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EXCERPT

PROJECTED ENERGY MARKET, CAPACITY MARKET AND EMISSIONS IMPACT ANALYSIS OF THE CHAMPLAIN – HUDSON POWER EXPRESS TRANSMISSION PROJECT FOR NEW YORK

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Prepared for

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1 Executive Summary

London Economics International LLC (LEI) was retained by Transmission Developers Inc. (TDI) to prepare a 10-year energy market price outlook for the New York wholesale power market, as well as forecast the impact of the proposed Champlain–Hudson Power Express (CHPE) HVdc project on New York market prices. The CHPE HVdc project proposes to build a 1,000 MW DC-based transmission line that provides low cost, low-carbon renewable energy from the New York-Canada border into the New York City zone (which we refer to as the NYC sub-region in our modeling) within the markets operated by the New York Independent System Operator (NYISO).

In this report, LEI presents the impact of the CHPE project on the New York power markets, focusing on three main metrics: (1) energy market benefits, including ratepayer benefits, in the form of reduced electricity costs because of reductions in locational based marginal prices ("LBMPs"), as well as production and generation cost savings; (2) capacity market benefits, in the form of reduced capacity prices; and (3) environmental benefits, measured as the total reductions in NO_X, SO_2, and CO_2 emissions in metric tons.

In addition, we conducted sensitivities around the major inputs in our modeling and present in this report the impact of assumptions changes on the projections of energy market ratepayer benefits, production and generation cost savings, and environmental benefits.[1] Lastly, we briefly discuss other potential benefits CHPE could provide.

LEI employed its proprietary production-cost based simulation model, POOLMod, to simulate future market conditions.[2] We modeled the market outcomes for New York both with and without the 1,000 MW CHPE transmission project, from 2015 through 2024, in order to measure the expected future market impact of the CHPE transmission project from the perspective of consumers (ratepayers) in NYISO once CHPE begins commercial operation.[3] We refer to the two scenarios as the Base Case (without CHPE) and the Project Case (with CHPE). In modeling the Project Case, we assumed renewable energy would flow on CHPE at levels equivalent to a 90% capacity factor.

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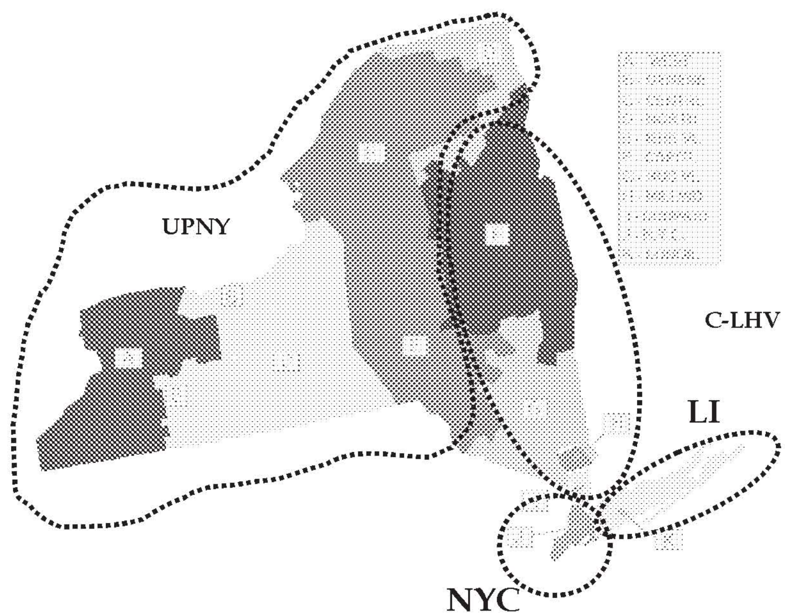
[1] In order to more accurately reflect the potential impact of the sensitivities on the projected outcomes and assess whether it is statistically meaningful), we have re-modeled the Base Case (and Project Case) and the sensitivities using a batch processing approach with 20 iterations, where we modify the within-year randomized schedule of generation availability in each iteration. In other words, all the results documented in this report are based on the average of 20 modeling iterations for each year and each case. The 20 iterations ensured that no single maintenance and forced outage schedule was potentially skewing the results.

[2] We describe POOLMod in more detail in Section 2.1.

