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June 6, 2016

VIA ELECTRONIC MAIL

Hon. Kathleen H. Burgess
Secretary to the Commission
New York State Public Service Commission
Three Empire State Plaza
Albany, New York 12223

RE: Case 15-E-0302- In the Matter of the Implementation of a Large-Scale Renewable Program and a Clean Energy Standard

Dear Secretary Burgess:

In accordance with the April 8, 2016 "Notice of Comment Period for Staff White Paper and Cost Study," Alliance for a Green Economy and Nuclear Information and Resource Service hereby submit the following comments on the "Clean Energy Standard White Paper – Cost Study" in the above referenced proceeding.

Respectfully submitted,

/s/
Jessica Azulay Chasnoff
Alliance for a Green Economy

/s/
Tim Judson
Nuclear Information and Resource Service

NEW YORK STATE
PUBLIC SERVICE COMMISSION

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Proceeding on Motion of the Commission
to Implement a Large-Scale Renewable
Program and a Clean Energy Standard: Case 15-E-0302

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# COST STUDY COMMENTS BY ALLIANCE FOR A GREEN ECONOMY AND NUCLEAR INFORMATION AND RESOURCE SERVICE

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AND NUCLEAR INFORMATION AND RESOURCE SERVICE

## Contents



## 1. Introduction

On April 8, 2016, the Department of Public Service ("DPS") published the "Clean Energy Standard White Paper – Cost Study" ("Cost Study"). The analysis is a companion to an earlier White Paper published by DPS to propose a Clean Energy Standard program. The program would commit New York's load serving entities ("LSEs") and by extension LSE customers to buying increasing percentages of their electricity from renewable and nuclear energy sources.

For a policy of this magnitude and importance, it is critical that New York's public be provided with accurate information about the costs and benefits posed by the DPS proposal. Without accurate and transparent information, the opportunity for public comment is meaningless.

It is equally important that the Public Service Commissioners who must ultimately rule on the merits of the Clean Energy Standard proposal be provided with accurate information.

The White Paper proposes three tiers of subsidized resources for New York's Clean Energy Standard. Tier 1 would support new renewable energy, Tier 3 would support existing renewable energy facilities, while Tier 3 would bail out unprofitable nuclear reactors in Upstate New York.

We are confident that other environmental and consumer protection organizations will adequately critique the strengths and weaknesses of the Cost Study as it relates to the renewable energy tiers. The DPS provided hundreds of pages of documentation about those tiers and how it arrived at the numbers in the Cost Study.

By contrast, almost no information was provided on the costs and benefits of Tier 3. As nuclear watchdog organizations with a focus on nuclear economics and consumer advocacy, Alliance for a Green Economy ("AGREE") and Nuclear Information and Resource Service ("NIRS") take this opportunity to thoroughly comment on the Cost Study's treatment of the Nuclear Tier.

Our comments focus on the following items:

(1) The Cost Study does not meet a reasonable standard of transparency and detail, thereby depriving the public, parties and the Commission of the information needed to analyze the costs and benefits of the nuclear tier.

(2) The Cost Study dramatically underestimates the likely costs of the nuclear tier. The true cost of the nuclear bailout contemplated is likely to be at least $3 billion over the life of the proposed Clean Energy Standard.

(3) The Cost Study overestimates the carbon-displacement benefits of preserving the upstate New York nuclear fleet. It does not take into account the life-cycle greenhouse gas emissions associated with nuclear power. It also assumes that not even one megawatt of nuclear generation could be replaced in the coming years by renewable energy or energy efficiency.

(4) The Cost Study fails to consider other social costs of nuclear energy, which are externalized in the form of public subsidies, health impacts, water usage, environmental damage and risk. When these externalized costs, many of which are unique to nuclear power, are taken into account, the costs of the nuclear tier far outweigh the benefits, even using conservative numbers.

| **Costs in millions through 2023** | **Low Subsidy** | **High Subsidy** | | **Total Carbon Benefit** | **Net Costs - Low** | **Net Costs – High** |
|---|---|---|---|---|---|---|
| DPS Cost Study Estimates | $59 | $658 | | -$1586.5 | | |
| AGREE/NIRS Cost Estimates | $1340 | $1340 | | | | |
| Life Cycle Adjustment GHG | | | | $174.5 | | |
| Uranium Mining Externalities | 172.3 | 424 | | | | |
| Waste Management and Decommissioning Externalities | $384.3 | $1444.3 | | | | |
| Accident Risk Externalities | $132.5 | $3312.5 | | | | |
| Water Usage Subsidy | $212 | $238.5 | | | | |
| **Total** | **$2,241.1** | **$6,759.3** | | **-$1412** | **$829.1** | **$5,347.3** |

(Details for this chart are provided in sections below.)

(5) The Cost Study inexplicably considers no scenario in which wholesale electricity rates remain relatively flat, despite the Commission's various policies and NYISO's market responses that would suppress prices. As a result, the Cost Study sets consumers up for unexpected above-market rates for the nuclear tier that are not accounted for in the Cost Study.

(6) The Cost Study incorporates, without critique, a biased pro-nuclear study that dramatically exaggerates the impact that New York's nuclear fleet has on the economy. No attempt was made to survey studies put forth by independent researchers or nuclear watchdogs or to provide a DPS analysis of the merits of the study.

These issues are detailed below.

## 2. Inadequacy of information provided on nuclear costs

The Cost Study contains insufficient information on nuclear tier costs to support its inclusion in the Clean Energy Standard program. What is more, the cost estimates provided are inconsistent with other available information on nuclear operating costs and cost trends, and appear to substantially underestimate nuclear tier costs. In addition, Staff has provided no information on the methodology used to arrive at the cost estimates.

In the Cost Study, a 297-page document, DPS presents much detailed information on the projected and estimated costs of various renewable energy resources, as well as its market price forecasts. However, the Cost Study contains only three pages of information with respect to Tier 3:

- Page 84 provides some general notes on the cost analysis methodology, a total net cost range for the nuclear program through 2023, and an explanation for the lack of any detail comparable to that provided for other parts of the CES;
- Page 275 discusses in very general terms the factors considered in the Tier 3 analysis, and reiterates the explanation for not providing a comparable level of detail to the treatment of Tiers 1 and 2; and
- Page 103 uncritically accepts and incorporates by reference the net economic impact estimates of some New York nuclear reactors from an industry-funded report produced by the Brattle Group.

