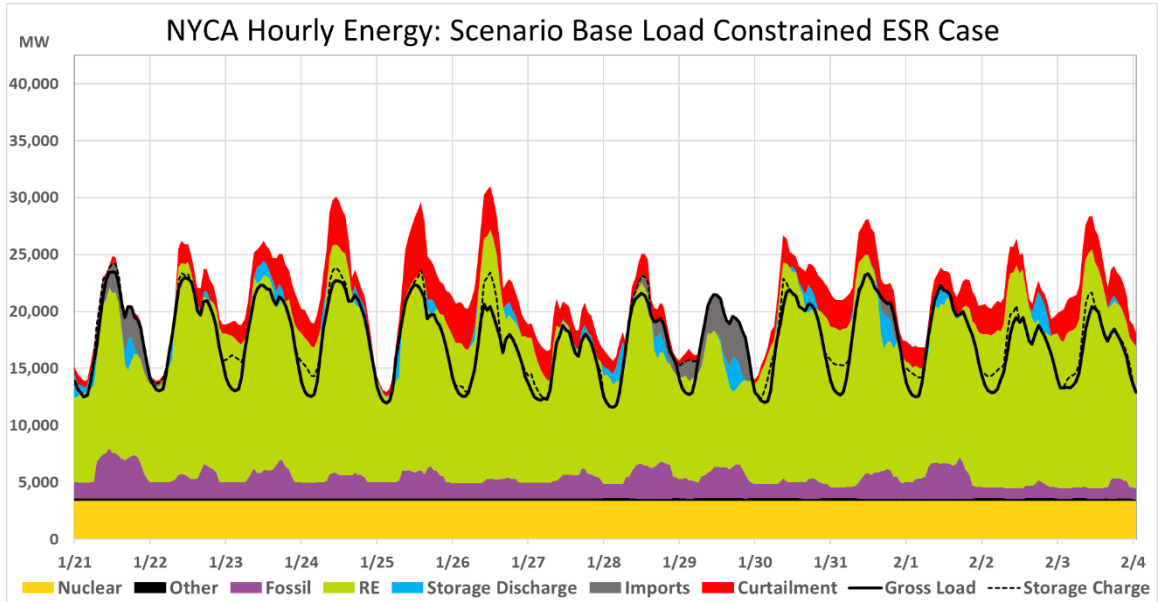
**Figure 84: Sample Interval Hourly Examples: Base Load Nuclear Retired Case**

