BEFORE THE STATE OF NEW JERSEY

BOARD OF PUBLIC UTILITIES

I/M/O THE IMPLEMENTATION OF	]	
L. 2018, c.16 REGARDING THE	]	
ESTABLISHMENT OF A ZERO EMISSION	]	BPU DKT. NO. EO18080899
CERTIFICATE PROGRAM FOR	]	
ELIGIBLE NUCLEAR POWER PLANTS	]	

JOINT CERTIFICATION OF BOB FAGAN AND MAXIMILIAN CHANG
ON BEHALF OF THE
NEW JERSEY DIVISION OF RATE COUNSEL

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PUBLIC VERSION

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I. Introduction

My name is Bob Fagan. I am a vice president at Synapse Energy Economics ("Synapse"). Synapse is a consulting firm that provides economic and expert advice to public interest clients on electricity matters. My business address is 485 Massachusetts Avenue, Cambridge MA 02139.

I am a mechanical engineer and energy economics analyst, and I've analyzed energy industry issues for more than 30 years. My activities focus on many aspects of the electric power industry, in particular: production-cost modeling of electric power systems, general economic and technical analysis of electric supply and delivery systems, wholesale and retail electricity provision, energy and capacity market structures, renewable resource alternatives (including wind and solar PV) and assessment and implementation of energy efficiency and demand response alternatives. I hold an M.A. from Boston University in energy and environmental studies and a B.S. from Clarkson University in mechanical engineering.

My name is Maximilian Chang. I am a principal associate at Synapse Energy Economics ("Synapse") and work out of our Cambridge, Massachusetts office.

I have experience working with public interest clients in the electric utility and natural gas industries, as well as with private entities. My electric industry work has focused on regulatory policy, distribution system reliability, and resource economics. I joined Synapse in 2008. Before that, I was a senior scientist at Environmental Health and Engineering, which I joined in 2001. I received an A.B. in classical civilization and biology from Cornell University, and an S.M in environmental health and engineering from the Harvard School of Public Health.

I have provided testimony or testified before the public utility commissions of Delaware, District of Columbia, Hawaii, Illinois, Kansas, Maine, Maryland, Massachusetts, New Jersey, New Hampshire, and Vermont.

II. Purpose

PSEG Nuclear LLC and Exelon Generation Company, LLC ("the Applicants") seek approval from the New Jersey Board of Public Utilities ("BPU" or "the Board") to receive zero emission credits ("ZEC") under the ZEC Act.[1]

The purpose of our certification to review and comment on aspects of the Applicants' materials as it pertains to the ZEC Act. If approved in its current form, the three applications for Hope Creek, Salem 1, and Salem 2 would transfer approximately $300 million per year from New Jersey ratepayers to the Applicants over the next three years. That we do not comment on other components of the Applications does not mean that we necessarily agree.

III. Executive Summary

We recommend that the Board deny the Application for ZECs for the following reasons:

- The Applicants' reliance on forward energy prices **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** skews the projected energy revenues for the three units. We find that current energy price forwards are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**, and **[Begin PSEG Confidential]** [redacted] **End PSEG Confidential]** than the Applicants' forward energy prices.

[1] N.J.S.A. 48:3-87.3 to -87.7

- The Applicants' capacity price forecast is **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** lower than current capacity prices for the EMAAC zone.
- The Applicants did not provide any sensitivity analyses of revenues or costs to show either upper or lower bounds of the cash flow for the three units. **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**
- The Applicants' do not account for but rely on energy traders to implicitly factor in policy changes such as: the re-entry of New Jersey into RGGI, New Jersey's procurement of 1,100 MW of offshore wind, increases in the RPS requirements, and implementation of increased energy efficiency requirements. In addition, FERC has allowed a delay in the upcoming capacity market auction to give PJM more time to incorporate changes in the capacity market. While the exact nature of the changes is not known now, there is a general expectation that capacity market prices will be higher, not lower. At the very least, the price increases that result from these changes in energy and capacity prices should ultimately be deducted from the ZEC subsidy, if the Board approves the ZEC application.
- The Applicant's emission and fuel diversity modeling contains deficiencies that overstate the units' emission and fuel diversity benefits. The modeling period is limited to the next three years and ignores significant policy initiatives (e.g. offshore wind) that will impact the state's emission and fuel diversity.
- The modeling also makes unrealistic assumptions about the timing of unit retirements. The Applicants' timing of earliest retirement dates is **[Begin PSEG Confidential]**

[redacted]. **[End PSEG Confidential]** In addition, the Applicants have market obligations that would result in penalties should the units retire early.