An additional page, 85, includes two bullet points providing general notes on how the sensitivity analysis for Tier 3 costs was conducted.

The level of detail provided in the analysis of Tier 3 costs is completely inadequate for parties to offer meaningful comment, an infringement upon our rights to due process. There is a wide degree of divergence between the Cost Study's estimates of the net cost of Tier 3 and AGREE and NIRS's estimate of the program costs, which we provide herein, with much greater detail about our methodology, data sources, and parameters. It is impossible to reconcile our estimate of direct program costs with Staff's analysis, absent any relevant detail in the Cost Study.

Staff has only offered inadequate justifications for its decision not to provide further detailed information on its Tier 3 cost analysis. On pages 84 and 275, Staff proffers that doing so would "prejudice" the proposed pricing process for Tier 3 credits, an explanation reiterated at the May 4, 2016, technical workshop. This is specious reasoning, as the Public Service Commission ("Commission") has already set precedent for determining going forward costs of nuclear generation and detailed the approximate costs for at least one of the reactors expected to qualify for Tier 3. In fact, Staff recognizes this in the White Paper. Staff states that the pricing of ZECs would be comparable to the methodology for determining the going forward cost of operation for a nuclear unit in the recently concluded proceeding on the Ginna Reliability Support Services Agreement ("RSSA", Case 14-E-0270),[1] which includes an estimate of the direct program costs of the subsidy to be borne by Rochester Gas & Electric ("RG&E") customers.[2]

Staff attempts to justify this inadequate presentation by claiming that a more detailed and transparent account of its analysis would prejudice the pricing of Nuclear ZECs. Staff argues that the proposed pricing scheme is expected to be an uncompetitive process, with at most two corporations selling Nuclear ZECs.

This argument in unconvincing. The key details of the proposed pricing scheme have already been determined in Case 14-E-0270. The proposed pricing scheme follows the model used to determine the going forward costs of Ginna in the Reliability Support Services Agreement (RSSA) approved by the Commission in that case. In its decision and order approving the RSSA, the Commission recognized the projected cost over the two years of the program (April 1, 2015 to March 31, 2017), of $165.2 million.[3] Staff negotiated the going forward cost for Ginna in that proceeding, and Staff is proposing to carry over key aspects of the RSSA settlement to structure the Nuclear ZEC pricing scheme. As a result of the extensive settlement negotiations, Exelon already has a well-developed understanding of Staff's views on how going forward costs should be calculated.

Therefore, Staff's refusal to provide a detailed account of its analysis for the cost study only puts the public and other parties in this case at a disadvantage in evaluating the Cost Study, in particular, and the proposed Nuclear Tier in general. This is a violation of our rights to due process and equal protection under the law: due process, because we are unable to understand and provide meaningful comment on Staff's estimate; equal protection, because at least one party, Exelon, has been privy to negotiations

[1] Department of Public Service. "Staff White Paper on Clean Energy Standard." January 25, 2016. Page 30.
[2] New York Public Service Commission. "Order Adopting the Terms of a Joint Proposal." Case 14-E-0270. February 24, 2016. Page 8.
[3] Ibid.

with Staff that shaped the cost analysis, and therefore has information regarding Staff's methodology and calculations that other affected parties do not.

Furthermore, the Tier 3 program as proposed is likely to be fundamentally anti-competitive, with potentially only one generation owner providing ZECs -- Constellation Energy Nuclear Group ("CENG"). In evaluating the potential costs of such an anti-competitive and expensive arrangement, it is incumbent on the Staff to ensure as much transparency as possible. Parties to this proceeding, as well as the public, must be able to understand both the direct costs and the Staff's calculation of the total net costs in order to offer substantive comments and exercise our rights to due process. In determining whether to approve nuclear subsidies as part of this case, the Commission also will need this information. Because of the Cost Study's deficiencies, on May 9, 2016, we submitted a request that Staff provide detailed information on its cost analysis for Tier 3, clearly breaking out direct costs of the program, including but not limited to projected nuclear operating cost estimates, constituent costs and their basis, and market revenue projections, as well as indirect costs and projected benefits. To date, Staff has provided no response. We therefore request that the Commission order Staff to supplement the Cost Study with a detailed presentation of its Tier 3 analysis.

Meanwhile, in a parallel proceeding to this Clean Energy Standard case, the Commission has already assigned an Administrative Law Judge who has set in place a protective order to allow parties to begin discussing the eligible costs for calculating Nuclear ZEC payments for Ginna and Nine Mile Point. A comment deadline has been set in that parallel proceeding for June 20, 2016. If potential costs are already being discussed among parties and DPS staff in another case, why shouldn't the transparency and information provided in that case (16-E-0270) be applied to the main Clean Energy Standard case in the form of a more detailed and accurate accounting of the potential costs for the Nuclear Tier?

## 3. Staff has likely gravely underestimated the costs of Tier 3

The direct costs of the nuclear tier are likely to be far greater than reflected in the cost study. As discussed in our comments on the White Paper, the major factor affecting the long-term economic viability of nuclear reactors is the trend of super-inflationary cost escalation of aging reactors. The Nuclear Energy Institute's biannual cost surveys have documented a persistent trend of cost escalation for over 10 years. In 2002, the average operating cost of nuclear reactors was $28.75/MWh (in 2014 dollars).[4] The average operating cost in 2012 was 58.6% higher than in 2002, at $45.50 (2014 dollars). Exelon has publicly reported the average operating cost of its New York reactors is $50/MWh.