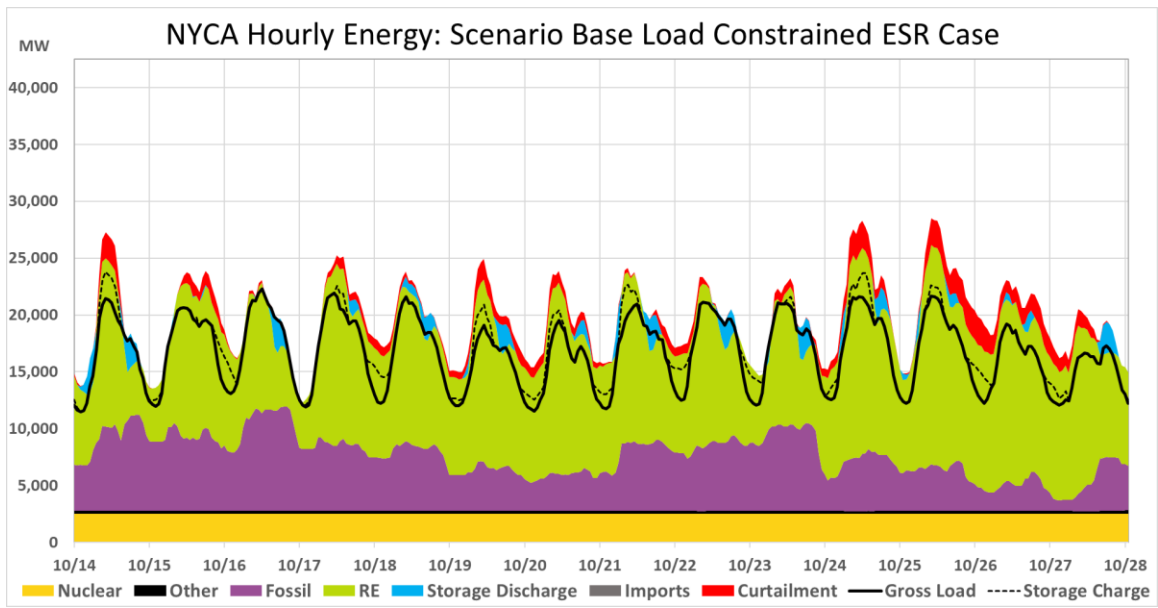
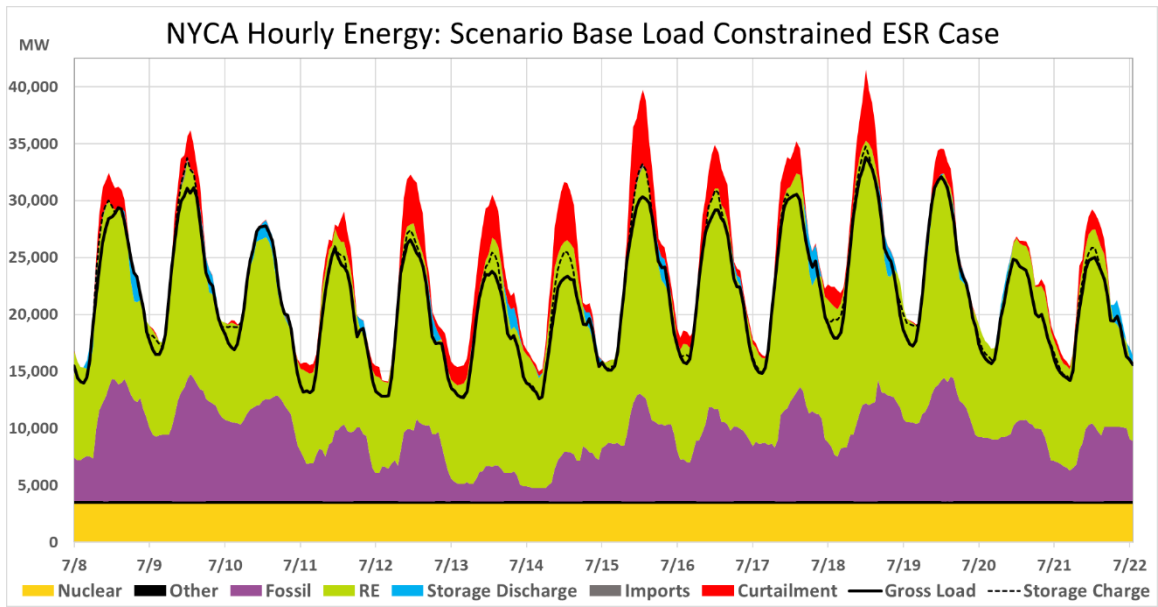