- Even including modeling deficiencies, the Applicants' emissions model results show that New Jersey will continue to meet the 2020 Global Warming Response Act ("GWRA") greenhouse gas ("GHG") limit of 125.6 megatons under the three-unit retirement scenario.
- Even including modeling deficiencies, the Applicants' emissions model results show that New Jersey's ozone emissions would only increase by 0.57 ppb under the three-unit retirement scenario. This increase represents 0.8 percent of New Jersey's 8-hour ozone limit of 70 ppb. The ozone emissions incorporate a modeled increase in NO_x emissions of 18.3 tons per day.
- We find that an increase in energy revenues of three percent and capacity revenues of ten percent would result in positive aggregate cash flow for the three units in 2019 and 2020, if the Applicants' assumption of market and operational risk are removed.
- We find that an increase in energy revenues of ten percent and capacity revenues of ten percent would result in positive aggregate cash flow for the three units in 2019, 2020, and 2021; if the Applicants' assumption of market and operational risk are removed.

IV. Background on ZEC Act

On May 23, 2018, Governor Phil Murphy signed into law the ZEC Act.[2] The Act requires the Board to create a program and mechanism for the issuance of ZECs for nuclear units. Each ZEC

[2] https://www.utilitydive.com/news/new-jersey-gov-murphy-signs-bills-creating-zero-emission-credits-for-nucle/524238/

represents the fuel diversity, air quality, and other environmental attributes of one megawatt hour ("MWh") of electricity generated by eligible nuclear unit(s) selected by the Board.[3] The ZEC Act states that applicants need to provide to the Board:

> [C]ertified cost projections over the next three energy years, including operation and maintenance expenses, fuel expenses, including spent fuel expenses, non-fuel capital expenses, fully allocated overhead costs, the cost of operational risks and market risks that would be avoided by ceasing operations, and any other information, financial or otherwise, to demonstrate that the nuclear power plant's fuel diversity, air quality, and other environmental attributes are at risk of loss because the nuclear power plant is projected to not fully cover its costs and risks, or alternatively is projected to not fully cover its costs and risks including its risk-adjusted cost of capital.[4]

On November 19, 2018, in BPU Docket EO18080899, the Board established the process and procedural schedule for ZEC applications and comments on the applications.[5] The Board also indicated that the final ranking method to determine the rank-order of the ZECs would be presented to the Board at its February 2019 meeting.[6]

On December 19, 2018, the Applicants filed applications for Salem Unit 1 and Salem Unit 2. Separately, PSEG Nuclear LLC filed an application for Hope Creek. No other units outside of New Jersey applied to the Board.

[3] N.J.S.A. 48:3-87.3 (3)(a)
[4] N.J.S.A. 48:3-87.3 (3)(a)
[5] I/M/O the Implementation L. 2018 c. 16 Regarding the Establishment of a Zero Emission Certificate Program for Eligible Nuclear Power Plants. BPU Docket EO18080899.
[6] I/M/O the Implementation L. 2018 c. 16 Regarding the Establishment of a Zero Emission Certificate Program for Eligible Nuclear Power Plants. BPU Docket EO18080899. Page 11.

Should the Board award ZECs to a nuclear unit, then the unit will receive ZECs for the period from April 19, 2019 through May 2019, and then the three following energy years (2019-2020, 2020-2021, and 2021-2022).[7]

The ZEC Act states that the Board will select eligible nuclear units until the combined MWh produced in the energy year immediately prior to the date of the enactment (since the Statute was signed in May 2018, the energy year would be June 2016-May 2017) reaches 40 percent of the total MWhs distributed by the electric public utilities in the same energy year (June 2016-May 2017).[8]

[7] I/M/O the Implementation L. 2018 c. 16 Regarding the Establishment of a Zero Emission Certificate Program for Eligible Nuclear Power Plants. BPU Docket 18080899. Page 12.

