Comment on Legislative and Budgetary Actions Necessary to Implement the CLCPA Scoping Plan

I submitted a separate general comment on the legislative and budgetary actions necessary to implement the CLCPA Scoping Plan and then realized that a post I was planning to publish at my blog this evening was entirely relevant to this process. I recently described my initial impression of the New York cap and invest program and noted that it was not clear what the target revenue cap would be. The post I am planning to publish looks at some alternative revenue projections.

Cap and Invest Investment Projection

My initial impression of the New York cap and invest program post calculated a revenue projection for the proposed cap and invest program. From 2025 to 2030 I estimate that emissions will have to go down 14.76 million tons per year to meet the 2030 GHG emissions target. New York's investments in the Regional Greenhouse Gas Initiative yield an expected cost per ton reduced of $537 for a total of $7.9 billion. Governor Hochul proposed "legislation to create a universal Climate Action Rebate that, subject to a stakeholder and rulemaking process, is expected to drive more than $1 billion in annual cap-and-invest proceeds to New Yorkers". In this approach the total revenues needed would be $9 billion per year.

Scoping Plan Cost Projection

The primary documentation for the numbers presented in the Scoping Plan is the Tech Supplement Annex 2. Key Drivers Outputs spreadsheet. The Scoping Plan has been described as a "true masterpiece in how to hide what is important under an avalanche of words designed to make people never want to read it." The spreadsheet is worse. Not only is the information provided buried in a massive spreadsheet but the authors of the Integration Analysis presented misleading, inaccurate, and biased data to support the narrative that the costs of inaction are more than the costs of action. I have extracted the relevant tabs from the massive reference spreadsheet for my analysis spreadsheet to address the first concern.

The data in the Integration Analysis that is used in the Scoping Plan is misleading. For one thing, as many numbers are possible are only provided relative to a Reference Case instead of a status quo or business-as-usual case that represents the full costs of the control strategies necessary to meet the net-zero by 2050 Climate Act goal. I maintain that the true cost of New York's net-zero transition by 2050 should include all costs associated with all programs designed to reduce GHG emissions. That is the cost value that legislative and budgetary actions needs to use. The authors of the Integration Analysis and Scoping Plan excluded decarbonization costs that I believe should be included and provided insufficient documentation to enable anyone to determine what is in or out of the Reference Case. For example, consider the supporting data for Figure 48 (Fig 48 tab in my spreadsheet). Note the transportation investments in the Reference Case total $1.056 trillion but that the cost for the Low-Carbon Fuels scenario is only $3.4 billion more. That means the majority of the costs associated with capital and operating expenses for light-duty vehicles, medium- and heavy-duty vehicles, and buses as well as charging infrastructure costs are buried in the Reference Case because those costs are a lot more than $3.4 billion.

Figure 48: Net Present Value of System Expenditures ($ billions) in Reference Case and Scenarios 2-4 (2020-2050)				
Category	**Reference**	**Low-Carbon Fuels**	**Accelerated Transition**	**Beyond 85% Reductions**
Other Fuel	$ 24.16	$ 20.08	$ 20.89	$ 20.89
Fossil Gas	$ 66.51	$ 37.96	$ 39.23	$ 37.38
Fossil Liquids	$ 475.88	$ 312.79	$ 359.09	$ 336.23
Buildings Investment	$ 566.25	$ 800.76	$ 805.29	$ 805.29
Transportation Investment	$ 1,056.43	$ 1,059.83	$ 1,072.23	$ 1,095.47
Electricity	$ 419.64	$ 501.26	$ 520.74	$ 512.39
Renewable Liquids	$ 5.05	$ 105.40	$ 7.55	$ 33.41
Renewable Gas	$ -	$ 23.98	$ 6.05	$ 21.05
Negative Emissions Technologies	$ -	$ 5.73	$ 8.86	$ (0.00)
Non-Energy	$ -	$ 19.46	$ 20.16	$ 25.15
Others	$ 90.89	$ 114.00	$ 113.59	$ 113.59
Total	$ 2,704.81	$ 3,001.24	$ 2,973.68	$ 3,000.87
Annual Expenditures	$ 100.18	$ 10.98	$ 9.96	$ 10.97