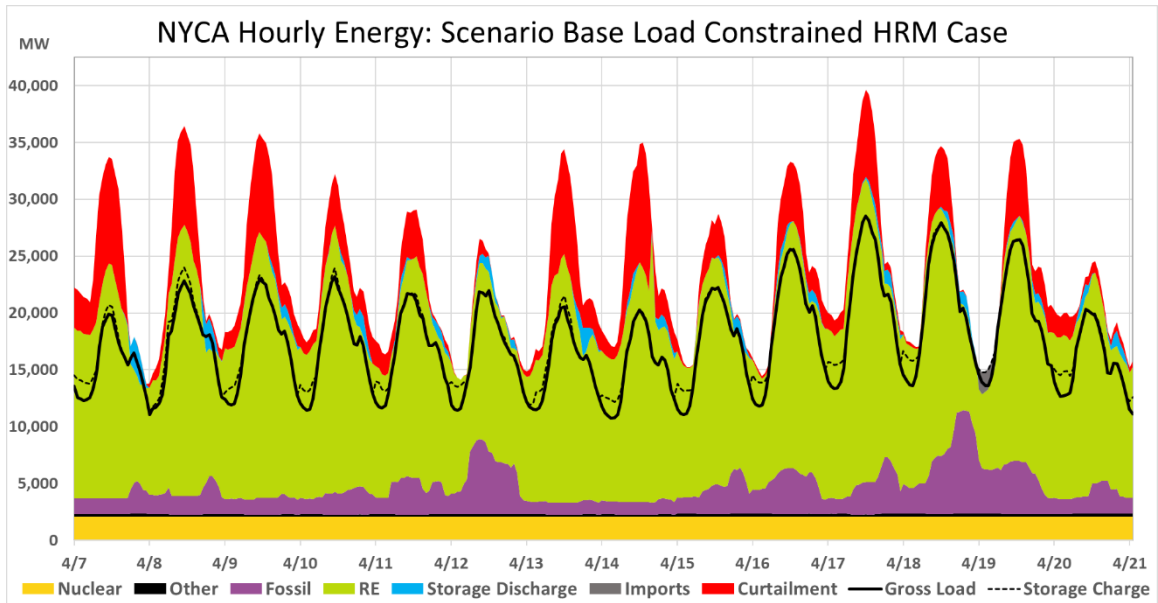
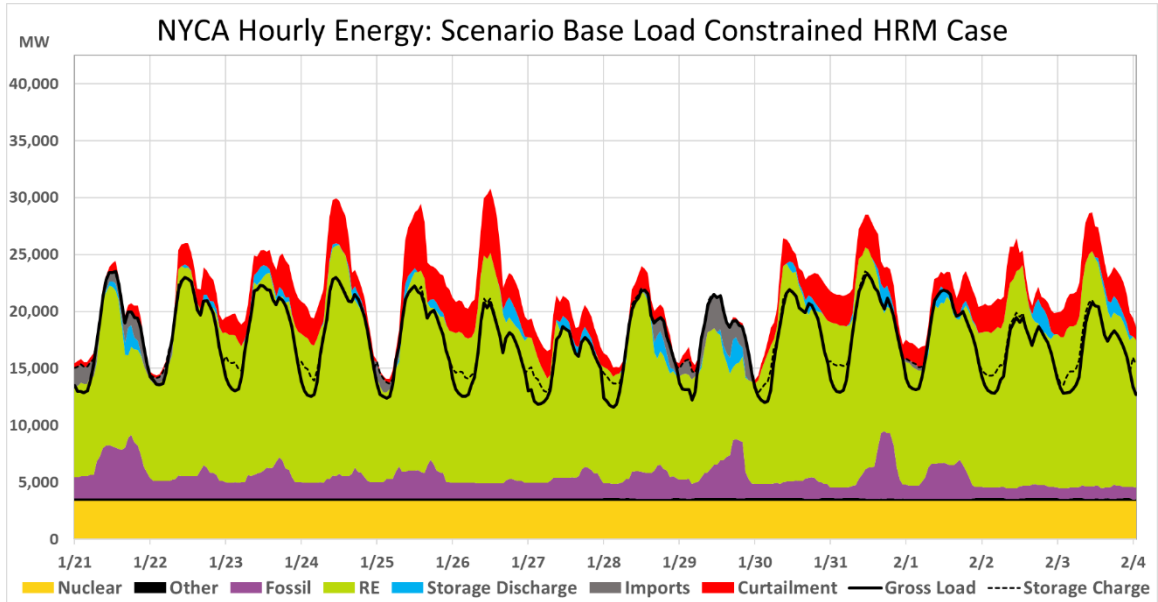