[3] The ten-year modeling timeframe provided for a reasonable timeframe for estimating and characterizing the benefit streams from CHPE. Although we recognize that the economic life of CHPE is much longer and that there are going to be benefits attributable to CHPE after 2024, we did not believe it was useful to complete the modeling for a longer time period because the results would be subject to a larger (and escalating) forecast error due to increased uncertainty in key inputs and assumptions the further one looks in time. Modeling results would not be very reliable over much longer periods of time.

As we discuss further in Appendix A, we modeled New York as four separate sub-regions: Western and Northern New York (which we refer to as UPNY), the Capital and Lower Hudson Valley regions east of the Central-East Interface (which we refer to as C-LHV), New York City (NYC), and Long Island (LI). The modeled sub-regions represent an amalgamation of the 11 existing internal zones (A to K, see Figure 1). We model the four external zones (which NYISO labels M to P) as import/export regions, and therefore do not specifically model energy prices for these zones (Figure 2).[4]

Figure 1. Aggregated NYISO zones



Energy market impacts under the Baseline[5]

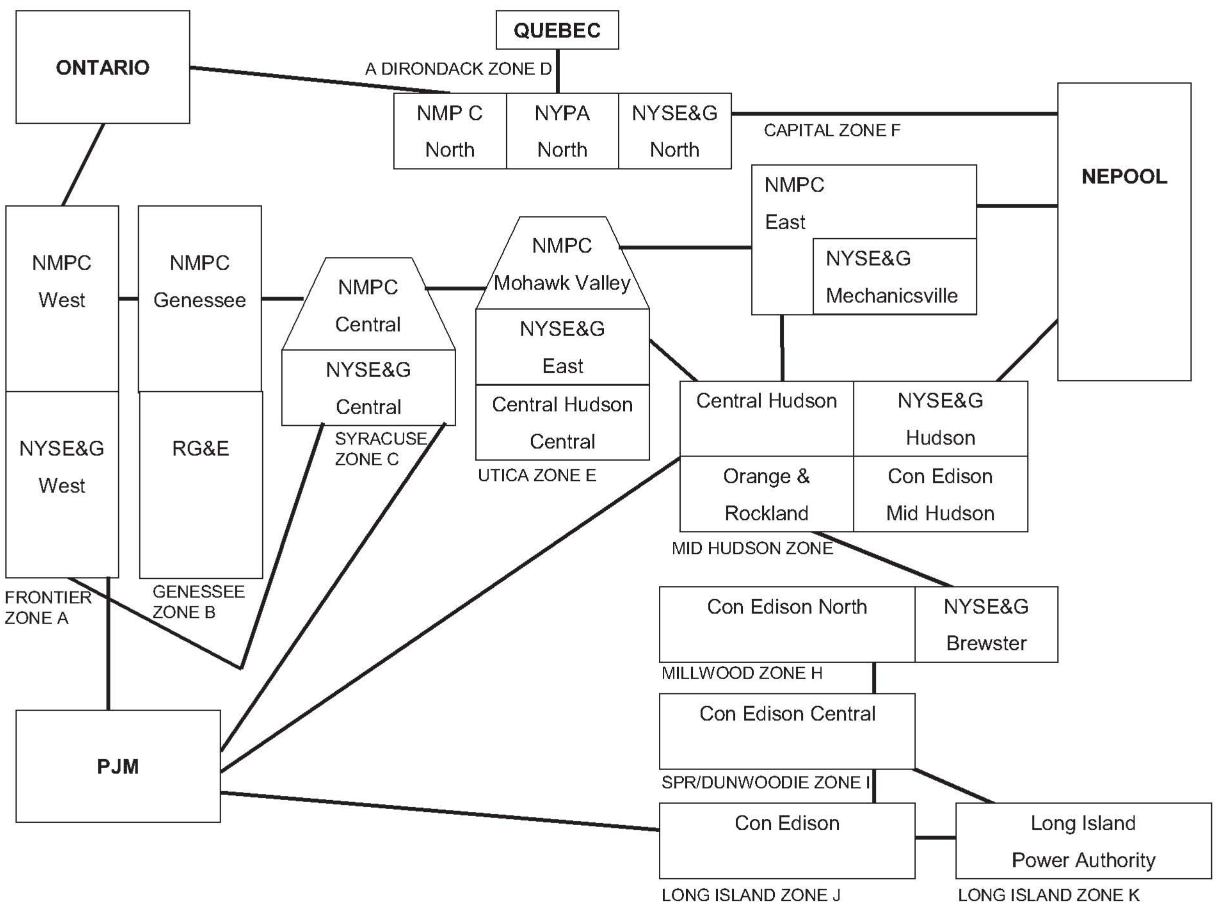
A comparison of prices between the Base Case (without CHPE) and the Project Case (with the 1,000 MW CHPE) allows us to estimate the expected cost savings that the project produces for consumers. With the CHPE Project, we observe that, on average, annual LBMPs in NYC will decline by $9.0 per MWh, annual LBMPs in LI will decline by $7.0 per MWh, annual LBMPs in C-LHV will decline by $3.6 per MWh, and LBMPs in UPNY will decrease by an insignificant amount (less than $0.01 per MWh). On a load-weighted average basis, across the entire New York Control Area ("NYCA"), ratepayers see a decline in energy prices of $4.6 per MWh. This