[8] Section 3.g.(1)

A. Impact of ZECs on Ratepayers

The purported purpose of the ZEC Act is to address the Applicants' concerns that the Hope Creek and Salem 1 and 2 nuclear power units are at risk of closure in the near future.[9] The ZEC Act requires New Jersey electric public utilities to impose a "non-bypassable, irrevocable charge" of $0.004/kWh on electric utility retail distribution customers.[10] The ZEC Act provides neither an explanation nor a quantitative analysis of the $0.004/kWh rate. For illustrative purposes, we have applied the $0.004/kWh charge to the Energy Information Administration's ("EIA") statistics for New Jersey's total electricity consumption for the last five years as shown in the table below:

Table 1 Illustrative Cost of ZEC Charge on New Jersey

Year	Total Sales (MWh)	Calculated Collected Amount ($0.004/kWh)
2012	75,052,914	$300,211,656
2013	74,642,399	$298,569,596
2014	73,866,078	$295,464,312
2015	75,489,623	$301,958,492
2016	75,359,371	$301,437,484
2017	73,382,940	$293,531,760
Notes New Jersey data from EIA 861		

The data suggests that the ZEC Act would require New Jersey electric distribution companies ("EDC") to collect approximately $300 million per year from New Jersey retail distribution

[9] https://www.utilitydive.com/news/pseg-ceo-salem-hope-creek-nukes-will-close-absent-subsidies/512345/
[10] Section 3.j.1

customers based on annual data. This amount would be incremental to charges collected from distribution customers and transmission for other programs. For the three nuclear units, the ZEC Act would result in a $10/MWh revenue adder for each unit's owner if the Board approves the three applications. ($0.004/kWh ÷ 40% of distributed electricity). The ZEC Act allows the Applicants, who are merchant owners, to cover costs—including the cost of capital. Currently, the Board has no jurisdiction to regulate the cost of capital of merchant generators. As noted in Rate Counsel's accompanying comments, New Jersey enacted the EDECA to introduce market competition to electricity generation to lower prices for ratepayers.

V. Background: Wholesale Markets and Nuclear Operations

The ZEC Act subsidizes the continued operations of the three remaining nuclear units within New Jersey. To take a step back, we discuss wholesale energy and capacity markets that affect New Jersey and the economics of nuclear power plant operations in these markets.

A. Wholesale Markets

At a high level, energy and capacity markets compensate different aspects of providing electric power to the grid. Energy is what is generated and consumed and is quantified in kilowatt-hours ("kWhs") or MWhs. Capacity is a measure of the capability to generate power and is measured in kilowatts ("kW") or megawatts ("MW"). The design of the wholesale energy and capacity markets is intended to provide appropriate price signals to market participants (e.g., generators, developers, and investors) to incent economically efficient decisions to build new generation, or to retire old, costly power plants when appropriate. New Jersey operates within the broader construct of the PJM region, which includes the movement of wholesale electricity in all or part of 13 states (Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North

Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia) and the District of Columbia. PJM serves 65 million people with a peak load of 165,492 MW and with 178,563 MW of generating capacity. In addition to planning and operating the transmission system within its territory, PJM runs three separate markets, a Capacity Market, an Energy Market, and an Ancillary Services Market.

B. Energy Markets

The PJM energy market procures electricity to meet consumers' demands both in real-time (five minutes) and on a day-ahead (one-day forward) basis. PJM uses locational marginal prices ("LMPs") to price energy purchases and sales. The LMP is the clearing price in energy markets based on the cost of generating the last quantity of electricity needed to meet demand in the moment (and location). The clearing price is paid to all accepted bidders in that specific location. PJM ensures the lowest production cost by requiring generators to bid the price and amount of generation at generator-specific locations (i.e., a generator "bus") and accepting bids from the lowest until the accepted amount meets the demand.

Because nuclear units are slower to increase or decrease their energy output and generally run continuously at maximum output, they tend to bid as price-takers in energy markets to ensure that they can continuously sell their energy, regardless of the clearing prices in either the day-ahead and real-time energy market auctions.

C. Capacity Markets

Capacity markets establish a value for generators to be available to provide power to the electric grid when needed. Because heat waves or cold snaps can push the demand for electricity very high for short periods—much higher than the average level over a typical year—wholesale markets require more capacity to be available than is generally needed to produce energy for much of the year. Without enough capacity, there would be blackouts during peak periods of demand. This capacity need creates value for a unit, even if its output is needed infrequently.

The PJM capacity market, known as the Reliability Pricing Model ("RPM"), ensures long-term grid reliability by procuring the amount of capacity resources needed to meet forecasted energy demand three years in the future. In theory, the RPM provides long-term price signals to attract sufficient generation infrastructure investments within PJM. Like the energy market, RPM participants offer power supply resources that either increase energy supply or reduce demand at a certain price and volume at specific locations.