The cost data in the Integration Analysis that is used in the Scoping Plan is inaccurate. For example, in the calculations for the new wind, solar, and energy storage resources needed to replace existing fossil-fired resources it is assumed that none of the existing or newly developed resources reach their effective life expectancy. Wind, solar, and energy storage resources all have expected lifetime less than 25 years and it is more than 25 years to 2050 so this inaccurately underestimates the cost of renewable energy electric generation.

The data in the Integration Analysis that is used in the Scoping Plan is biased. Wind and solar resources are intermittent so the assumption of the amount of energy produced affects the projected capacity of resources needed. Without exception the future amount of energy from wind and solar resources is biased high relative to the New York Independent System Operator projections. As a result, the costs projected are unreasonably low. Based on my evaluation the Integration Analysis biased every choice to make the zero-emissions replacement resources cheaper.

I emphasize that the annual revenue numbers that I believe should be clearly listed in the Integration Analysis and Scoping Plan are not provided so I can only make an estimate. Given all the limitations described above, the revenue values in the final row in my version of the Figure 48 table shown above should be used cautiously. The annual expenditure values listed are the difference between the mitigation scenarios and the Reference Case divided by the number of investment years (27) from 2024 to 2050. The values range between $10 and $11 billion.

Other Cost Projections

I have heard other numbers tossed around so I did a bit of research to docuemnt other values.

In testimony regarding the environmental provisions of Governor Cuomo's Executive Budget Proposal for SFY 2020-2021, Peter Iwanowicz, Executive Director, Environmental Advocates of NY, January 27, 2020 stated:

> The costs of inaction are enormous. Based on the widely accepted social cost of carbon pollution of $50 per ton, New York has $10.2 billion dollars in costs per year attributed to the pollution we emit that is fueling climate change. This is a staggering blow to our health, our environment, our communities, and our economy.

Back calculating this projection assumes 204 million tons which is about the total CO2 emissions for 2017. The problem is that social cost of carbon parameter can only be applied once because it represents all the impacts from the time of the reduction to 2300. Counting them more than once is the same as claiming that because I lost ten pounds five years ago that I lost 50 pounds.

New York Lawyers for the Public Interest Nov. 8 Elections show that New Yorkers Overwhelming Support Climate Funding:

> The Bond Act is a good start—but it's not enough. It's been three years since New York passed our landmark climate law, the Climate Leadership and Community Protection Act (CLCPA), and we're far from achieving the law's mandate of largely decarbonizing the state economy by 2040. The state's own analysis shows that we'll need to invest roughly $15 billion a year by 2030, and $45 billion a year by 2050.

The Integration Analysis does include annual projections for net direct costs of between $10.4 and $12.2 billion for 2030 and between $41.0 and $41.3 billion in 2050.

New York Renews: Climate Coalition launches campaign for state action

> Among NY Renews' key goals for the upcoming legislative session is the creation of a $10 billion Climate and Community Protection Fund, modeled after the state's Environmental Protection Fund. It's an amount in line with the Climate Action Council's estimates of what meeting the goals in the climate plan will cost: $10 to 15 billion a year, whether the costs are paid by the state, the federal government, industry, ordinary New Yorkers, or a mix of all of the above.

These estimates are consistent with other guesses.

I found a couple of independent estimates of the total costs to meet the net-zero target by 2050: An article by Ken Gregory critiques a report by Thomas Tanton "Cost of Electrification: A State-by-State Analysis and Results". In Tanton's analysis the estimated total installed cost (overnight) is approximately for New York is $1.465 trillion or $54.3 billion per year. Gregory's total national capital cost of electrification is $433 trillion and New York's proportional share based on Tanton is $22.2 trillion. Overbuilding solar and wind by 21% reduces New York overall costs to $18.2 trillion. Allowing fossil fuels with carbon capture and storage to provide 50% of the electricity demand reduces New York's estimated costs to $1.2 trillion or $44.4 billion per year.