[4] With the exception of ISO New England control area. Resources and demand within ISO-NE are modeled explicitly at the unit level, rather than in aggregated form (as is the case with other interconnecting markets to the NYISO). Therefore, the modeling did produce energy prices for New England. We have not reported those New England market prices in this report, given the limited relevance to NYDPS.

[5] Baseline refers to the market impact of CHPE (the difference between the Base Case and Project Case) under our Baseline assumptions, such as fuel prices, carbon allowance price, demand and CHPE utilization rate. We have conducted sensitivities around our Baseline assumptions and presented the market impact of CHPE under each sensitivity compared to our Baseline projections.

translates to an annual average reduction in ratepayer costs of energy of $813.5 million. NYCA ratepayer benefits from the decline in NYISO prices total $8.1 billion (undiscounted) over the ten-year modeling period. In Figure 3 on page 10, we show total ratepayer benefits from energy price reduction for the NYCA in each year of the modeling horizon under our Baseline projections.

Figure 2. Transmission Service Areas in NYCA



Source: NYISO. "Transmission Services Manual." 2005. Page 1-2.

Figure 4 on page 10 shows annual production cost and generation cost savings under the Baseline projections. The CHPE project, along with the renewable energy that is being imported as a result of the CHPE project, produces annual production cost savings that average $737 million for the entire NYCA. The total ten-year undiscounted value of these production cost savings amounts to $7.4 billion. Generation cost savings are smaller because the cost savings associated with imports are excluded: these average $668 million per year, and total $6.7 billion over ten years (undiscounted).

Figure 3. Forecast energy market savings to New York ratepayers from 1,000 MW CHPE transmission project