The PJM capacity market accepts offers from the lowest bid price until the requisite amount of capacity for each zone has been met. The last accepted offer in each capacity zone establishes the market-clearing price for that zone, and all accepted capacity resources in that zone are paid the respective market-clearing price regardless of the original offer price. For example, if the unit bid $5.00 per megawatt per day, and the ultimate clearing price is $150.00 per megawatt per day, that unit and all cleared units receive the $150.00/MW clearing price. Any unit that clears the base residual auction ("BRA") has a capacity obligation to PJM and must deliver the amount of capacity cleared in the auction to PJM on demand during the delivery year or face financial penalties.[11]

The overall economic viability of a generator that participates in PJM depends on its total costs relative to the combined revenue the generator can receive from both the PJM energy and capacity markets as well as other sources of income available to the plant. Plant costs include not

[11] A unit can shift its capacity commitment to other units in the generator owner's portfolio.

only current generating costs, but also the ongoing fixed costs that are required to keep the plant ready to operate when needed. Fixed costs may be avoidable only through plant retirement. For an analysis of the Applicants' projected costs, see the Certification of Andrea Crane, submitted herewith.

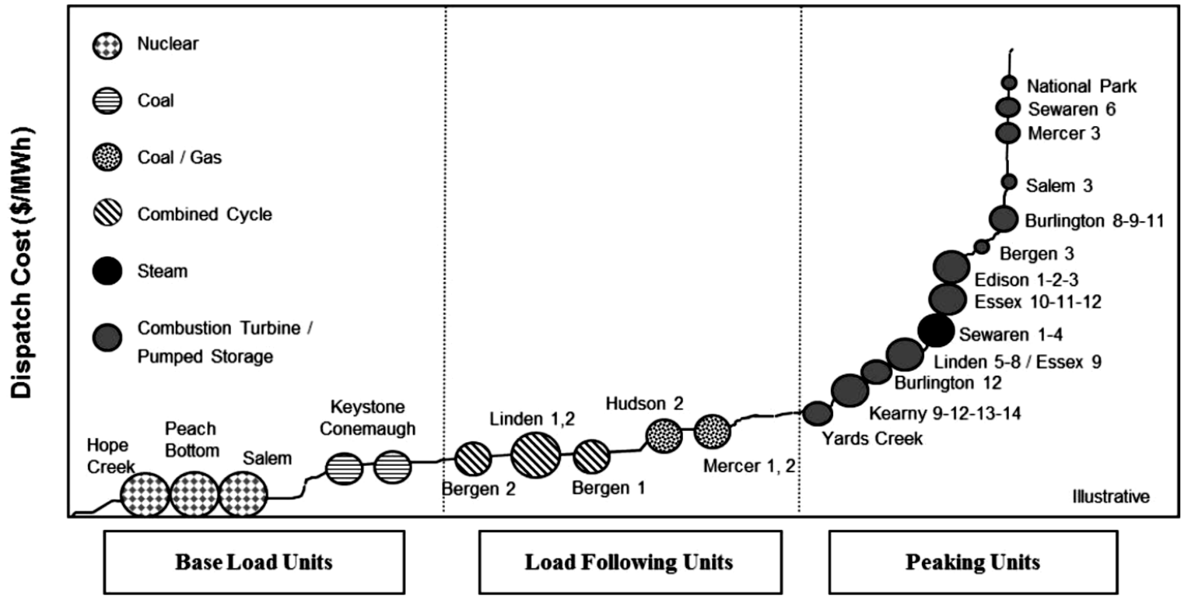
D. Nuclear Operations

Nuclear power generators (and coal plants) have traditionally had low marginal costs of generating energy (e.g., fuel), but high fixed costs.[12] Other types of plants, such as combustion turbines that burn natural gas or oil, have relatively high costs of generating energy, but low fixed costs. As stated earlier, all plant owners in PJM need to earn revenue from capacity and energy markets to cover their costs. The following chart taken from PSEG's 2014 10-K illustrates the dispatch costs associated with PSEG's portfolio of generating units, including the three nuclear units.[13]

[12] The cost overruns and schedule delays associated with the construction of new nuclear reactors (Vogtle 3 and 4, and the cancelled VC Summer 2 and 3) in the United States highlight the high fixed costs associated with building nuclear power plants.