Conclusion

The legislative and budgetary actions have to be based on estimates of the revenues needed. It is very important that the Legislature understand that the numbers presented in the Scoping Plan are inappropriate for any future legislative actions. Those actions have to be based on the total costs of implementation and not just the costs relative to a Reference Case. Beyond that I can offer no substantive recommendation for revenues needed because of inadequate documentation in the Scoping Plan.

Background

I submitted comments on the Climate Act implementation plan and have written over 270 articles about New York's net-zero transition because I believe the ambitions for a zero-emissions economy embodied in the Climate Act outstrip available renewable technology such that the net-zero transition will do more harm than good. I also follow and write about the Regional Greenhouse Gas Initiative (RGGI) market-based CO_2 pollution control program for electric generating units in the NE United States. I have extensive experience with air pollution control theory, implementation, and evaluation having worked on every cap-and-trade program affecting electric generating facilities in New York including the Acid Rain Program, RGGI, and several Nitrogen Oxide programs. The opinions expressed in these comments do not reflect the position of any of my previous employers or any other company I have been associated with, these comments are mine alone.

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Addendum Description of Scoping Plan Methodology

This reference extracts the methodology description in [Tech Supplement Annex 2. Key Drivers Outputs](). The "Cost Methods Overview" tab describes the methodology used to calculate embedded system costs and scenario costs for each category.

The incremental electricity costs includes capital and operating costs for electricity generation, transmission, costs to upgrade existing distribution system, and in-state hydrogen production costs.

> "Electric sector costs are calculated within E3's capacity expansion model, RESOLVE, which performs least-cost optimization to identify resource portfolios that meet New York State's policy goals while also maintaining reliability. Based on the resource portfolios developed in RESOLVE for each scenario, provided in Annex 2, system costs are calculated within the model using the levelized investment costs and fuel prices provided in the ""Resource Costs - Mid"" and ""Mid Case Fuel Projections"" tabs of Annex 1, as well as the ongoing costs of operating existing generation units, provided in the ""Going Forward Fixed Costs"" tab. Incremental distribution system costs are calculated using the DRV values provided on the ""Distribution System Costs"" tab of Annex 1, scaled to the increases in peak load by scenario. These costs are aggregated and levelized for the system, and calculated on an NPV basis over the 2020-2050 period. More detail on the electric sector modeling methodology can be found in Chapter 5 of Appendix G.
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> Where embedded system costs are estimated (Figures 45, 48, 50), AEO 2021 modeled prices for New York system in the Reference case (AEO includes NPCC for Upstate New York and for NYC+LI) are used to develop an estimate of current system expenditures (multiply AEO prices for generation, transmission, and distribution by load). This results in estimates of expenditures for generation, transmission, distribution in 2020. These are combined to create an estimate for total current system costs in 2020. We net out the generation and transmission costs captured by RESOLVE modeling in 2020 to ensure no double-counting of these costs, and hold the calculated embedded costs constant through 2050."

The Transportation Investments includes capital and operating expenses for light-duty vehicles, medium- and heavy-duty vehicles, and buses, in addition to charging infrastructure costs.