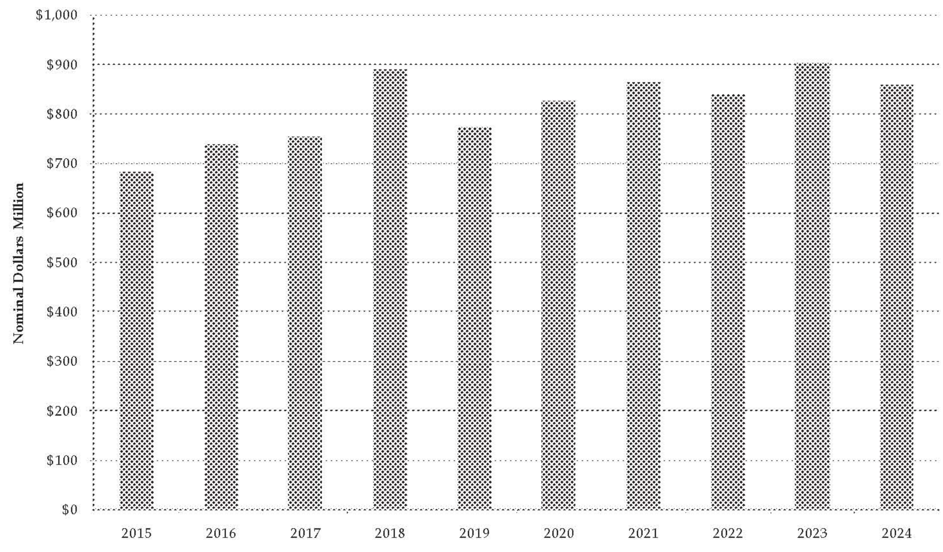
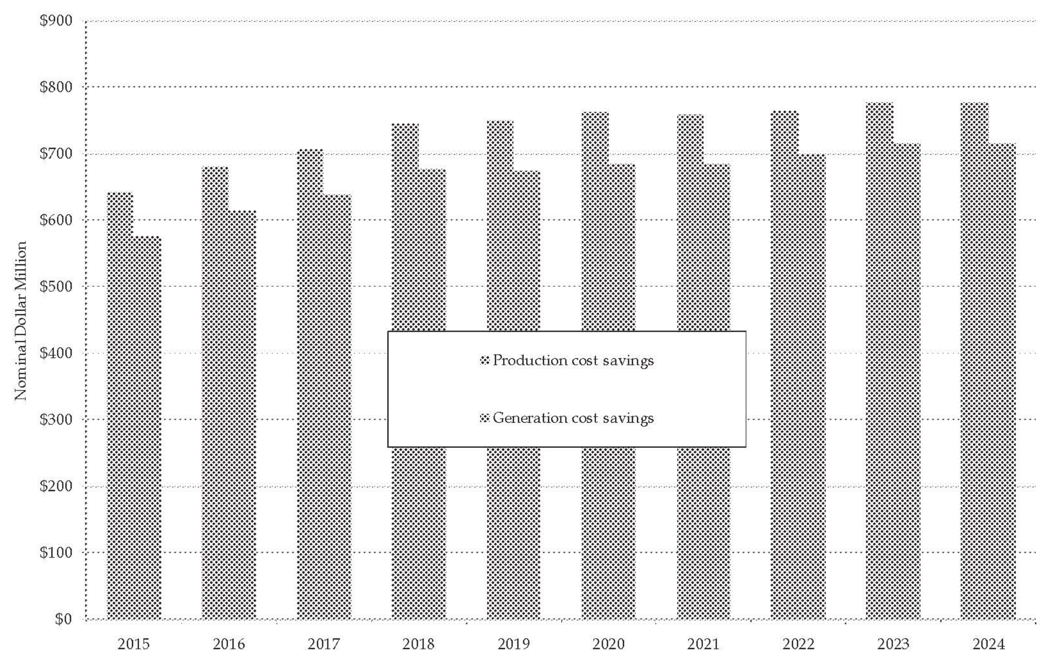


Figure 4. Annual generation cost and production cost savings under the Baseline



Capacity market impacts under the Baseline

In addition to the energy market benefits, CHPE is expected to produce capacity market benefits. NYISO is still studying the deliverability of CHPE. For the sake of analysis, we have assumed that CHPE's capacity would be deemed deliverable and UDRs would be awarded. If we conservatively assume only half of the capacity of the line (500 MW) is deemed deliverables and is allocated UDRs that are then converted into UCAP, the annual average reduction in capacity price is projected to be $1.3/kW-month for the NYCA market and $2.6/kW-month for the NYC market. For LSEs in NYC, lower UCAP prices would lead to average annual reduced costs of $296 million, with the majority savings (approximately 80%) coming from reduction in NYC capacity prices. In the NYCA capacity market, average annual cost reductions would be $501 million based on our long-term projections.

Environmental impacts under the Baseline

The introduction of 7.64 TWh per year of inexpensive, clean energy into New York's power markets will displace SO_2, NO_X, and CO_2 emitting generation. We are able to estimate the decline in emissions from these three pollutants by comparing the plant-level emissions in the Base Case with those in the Project Case. We find that, over the ten-year period modeled, New York generation would emit 6,800 tons less of SO_2, 10,800 tons less of NO_X, and close to 37 million tons less of CO_2. The Baseline projected annual emissions levels by pollutant are presented in Figure 5 through Figure 7 below.