[13] S1-SSA-0009-10913

Figure 1 2014 PSEG Reported Dispatch Costs for Generation Fleet



In 2014, the three nuclear units had the lowest dispatch costs within PSEG's generation fleet. While nuclear power plants have low dispatch costs, nuclear power units are also relatively slow at starting up and ramping up and down. This means that the most economic mode of operation for the three plants is to run at a steady, constant level throughout the year. As a result, the nuclear units' profitability is largely dependent on energy prices that fluctuate year to year, and seasonally.

E. New Jersey Nuclear Power Plants

New Jersey currently has three operating nuclear power units located on Artificial Island. Exelon shut down its Oyster Creek plant in 2018.[14] Nonetheless, the ZEC Act uses the estimate that

[14] http://www.world-nuclear-news.org/Articles/Oyster-Creek-retires-after-49-years

nuclear generation produces 40 percent of the total generation. The historical generation of all of the New Jersey nuclear units, including Oyster Creek, is summarized in the table below.[15]

Schedule 1 New Jersey Nuclear Unit Net Electricity Generation 2012-2017[16]

Calendar Year	Table 1 Total Annual NJ Sales (MWh)	40% of Sales (MWh)	Table 2 Actual NJ Nuclear Generation (MWh)
	a	b=a*0.4	c
2012	75,052,914	30,021,166	28,395,547
2013	74,642,399	29,856,960	28,278,134
2014	73,866,078	29,546,431	26,656,214
2015	75,489,623	30,195,849	28,002,931
2016	75,359,371	30,143,748	25,300,096
2017	73,382,940	29,353,176	28,602,507

The table shows that the New Jersey nuclear units even with Oyster Creek included generally comprised less than 40 percent of New Jersey's annual energy sales reported for the calendar year. This distinction has the practical impact of virtually guaranteeing that all of the energy output from the three units would receive ZECs, should the Board approve the ZEC applications.

As stated earlier, nuclear power plants are designed to operate as continuously as possible. The standard industry metric to quantify nuclear power plant efficiency is capacity factors or

[15] The Act states terms in energy year (June 1st to May 31st). The data from EIA and information from the Applicants is sometimes reported in calendar year.

[16] Data from EIA 861 and EIA 923 forms

operational hours.[17] In the Applications, the Applicants provided the percentage of operational hours for the three units since 2008.[18] These are summarized below:

Schedule 2 PSEG Nuclear Unit Historical Operational hours

Year	Hope Creek	Salem 1	Salem 2
2008	99.7%	92%	83%
2009	92.6%	100%	92%
2010	91.4%	87%	98%
2011	99.2%	90%	90%
2012	92.7%	96%	89%
2013	88.0%	88%	100%
2014	98.6%	87%	74%
2015	90.1%	98%	88%
2016	92.1%	71%	87%
2017	100.0%	91%	87%
YTD 2018	**89.5%**	**100%**	**98%**
Average	**94.0%**	**90.9%**	**89.7%**
Notes			
Adjusted for leap years (2008, 2012, 2016) Source: S1-GAIO-0009			

The table shows that the three nuclear units are generally operating most hours during the year. The information shown in the table does not indicate at what level of power the plants are operating during the same period, so it is not the same as capacity factor. Periods when a nuclear unit is powering up or down would still allow the Applicants to claim that a unit was operational.

[Begin PSEG Confidential] [redacted]

[17] Capacity factor is the ratio of an actual electrical energy output over a given period to the maximum possible electrical energy output over that same period.

[18] S1-GAIO-0009

[redacted].[19] **[End PSEG Confidential]**

Generally, the greatest period of downtime for a nuclear unit occurs during regularly scheduled refueling outages. Refueling outages require the nuclear unit to cool down to enable the safe removal and replacement of spent fuel rods. These events take several weeks, and nuclear power plant owners try to schedule as much maintenance as possible during the refueling outage. All three units are on an 18-month refueling schedule and outages are scheduled during the Spring or Fall when energy prices are lower. Both PSEG and Exelon track and manage the duration of refueling outages, since the outage duration impacts generation and hence revenues.

VI. Background: Historical Revenues

The following schedule provides the total revenues (energy, capacity, and ancillary services) for all three units as reported by both Applicants.