> "Transportation sector investment includes capital cost and ongoing O&M cost (excluding cost for fuel and electricity, which are included in other cost categories). Capital costs are calculated by multiplying sales in each year in each scenario, available in Annex 2, by overnight capital costs, available in Annex 1. These overnight capital costs are then levelized according to sector-specific interest rates, provided in Annex 1. This category also includes cost for EV charging infrastructure, calculated on a per-vehicle basis and meant to represent cost for EV charging infrastructure levelized over each individual vehicle, with the per-unit cost for EV chargers included in Annex 1. Note capital cost for non-stock transportation end uses (such as rail, maritime, aviation) are generally excluded with exceptions noted below, and VMT reductions achieved in Scenarios 1-3 are assumed to occur at no incremental cost. Note Scenario 4 does include incremental costs associated with VMT reductions above Scenarios 2 and 3 (using data from DOE Moving Cooler report), in-state rail expansion (data from Environmental Impact Statement for Empire State Rail), and includes incremental cost for hydrogen and electric

aviation (sourced from an EU funded report on hydrogen aviation: https://www.fch.europa.eu/publications/hydrogen-powered-aviation).

Where embedded system costs are estimated (Figure 45, 48, 50): to estimate ongoing payments for financed technologies, we take the modeled sales of devices in 2019, multiplied by $/device price in 2019, and back-cast by the financing lifetime of the technology (i.e., we are trying to capture ongoing payments for devices sold prior to the first modeled year but which are still within their financial lifetime). We combine the embedded system cost estimate with modeled estimate of investments in 2019 and 2020 to estimate the current expenditures in 2020. We recognize this is an approximation of ongoing financing payments for existing energy infrastructure. "

Building investments include capital and operating expenses for building equipment and appliances (e.g., space heaters, air conditioners, water heaters) and investments for building shell upgrades.

"Building sector investment includes capital cost and ongoing O&M cost (excluding cost for fuel and electricity, which are included in other cost categories). Capital costs are calculated by multiplying sales in each year in each scenario, available in Annex 2, by overnight capital costs, available in Annex 1. These overnight capital costs are then levelized according to sector-specific interest rates, provided in Annex 1

Where embedded system costs are estimated (Figure 45, 48, 50): to estimate ongoing payments for financed technologies, we take the modeled sales of devices in 2019, multiplied by $/device price in 2019, and back-cast by the financing lifetime of the technology. We combine the embedded system cost estimate with modeled estimate of investments in 2019 and 2020 to estimate the current expenditures in 2020. We recognize this is an approximation of ongoing financing payments for existing energy infrastructure. "

Non-energy costs include mitigation costs for all non-energy categories, including agriculture, waste, and forestry.

"Differences in annual non-energy emissions between mitigation scenario and the Reference scenario (found in Annex 2) are multiplied with annual $/tCO2e costs (found in Annex 1, tab ""Non Energy Costs""). We calculate net investment for each Mitigation scenario relative to the Reference scenario, and costs are displayed on an NPV basis over 2020-2050 period. The non-energy emissions costs are calculated for waste, agriculture, and forestry and land use categories separately. Agriculture and Waste costs are sourced from US data within EPA's 2019 report on Global Non-CO2 Greenhouse Gas Emission Projections & Mitigation report, while Forestry and Land Use mitigation costs are sourced from WRI's 2020 CarbonShot report. Mitigation costs on a $/tCO2e basis were applied to reductions/increased sequestration in each scenario (after adjusting for differences in GHG accounting between the EPA/WRI reports and the Climate Act accounting conventions).

Waste and agriculture costs for Scenarios 1-3 do not use the most expensive mitigation potential within the EPA report. Scenario 4 (Beyond 85% Reductions) includes incremental ambition in waste and agriculture beyond the other mitigation scenarios, so the incremental cost of agriculture and waste mitigation above the levels of Scenarios 1-3 are costed at a higher level in Scenario 4. "

Renewable gas includes fuel costs for renewable natural gas and imported green hydrogen consumed for final energy demand (excludes fuel used for electricity generation).

Final energy demand in MMBtu was multiplied by energy prices in $/MMBtu from internal E3 analysis of biofuels prices based on DOE Billiion Ton Report, NYSERDA Potential of RNG report, and E3 analysis for hydrogen production costs. Note that renewable gas costs are meant to represent wholesale costs of gas, not retail rates for these fuels. See prices as published in Annex 1.