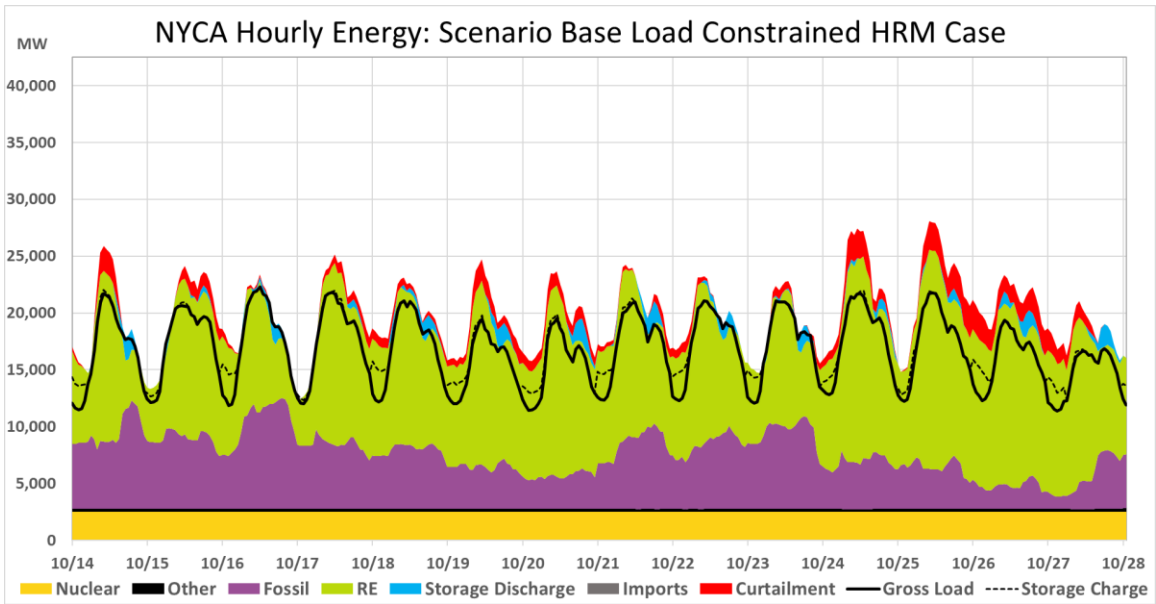
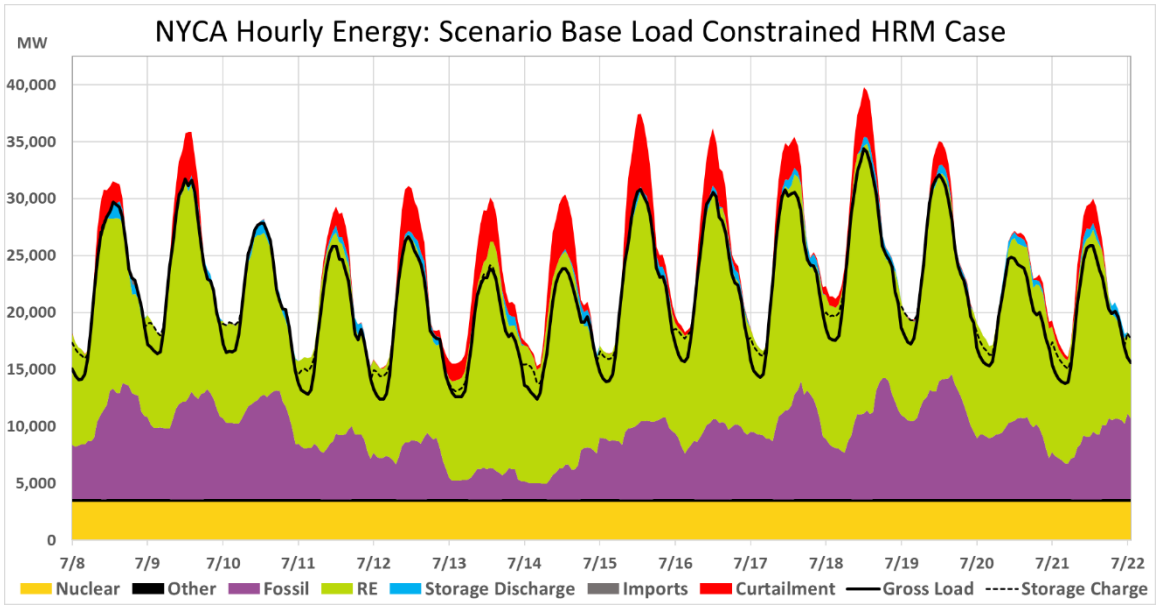
**Figure 85: Sample Interval Hourly Examples: Base Load ESR Case**