[19] S1-GAIO-0006 Confidential

Schedule 3 Historical Total Revenues of ZEC Applicant Units ($ millions)

[Begin PSEG/ Exelon Confidential]

[redacted]

[End PSEG/ Exelon Confidential]

The table shows that during the period from 2013 through 2017, the three units generated **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** in revenues for PSEG and **[Begin Exelon Confidential]** [redacted] **[End Exelon Confidential]** in revenues for Exelon.[20] In aggregate, the three units generated **[Begin PSEG/ Exelon Confidential]** [redacted] **[End PSEG/ Exelon Confidential]** for the Applicants. The table shows that while 2016 revenues for the three units were lower than the average for the five-year period, 2017 revenues increased by 23 percent from the lows seen in the previous year. In this proceeding, the Applicants now claim

[20] The Board should also evaluate the reasonableness of the Applicants' calculation of current and past capacity revenues.

that the same three nuclear units are at risk of becoming unprofitable without the ZEC in the next three years.

A. Historical Energy Revenues

The following schedule provides only the energy revenues for all three units as reported by both Applicants.

Schedule 4 Historical Energy Revenues of ZEC Applicant Units ($ millions) ***[Begin PSEG/Exelon Confidential]***

[redacted]

[End PSEG/Exelon Confidential]

The table shows that during the period from 2013 through 2017, the three units generated **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** in energy revenues for PSEG and **[Begin Exelon Confidential]** [redacted] **[End Exelon Confidential]** in energy revenues for Exelon. In aggregate, the three units generated **[Begin PSEG/ Exelon Confidential]** [redacted] **[End PSEG/ Exelon Confidential]** for the Applicants. The table shows that in 2016 energy revenues for the three units were lower than the average for the five-year period, but then those revenues increased in 2017. Overall, energy revenues comprise approximately **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** percent of the units' revenues. This amount varies slightly among the three units.

B. Historical Capacity Revenues

The next category for revenues for the three units are capacity revenues. Capacity revenues represent approximately **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** percent of the units' revenues. The nuclear units' historical capacity revenues are presented below.

Schedule 5 Historical capacity Revenues of ZEC Applicant Units ($ millions) ***[Begin PSEG/Exelon Confidential]***

[redacted]	[redacted]				[redacted]	
	[redacted]					
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						

[redacted]. **[End PSEG/Exelon Confidential]** Capacity revenues have steadily fallen in the last five years; however, the expectation is that there are upcoming capacity market changes that will affect capacity prices.[21]

[21] https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/20181214/20181214-item-04-price-formation-paper.ashx

VII. Critiques of Applicants Revenue Assumptions

The income component of the Applicants' nuclear units is comprised mainly of energy and capacity revenues. The Applicants understate the units' expected revenues in several significant ways.

- The Applicants entire revenue projections for the next three years are based on energy price forwards for a **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** Energy price forwards will fluctuate up and down over the year and across years. The Applicants do not make any attempt to provide an upper or lower bound of energy revenues that could impact the cash flow models provided in the applications.

- NYISO has identified Hope Creek on a NYISO generator list. This indicates that PSEG has offered some portion of Hope Creek's capacity into NYISO at some point in time. The Board should investigate this issue further to determine if some portion of the unit's capacity is claimed outside of New Jersey and PJM.

- The Applicants' revenue assumptions do not explicitly quantify the impacts of changes in New Jersey energy policy that may affect energy revenues for the three nuclear units. The Applicants instead rely on the belief that energy forwards implicitly impute such policy changes.

- The Applicants' projected energy and capacity prices are skewed lower, which reduces the projected revenues for the three nuclear units.

A. Energy Revenue Deficiencies

The Applicants failed to provide the Board with a reasonable range of energy revenue projections that would assess the need for ZECs and the appropriate quantity of ZEC, if needed. As required under the ZEC Act, the Applicants are required to provide a projection of future energy revenues. The Applicants chose to base their projected energy prices on power price forwards for a **[Begin PSEG Confidential]** [redacted][22] [redacted] **[End PSEG Confidential]** Energy revenues comprise **[Begin PSEG/Exelon Confidential]** [redacted] **[End PSEG/Exelon Confidential]** percent of revenues, so the accuracy of these projections has a substantial impact on the units' overall future revenues.

Using forwards from **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** skews the interpretation of the results when compared to forwards from different points in time. The period chosen may have a significant impact on the estimates of future revenues. For this reason, for example, the New Jersey offshore wind guidance document asked bidders to use August 24, 2018 forwards so that the BPU could compare different offshore wind bids without concern that the date chosen would make a comparison difficult.[23] For illustrative purposes, the 2021 forwards from the NJ guidance document are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** than the forwards provided by the Applicants. Unlike the PSEG analysis, the BPU offshore guidance document seeks to maintain consistency across bids, by using the same inputs.

