Appendix C. Cost Analysis

C.1 Introduction

The New York State Energy Research and Development Authority (NYSERDA) led analysis to assess the benefits and cost as well as ratepayer impacts of the proposed Tier 4 Projects.

The benefit cost analysis (BCA) forms part of the Public Interest Review carried out for Tier 4 Proposals, and in particular addresses the first component of the Public Interest Review as specified in the Order and the Tier 4 RFP:

> "… whether the agreement is a cost-effective means of progressing toward the CLCPA's 2030 and 2040 Targets in light of the unique challenges of reducing fossil fuel use in Zone J"

Benefit cost analysis was conducted separately from the price and non-price evaluation and resulting ranking process described in Section 4 of this filing. The analysis was carried out and applied as a requirement for award selection, with any selected Project needing to demonstrate that benefits exceeded costs. The results of the analysis are presented here for Clean Path New York (CPNY) and H.Q. Energy Services (U.S)/ Champlain Hudson Power Express (CHPE) as being the Projects recommended for award.

While the BCA considers whether benefits outweigh costs from the perspective of society as a whole, in addition, ratepayer impact analysis was conducted to project the impact of Tier 4 program costs more specifically on customer bills. This analysis also considers potential factors that may change ratepayer bill impact, including voluntary purchase of Tier 4 RECs in particular by New York City, federal tax credits, and possible wholesale energy price effects where the Tier 4 program may result in changes to wholesale energy prices, which would potentially impact all ratepayers.

NYSERDA acknowledges the contributions of Siemens Power Technologies International, ICF, Abt Associates and The Brattle Group to the analysis described in this appendix.

C.2 Overview

C.2.1 Benefit Cost Analysis

Cost effectiveness in this analysis is defined as the projected benefits exceeding the cost, in accordance with the Commission's January 2016 Benefit Cost Analysis Framework Order (BCA Framework Order).[1]

[1] Case 14-M-0101. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework (issued January 21, 2016), Appx. C. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F8C835E1-EDB5-47FF-BD78-73EB5B3B177A}

The analysis quantifies four primary cost and benefit components:

- Resource investment
- System resource value
- Carbon value
- Air quality value

Resource investment quantifies the total investment amount of the Tier 4 Projects themselves, calculated by multiplying each Project's levelized Strike Price per MWh (as shown in Section 5.8 of this filing and reflecting the Project's Tier 4 Bid Price) by the projected generation (Bid Quantity) for each of the 25 years of the Tier 4 contract period. System-wide resource value was estimated as the difference between a simulation of electricity system costs in a scenario without the Tier 4 Project, minus those in a scenario with the Tier 4 Project, with the difference constituting a benefit of net avoided system cost to New York. In addition, the value of avoided greenhouse gas emissions and the additional health benefits from reduced air quality pollutants were counted as benefits.

The three value components were added, and the resource investment cost was subtracted, to produce an estimate of net lifetime benefits (or costs). The analysis was performed separately for each Project, reflecting the requirement that each Project needed to demonstrate in isolation that it delivers net benefits and thus passes the benefit cost test; in addition, a separate scenario was considered reflecting the impact of the two recommended Projects together.

This appendix provides further detail on the quantification methodology for each of these benefit components in Sections C.3 to C.5. A discussion of the benefit cost analysis results under a range of scenarios is provided in the final Section C.7 of this appendix.

C.2.2 Ratepayer Impact Analysis

Ratepayer impact in this analysis examines the projected Tier 4 program cost, quantified as the real 2021-dollar net present value of the net REC costs over the project lifetime, the levelized percentage impact on customer bills over the project lifetime, and the near-term percentage impact on customer bills in 2028 (being the first year of expected full operation of both Tier 4 projects).

Separate scenarios assess the extent to which the ratepayer impact may be reduced by any energy price effects that may occur as a result of Tier 4, any voluntary purchase of Tier 4 RECs that reduces the number of Tier 4 RECs that must be purchased by obligated parties, and as a result of federal tax credits that would become available if the budget reconciliation bill currently pending in Congress is passed in its current form.

As Sections 5.8-5.9 of this filing note, the projected program cost under the Index REC structure applicable to both Tier 4 projects reflects the Project Strike Price minus energy and capacity revenue

projections. Section C.6 describes the energy and capacity forecasts used to offer a range of resulting projected ratepayer impacts. Section C.6 also provides further details on the assumptions made as regards Tier 4 voluntary purchase opportunities and wholesale price effects.

C.3 BCA: System Resource Value

System resource value was calculated to reflect system-wide benefits from the difference in investment, fixed, and production costs between a scenario with and a scenario without a Tier 4 project (referred to as system resource value). Scenarios were produced reflecting each Tier 4 project separately as well as the combination of the recommended two Projects.

To estimate system resource value, electricity system expansion capacity and dispatch was simulated out to 2040 with and without the Tier 4 project in question. The analysis included the following sequence of modeling steps for the Reference Case without Tier 4 and the Tier 4 project scenario:

1. **AURORA capacity expansion modeling from 2021 to 2040** to project generation investments and retirements to economically meet energy, capacity, and clean energy requirements, with and without Tier 4 projects. Resource capacity results are used as an input to PROMOD.
2. **PROMOD nodal dispatch modeling in 2025, 2030, and 2040** to calculate the resulting system dispatch cost and congestion.

This section provides a summary of key Tier 4 scenario inputs into the system resource value analysis relating to each recommended Project, as well as a brief description of the above-mentioned modeling tools used. The application of the AURORA and PROMOD tools to the Tier 4 analysis is consistent with the Power Grid Study published by DPS and NYSERDA in January 2021. For details, please refer to Appendix E of the Power Grid Study.[2]

C.3.1 Tier 4 Scenario Inputs – CPNY

The CPNY proposal was modeled representing its three main components:

- The new Tier 4 renewable generation to be built in New York (CPNY Resources), located largely upstate,
- A new 1,300 MW HVDC controllable link from the Fraser 345 kV substation (Zone E) to Rainey 345kV (Zone J NYC), and
- The use of the NYPA owned Blenheim Gilboa pump storage facility to store energy produced by the CPNY resources that is generated in excess of the Tier 4 transmission capacity.

[2] NYSERDA. 2021. New York Power Grid Study, Appendix E. https://www.nyserda.ny.gov/About/Publications/New-York-Power-Grid-Study

CPNY Resources were modeled using the sites and hourly production profiles provided as part of the CPNY proposal and at the zonal level in Aurora or using the actual injection substations in PROMOD. The resulting CPNY generation mix was modeled with a capability to produce up to a total of 8,527 GWh per year.

The CPNY 1,300 MW capacity HVDC link was modeled both in PROMOD and AURORA with the capability to deliver both CPNY Tier 4 energy as well as other economic energy from upstate, maximizing the value of the link. When the CPNY Tier 4 Resources were producing (or energy from the Tier 4 storage was discharging) these were considered the first to be delivered by the link, ahead of any other flows that would use any remaining capacity.

The Blenheim Gilboa pump storage facility was modeled as available to CPNY generation and dispatched following a profile to match pumping whenever CPNY output exceeded the capacity of the HVDC link, and discharge when there was available capacity on the link to take advantage of premium Tier 4 REC value. The charge and discharge incurred round trip losses of approximately 25% for stored energy.

Other economic energy could be stored in the facility, and this was modeled by treating the storage as two components; one with 850 MW pumping/generating capacity dedicated to CPNY and another with 318 MW to be utilized economically.

C.3.2 Tier 4 Scenario Inputs – CHPE

The CHPE project was modeled in AURORA as an injection into NYC (Zone J) with two components totalling the project capacity of 1,250 MW.

The first component represents the Tier 4 proposal and delivers up to 10 TWh of energy per year to New York City. The second component was designed to maximize the value of the link by utilizing the remaining capacity to capture the additional benefits of the interconnection with HQ and can deliver up to 0.95 TWh per year, subject to the energy prices in New York City (Zone J) justifying the transaction. In PROMOD, CHPE was modeled in the same way, but a specific node in New York City was selected, with the exception that the injection was modeled at the Astoria Annex Substation 345 kV, due to the nodal nature of this model.