Operating cost escalation is the primary factor in the unprofitability of some reactors in New York. Had costs remained steady, reactors in New York would likely still be profitable to operate going forward. Even at the historic low wholesale market prices in 2015, the net of wholesale and capacity market revenues totaled over $30/MWh in Zones B and C, higher than the inflation-adjusted average operating costs in 2002. The five-year average of market revenue rates (2011-2015) is more than 35% greater than

[4] Nuclear Energy Institute. Nuclear Energy 2014: Status and Outlook: Annual Briefing for the Financial Community. February 13, 2014. Page 6,

2015 prices ($39.50 in Zone B, and $40.81 in Zone C). The fact that Ginna and FitzPatrick are operating with such large cash flow deficits on that basis indicates that their operating costs have indeed increased substantially. Ginna is projected to operate at a cost about $18/MWh higher than projected market revenues. Entergy reports FitzPatrick is projected to operate at a loss of $225-$275 million over five years, or $50 million/year on average, with single-year losses surpassing $60 million (or $9/MWh).

Based on historical average wholesale market prices (2011-2015) in NYISO market zones B and C, where Ginna, Nine Mile Point and FitzPatrick operate, the upstate reactors would require ZEC prices ranging from $9.20-$10.50/MWh. At average annual capacity factors of 90%, that would result in direct annual program costs of $249 million, and a total 2030 program cost of $3.0 billion, if reactors phased into the Tier 3 program on the schedule provided in the White Paper and operated until the end of their federal operating licenses or 2030, whichever comes first. Through 2023, the total direct costs would be over $1.3 billion, twice the amount Staff reports as the high end estimate of 2023 Gross Program Costs.

| Reactor | Capacity (MW) | Capacity Factor | Market Revenue ($/MWh) | ZEC Revenue ($/MWh) | Hrs/Year | ZEC Costs | Years to 2023 | 2023 Cost | Total Years | 2030 ZEC Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Nine Mile 1 | 621 | 0.9 | 40.80 | 9.20 | 8,760 | $45,042,869 | 5.00 | $225,214,344 | 10.75 | $484,210,840 |
| Ginna | 581 | 0.9 | 39.50 | 10.50 | 8,760 | $48,096,342 | 6.75 | $324,650,309 | 12.5 | $601,204,275 |
| FitzPatrick | 838 | 0.9 | 40.80 | 9.20 | 8,760 | $60,782,486 | 6.75 | $410,281,783 | 13.75 | $835,759,188 |
| Nine Mile 2 | 1,311 | 0.9 | 40.80 | 9.20 | 8,760 | $95,090,501 | 4.00 | $380,362,003 | 11 | $1,045,995,509 |
| **TOTAL** | **3351** | | | | | **$249,012,198** | | **$1,340,508,340** | | **$2,967,169,811** |

We believe ours to be a conservative estimate of the direct program costs, for several reasons:

- It assumes reactors phase into the Tier 3 program according to the schedule provided in the White Paper, rather than all reactors entering the program in 2017, as recently requested by Constellation Energy Nuclear Group.

- It assumes operating costs remain steady at $50/MWh through 2030, and that the trend of super-inflationary cost escalation does not continue.

- It assumes that reactors sustain 2012-14 statewide performance levels, with an average annual capacity factor of 90%.

- The five-year average wholesale market prices includes two years of unusually high market prices (2013 and 2014), as well as two years of historically low market prices (2012 and 2015), creating a reasonably conservative proxy for future market price trends.

| Market Price Data | Zone B | Zone C |
|---|---|---|
| **2011 Average Day-Ahead Wholesale Price ($/MWh)** | 39.98 | 40.98 |
| **2012 Average Day-Ahead Wholesale Price ($/MWh)** | 31.97 | 32.59 |
| **2013 Average Day-Ahead Wholesale Price ($/MWh)** | 37.45 | 38.93 |
| **2014 Average Day-Ahead Wholesale Price ($/MWh)** | 46.28 | 48.53 |
| **2015 Average Day-Ahead Wholesale Price ($/MWh)** | 27.42 | 28.78 |
| **2011-15 Average Day-Ahead Wholesale Market Price ($/MWh)** | 36.62 | 37.96 |
| **2011-15 Average Capacity Market Price ($/kW-month)** | 2.08 | 2.08 |
| **2011-15 Average Capacity Market Price ($/MWh)** | 2.85 | 2.85 |
| **TOTAL Market Revenue Rate** | **39.47** | **40.81** |

If one or more of the first three factors changes in the direction of recent trends, the direct costs of Tier 3 would increase substantially. The same is true if market prices trend lower than the 2011-2015 average. If all three factors trend unfavorably -- costs rising, performance declining, and market prices trending lower -- then the direct program costs could be substantially greater. For instance, if average operating costs increased 10%, capacity factors decrease 5%, and market prices trended 10% lower than the 2011-2015 average, the average annual cost would be $461 million. The total 2030 cost would be $5.5 billion.

Staff's estimates appear to be inconsistent with what is known about nuclear operating costs and the program structure outlined in the White Paper. On the one hand, the low-end Gross Program Cost estimate of $59 million is less than one year of the cost of the Ginna RSSA, and less than the highest year of cash flow losses Entergy has projected for FitPatrick to 2020. Ginna and FitzPatrick alone are projected to require subsidies of over $140 million per year, and through 2023, would total $735 million, more than Staff's high-end cost projection. It is difficult to conceive that Staff's sensitivity analysis as described in the Cost Study could yield a high-end projection less than the cost of only two of the four reactors expected to participate in the program:

| Reactor | Size (MW) | CapFactor1 | Rate ($/MW) | Capacity ($/MW-mo) | Hrs/Year | Capacity/Subsidy 1 ($) | Years | Total Subsidy |
|---|---|---|---|---|---|---|---|---|
| Nine Mile 1 | 621 | 0.85 | 36.72 | 18.28 | 8,760 | $84,526,098 | 10.75 | $908,655,559 |
| Ginna | 581 | 0.85 | 35.55 | 19.45 | 8,760 | $84,143,151 | 12.5 | $1,051,789,384 |
| FitzPatrick | 838 | 0.85 | 36.72 | 18.28 | 8,760 | $114,062,593 | 13.75 | $1,568,360,660 |
| Nine Mile 2 | 1,311 | 0.85 | 36.72 | 18.28 | 8,760 | $178,443,986 | 11 | $1,962,883,842 |
| **TOTAL** | **3351** | | | | | **$461,175,828** | | **$5,491,689,445** |

> The likely costs associated with ZEC payments for nuclear installations have been analyzed based on low and high assumptions of the cost of generation of nuclear power and future energy prices.[5]

Furthermore, the White Paper proposal does not contemplate nuclear generators paying back subsidies in years when a reactor/s turns a profit. It is not clear what might happen in a year when market prices turn out to exceed projections used to establish Nuclear ZEC prices, as they might have in 2013 and 2014. In any case, there is no provision for Tier 3 costs, once incurred, to be reduced in future years. Therefore, staff's low-end cost estimate does not appear to be realistic; likewise, the high-end estimate appears too low to truly represent an upward bound of the potential program costs.