Figure 5. Projected annual SO_2 emissions in New York under the Baseline

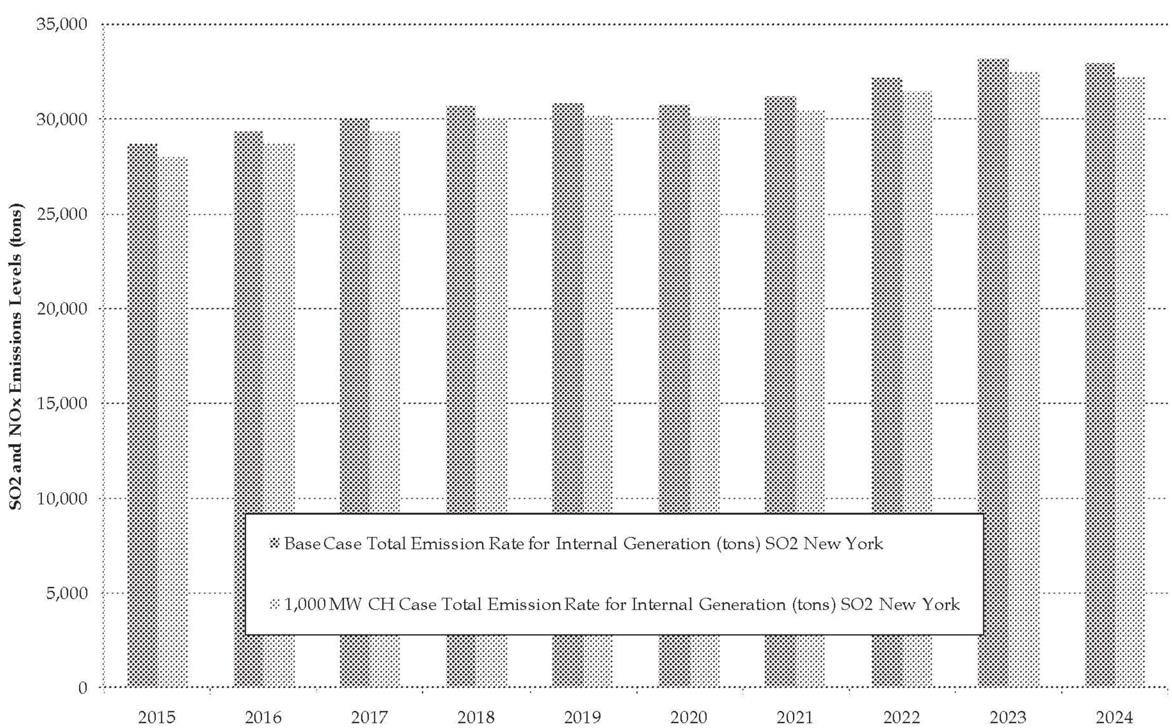


Figure 6. Projected annual NO_X emissions in New York under the Baseline

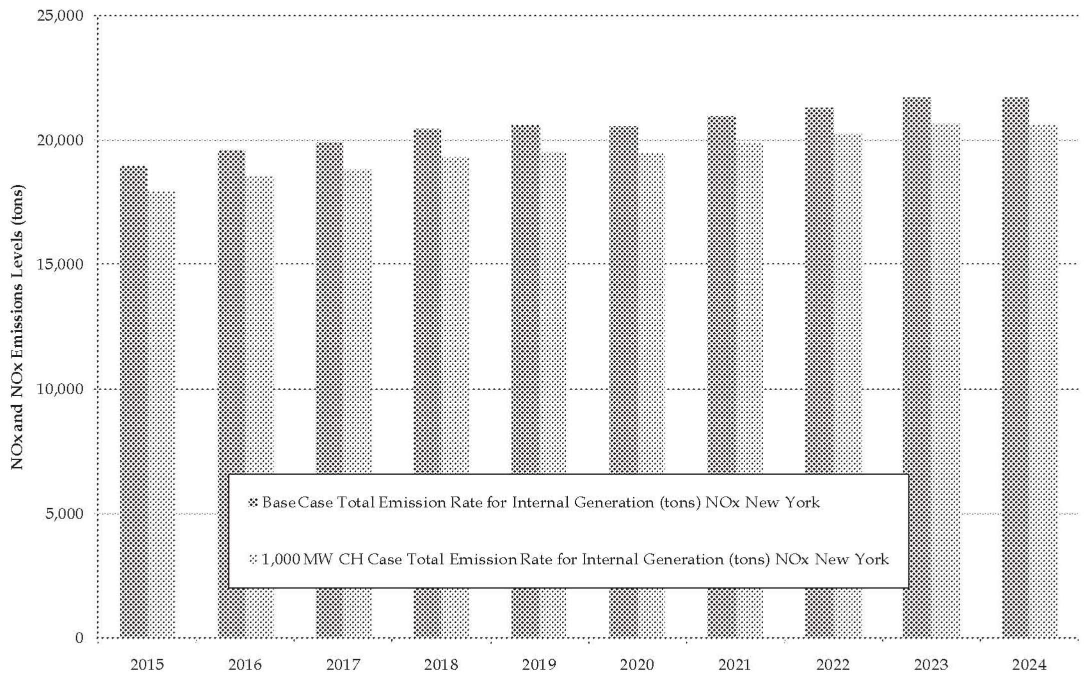
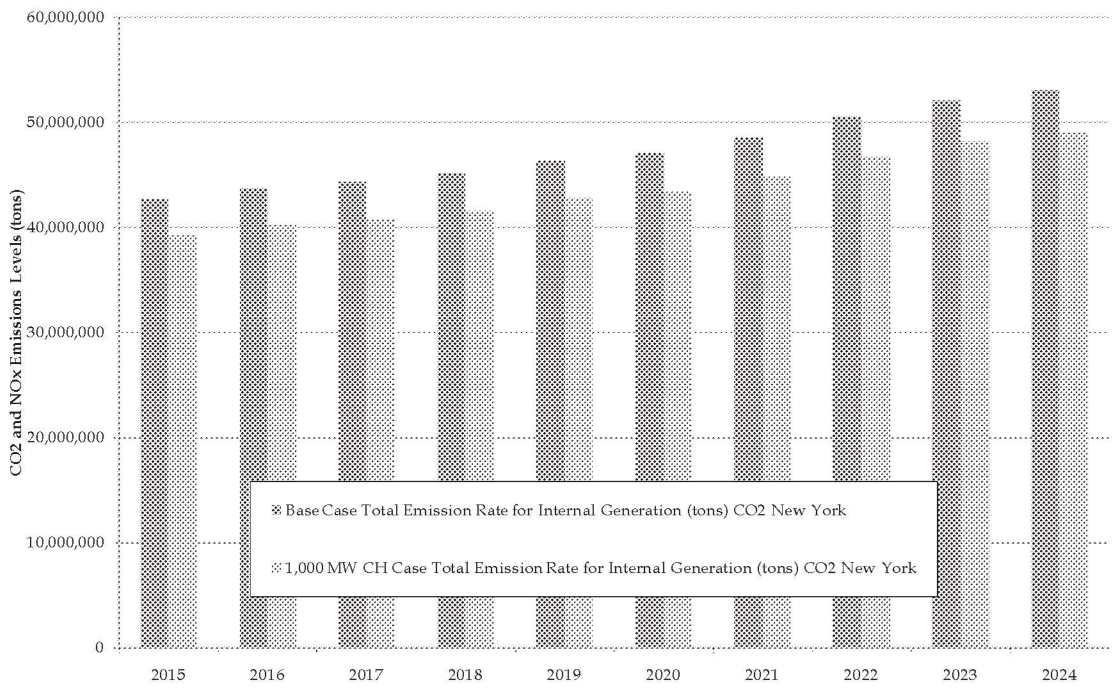


Figure 7. Projected annual CO_2 emissions in New York under the Baseline



Sensitivity analysis

We have conducted sensitivities around four major inputs in our simulation modeling of the CHPE project: fuel prices, carbon allowance prices, demand levels, and our assumption about the energy flows on CHPE (the utilization rate). In testing these four sensitivities, we re-modeled both the case without the project and the case with the project under the varied assumptions. We then observed the change on energy market metrics, such as the ratepayer benefit and the production and generation cost savings, as compared to the Baseline. We also documented the change in emissions, as compared to the Baseline. In summary form, Figure 8 below lists the sensitivity results as compared to the Baseline.