The extraction point of the CHPE link was not modeled as the energy delivered by the project will come from an area of HQ system that is electrically isolated from the rest of the Eastern Interconnection (to which NYCA belongs) and is interconnected only with other controllable HVDC links. This decoupling also allows to omit from the modeling the cost impacts in Quebec of the energy delivered to New York. Note however that for the second component above, it was assumed that the cost of the energy from Quebec would be $20/MWh, and only if the price in NYC was above this value the energy would be delivered.

C.3.3 Tier 4 Scenario Inputs – Combined Scenario CPNY and CHPE

A combination of the two projects above CHPE and CPNY was also modeled by representing the simultaneous effects of the two injections into New York City and modeling the CPNY Tier 4 renewable generation described above, with the CHPE hydro injections. This resulted in a different capacity expansion plan than that for the individual Tier 4 project, particularly for the period 2030 to 2040 when both Tier 4 Projects contribute to the 100 by 40 clean energy goal. For 2030 and prior years the differences are smaller as the Tier 4 projects are modeled as incremental to the 70 by 30 renewable energy goal.

C.3.4 AURORA Capacity Expansion Modeling

AURORA is a capacity expansion model that determines the economic mix of generation and energy storage resources that achieve the State's renewable energy requirements while maintaining all operational reliability requirements. AURORA's objective function seeks to minimize power system costs, while considering the need for resource revenue adequacy.[3] The AURORA model was run in "zonal mode" with each NYISO zone represented by its portfolio of supply, load, and transfer limits to adjacent zones.

AURORA was run for the Reference Case and each Tier 4 case in hourly chronological mode from 2021 to 2040. The study utilized a broad set of power market assumptions across a 20-year period. Inputs to the modeling process such as load forecasts, fuel and technology price curves, and other factors are derived from multiple sources including third-party providers such as S&P Global Platts, IHS and other independent sources such as the Energy Information Administration (EIA); American Wind Energy Association (AWEA); National Renewable Energy Laboratory (NREL); and the Environmental Protection Agency (EPA).

Key model setting that were updated since the Power Grid Study include:

- **Annual renewable build limitations**, which were added by technology type, year, and zone using information from the 2020 CES cost study analysis.[4]

[3] Aurora does not include local transmission and distribution costs in its algorithm.

[4] CASE 15-E-0302; Cost Analysis Appendix to White Paper on Clean Energy Standard Procurements to Implement New York's Climate Leadership and Community Protection Act (Submitted June 18, 2020). https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DCA9763C-D2DA-4FD1-9801-D859E7ED8FE3}

- **Fixed Operating and Maintenance costs** for thermal units using information from the 2018 NYISO State of the Market Report[5] and 2020–21 Demand Curve Reset Study.[6]
- **Updated transfer limits for the Central East interface,** to be consistent with observed margins that operators maintain in the flow across this interface with respect of the limits in studies[7]. Updates were made to AURORA and PROMOD models. The study assumed that the Central East was upgraded in 2025 with the entry of the AC project segment A and subsequent upgrades were made in 2030 and 2035 reaching 3925 MW limit.
- **Several transmission reinforcements in Zone J** were added to the modeling, reflecting the Consolidated Edison local transmission and distribution Phase 1 project.[8]

The detailed resource retirements and additions as provided by AURORA are used as inputs to the PROMOD model. In addition, system fixed costs (investment capital and fixed operating and maintenance costs) are used in the total system resource cost calculation.

C.3.5 PROMOD Dispatch Modeling

PROMOD is a detailed electric market simulation model that chronologically computes hour-by-hour dispatch, prices and production costs while recognizing the constraints on the dispatch of generating units imposed by the transmission system. PROMOD IV uses an electrical model of the entire transmission network, along with generation shift factors, to calculate the real power flows on the network for each generation dispatch. It simulates a security-constrained economic dispatch considering all the monitored constraints (monitored elements/ contingencies) provided for the analysis. In the study, PROMOD monitored all elements 230 kV and above in New York Control Area (NYCA), interfaces to neighboring systems, and transformation to lower voltages.

The resulting production costs from PROMOD were used in the total resource cost calculation. In addition, generation and fuel use information from PROMOD modeling for 2025 and 2030 were used to develop the estimated difference in carbon emissions (quantified as the emissions from the simulated

[5] Potomac Economics for the New York Independent System Operator. 2019. 2018 State of the Market Report for the New York ISO Markets. https://www.nyiso.com/documents/20142/2223763/2018-State-of-the-Market-Report.pdf/b5bd2213-9fe2-b0e7-a422-d4071b3d014b?t=1557775606716

[6] New York Independent System Operator. 2020. Proposed NYISO Installed Capacity Demand Curves for the 2021-2022 Capability Year and Annual Update Methodology and Inputs for the 2022-2023, 2023-2024, 2024-2025 Capability Years. https://www.nyiso.com/documents/20142/14404876/NYISO%20Staff%20Draft%20DCR%20Recommendations%20Final.pdf/1aa489fc-b751-a81f-b806-5901dc402404

[7] The New York State Independent System Operator (NYISO). 2020. 2020 RNA Report (Reliability Needs Assessment), Figure 46. https://www.nyiso.com/documents/20142/2248793/2020-RNAReport-Nov2020.pdf/64053a7b-194e-17b0-20fb-f2489dec330d

[8] Case 20-E-0197; Proceeding on Motion of the Commission to Implement Transmission Planning Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act (Issued and Effective February 11, 2021). https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BF8CA2C7D-F6A9-480D-8329-AA0312C5F3E4%7D

fuel burn at each generating plant) and pollutant emissions (e.g., primary $PM_{2.5}$) between the Reference scenario and the Tier 4 scenario, discussed further below.

C.3.6 Capacity Value Adjustments

The analysis included a Low Capacity Value Scenario to reflect uncertainty in respect of NYISO market rules for internal controllable lines and the potential resulting impact on capacity value. As discussed in Section 6.3 of this filing, development of NYISO market rules for internal controllable lines such as the CPNY project is still underway. Depending on the outcome of this process, a lower quantification of capacity value may be appropriate, reflecting a scenario where the capacity of the Tier 4 transmission line might not translate fully to an equal reduction of New York City's capacity requirements. This scenario was assessed by assuming a value reduction applied in this sensitivity as 50% of the UCAP multiplied by the capacity price difference between Zone J and the CPNY transmission origination zone. This sensitivity was only applied to BCA results for CPNY since the market rule uncertainty applies with respect to internal controllable lines.

All system resource cost value results for CHPE were adjusted to reflect that the selected CHPE bid does not include winter UDRs, by applying a value reduction calculated as UCAP multiplied by the Zone J capacity price for the winter months.

C.4 BCA: Carbon Value

The analysis quantifies the amount of greenhouse gas equivalent emissions (carbon emissions) saved based on a comparison between a scenario without Tier 4 and a scenario with the Tier 4 Project(s) in question. The modeling reflects the impact of the new transmission line of each of the Projects as well as, in the case of the CPNY project, the impact of the new upstate renewable generation assets, as described in Section C.3.

Carbon emissions are quantified as the emissions from the simulated fuel burn at each generating plant as provided by PROMOD. Under this methodology, net carbon value provided by the Project is quantified as the difference in carbon emissions between the scenarios with and without Tier 4 on an annual basis, multiplied by respective the social cost of carbon (SCC) per ton of carbon emissions. Both scenarios are set up in the analysis to achieve New York's goal of 100% carbon-free generation by 2040, so by 2040 the difference in carbon emissions between the two scenarios reduces to zero. This therefore represents a conservative approach that does not quantify carbon reduction benefits for the full 25-year Tier 4 contract period or for the lifetime of the Projects beyond the contract period.