This is a crucial point in evaluating the cost of Tier 3 and the risk to which it would expose ratepayers. As we and others have argued in comments, the proposed Tier 3 program would contain no meaningful cost controls. Staff's proposal is predicated on an ultimatum: that state policy objectives cannot be met if, presumably, any Tier 3-eligible reactors cease operations, and therefore Staff provides no alternatives. As we discuss in our comments and reply comments, Staff has not demonstrated a technical basis for this premise, and we have shown it to be unfounded. But as a result, Staff has not proposed any alternatives to the purchase of ZECs for achieving the state's policy objectives, should reactors close regardless of the financial incentives provided, nor if program costs turn out to greatly exceed projected levels.

In its proposal for Tier 3, Staff makes reference to the Alternative Compliance Payment model proposed for Tiers 1 and 2, but in fact states that there is no alternative to providing subsidies under Tier 3. Staff instead proposes that the Commission impose an administratively-determined price cap on ZECs as a cost control mechanism. However, this only provides a means for ensuring nuclear generators do not unduly inflate ZEC prices by including illegitimate costs, return on investment, or through mere exercise of ZEC market domination. However, the Staff proposal provides no mechanism for reducing the risk to ratepayers of operating cost escalation either for individual reactors or the program as a whole. There is no provision proposed for load serving entities to otherwise comply with the Clean Energy Standard mandate to purchase ZECs. As a result, the Commission could be held hostage to approving increasingly expensive subsidies with no alternative.

The risks to ratepayers are enormous, due to the extremely high cost of repairing and replacing major reactor components, such as steam generators, reactor vessel heads, etc. Even the historical rate of operating cost escalation has been extraordinary, with industry-wide average costs rising over 50% from 2002-2012, as discussed above.

Recently, the nuclear industry has announced plans to implement measures designed to halt the cost escalation trend and actually reduce average operating costs 30% by 2018.[6] This claim should be

[5] Cost Study. Page 85.

[6] Thomas, Karen. US utilities must commit to digitization to cut operating costs by 30%. Nuclear Energy Insider. April 29, 2016. http://analysis.nuclearenergyinsider.com/us-utilities-must-commit-digitization-cut-operating-costs-30?utm_campaign=NEI%2004MAY16%20Newsletter%20Subject%20Line%20B.htm&utm_medium=email&utm_source=Eloqua

regarded with great skepticism, based on the historical record, the cost dynamics with nuclear reactors, inconsistencies in the industry-produced data, and its applicability to New York reactors. There is good reason to suspect that nuclear operating costs may continue to rise, regardless of the announced industry cost-reduction initiatives.

- Merchant nuclear reactors have been under pressure to exercise strict cost discipline for over 15 years, since the advent of deregulation. Despite the fact that reactors may have been insulated against cost pressures due to rising wholesale prices for the first several years of deregulation through 2008, their owners had strong incentives to maximize profitability and implemented significant cost reduction measures, including property tax agreements, staff reductions, and shortened refueling outage times.

- Since wholesale market prices fell beginning nearly eight years ago in 2008-2009, merchant nuclear generators have had even stronger incentives to reduce operating costs, initially to shore up profits and later to prevent or mitigate losses.

- Merchant reactors have demonstrated significant cost reductions since ownership was transferred from utilities under deregulation. For instance, staff at Nine Mile Point has reduced from over 1,800 full time employees in the 1990s to approximately 800 today. The workforce at FitzPatrick has reduced by 30-40% from levels maintained under NYPA ownership.[7]

- Operating costs have risen and cash flow margins have declined despite these dynamics, indicating that aging reactors have inherently rising maintenance costs.

- Utility-owned reactors have been insulated against cost pressures, so the industry's greatest opportunities for cost-reduction are among that sector of the industry, through replicating measures long since implemented by merchant nuclear generators. However, that means whatever measures the industry implements to reduce average operating costs will not significantly impact the operation costs of merchant reactors.

- To the extent that the industry seeks cost reductions through reducing regulatory requirements, such measures may impact nuclear safety margins and accident risks. While New York cannot affect these measures with much certainty, it could impact externality costs, such as risk insurance or the actual likelihood of a catastrophic nuclear safety failure and radiological release.

- Nine Mile Point 2 is just now reaching 30 years of operation, the age range when reactor operating costs likely begin to escalate.

- No commercial nuclear reactors in the world have ever operated beyond the present age of Ginna and Nine Mile Point 1, the oldest reactors in New York. While the maintenance cost profile of reactors in the 50+ year operation range is unknown, it could well entail increased costs, for instance, due to

[7] Entergy Corporation. Entergy, NYPA Agree on Sale of Two Nuclear Power Plants. February 14, 2000. Citing 1,700 full-time NYPA employees supporting operations at FitzPatrick and Indian Point 3. http://www.prnewswire.com/news-releases/entergy-nypa-agree-on-sale-of-two-nuclear-power-plants-72560602.html

degradation of robust components and the difficulty of finding and fitting replacement components for systems that are no longer serviced by the original manufacturers.

- Unforeseen safety problems, such as the unprecedented degradation of reactor vessel baffle-former bolts at Indian Point 2, may occur at other reactors, impacting maintenance costs and capacity factors. As at Indian Point 2, the degradation of one component (baffle-former bolts) is an indicator of potential degradation of other components (baffle and former plates, reactor pressure vessel, etc.).