Figure 8. Summary of sensitivity results as compared to the Baseline results

in nominal $ billion

	Ten-year total undiscounted energy market ratepayer benefits (NYCA)	Ten-year total undiscounted production cost savings (NYCA)	Ten-year total undiscounted generation cost savings (NYCA)
Baseline	$8.1	$7.4	$6.7
Low Fuel Price Case	$6.6	$5.2	$4.7
High Fuel Price Case	$11.0	$9.2	$8.7
Low Carbon Allowance Price Case	$7.9	$7.3	$6.6
2010 Gold Book Base Demand Case	$7.4	$7.3	$6.6
2010 Gold Book Low Demand Case	$6.9	$7.0	$6.3
2010 Gold Book High Demand Case	$8.8	$7.8	$7.0
75% Utilization Case	$6.9	$6.3	$5.7

in tons

	Ten-year total SO2 emission reductions (NYCA)	Ten-year total NOx emission reductions (NYCA)	Ten-year total CO2 emission reductions (NYCA)
Baseline	6,837	10,835	36,827,313
Low Fuel Price Case	5,738	11,467	35,255,552
High Fuel Price Case	4,790	10,324	37,433,744
Low Carbon Allowance Price Case	6,667	10,686	36,130,302
2010 Gold Book Base Demand Case	6,401	9,950	36,328,506
2010 Gold Book Low Demand Case	6,316	8,704	35,861,838
2010 Gold Book High Demand Case	7,106	11,869	37,645,974
75% Utilization Case	5,262	9,085	30,702,514