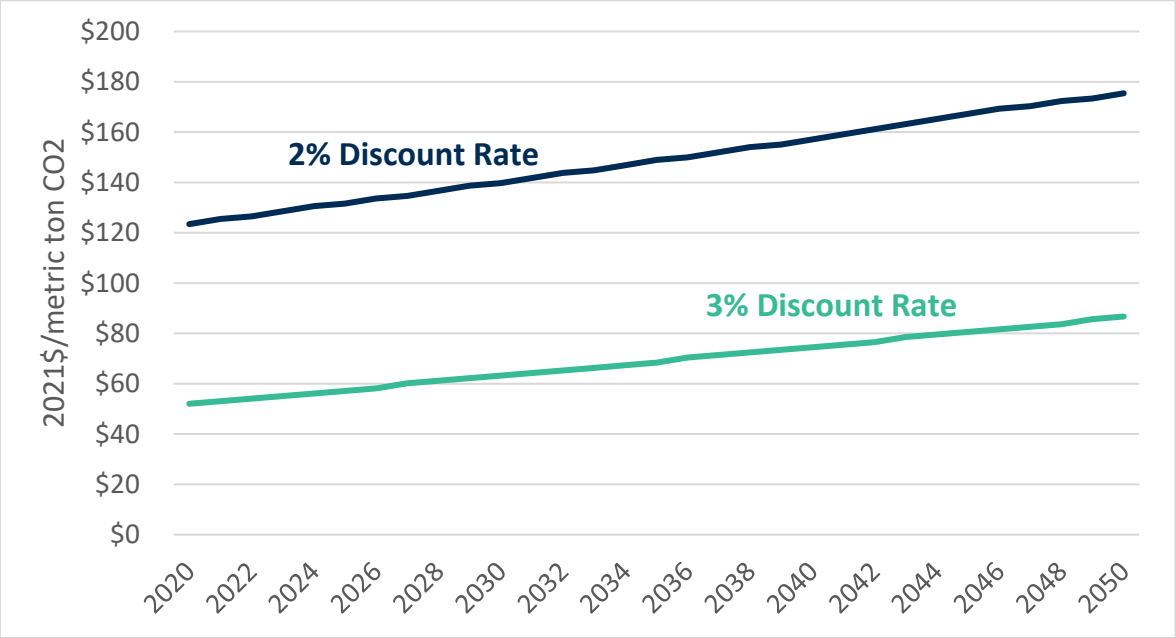
Over the period to 2040, Tier 4 is expected to deliver carbon abatement compared to the Reference Scenario without Tier 4 totaling 49 million metric tons of carbon for the CPNY project, 37 million metric tons for the CHPE project, and 78 million metric tons for the combination of the two projects.

Under the Department of Environmental Conservation's (DEC) Value of Carbon Guidance (December 2020, Revised June 2021),[9] the SCC can be quantified using a range of discount rates applied to the future damage cost of greenhouse gas emissions. These SCC values are based on the U.S. Interagency Working Group's SCC estimates. For this analysis, two sets of values for the SCC were used. The first set reflects a 2% discount rate, which is consistent with the DEC Guidance and the approach being used for development of the NYS Climate Action Council's Scoping Plan.

In addition, a Low Carbon Value Scenario was analyzed, reflecting a higher discount rate of 3% (which leads to a lower SCC), to ascertain if the Tier 4 projects would still pass the BCA test.

Figure 1 shows the carbon value per ton of emissions over time under both scenarios. Resulting total carbon value is shown in the analysis results in Section C.7 below.

Figure 1: DEC Social Cost of Carbon Per Metric Ton



C.5 BCA: Air Quality Value

The PROMOD modeling described above, combined with analysis using the CO-Benefits Risk Assessment (COBRA) modeling platform, was also used to estimate the extent to which Tier 4 projects' impact on combustion-based generation in New York City, the rest of New York State, and other regions affected by the projects would change pollutant emissions and the ensuing air quality and public health outcomes.

[9] New York State Department of Environmental Conservation. Value of Carbon Appendix, Revised 2021. https://www.dec.ny.gov/docs/administration_pdf/vocapprev.pdf. See also https://www.dec.ny.gov/regulations/56552.html

The health impact assessment focused on the reduction in fine particulate matter and did not include benefits from reductions in ozone formation or reductions in emissions of toxic air pollutants. This approach is also being used for development of the Climate Action Council Scoping Plan, and in that context it has been acknowledged that this approach is a conservative estimate, i.e., under-estimate, of the health benefits.

To estimate air quality effects, facility-level fuel use data from the PROMOD analysis for 2025 and 2030 described in Section C.3 was translated into county-level NO_x, SO_2, and $PM_{2.5}$ emissions, which were used in the COBRA model to estimate pollutant dispersion and transformation. Based on the resulting annual average pollutant concentrations, COBRA estimated health impacts throughout New York State and the surrounding regions for each Tier 4 Project Case relative to a Reference Case without Tier 4. Pollutant emissions between the years 2025 and 2030 were interpolated based on the modeling for those years. Beyond 2030, the difference in emissions between the Tier 4 and Reference Case as modeled for 2030 was quantified as declining to zero by 2040 in a linear manner, reflecting an assumption that in 2040 the zero GHG emission grid target in the Climate Act would result in there being no substantial difference in other pollutant emissions and emission locations between the cases.

Criteria pollutant emissions from the electricity generation sector were estimated based on the PROMOD fuel consumption output, including $PM_{2.5}$, NO_x, and SO_2. NO_x, SO_2 and $PM_{2.5}$ emission rates were obtained from EPA data sources, including the National Electric Energy Data System (NEEDS)[10] and the Air Markets Program Data,[11] and the Emissions and Generation Resource Integrated Database (eGRID).[12] The emissions and generation projections were benchmarked against historical EPA emission data and generation reported from NYISO.

COBRA is a screening tool developed by EPA that helps state and local governments evaluate the public health benefits of changes in emissions of criteria pollutants.[13] COBRA provides preliminary estimates of the effects of air-pollutant emission changes (e.g., NO_x, SO_2 and $PM_{2.5}$) on ambient air concentrations of $PM_{2.5}$ using a reduced-form air quality model called the Phase II Source-Receptor Matrix. COBRA then translates the estimated changes in ambient $PM_{2.5}$ concentrations into the number of avoided adverse health effects, such as premature mortality, nonfatal heart attacks, asthma exacerbations, and work loss days, using concentration-response functions from the published epidemiological literature. Finally, COBRA estimates the monetary value of the avoided health effects using published values from the literature.

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[10] EPA. 2019. National Electric Energy Data System (NEEDS) v6. https://www.epa.gov/airmarkets/national-electric-energy-data-system-needs-v6.

[11] EPA. 2019. Air Markets Program Data. https://ampd.epa.gov/ampd/.

[12] EPA. 2020. Emissions and Generation Resource Integrated Database (eGRID): eGRID2018. https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

[13] U.S. Environmental Protection Agency. 2018. CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool. https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool

COBRA uses two different methods to estimate the impacts of $PM_{2.5}$ concentration reductions on premature mortality and non-fatal heart attacks based on two epidemiological studies of the impacts of air quality on public health. For this reason, COBRA reports the estimated public health benefits as two distinct results, a 'High' and a 'Low'. For the purpose of the Tier 4 benefit cost analysis, public health effects were first quantified using the high end of the range, consistent with the approach adopted for the Climate Action Council's Scoping Plan as referenced in Section C.4. A separate Low Air Quality Value Scenario is also presented, reflecting the low potential benefits estimate provided by COBRA.

The assumptions used in COBRA are consistent with those used in U.S. EPA analyses of air pollution regulations. This analysis used COBRA v3.2, which was released in October 2017.

Full achievement of the local health benefits will likely require additional local transmission and distribution upgrades to relieve local load pocket constraints.