**Figure 86: Sample Interval Hourly Examples: Base Load HRM Case**



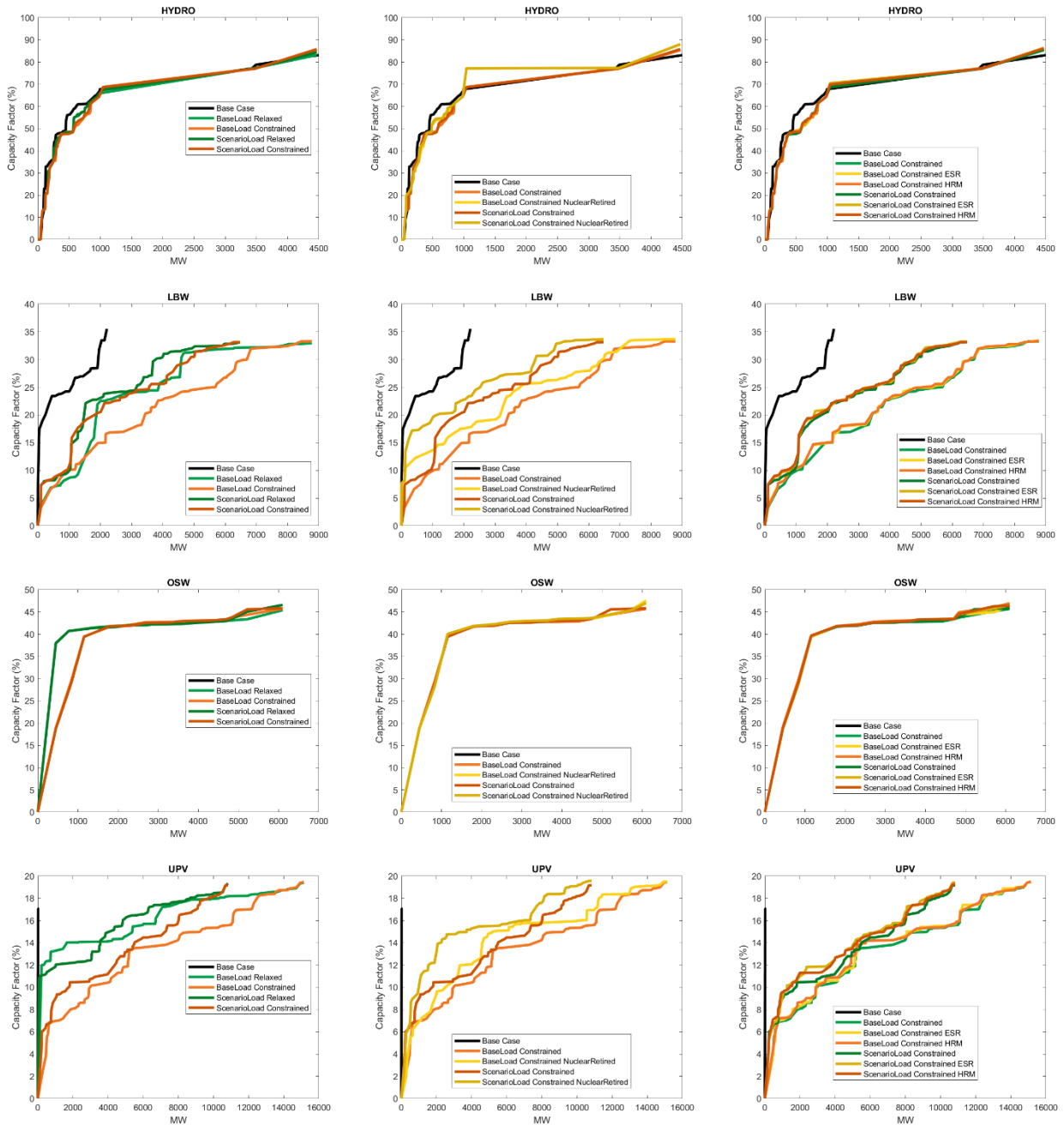


## Renewable Fleet Output Comparison

Cumulative capacity factor curves, described on the 70x30 Section of the report and presented in this section of the appendix, provided output metrics for the fossil fuel-fired generators. Similar quantification allows the variation in RE resource output across cases to be examined in more detail. Figure 87 shows the output capacity factor of the hydro, LBW, OSW, and UPV generators modeled across the 70x30 Scenario cases. Relative shifts in the curve down and to the right in these graphs indicate increased curtailments. The RE fleet modeling was consistent across cases at the same load level as described in the 70x30 Section of the report. Principle observations from these charts show that:

1. Relaxation of internal transmission constraints increases RE output rates, indicating that curtailments are reduced under relaxed conditions,
2. Retirement of the nuclear fleet increases RE output rates as the upstate fleet flexibility increases with the removal of base loaded nuclear generators,
3. Distributed ESR additions increase RE output rates to a lesser extent than either the relaxation of transmission constraints or the retirement of the nuclear fleet, and
4. OSW is only significantly impacted for a subset of generators in the relaxation sensitivity owing to local transmission constraints in the assumed interconnection points for the affected generators in New York City and Long Island.