The first sensitivity is around fuel prices, where we tested fuel prices that are 31% lower or 31% higher than the Baseline fuel price. This sensitivity analysis shows that CHPE is expected to produce greater savings (35% higher than the Baseline) for NYCA ratepayers when fuel prices are higher, but the reduction in ratepayer benefits in the case of lower fuel prices is much more moderate (19% lower than the Baseline). Generation and production cost savings in the NYCA reflect the change in fuel prices and are in general 30% lower or higher than the Baseline. Emission reductions under the fuel price sensitivity vary depending on the type of pollutant. We have observed lower SO_2 reduction in both the Low Fuel and High Fuel Price Cases

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compared to the Baseline, lower NO_X reduction under the High Fuel Price Case and higher NO_X reduction under the Low Fuel Price Case compared to the Baseline, and lower CO_2 reduction under the Low Fuel Price Case and higher CO_2 reduction under the High Fuel Price Case.

The second sensitivity is around carbon allowance price, where we tested lower carbon allowance prices (on average $10/ton lower than the Baseline), aligned with assumptions in NYISO's CARIS process. As carbon cost is a small portion of the generation cost, it has a smaller impact on the modeling results than the fuel prices. Estimated NYCA ratepayer benefits are 3% lower than the Baseline, while generation and production cost savings are projected to be 1% lower than the Baseline. Emission reductions under the Low Carbon Allowance Price Case are slightly lower than the Baseline.

The third sensitivity is around demand levels, where we tested using updated base case demand projections from the 2010 Gold Book published by NYISO, as well as the low and high demand projections in the 2010 Gold Book. The 2010 Gold Book Base Case is in general lower than our Baseline assumptions, which are based on the 2009 Gold Book. We first compared the 2010 Gold Book Base Case to the 2009 Gold Book Base Case (Baseline), and then compared the Low, Base and High Cases within the 2010 Gold Book. Estimated ratepayer benefits for NYCA are 8.5% lower under the 2010 Gold Book Base Case as compared to the 2009 Gold Book Base Case, while generation and production cost savings in NYCA under the 2010 Gold Book Base Case are 1% lower than the 2009 Gold Book Base Case. Emission reductions are in general lower under the 2010 Gold Book Base Case. Within the three 2010 Gold Book Cases, the 2010 Gold Book Low Case produces 7% lower NYCA ratepayer benefits compared to the 2010 Gold Book Base Case, while the 2010 Gold Book High Case produces 17% higher NYCA ratepayer benefits. Similar to the fuel sensitivity, CHPE is expected to produce greater savings for ratepayers when demand is higher while reduction in ratepayer benefits is much more moderate under lower demand. In these demand sensitivities, the estimate of ratepayer benefits is affected not only by price changes but also by the quantity change represented in the demand forecast itself. Generation and production cost savings under the 2010 Gold Book Low Case are 4% lower compared to the 2010 Gold Book Base Case, while 6% higher under the 2010 Gold Book High Case. Emission reductions are in general lower under the 2010 Gold Book Low Case, and higher under the 2010 Gold Book High Case, compared to the 2010 Gold Book Base Case.

The last sensitivity is around the utilization of the CHPE line, where we tested a 75% utilization rate as compared to the 90% utilization rate assumed under the Baseline. In other words, we assumed in the sensitivity 6.37 TWh annually of low cost renewable energy flowing on the CHPE, instead of the Baseline assumption of 7.64 TWh. Both ratepayer benefits and generation and production cost savings are projected to be 15% lower under the 75% Utilization Case, as compared to the Baseline. Emission reduction is significantly lower under the 75% Utilization Case, because the reduction in emissions-free energy available from the CHPE line translates into reduced displacement of existing generation.

Lastly, it is important to note that this study did not exhaustively study all sources of benefits generated by this project in and around New York. In Section 8 of this Report, we discuss other potential benefits of the CHPE project, such as its impact on the RPS program, reduction of potential market power as well as system reliability.