C.6 Ratepayer Impact Methodology

Under the Index REC approach applicable to both Tier 4 Projects, NYSERDA program payments will be calculated as the Strike Price minus Reference Energy and Capacity Prices, referred to as the net REC cost. Ratepayer impacts are projected as the net REC costs over time under a range of energy and capacity price forecasts and presented in Section C.7 both as the net present value of the program cost and the percentage impact on customer bills, either levelized over the program period or in 2028 as the first year of operation of both Projects. Levelized percentage bill impact metrics are calculated as the net present value of the annual program costs over the Tier 4 program period, divided by net present value of the statewide spend on energy over the same period.

Program costs are projected reflecting each Project's Bid Quantity (7,870,865 MWh per year for CPNY and 10,402,500 MWh per year for CHPE).

Consistent with previous CES cost studies, this analysis assumes that costs are borne statewide, across both jurisdictional and non-jurisdictional entities.

This section also discusses effects that would change ratepayer bill impacts, in particular sales of Tier 4 RECs to voluntary purchase customers that reduce costs to be borne by statewide ratepayers, federal tax credits and energy price effects.

Program administrative and transactional costs are not assessed in this analysis.

C.6.1 Energy and Capacity Price Forecasts

For this analysis, and consistent with the approach across CES programs, the latest CARIS energy price forecast and DPS capacity price forecast were used both for the price score evaluation (discussed in Section 4.4 of this filing) and as the starting point for ratepayer impact projections.

For energy, this regards the 2019 NYISO CARIS I[14] energy price forecast. This forecast applies through 2028. Thereafter, the energy price is assumed to stay constant in real dollar terms at the 2028 level (i.e., continuing to increase with inflation annually in nominal dollar terms).

For capacity revenue, at the time of evaluation, the latest available forecast was the DPS August 2020 forecast, which provides zonal summer and winter Installed Capacity Market (ICAP) generator prices from 2020 to 2040. In 2041 and thereafter, the capacity prices were held constant at the 2040 level in real dollar terms (increasing with inflation in nominal dollar terms). For the calculation of each Project's monthly capacity market revenues, the $/kW-month capacity price was multiplied by the Project's total capacity and Unforced Capacity Deliverability Rights (UDR), the latter of which was submitted by the project developer as part of the bid. These "Gross Capacity Revenues" were then reduced by project-specific Loss and Unavailability Factors, which developers were also required to submit with each respective bid.

While all commodity price forecasts are subject to uncertainty, this analysis recognizes that the CARIS energy and DPS capacity price forecasts are subject to some specific limitations. These forecasts do not reflect the impact of New York achieving its goal of 70% renewable electricity by 2030; and in particular the CARIS energy forecast has not been updated since 2019 to reflect latest insights and developments. An alternative, lower electricity and capacity price forecast was developed to test the sensitivity of program costs to commodity price projections. This "Low Commodity Pricing" scenario reflects an average of, firstly, the forecasts produced in 2020 by Wood Mackenzie and, secondly, forecasts implied by the Tier 4 benefit cost analysis modeling described in Section C.3. The latter forecasts were produced by the Tier 4 analysis separately for the Reference Case without Tier 4, cases with CPNY and CHPE separately, and the Combined Case with both Tier 4 Projects, and used accordingly. Differences between these forecasts from the Tier 4 analysis reflect modeled price effects, discussed further in Section C.6.3.

Tier 4 bid price scores (see Section 4.4 of this filing) were also tested under this alternative lower commodity price forecast, which confirmed that no change to the ranking of bids would have occurred under this forecast.

[14] The New York State Independent System Operator (NYISO). 2019 Congestion Assessment and Resource Integration Study; Comprehensive System Planning Process, CARIS – Phase 1, Appendices B – M. (CARIS)

The resulting range of forecasts is summarized in Figure 2 and Figure 3, shown for Zone J (New York City) as most relevant to the Tier 4 analysis. Figure 3, which shows capacity prices, also includes the most recent (2021) DPS capacity price forecast for illustration, which was not available in time for consideration as part of the Tier 4 evaluation; as shown, this forecast falls well within the tested forecast range.

Figure 2: Zone J Energy Price Forecasts

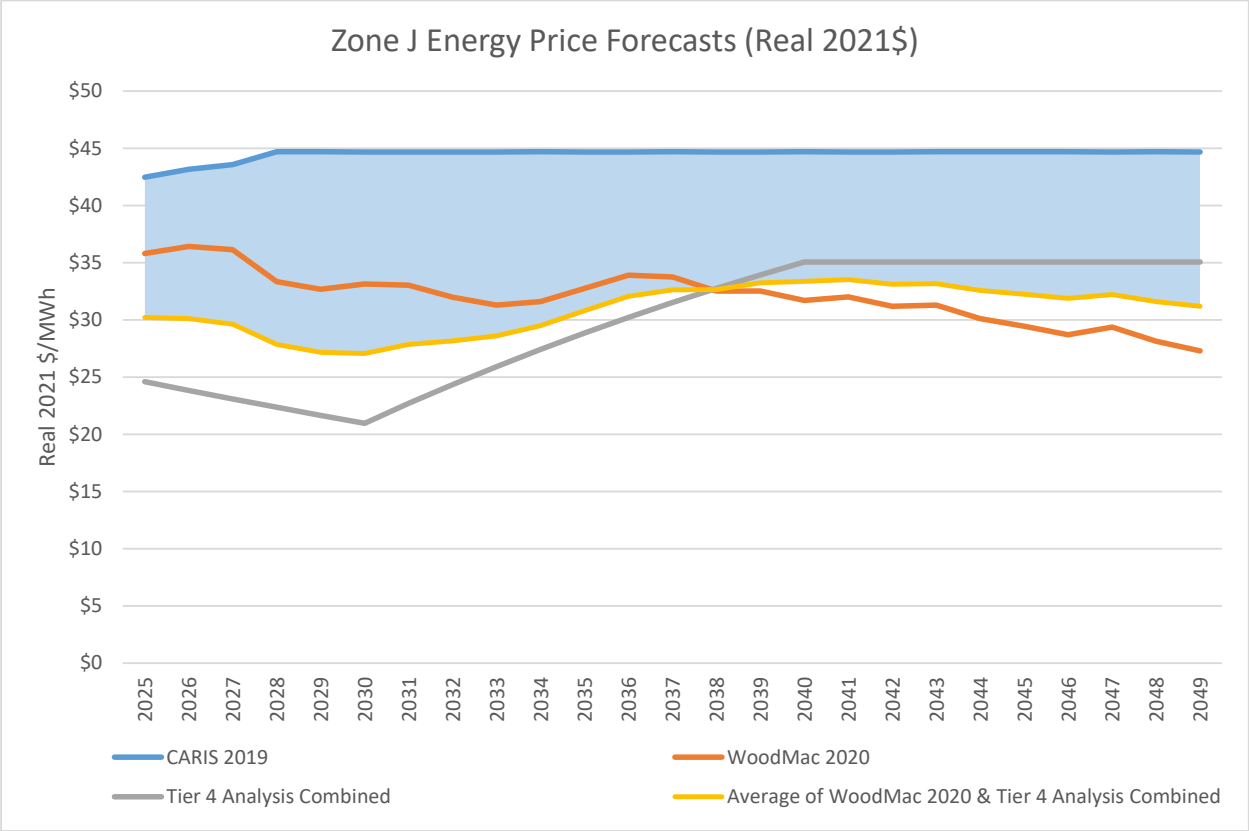
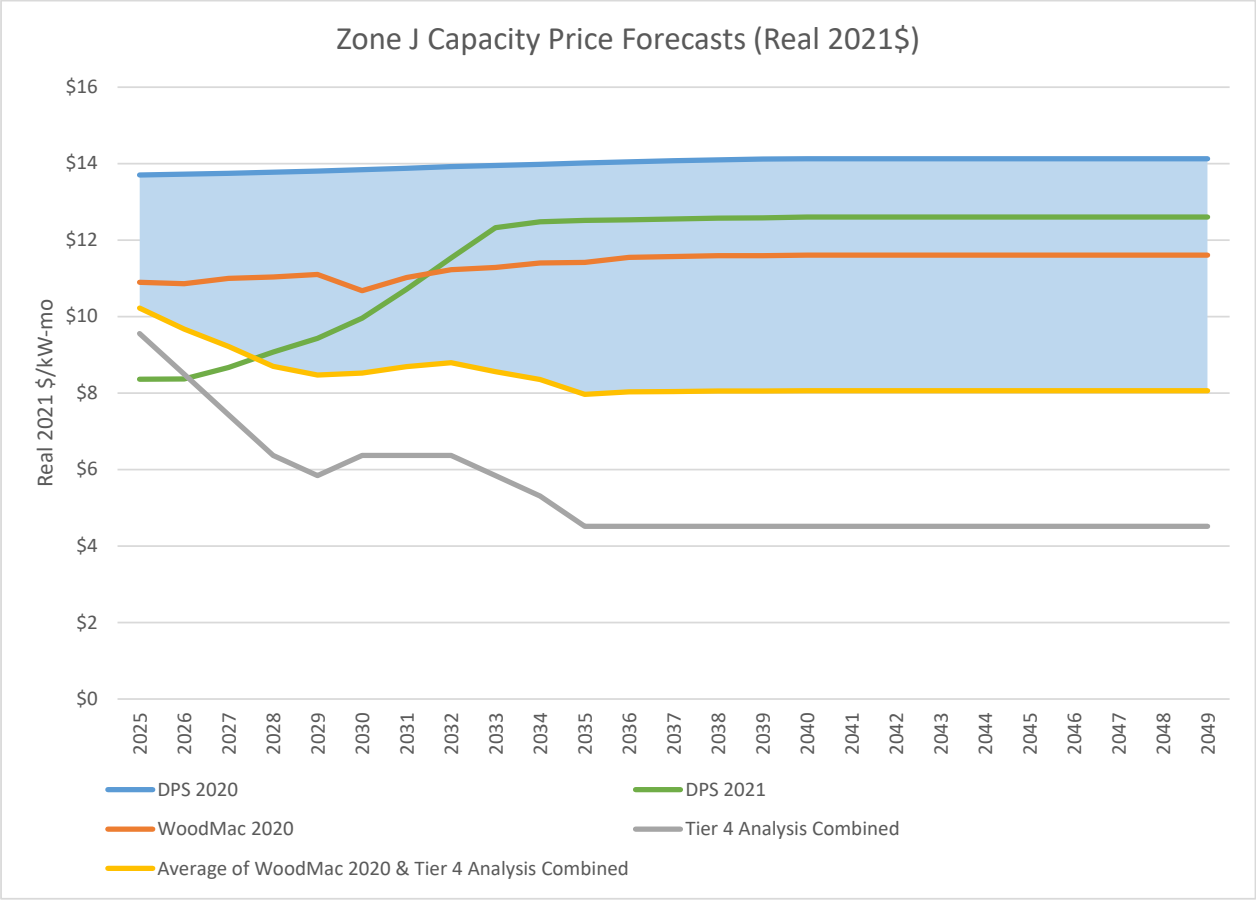