**Figure 87: Renewable Fleet Cumulative Capacity Factor Curves**



## Appendix M – CARIS Public Data File Directory

Throughout the CARIS study and stakeholder process, various data files have been published on the NYISO public website. The full set of available data files and descriptions of each have been tabulated below.

### March 16, 2020

- [Monthly Case Energy Output MWh – Updated April 6, 2020](#)
- [70x30 Build Out Scenario Load](#)

### April 6, 2020

- [Case Output By Type and By Zone – Updated April 23, 2020](#)
- [Monthly Case Type Energy MWh – Updated April 23, 2020](#)
- [70x30 RE Buildout Base Load](#)
- [Preliminary 70x30 Scenario Pocket Map](#)

### April 23, 2020

- [Case Output By Type and By Zone](#) – Annual NYCA metrics by generator type, by Zone
- [Case Output By Type and By Pocket](#) – Annual NYCA metrics by generator type, by Generation Pocket
- [Monthly Case Type Energy MWh](#) – Monthly NYCA energy metrics by generator type, imports and exports by pool, RE curtailment, and gross load
- [Monthly Average Zonal LBMP](#) – Monthly Zonal average LBMP across all hours, on-peak, and off-peak hour windows
- [Hourly Information By Pocket](#) – Hourly input total RE generation, total RE curtailment, and congestion flag for each generation pocket.

**May 22, 2020**

- [Hourly Wind Solar Curtailment By Pocket](#) – Hourly wind and solar generation and curtailment for each generation pocket.
- [Hourly Zonal Net Load](#) – Hourly zonal net load profiles for the Base Load and Scenario Load forecasts
- [Fuel Forecast](#)