- Maintaining adequate performance levels for aging reactors may require more preventative maintenance, decreasing average annual capacity factors from exceptional levels (>90%) in order to ensure against significant performance shortfalls or extensive maintenance backlogs, leading to cost escalation and potential reactor closures. Over the last eight years, there has been a demonstrated decline in reactor performance in New York, from an average annual capacity factor from 2008-2014of 92.0% statewide and 91.4% among the upstate reactors; to 90.0% statewide and 88.8% upstate from 2012-2014. Each upstate reactor's performance declined during the period. Decreasing capacity factors lead to increased operating cost rates, as costs are distributed over fewer full power generating hours.

Nevertheless, the nuclear industry is claiming it can reduce costs significantly, a claim that DPS staff echoed at the recent technical conference on the cost study. As discussed above, NEI's biannual reports from 2002-2012 indicated a significant but consistent rate of super-inflationary cost escalation for a decade, through to the report released in early 2014. The most recent report, released in early 2016, updated industry-wide operating costs through 2014. It reported a reversal in the decade-long growth in operating costs, with an 8.6% decrease in operating costs from 2012.

| Reactor | Average CF (2008-2014) | Average CF (2011-2014) | Average CF (2012-2014) |
|---|---|---|---|
| **Ginna** | 93.6% | 89.5% | 91.3% |
| **Nine Mile Point 1** | 92.0% | 89.3% | 91.0% |
| **Nine Mile Point 2** | 91.7% | 91.0% | 89.7% |
| **FitzPatrick** | 88.9% | 87.3% | 84.0% |
| **Indian Point 2** | 89.9% | 89.5% | 86.7% |
| **Indian Point 3** | 96.1% | 95.5% | 97.3% |
| **TOTAL** | 92.0% | 90.6% | 90.0% |
| **Upstate** | 91.4% | 89.5% | 88.8% |
| **Downstate** | 93.0% | 92.5% | 92.0% |

However, there are significant and as-yet-unexplained inconsistencies in the historical data provided in the 2016 and 2014 NEI reports. The 2012 total operation and maintenance costs reported in the 2016 NEI report (2002-2014) are 12.74% lower than what they reported for 2012 two years, when adjusted for inflation (Consumer Price Index indicates 3% inflation between the two reporting periods). There should not be much reason for the difference in the numbers unless NEI changed its methodology. The 2014 report already excluded several reactors not deemed to be indicative of industry-wide costs or performance because of criteria NEI used to exclude them: San Onofre, Kewaunee, Crystal River 3, and Fort Calhoun. Each of these reactors was subject to long-term outages and/or closure in 2013. Only one other reactor closed in the period covered by the 2016 report -- Vermont Yankee -- and that was at the very end of 2014, so it should not have affected the reported 2014 numbers very much, even if NEI did exclude it.

NEI's reports break down operating costs into major categories: fuel, capital, and operations and maintenance. Inflation-adjusted fuel costs do not diverge very much (1.46%). Nuclear fuel costs are well-known throughout the industry due to the global nature of the uranium commodity market, so changes in NEI's methodology should not have had a significant impact on fuel costs.

The inflation-adjusted 2012 capital costs published in the 2016 report are 19.39% lower than in the 2014 report. The total cost escalation rate for the 2002-2012 period is 28.7% lower in the 2016 report, on an inflation-adjusted basis. The inflation-adjusted 2012 operating costs are 12.64% lower in the 2016 report, and the total cost escalation rate from 2002-2012 is 45.5% lower than in the 2014 report.

On top of these significant inconsistencies, the 2016 NEI report shows an immediate and significant reversal in 2013 and 2014, after a decade of persistent cost escalation. Without having the opportunity to review the full NEI report, we note that the results of the 2016 report serve the industry's short-term policy and investment interests quite well. If costs had continued to rise at the rate reported for 2002-2012 in the 2014 report, average operating costs would have increased to $49.87/MWh in 2014. The 2014 average operating cost reported in the latest report ($36.27/MWh) is 27.3% lower than that. Thus, the industry would only need to report an average cost reduction of 2.7% in 2018 to achieve the stated goal of reducing industry-wide costs by 30%. Unfortunately, while 2.7% industry-wide cost reductions might be an aggressive, though conceivably achievable, two-year objective, the industry's strategy for achieving the 30% reduction goal would appear to be far more of an exercise in creative accounting and public relations than actual cost reductions, utilizing methodological adjustments to create the impression of financial viability.

To illustrate, the industry has been remarkably vague about how it might achieve the proposed 30% reduction in operating costs. When pressed for details on how the industry can reduce cost so aggressively in such a short period of time, the examples NEI and others have provided are not convincing. For instance, NEI says the industry can reduce operating costs by 3% by shifting to electronic work packages, equipping workers with digital handheld devices that contain instructions and documentation and eliminating hard-copy documentation.[8] However, it is unlikely that the entire industry could efficiently and cost-effectively make such a transition in just two years, which would

[8] Thomas, Karen. US utilities must commit to digitization to cut operating costs by 30%. Nuclear Energy Insider. April 29, 2016.

| Year | 2012 Fuel | 2012 Capital | 2012 Operating | 2012 Total | Inflation (2012-2014) | 2012 Total ($2014) | 2014 Fuel | 2014 Capital | 2014 Operating | 2014 Total | Difference (2012-2014) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2002** | 5.57 | 3.76 | 18.58 | 27.91 | 1.03 | 28.75 | 5.72 | 3.92 | 18.59 | 28.23 | -1.80% |
| **2003** | 5.47 | 5.02 | 20.27 | 30.75 | 1.03 | 31.67 | 5.59 | 4.93 | 18.84 | 29.37 | -7.27% |
| **2004** | 5.1 | 6.12 | 19.56 | 30.78 | 1.03 | 31.70 | 5.28 | 5.65 | 18.54 | 29.47 | -7.04% |
| **2005** | 4.89 | 6.56 | 20.27 | 31.73 | 1.03 | 32.68 | 5.02 | 5.8 | 18.95 | 29.77 | -8.91% |
| **2006** | 4.81 | 6.42 | 20.71 | 31.94 | 1.03 | 32.90 | 5.04 | 5.56 | 19.21 | 29.81 | -9.39% |
| **2007** | 4.98 | 6.34 | 20.31 | 31.62 | 1.03 | 32.57 | 5.13 | 6.12 | 19.07 | 30.31 | -6.93% |
| **2008** | 5.24 | 7.27 | 20.78 | 33.29 | 1.03 | 34.29 | 5.35 | 6.76 | 19.51 | 31.62 | -7.78% |
| **2009** | 5.89 | 10.58 | 22.46 | 38.92 | 1.03 | 40.09 | 5.93 | 8.91 | 20.49 | 35.33 | -11.87% |
| **2010** | 6.67 | 10.53 | 22.49 | 39.69 | 1.03 | 40.88 | 6.76 | 9.16 | 20.63 | 36.55 | -10.59% |
| **2011** | 7.01 | 11.5 | 23.34 | 41.85 | 1.03 | 43.11 | 7.1 | 10.06 | 21.88 | 39.04 | -9.43% |
| **2012** | 7.35 | 12.96 | 23.86 | 44.17 | 1.03 | 45.50 | 7.46 | 10.76 | 21.47 | 39.7 | -12.74% |
| **2013** | 7.56 | 14.67 | 24.46 | | | | 7.73 | 8.2 | 20.93 | 36.86 | |
| **2014** | 7.77 | 16.60 | 25.08 | | | | 7.17 | 8.18 | 20.92 | 36.27 | |