Figure 3: Zone J Capacity Price Forecasts



C.6.2 Low Capacity Revenue Scenario

As referenced in Section 6.3 of this filing, development of NYISO market rules for internal controllable lines such as the CPNY project is still underway. Depending on the outcome of this process, the CPNY project may not be fully rewarded for the capacity value it brings to Zone J in the form of capacity revenue equivalent to the Zone J capacity price forecast. Depending on the outcome of this process, increased REC payments in respect of the CPNY project might be needed if capacity value is not compensated through Zone J capacity revenue.

An "Upstate Capacity Revenue" scenario was developed to quantify potential higher program costs, where CPNY may only receive capacity revenue at the point of generation (i.e., Upstate NYISO Zones) of each Resource.

C.6.3 Commodity Price Effects

Price effects, also referred to as the merit order effect, can occur where deployment of program resources, in this case under the Tier 4 program, would result in lower energy and/or capacity prices than would otherwise have been the case. Such effects are linked to the nature of most renewable generation to generate electricity with no or very low operating costs. This allows renewables to generate, and sell electricity, at a price level below the fuel cost of fossil generators, potentially leading to lower wholesale electricity prices. In addition, as regards Tier 4, the construction of new transmission assets helps to reduce transmission congestion and associated costs. The analysis described in Section C.3 offers an implied quantification of price effects in the form of the difference between the energy and capacity price forecasts between the Reference Case and Tier 4 Cases. This analysis thus allows price effects to be quantified by multiplying such projected price impacts with the load/capacity in the zone in question.

The BCA Framework Order recognizes that such price effects are more likely to occur in the near term, and that their magnitude, location and duration is difficult to predict. The BCA Framework Order references options to model these effects over a one-year or three-year period. Accordingly, this filing takes a conservative view in its assumptions on the extent to which such price effect is expected to offset the Tier 4 program costs and includes price effects only in the ratepayer impact results shown in Section C.7 for 2028 (as the first year both Tier 4 Projects would be operational). 2028 cost metrics are provided both with and without price effects. Price effects are omitted from the levelized cost metrics (which reflect average cost over the 25-year contract period).

Modeling results in respect of capacity price effects were assessed to be insufficiently robust for inclusion and were disregarded in the analysis, with only energy price effects included.

C.6.4 Voluntary Purchase of Tier 4 RECs

In addition to contributing to New York's Climate Act targets, Tier 4 provides important benefits to New York City and furthers New York City's clean energy goals. The Government of the City of New York (the "City") has stated its intention to couple its efforts to reduce its carbon footprint through energy efficiency with an investment into large-scale renewable energy, in particular by means of a purchase of Tier 4 RECs. Negotiations between NYSERDA and the City in this respect are currently underway. Such purchase would reduce the remaining Tier 4 program cost that would be borne by statewide ratepayers.

The City has filed concurrently with this filing a Notice with the Commission reflecting an expected reduction in its participation in CES programs other than offshore wind, in recognition of the significant financial commitment it would take on through its Tier 4 REC purchase and the resulting net benefit to statewide ratepayers. The City indicates in its Notice that it estimates the benefit statewide ratepayers will experience from the purchase of Tier 4 RECs, net of such reduction in its contribution to CES obligations, as a net reduction in the ratepayer impact from the Tier 4 program on other ratepayers of

approximately $0.8-$1.7 billion (net present value). NYSERDA's analysis reaches a similar conclusion. This range equates to a reduction of the Tier 4 program cost of at least 12%, and is applied accordingly in the results of scenarios with City Tier 4 purchase in Section C.7. These scenarios also reflect the current status of negotiations with the City on other key terms of the purchase, as further described in Section 5.10 of this filing.

Further opportunities for voluntary purchase of Tier 4 RECs to reduce the cost to Statewide ratepayers could be expected to occur as a result of New York City Local Law 97,[15] which places obligations on owners of large buildings to reduce carbon emissions that may be pursued through purchase of RECs. A study by Level Agency for Infrastructure, LLC for the Real Estate Board of New York[16] indicates that demand for RECs such as Tier 4 RECs pursuant to Local Law 97 could range from 5.1 TWh to 12.8 TWh per year by 2030 in addition to a purchase by the City. When taken together with the estimated City Tier 4 purchase quantity,[17] this results in a potential total upper range voluntary purchase quantity approaching the total Bid Quantity of CPNY and CHPE of approximately 18 TWh and indicating the potential significance of these REC sale opportunities for reducing residual ratepayer impacts from the Tier 4 program.

Section C.7 includes results for scenarios reflecting these low- and high-end estimates of Local Law 97 Tier 4 purchase opportunities. In each case, it is assumed that such voluntary sale/purchase of Tier 4 RECs takes place at the average net REC cost paid by NYSERDA to Projects and over the Tier 4 contract lifetime, such that cost reductions to statewide ratepayers are proportionate to the sale quantity. These low and high cases also reflect potential benefit sharing of Local Law 97 sale opportunities with the CPNY Project as described in Section 6 of this filing, with the low case assuming that CPNY delivers Additional RECs to enable it to share in the voluntary sale proceeds and the high case assuming that no Additional RECs are delivered and that accordingly no such benefit sharing occurs.