In contrast to the information provided in the application, PSEG's own cash flow analyses of its nuclear units include **[Begin PSEG Confidential]** [redacted].[24] [redacted]. **[End PSEG Confidential]** Thus, the Applicants

[22] S1-ZECJ-FIN-0004
[23] Available at: https://nj.gov/bpu/pdf/boardorders/2018/20180917/9-17-18-8G.pdf
[24] S1-IUD-0004 Confidential

have failed to provide a robust range of reasonable revenue projections that would enable the Board to adequately assess the financial condition of the unit.

1. Future Energy Prices

The energy price forwards change over the year. Recent energy forwards are higher than the forwards provided by the Applicants. These fluctuations have an impact on the profitability analysis provided by the Applicants. The following figure shows the PJM Western Hub forwards from PSEG and recent energy forwards for the same period. **[Begin PSEG Confidential]** [redacted].[25] **[End PSEG Confidential]** As a point of comparison, we have charted energy price forwards for the same zone over the last two weeks compared to the forwards used by the Applicants.[26] The figure below shows the difference in the averages of the monthly energy price forwards.

[25] S1-ZECJ-FIN-004

[26] https://www.cmegroup.com/trading/energy/electricity/pjm-western-hub-peak-calendar-month-real-time-lmp.html

[Begin PSEG Confidential] [redacted]

[redacted]

[End PSEG Confidential]

There are several components to this figure. First, the PSEG line plots the average of the monthly **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** energy price forwards for **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** Second, the PSEG line **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** Third, the line labeled Actual plots the average of the **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** on the date shown on the x-axis of the figure. The Actual line illustrates the point that recent energy price forwards are higher than the Applicants' forwards.

The figure above shows that energy price forwards in the last two weeks are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** higher than the energy price forwards used by the Applicants.

The Applicants also provide prices for the **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** They claim that the prices in this zone are closer to the realized prices seen at the three nuclear units.[27] The average of the monthly energy price forwards for this zone as used by the Applicants and as collected by us are shown below: **[Begin PSEG Confidential]**

[redacted]

[redacted]

[End PSEG Confidential]

The above figure follows the same methodology to present the average of the monthly futures as described above. On average the recent energy price forwards for **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** than the values reported by the

[27] S1-ZECJ-FIN-0004

Applicants. These values indicate that the current market sentiment for energy prices in the future is higher than what is reflected in of the Applicants' analysis.

2. Future Natural Gas Prices

Natural gas prices have a major influence on the price that generators will receive for their output, especially in periods of relatively strong or weak demand. Therefore, changes in the price of natural gas translate into changes in the wholesale price of electricity.

As required, the Applicants provided natural gas forecasts. However, the Applicants noted that **[Begin PSEG Confidential]** [redacted].[28] **[End PSEG Confidential]** In 2017, natural gas units were on the margin 53.4 percent of the time in PJM.[29] Natural gas prices have an impact on future energy prices. **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**

[28] RCR-PS-S1-E-0003 Item (iii)

[29] Monitoring Analytics, LLC. 2017 *State of the Market Report for PJM Volume 2: Detailed Analysis*. March 8, 2018 Page 22. http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2017/2017-som-pjm-sec1.pdf

Figure 4 Average of Monthly Henry Hub Prices (Feb 2019- Dec 2023) ($/MMBtu)

[Begin PSEG Confidential]

[redacted]

[End PSEG Confidential]

The above figure follows the same methodology to present the average of the monthly futures as described earlier. On average the recent Henry Hub futures are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** than the values reported by the Applicants. These values indicate that the current market sentiment for natural gas prices in the future is higher than energy prices reflected in the Applicants' analysis. **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**

B. Capacity Revenue Concerns

[Begin PSEG Confidential] [redacted]

> [redacted]

[redacted] **[End PSEG Confidential]** Hope Creek appears on the NYISO generator list.[32] The fact that Hope Creek apparently provides some of its capacity to NYISO indicates that PSEG Nuclear would need to supplement some portion of Hope Creek's nuclear capacity in PJM with other units. **[Begin PSEG Confidential]** [redacted]

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[30] HC_SSA_0016 attachment (confidential)
[31] HC_SSA_0016 attachment (confidential)
[32] http://mis.nyiso.com/public/htm/generator/generator.htm

[redacted].[33]

[End PSEG Confidential] This undercuts the Applicants' argument that the nuclear units provide carbon-free capacity to PJM. **[Begin PSEG Confidential]** [redacted].[34] **[End PSEG Confidential]** The treatment of the capacity from this unit in conjunction with the capacity from other PSEG units supports reviewing the application on a portfolio basis rather than an individual unit basis, since the nuclear units are managed in conjunction with other generating units with PSEG. The Board should determine if some portion of the unit's capacity is claimed outside of New Jersey and PJM as part of its evaluation process.