require substantial training and expense to implement. Either a substantial portion of the industry has already made the switch, in which case the cost-reduction opportunity is reduced; or a dramatic, industry-wide change in work practices could be subject to complications, delays, and cost overruns.

Another example was provided at a joint NEI and Department of Energy summit in May.[9] An industry panelist was asked to provide an example of how nuclear generators are going to cut costs to meet the goals of NEI's 30% by 2018 cost reduction target. The panelist, William Levis, President and COO, PSEG Power, which operates three reactors in New Jersey, said the industry could achieve significant efficiencies in employee "badging times," explaining that reactor operators expend a large amount of human resources on background checks and certifying workers for qualifications and security clearance (badging). Mr. Lewis explained that badging times could be reduced from five days to 15 minutes. He estimated that this measure could reduce operating costs for Exelon's Quad Cities nuclear plant from 2.8 cents/kWh to 2.5 cents/kWh. This is inconsistent with Exelon's recently reported operating cost of 3.4 cents/kWh for Quad Cities. Nevertheless, the projected cost reduction rate would equate to $40 million/year at Quad Cities, or the equivalent to the salary of 335-400 employees (depending on average

[9] Department of Energy Summit on Improving the Economics of America's Nuclear Power Plants. May 19.2016. See video record at 1:28:00. https://gain.inl.gov/SitePages/DOE%20Congressional%20Event.aspx

salary rates) -- or 40-50% of the plant's workforce. It strains credulity to suggest that 40-50% of Quad Cities payroll is being expended on badging workers, particularly because Quad Cities is a merchant plant that has major incentives to implement cost efficiencies for over 15 years. If Exelon were wasting 40% of its human resource capacity on badging workers, it would have identified that as a problem and implemented solutions years ago.

It is more likely that merchant reactors like those in New York have little margin for significant cost reductions beyond what their owners have already achieved, and there is not much that can be done to reverse the escalation trend. Thus, it would be prudent to assume in the Cost Study that nuclear operating costs remain the same or increase, and to model the direct gross cost projections accordingly.

## 4. Electricity Cost Assumptions are Potentially Inaccurate

The cost study assumes a dramatic rise in natural gas prices over time and a corresponding wholesale electricity price increase. While this is certainly one potential scenario for the future, it is not the only reasonable one that should be modeled.

The Clean Energy Standard and the Reforming the Energy Vision regulatory proceeding seek to dramatically overhaul New York's electricity markets. We are heading into a transformed system if the proposed policies deliver the results they promise. The REV and CES project that half of the electricity in New York will be served by renewable resources, which generally have fixed costs and no fuel prices. Additionally, in order to reduce greenhouse gas emissions 40% by 2030, natural gas use in the space heating sector will need to be reduced significantly. If the policies work as expected, we should see a reduction in demand for natural gas in both the electricity and space heating sectors, coupled with reduced peak load as a result of REV's focus on demand response and other peak shaving resources. The success of these policies should suppress wholesale electricity prices.

Yet, none of this is taken into account or modeled by the cost study. As a result, the Staff models a business as usual case for market rates for a system and policy changes that will look nothing like business as usual. Additionally, one only needs to take a backwards look at natural gas prices over the past 13 years to know that a rise in natural gas prices is not inevitable, even under a business as usual scenario. Recent years have seen historic highs followed by historic lows. We think it's safe to say that no one has any idea what gas prices will do in the coming years as our entire energy sector changes.

By using only scenarios that project gas prices rising significantly over the next 13 years, the Staff have managed to erase most of the projected costs of the nuclear tier. This does not serve the public or the Commission well because it fails to reveal the truth – that the nuclear tier may very well cost much more than projected here.

## 5. Failure to account for the greenhouse gas emissions of nuclear power

The Cost Study overestimates the benefit that should be attributed to nuclear power plants as a result of greenhouse gas emissions displacement. Nuclear power contributes to greenhouse gas emissions in a variety of ways, including through uranium mining and milling, fuel transport, and fuel enrichment. Additionally, nuclear plants rely on outside power sources (currently fossil-fuel heavy) for cooling during outages, which are often prolonged such as for refueling and for maintenance.

An article published in *Energy Policy* in 2008 by Benjamin K. Savocool surveyed available studies on nuclear fuel cycle greenhouse gas emissions. He found a range for nuclear fuel cycle greenhouse gas emissions from 1.4g of carbon dioxide equivalent per kWh (gCO2e/kWh) to 288gCO2e/kWh, with a mean value of 66gCO2e/kWh, well above life cycle greenhouse gas emissions for renewable energy sources.[10] The cost-study should take these life-cycle greenhouse gas emissions into account and reduce the projected net benefit based on social cost of carbon accordingly.