Local Law 97 purchase scenarios are only included in levelized ratepayer impact metrics (reflecting the average impact over the Tier 4 contract period) and ignored in near-term metrics (showing the impact in 2028) given uncertainty when voluntary purchase opportunities under Local Law 97 could commence.

C.6.5 Federal Tax Credits

As Section 6.2 of this filing notes, both the CPNY Contract and the CHPE Contract include a provision that would result in a reduction in Tier 4 REC payments to each Project if applicable federal transmission tax

[15] Local Laws of the City of New York for the Year 2019, No. 97. 2019. https://www1.nyc.gov/site/sustainablebuildings/ll97/local-law-97.page

[16] LL97 Compliance REC Demand Analysis Methodology and Results. 2021. https://www.rebny.com/content/dam/rebny/Documents/PDF/Policy/210809%20REC%20Analysis%20Summary%20Memo.pdf

[17] Assumed for the purpose of this analysis as the level of the current load of the City, at approximately 4,100 GWh per year.

credits materialize. At the time of filing, the Build Back Better Act (H.R. 5376) passed by the U.S. House of Representatives provides that up to a 30% transmission tax credit would be available, if passed by the U.S. Senate and signed into law. Section C.7 includes scenarios that estimate resulting cost reductions.

C.7 Analysis Results

C.7.1 Summary of Tier 4 Key Findings

The following high-level observations are presented from the Tier 4 analysis:

- Across a wide range of scenarios, the CPNY and CHPE Projects both individually and combined present net societal benefits, allowing for a high level of confidence in the overall conclusion that the societal benefits from the recommended Projects exceed costs and that the Projects thus pass the benefit cost test. Net benefit projections for the combined projects range from $2.9 billion to $7.4 billion (net present value). In most scenarios, benefits from the system expenditure savings alone (such as fewer additional investments needed in energy storage and transmission as a result of the Tier 4 Projects) almost equal the resource investment cost of the Tier 4 Projects or even outweigh them. In addition, societal benefits include significant health benefits from better air quality and the value of avoided greenhouse gas emissions.

- Without accounting for ratepayer impact mitigation through voluntary purchase of Tier 4 RECs or federal tax credits, the analysis projects electricity bill increases from Tier 4 ranging on average (levelized, statewide) from 2.4% – 4.3% for the combined Projects, depending on the assumed energy and capacity price forecasts. This indicates a substantial level of sensitivity of costs to commodity price forecasts. However, the impact of any increased program costs as a result of lower commodity prices would be counterbalanced by the benefit ratepayers would experience from lower commodity prices in the form of lower electricity bills.

- A further uncertainty that could increase ratepayer impact has been identified in respect of ongoing development of NYISO market rules relating to internal controllable lines, i.e., as regards Tier 4 the CPNY project. This could result in CPNY receiving less capacity revenue than the capacity value it offers, which in turn could result in higher Tier 4 REC payments to CPNY. In this case, CPNY would still deliver capacity value to New York City, but because it wouldn't receive equivalent remuneration, the result would likely be at least partially a cost shift from New York City to Statewide ratepayers. The impact of this possibility on program cost would depend on the level of capacity prices, with a relatively lower impact in case of lower capacity prices. In the high commodity price scenario, this uncertainty could increase bill impact from 2.4% to 3.1%; in the low commodity prices scenario, the incremental impact would be more modest, with an increase from 4.3% to 4.7%.

- Significant opportunities exist to mitigate statewide ratepayer impact from Tier 4 through voluntary purchase of Tier 4 RECs, in particular by the City. Negotiations to enter into a Tier 4 sale agreement with the City are underway and such purchase could reduce statewide levelized ratepayer impacts to from 2.4% – 4.7% to 2.1% – 4.1%, depending on commodity prices and NYISO market rules (ranges shown in the remainder of this section also reflect the range of commodity price and market rule scenarios). Federal transmission tax credits, if enacted, could have a similar cost reduction effect, reducing estimates to 2.1% – 4.3%. With both purchase by the Government of New York City and federal transmission tax credits, these estimates would reduce to 1.8% – 3.8%.

- Further significant benefits could materialize in the form of Tier 4 REC purchases by New York City building owners under Local Law 97. The analysis includes estimates for the benefits from Local Law 97 demand under low and high case assumptions. Scenarios with all of these cost mitigation opportunities, including purchase by the City, under Local Law 97, and with federal transmission tax credits, could see residual statewide levelized Tier 4 ratepayer impacts reduce further to 1.5% – 3.2% in the low case, or 0.4% – 0.8% in the high case.

- First-year ratepayer impact percentages, quantified for 2028 as the first year of full operation for both Tier 4 projects, could be lower than the levelized projections quoted above due to potential near-term commodity price effects. These price effects can occur under the Tier 4 program where renewable generation, due to its low operating cost, can generate, and sell electricity, at a price below that of fossil generators, and as a result of reduced transmission congestion costs. Excluding such energy price effects, bill impacts in 2028 are projected as 3.0% – 5.7%; with energy price effects, a lower level of bill impact is estimated as 1.8% – 4.5% (without assuming any voluntary purchase or other cost mitigation). With the further addition of Tier 4 REC purchase by the City, these estimates could reduce to 2.7% – 5.0% without energy price effects or 1.4% – 3.8% with energy price effects. Federal transmission tax credits would be expected to have a similar effect, achieving a reduction to 2.7% – 5.3% without energy price effects or 1.4% – 4.1% with energy price effects. City purchase and tax credits together are projected to result in a 2028 cost impact of 2.3% – 4.7% without energy price effects or 1.0% – 3.4% with energy price effects.

- Tier 4 program costs will be borne across Statewide customers based on electric load, with each utility's customers contributing reflecting their load share. Nevertheless, the resulting customer bill impact percentage can vary by utility and customer class, with percentage bill impacts in upstate utilities reaching up to twice the statewide average – National Grid is projected to see a near-term impact of 5.2% – 9.9% without energy price effects or 3.7% – 8.4% with energy price effects (without assuming any voluntary purchase or federal tax credits), compared to 2.6% – 4.9% without or 1.2% – 3.5% with energy price effects in ConEd. This is primarily because

customers' bills vary by utility. In upstate utilities, where electric bills tend to be lower than downstate, this can lead to higher percentage impacts. These dynamics also underscore the importance of voluntary Tier 4 REC purchases by the City as the recipient of Tier 4 clean energy in order to mitigate these upstate impacts.

C.7.2 Benefit Cost Analysis Results

All dollar figures shown in this Appendix are presented as real dollar amounts discounted to 2021 net present value at a real discount rate of 3.68%, unless noted otherwise.

Table 1 summarizes the benefit cost analysis scenarios presented in this analysis.

Table 1: Tier 4 Benefit Cost Analysis Scenarios

Scenario	Notes
High Capacity Value Scenario	Full (Zone J) capacity value, carbon value reflecting 2% damage cost discount rate, high air quality value
Low Capacity Value Scenario	Capacity value reduction of 50% of the UCAP multiplied by the capacity price difference between Zone J and the Tier 4 transmission origination zone (CPNY only)
Low Carbon Value Scenario	Carbon value reflecting 3% damage cost discount rate
Low Air Quality Value Scenario	Lower range air quality value as provided by COBRA analysis

Results are provided for CPNY and CHPE as the recommended Tier 4 Projects in this filing, and the combination of the two Projects. The below tables provide the benefit cost analysis results across the scenarios and across the cost and value components as explained in Section C.2: resource investment, system resource value, carbon value and air quality value. The methodology for the analysis of these cost and value components is explained in more detail in preceding sections of this Appendix.