Note that the cost for hydrogen production and import into New York state is included 50% in the RESOLVE modeling and 50% in the demand-side modeling; see Annex 1 tab Hydrogen Costs for a breakdown of cost components of hydrogen we include.

Renewable liquids includes fuel costs for renewable diesel and renewable jet kerosene consumed for final energy demand.

Final energy demand in MMBtu was multiplied by energy prices in $/MMBtu from internal E3 analysis of biofuels prices based on DOE Billion Ton Report. See prices for renewable fuels as published in Annex 1.

Negative emission technologies (NETs) includes costs for direct air capture of CO2 as a proxy for NETs.

For scenarios with NETs, we multiply annual tons mitigated by $/ton costs, with per-ton estimates for cost of electricity and natural gas with CCS for ultimate prices as documented in Annex 1. Capital and O&M costs for direct air capture system taken from Keith, et al. 2018, with electricity price of $0.10/kWh and natural gas prices from EIA AEO 2021.

Other costs includes other direct costs including non-stock sector costs, oil & gas system costs, and HFC alternatives.

Non-stock sector costs (mostly industry EE but some EE for non-stock building EE) estimated using a $ per MMBtu saved value, oil & gas system costs are direct calculations of capital and operating costs for the oil & gas system in New York for each scenario from parallel Abt analysis, HFC alternatives are direct calculations of costs for new HFC replacements and refrigerant recovery for each scenario from parallel Guidehouse analysis.

These costs are calculated relative to a Reference scenario, so there are no HFC mitigation costs or non-stock cost for energy efficiency in the Reference case. Oil and gas system cost and HFC mitigation costs come form parallel analyses, non-stock cost for energy efficiency calculated by multiplying change in energy demand between Reference and mitigation scenarios by $/MMBTU cost for EE values for various sectors.

Where embedded system costs are estimated (Figures 45, 48, 50): for oil and gas system cost (the pipeline delivery system), we use EIA AEO data on sales, delivered cost, and wholesale cost of natural gas to estimate the cost of the natural gas delivery system, and treat that as embedded cost which is held constant throughout the model period in real dollar terms across all scenarios. Estimate of embedded system costs = delivered natural gas revenues - wholesale natural gas revenues in New York state, with data from EIA: https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

Fossil gas or natural gas to the rest of the English-speaking world outside of the Climate Action Council costs include fuel costs for fossil natural gas consumed for final energy demand (excludes fuel used for electricity generation).

Final energy demand in MMBtu was multiplied by energy prices in $/MMBtu for the Middle Atlantic census division from EIA AEO 2021. Annual demand for fossil gas (documented in Annex 2) multiplied by price for fossil gas (documented in Annex 1). Quantities of fuels are model outputs, with the model benchmarked to a variety of sources including the GHG Inventory and EIA State Energy Data System data for 2018. Note that fossil gas costs are meant to represent wholesale costs of gas, not retail rates for gas.

Fossil liquids include fuel costs for liquid petroleum products like gasoline, diesel, jet kerosene, LPG, and residual fuel oil consumed for final energy demand (excludes fuel used for electricity generation).

Final energy demand in MMBtu was multiplied by energy prices in $/MMBtu for the Middle Atlantic census division from EIA AEO 2021. Annual demand for fossil liquid fuels (documented in Annex 2) multiplied by price for fossil liquid fuels (documented in Annex 1). Quantities of fuels are model outputs, with the model benchmarked to a variety of sources including the GHG Inventory and EIA State Energy Data System data for 2018.

Other fuel includes fuel costs for other fuels such as wood, coal, and petroleum coke consumed for final energy demand (excludes fuel used for electricity generation).

Final energy demand in MMBtu was multiplied by energy prices in $/MMBtu for the Middle Atlantic census division from EIA AEO 2021. Annual demand for other fuels (documented in Annex 2) multiplied by price for other fuels (documented in Annex 1). Quantities of fuels are model outputs, with the model benchmarked to a variety of sources including the GHG Inventory and EIA State Energy Data System data for 2018.