Additionally, grid reliability regulations require a reserve margin of available generation capacity to ensure that the unanticipated loss of generation units does not cause blackouts or other transmission system failures. The reserve margin is set relative to the largest projected contingency event on the system, often the loss of the largest single generation unit. This means that certain power plants, often fossil fuel-fired units, must be constantly operating on stand-by without generating electricity. This results in additional greenhouse gas emissions, beyond what is needed to generate sufficient power to meet electricity demand.

Nuclear reactors are often the largest units on the system, and therefore can play a significant role in setting the local operating reserve requirement. Even the smallest commercial reactors in operation have greater generation capacity than the average coal or gas-fired units. New York is no exception. Nine Mile Point 2 is the largest single generation unit in the New York Control Area, with a rated generation capacity of over 1,300 MW. The New York Control Area operating reserve margins is set relative to a projected contingency event of 1,310 MW, with total operating reserves of 2,620 MW. To the extent that nuclear reactors raise the operating reserve requirement, their operation entails greenhouse gas emissions that must be accounted for.

We see no evidence that the cost study or the Department of Public Service White Paper evaluated this impact of Tier 3 – whether nuclear generation can entail significant greenhouse gas emissions due to reserves, in addition to or regardless of other life-cycle emissions. On May 9, 2016, we requested information about any analysis that has been done on this question and have received no answer to date.

[10] Benjamin K. Sovacool, *Energy Policy*, "Valuing the greenhouse gas emissions from nuclear power: A critical survey" Found at: http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf

## 6. Failure to account for other environmental and health costs of ongoing nuclear power production

In addition to greenhouse gas emissions that result from the nuclear fuel chain, there are costs of continued nuclear power that must be included in any cost-benefit calculation. These include:

a. **Environmental and health impacts of uranium mining and milling on workers and local communities**. For every 1 pound of nuclear fuel that is fabricated, approximately 25,000 pounds of mining waste (rock, mill tailings, and depleted uranium) are generated.[11] The average nuclear reactor uses 44,093 pounds of fuel every year, which means 1 billion pounds of radioactive mining waste is generated per reactor per year.

   An analysis by the Union of Concerned Scientists puts the externalized costs of uranium mining at 0.13 – 0.32 cents per kilowatt hour, or $1.3 – $3.2 per megawatt hour. [12]

b. **Routine and accidental radioactive releases during power production.** The legal limit for radiation exposure is a dose that will cause 1 additional cancer fatality per 286 people exposed. This estimate is based on exposure for a healthy man (called reference man). Women and children are more vulnerable to radiation than "reference man." The number doesn't include cancer rates that do not result in fatality. The health costs of this radiation exposure should be taken into account and quantified when discussing benefits vs costs of nuclear power.

c. **Economic, health and environmental costs of high level nuclear waste**.

*"Electricity is but the fleeting byproduct from atomic reactors. The actual product is forever deadly radioactive waste."*

*-- Michael Keegan, Coalition for a Nuclear-Free Great Lakes*

The true costs of the nuclear waste produced at nuclear power plants is unknown and will not be known for many generations. There is currently no permanent solution figured out for the long-term storage and isolation of highly radioactive nuclear waste being generated at New York's nuclear power plants. There are not even temporary safe storage strategies for this waste in place.

Up until 2014, the federal government was charging nuclear operators approximately $1 per megawatt-hour to put into a fund that would pay for the transport and storage of nuclear waste. Since there is no plan for such transportation and storage on the horizon, these fees have been suspended under a court order. That doesn't meant that these future costs have gone away. It just means that no funds are being collected from the industry to pay for it. A cost-

[11] WISE Uranium Project. Nuclear Fuel Materials Balance Calculator. http://www.wise-uranium.org/nfcm.html

[12] Doug Koplow, Union of Concerned Scientists. "Nuclear Power: Still Not Viable without Subsidies." February 2011. Pg. 76. http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf

benefit analysis of the nuclear tier should take into account these future costs that *will* be borne by taxpayers or ratepayers.

Additionally, the chronic underfunding of decommissioning trust funds sets up the possibility that taxpayers will also foot part of the bill for the dismantlement and decommissioning of nuclear facilities.

The Union of Concerned Scientists offers the estimate of the public subsidy to the nuclear industry to cover the decommissioning and nuclear waste storage costs is 0.29 – 1.09 cents per kilowatt hour, or $2.90 – $10.90 per megawatt hour.[13]

**d. Potential for catastrophic accident (property loss, health effects, and environmental harm**. Nuclear power carries risks like no other energy source. The potential cost of a catastrophic nuclear accident is so great that no private company will insure nuclear plants. Instead, the public holds the bag for most of the costs of any nuclear accident that occurs in the United States. Economists estimate the cost of this risk to be somewhere between 0.5 – 30 cents per kilowatt-hour, or $5-$300 per megawatt hour.[14]

The Union of Concerned Scientists estimates the cost at 0.10 cents to 2.5 cents, or $1 – $25 per megawatt hour. [15]

**e. Nuclear power plants use more water than almost any other energy source.**[16] This water is used for the cooling of the reactors, in order to prevent meltdowns. This water use results in thermal pollution, radioactive contamination of water, and destruction of aquatic life killed during water intake and as a result of warm, contaminated water released back into rivers, lakes and oceans used as cooling sources.

Union of Concerned Scientists estimates the cost of the free or subsidized water usage provided to nuclear plants in the US is between 0.16 – 0.18 cents per kilowatt hour, or $1.6 – $1.8 per

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[13] Doug Koplow, Union of Concerned Scientists. "Nuclear Power: Still Not Viable without Subsidies." February 2011. Pg. 102.
http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf
[14] Karl S. Coplan, The Externalities of Nuclear Power: First, Assume We Have a Can Opener . . ., 35 Ecology L. Currents 17 (2008), available at http://digitalcommons.pace.edu/lawfaculty/489/.
Anthony Heyes, *Regulation*, Winter 2002-2003. "Determining the Price of Price-Anderson" Found at: http://www.cato.org/pubs/regulation/regv25n4/v25n4-8.pdf
[15] Doug Koplow, Union of Concerned Scientists. "Nuclear Power: Still Not Viable without Subsidies." February 2011. Pg. 89.
http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf
[16] Doug Koplow, Union of Concerned Scientists. "Nuclear Power: Still Not Viable without Subsidies." February 2011. Pg. 73.
http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf

megawatt hour.[17] This estimate does not take into account the cost to the environment from thermal pollution or the killing of aquatic life.