Table 2: Benefit Cost Analysis Results – CPNY

Real 2021 $B NPV	Resource Investment	System Resource Value	Carbon Value	Air Quality Value	Net Benefit
High Capacity Value Scenario	$10.2	$9.9	$5.1	$2.8	**$7.5**
Low Capacity Value Scenario	$10.2	$9.3	$5.1	$2.8	**$7.0**
Low Carbon Value Scenario	$10.2	$9.9	$2.3	$2.8	**$4.7**
Low Air Quality Value Scenario	$10.2	$9.9	$5.1	$1.2	**$6.0**

Table 3: Benefit Cost Analysis Results – CHPE

Real 2021 $B NPV	Resource Investment	System Resource Value	Carbon Value	Air Quality Value	Net Benefit
High Capacity Value Scenario	$13.5	$13.9	$3.7	$1.6	**$5.7**
Low Carbon Value Scenario	$13.5	$13.9	$1.7	$1.6	**$3.6**
Low Air Quality Value Scenario	$13.5	$13.9	$3.7	$0.7	**$4.8**

Table 4: Benefit Cost Analysis Results – CPNY and CHPE Combined

Real 2021 $B NPV	Resource Investment	System Resource Value	Carbon Value	Air Quality Value	Net Benefit
High Capacity Value Scenario	$23.7	$19.0	$8.1	$4.0	**$7.4**
Low Capacity Value Scenario	$23.7	$18.6	$8.1	$4.0	**$6.9**
Low Carbon Value Scenario	$23.7	$19.0	$3.6	$4.0	**$2.9**
Low Air Quality Value Scenario	$23.7	$19.0	$8.1	$1.8	**$5.2**

Tables 2 through 4 show that both CPNY and CHPE separately, as well as CPNY and CHPE combined (Table 4) provide significant positive net societal benefits. System resource value alone either approaches (in the case of CPNY) or exceeds (in the case of CHPE) the project investment cost without

counting carbon and air quality value. Due to overlaps in the delivered benefits, the combined case projects somewhat lower value for each of the three value components than the total of the two projects in isolation. However, this quantification does not take into account the wider system benefits from the combination of the projects in terms of meeting system needs related to New York's 2040 zero emission goal under the Climate Act as referred to in Section 5 of this filing. Even within the confines of the BCA methodology, societal benefits from system resource value, carbon value and air quality value together outweigh the investment cost to a significant extent.

For all projects, both the air quality and carbon value are largest in the earlier years due to the projects' additionality to the 70% by 2030 target, and decline out to 2040 as a result of the analysis assumption that the grid achieves zero emissions both in the Reference and Tier 4 cases.

As regards system resource value, projects provide value by decreasing system-wide production and fixed costs compared to the Reference Case. In the early years, such value is driven primarily by production cost savings as Tier 4 energy displaces non-Tier 1 energy generation. After 2030, the Tier 4 Projects also provide significant fixed cost savings related to the reduction in costs in meeting the 2040 targets. The Tier 4 Projects are also beneficial by either crossing or bypassing the Central-East interface, a heavily congested interface in New York, and reducing the amount of clean energy and storage capacity needed in Zone J.

C.7.3 Ratepayer Impact Analysis Results

Ratepayer impact projections are provided as ranges, reflecting three uncertainties:

- **Commodity (energy and capacity) price forecasts**, shown as a high and low range;
- **NYISO market rule uncertainties**, adding a scenario that reflects a combination of the low range commodity forecast and NYISO market rules that would not allow CPNY to be fully compensated at Zone J capacity revenue levels (this scenario does not affect the CHPE Project and is not shown in results for CHPE);
- **Cost mitigation opportunities.** Scenario results include a range of combinations of sales of Tier 4 RECs to the City and under Local Law 97, as well as cost reductions to New York ratepayers from potential federal tax credits.

Further detail on the assumptions applied to assess these uncertainties is provided in Section C.6.

Output metrics are provided as the net present value of program costs, levelized percentage ratepayer bill impact and first-year (2028) percentage ratepayer bill impact.

As discussed in more detail in Section C.6.3, commodity price effects are considered a near-term effect, and are thus only reflected in the first-year bill impact metrics but not the levelized bill impact projections. First-year bill impacts are shown with and without energy price effects.

Scenarios with Local Law 97 voluntary purchase are not shown for the first-year ratepayer impact metrics given uncertainty whether Local Law 97 demand will have started at that time.

Table 5 and Table 6 estimate the difference in impact between high or low energy and capacity price forecasts. These tables show results assuming CPNY receives Zone J capacity revenue compensation, and assuming no cost mitigation through voluntary purchase or tax credits.

Table 5: High Commodity Price Scenario

	Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
CPNY	$2.3	0.9%	1.6%	0.8%
CHPE	$4.4	1.6%	1.4%	0.8%
CPNY + CHPE	$6.7	2.4%	3.0%	1.8%

Table 6: Low Commodity Price Scenario

	Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
CPNY	$4.4	1.7%	2.6%	1.8%
CHPE	$7.4	2.7%	2.6%	2.0%
CPNY + CHPE	$12.2	4.3%	5.3%	4.0%

The results in Table 7 provide results across the same range of commodity price assumptions, with CPNY instead assumed to receive lower Upstate capacity revenues.

Table 7: CPNY Upstate Capacity Revenue Scenario

		Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
High Commodity Prices	**CPNY**	$4.4	1.7%	2.5%	1.7%
	CPNY + CHPE	$8.8	3.1%	3.9%	2.7%
Low Commodity Prices	**CPNY**	$5.4	2.1%	3.0%	2.2%
	CPNY + CHPE	$13.2	4.7%	5.7%	4.5%

These results indicate a more significant increase in program cost under the High Commodity Scenario and a relatively modest change in the Low Commodity Scenario, reflecting the relative magnitude of capacity revenue lost in each case.

Table 8, Table 9, andTable 10 show costs of the combined Projects under scenarios with Tier 4 REC purchase by the City; federal transmission tax credits; and the combination of City purchase and tax credits. For the federal tax credits scenario, results are also provided by Project. In each case these are shown under assumptions ranging from high commodity prices and CPNY Zone J capacity revenue to low commodity prices and CPNY Upstate capacity revenue.

Table 8: City Tier 4 Purchase Scenario

CPNY + CHPE	Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
High Commodity Prices, CPNY Zone J Capacity Revenue	$5.9	2.1%	2.7%	1.4%
Low Commodity Prices, CPNY Upstate Capacity Revenue	$11.6	4.1%	5.0%	3.8%

Table 9: Federal Transmission ITC Scenario

		Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
High Commodity Prices, CPNY Zone J Capacity Revenue	**CPNY**	$1.9	0.8%	1.5%	0.6%
	CHPE	$3.9	1.4%	1.2%	0.6%
	CPNY + CHPE	$5.8	2.1%	2.7%	1.4%
Low Commodity Prices, CPNY Upstate Capacity Revenue	**CPNY**	$5.0	2.0%	2.8%	2.0%
	CHPE	$6.8	2.5%	2.4%	1.8%
	CPNY + CHPE	$12.3	4.3%	5.3%	4.1%

Table 10: City Purchase and Federal Transmission ITC Scenario

CPNY + CHPE	Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)	First Year (2028) Bill Impact, No Price Effects (%)	First Year (2028) Bill Impact, Energy Price Effects (%)
High Commodity Prices, CPNY Zone J Capacity Revenue	$5.1	1.8%	2.3%	1.0%
Low Commodity Prices, CPNY Upstate Capacity Revenue	$10.8	3.8%	4.7%	3.4%

Compared to the scenarios without cost mitigation further above, these results indicate a similar level of ratepayer impact reduction from either Government of New York City purchase or federal tax credits, and a more significant reduction of approximately 18-24% from both opportunities combined.

Table 11 shows projections for the combined effect of purchase by the Government of New York City, federal transmission tax credits and further voluntary purchase of Tier 4 RECs under New York City Local Law 97, reflecting low and high case Local Law 97 assumptions as described in Section C.6.4. Estimates are shown for the combination of CPNY and CHPE.

Table 11: All Voluntary Purchase and Federal Transmission ITC Scenario

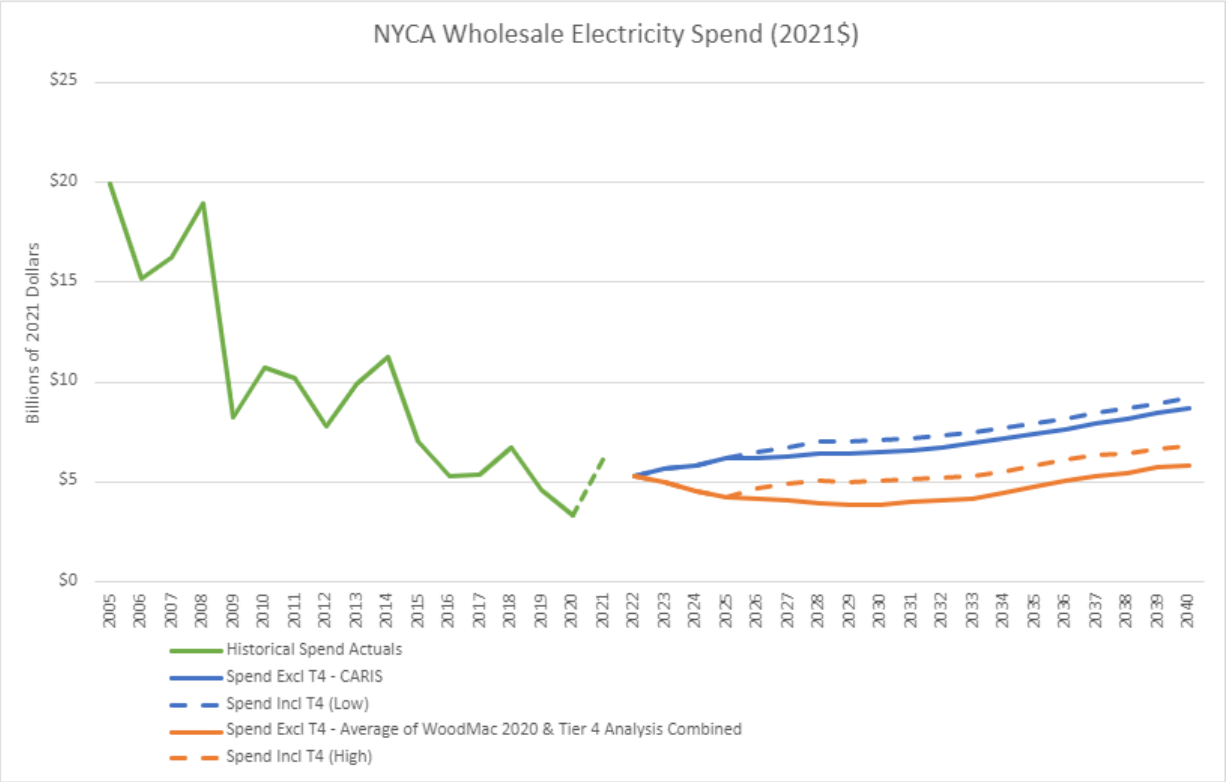
		Lifetime Program Cost, NPV (2021$B)	Lifetime Levelized Bill Impact (%)
High Commodity Prices, CPNY Zone J Capacity Revenue	**All Cost Mitigation (LL97 Low Case)**	$4.3	1.5%
	All Cost Mitigation (LL97 High Case)	$1.0	0.4%
Low Commodity Prices, CPNY Upstate Capacity Revenue	**All Cost Mitigation (LL97 Low Case)**	$8.9	3.2%
	All Cost Mitigation (LL97 High Case)	$2.2	0.8%

These scenarios indicate the significant further potential for reducing statewide ratepayer cost of the Tier 4 program from Local Law 97 and other voluntary purchases.

Across the range of scenarios, results indicate that in particular low energy and capacity prices could result in higher Tier 4 program costs. They also show that in this instance the higher program costs accompany low overall energy prices. Therefore, even with higher Tier 4 program costs ratepayers would experience relatively lower energy bills as compared to the alternative scenario of higher commodity prices accompanied by lower Tier 4 program costs. These dynamics are illustrated in Figure 4 In addition, this figure indicates that the Tier 4 pricing structure has the effect of mitigating ratepayers' exposure to increases in price, since Tier 4 program costs decrease as commodity prices increase.

Finally, this figure shows that even with the Tier 4 program costs, customers are expected to benefit from historically low forecasted commodity prices compared to 10-15 years ago.

Figure 4: Tier 4 Program Cost and Total Spend on Wholesale Electricity



Notes:

- This figure compares Tier 4 program cost to wholesale energy cost, not retail bills. Tier 4 costs would appear relatively lower when set against retail bills, as shown in the percentage ratepayer impact metrics further above.
- Historical Spend Actuals are quantified as the product of the historical annual statewide load and historical day-ahead annual average statewide wholesale electricity prices (load-weighted) as reported by NYISO.
- Future Spend Excluding Tier 4 is quantified as the product of the annual statewide load forecast and the respective annual average statewide (load-weighted) electricity price forecast for the scenario in question.
- Future Spend Including Tier 4 is the sum of the Spend Excluding Tier 4 and the projected annual Tier 4 program cost associated with the respective commodity price forecast scenario.
- The graph does not include other clean energy-related program costs above those reflected by wholesale electricity market clearing prices.

Ratepayer bill impacts shown above reflect statewide averages. Tier 4 costs will be borne by ratepayers based on electric load, with each utility's customers contributing based on their load share, as shown in Table 12 for the first full year of the program. Table 12 illustrates this for costs from the combined Projects under both the high commodity prices/ CPNY Zone J capacity revenue and the low commodity price/ CPNY Upstate commodity revenue assumptions (without voluntary purchase or tax credits).

Table 12: Tier 4 Program Cost Compared to Utility Load

2028	ConEd	Central Hudson	National Grid	NYSEG	Orange & Rockland	RG&E
Load (TWh)	55.4	4.9	32.1	15.4	3.9	7.0
Share of Load (%)[18]	40.2%	3.6%	23.3%	11.2%	2.8%	5.1%
Share of Program Cost,[19] High Comm./ Cap. Rev.	$290	$26	$168	$81	$21	$37
Share of Program Cost, Low Comm./ Cap. Rev.	$546	$49	$317	$152	$39	$69
Share of Program Cost (%)	40.2%	3.6%	23.3%	11.2%	2.8%	5.1%

However, when expressed as a percentage of customer electricity bills, as shown in the bill impact metrics throughout this analysis, the impact will nevertheless vary across utilities. This is primarily because customers' bills vary by utility. In upstate utilities, where electric bills tend to be lower than downstate, this can lead to higher percentage impacts. Also, because these costs are allocated across utilities and customers by kWhs, the % bill impacts will be greater for those customers that have higher consumption load factors. Table 13 illustrates these dynamics.

[18] Load percentages do not sum to 100% due to omission of LIPA-specific metrics in this analysis.

[19] Nominal $ million.

Table 13: First-Year Ratepayer Impact by Utility (CPNY and CHPE)

	High Commodity Prices/ CPNY Zone J Capacity Revenue		Low Commodity Prices/ CPNY Upstate Capacity Revenue	
	No Price Effects	Energy Price Effects	No Price Effects	Energy Price Effects
Statewide	3.0%	1.8%	5.7%	4.5%
Jurisdictional Utilities	3.4%	1.9%	6.3%	5.0%
Con Ed	2.6%	1.2%	4.9%	3.5%
Central Hudson	3.5%	1.7%	6.5%	4.8%
National Grid	5.2%	3.7%	9.9%	8.4%
NYSEG	4.6%	3.2%	8.6%	7.3%
Orange & Rockland	3.1%	1.3%	5.9%	4.1%
RG&E	4.0%	3.0%	7.5%	6.5%

Within utilities, further variation is possible between customer classes. In particular, impacts on large commercial customers may be up to twice the utility-wide averages; impacts on residential customers could be up to approximately a third lower.