## 7. A More Accurate Cost Benefit Analysis

If all the above adjustments are made to the Cost Study, the benefit-cost analysis for nuclear plants in New York looks much different:

| **Costs in millions through 2023** | **Low Subsidy** | **High Subsidy** | | **Total Carbon Benefit** | **Net Costs – Low** | **Net Costs – High** |
|---|---|---|---|---|---|---|
| DPS Cost Study Estimates | $59 (a) | $658 (a) | | -$1586.5 (b) | | |
| AGREE/NIRS Cost Estimates | $1340 | $2474 | | | | |
| Life Cycle Adjustment GHG | | | | $174.5 (c) | | |
| Uranium Mining Externalities(d) | 172.3 | 424 | | | | |
| Waste Management and Decommissioning Externalities(d) | $384.3 | $1444.3 | | | | |
| Accident Risk Externalities(d) | $132.5 | $3312.5 | | | | |
| Water Usage Subsidy(d) | $212 | $238.5 | | | | |
| **Total** | **$2,241.10** | **$7,893.30** | | **-$1412.00** | **$829.10** | **$6,481.30** |

(a) DPS Cost estimates for the cost of the ZECs is included here only for reference.

(b) DPS social cost of carbon benefit is used as a gross figure here, not net as was presented in the cost study. The gross was calculated by adding the costs back to the net. It should be noted that for the three scenarios provided in the supplementary document, the gross social cost of carbon benefit came out differently for the low-cost estimate. No explanation was provided for that, so we used the base case and high cost gross, because they were equivalent.

(c) The Sovacool study found a mean life-cycle greenhouse gas emissions value of 66gCO2e/kWh. That is 11% of the per-ton greenhouse gas emissions reductions that we think are implied by the Cost Study for the nuclear tier, so we provide a downward adjustment of 11%.

(d) Lows and highs for these items were taken from the Union of Concerned Scientists study on nuclear subsidies.

## 8. The Brattle Group Study is highly biased and should not be used unchallenged.

The Cost Study refers to a study published by the Brattle Group consulting firm, paid for by nuclear proponents. We anticipate that nuclear proponents will attempt to counter the cost-benefit adjustments we provided above by using the economic benefit claims created by the Brattle Group

[17] Doug Koplow, Union of Concerned Scientists. "Nuclear Power: Still Not Viable without Subsidies." February 2011. Pg. 76.
http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf

report. Therefore, we think it prudent to briefly discuss why that report cannot be taken as a credible accounting of the economic benefits of nuclear plants in Upstate New York.

Though it doesn't seem that any of the supposed benefits of the Upstate New York nuclear plants were taken into account for the cost benefit calculations provided by Staff, the results of the Brattle Group report are listed in the cost report as if they were vetted fact. For a government agency to uncritically adopt such a study and incorporate its results into the Cost Study with no independent analysis is beyond the pale.

Nearly all of the Brattle Group's supposed economic benefits (including almost all the jobs, tax revenue and GDP numbers) attributed to nuclear power plants stem from the claim that the Upstate nuclear plants suppress wholesale market prices by $10 per megawatt hour. The study provides no methodology or rationale to substantiate that claim, even though most analysts agree that, for now, natural gas prices set the wholesale market rates in New York, not nuclear. Additionally, the Brattle Group study does not contemplate the impact on market rates resulting from the nuclear subsidies proposed by the Clean Energy Standard.

After magically determining that wholesale market rates are decreased by $10 per megawatt hour because of the existence of nuclear power plants, the study goes on to calculate what those lower market rates mean in terms of economic activity. The premise is that lower electricity rates generate economic benefits in the form of jobs, tax revenues, and GDP. So in effect, nearly all the jobs and economic benefits claimed by the study are in fact provided by other businesses in the state, not the nuclear plants themselves. And if market rates do not rise $10 per megawatt hour as predicted upon closure of nuclear reactors, those economic benefits would exist irrespective of nuclear plants.

There are many reasons to question whether wholesale rates would rise upon closure of nuclear plants:

a. The Brattle study assumes all the nuclear plants would close at once, even though Nine Mile Point does not look poised to close any time soon.
b. The Brattle study assumes that natural gas would take the place of all the nuclear plants that close, yet assumes an increase in rates, even though natural gas is cheaper than nuclear
c. The Brattle study assumes no increases in energy efficiency and no increases in renewable energy, which directly contradicts recent and projected trends

It's instructive to note that similar claims were made when Vermont Yankee was headed toward closure. Business journals predicted dramatic increases in market prices as a result of the closure of the plant and increases in greenhouse gas emissions. Yet, in reality, prices in Vermont remained low even after the reactor closed. Here are the average electricity prices (per megawatt hour) in Vermont:

2011: $46.56
2012: $36.17
2013: $55.08
2014: $61.60 (Vermont Yankee shut down on December 31, 2014)
2015: $41.90[18]

## 9. Conclusion

The accounting of costs and benefits for nuclear plants considered by bailout by the Clean Energy Standard proposal must be redone to incorporate a more accurate look at nuclear energy's unique environmental, health and safety risks.

Meanwhile, the supposed economic and environmental benefits claimed by the Brattle Study, even if accurate, would not be unique to nuclear power. All energy generators create jobs and many have a greater impact on reducing wholesale market prices, including energy efficiency and renewables. The carbon-benefits claimed for nuclear are exaggerated because they fail to take into account life-cycle emissions. Greater benefits could be provided by replacing nuclear reactors with energy efficiency and renewable energy.

Perhaps most importantly, the Cost Study provides an estimated subsidy price for the nuclear program that defies what is known about nuclear losses and per megawatt-hour costs of nuclear plants operating in Upstate New York.

The portions of the Cost Study dealing with the nuclear tier must be redone to take these omissions into account.

Respectfully submitted,

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/s/
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[18] ISO New England "Internal Market Monitor 2015 - Annual Markets Report." May 26, 2016. http://www.iso-ne.com/static-assets/documents/2016/05/2015_imm_amr_final_5_25_2016.pdf