1. Future Capacity Prices

[Begin PSEG Confidential] [redacted]

[33] https://www.northjersey.com/story/news/environment/2017/05/31/coal-power-plants/355425001/
[34] HC_SSA_0016 attachment (confidential)
[35] RCR-PS-S1-E-0003
[36] RCR-PS-S1-E-0003

[redacted].[37] **[End PSEG Confidential]** The Applicants' assumption for EMAAC capacity prices are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** of historical prices as shown in the following figure taken from PJM.

Schedule 6 Recent RPM Base Residual Auction Results: EMAAC Clearing Prices[38]

Year	Clearing Price ($/MW-Day)
2021/2022	165.73
2020/2021	187.87
2019/2020	119.77
2018/2019	225.42
2017/2018	129
2016/2017	119.13
2015/2016	167.46
2014/2015	136.5
2013/22014	245
2012/2013	133.37
Average	162.925

The above table shows historical EMAAC BRA prices. Relative to historical prices, the Applicants' projection of future BRA prices is **[Begin PSEG Confidential]**[redacted] **[End PSEG Confidential]** the historical average from selected BRAs. The BRA prices have been set for the next three years (through June 2022). In reporting historical capacity revenues, the Applicants adjusted their BRA prices for incremental auction results from the 2020/2021 auction and previous auctions as well. FERC has allowed PJM to delay the 2022/2023 auction from May until August to allow PJM to finalize changes in the capacity market construct that we describe

[37] RCR-PS-S1-E-0003
[38] https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx

later. The anticipated changes are generally expected to raise prices. For comparison purposes, the Board's guidance for the offshore wind bids uses default capacity prices by EDC zone as default values for the offshore wind bid cost-benefit analyses.[39] The BPU's guidance values are \$190/MW-day for the PSE&G zone and \$165/MW-day for the Atlantic Electric Zone.[40] As shown, the Applicants' low capacity price assumptions skew their analysis.

C. Unquantified Policies

The Applicants acknowledge, but do not quantify, near-term changes in New Jersey energy policy that may impact demand and/or energy prices. The omission of these policy changes diminishes the applicability of their assumptions.

1. RGGI

The Applicants acknowledge that NJ will re-enter RGGI, and PA Consulting includes RGGI prices in its emissions modeling analysis. However, the Applicants do not explicitly attempt to quantify the impact of RGGI on energy prices. Instead, the Applicants state that they believe that "PSEG Nuclear estimates that electricity markets have already imputed some price increases in the forward energy curves related to New Jersey's rejoining RGGI; however, any additional impact on energy prices as a result of New Jersey rejoining RGGI will not be sufficient to prevent plant closure."[41] As stated earlier, an increase in energy prices of 10 percent has almost a similar percentage increase total revenues. Therefore, a material change in energy prices from New Jersey rejoining RGGI should have been explicitly analyzed by the Applicants.

[39] Attachment Seven: Standard Inputs for Cost-Benefit Analysis. Page 68. Available at https://nj.gov/bpu/pdf/boardorders/2018/20180917/9-17-18-8G.pdf

[40] Ibid.

[41] S1-SSA-0003

2. Offshore Wind

Neither the Applicants nor their modeling contractors (PA Consulting and ERM) quantified the impact of the expansion of offshore wind. The PA Consulting's retirement scenarios through 2022 ignore the Board's solicitation of 1,100 MW of offshore wind that was released in September 2018.[42] While the timing of the first 1,100 MW is unknown, it is anticipated that the first 1,100 MW will come online in 2021 and that 3500 MW will be developed by 2030.[43] This major development was not explicitly analyzed by the Applicants or its consultants.

3. Energy Efficiency

Neither the Applicants nor their modeling contractors (PA Consulting and ERM) quantify the impact of the expansion of energy efficiency requirements within the state. While the date of implementation of the energy efficiency legislation is unknown, the Applicants made no attempt to quantify the policy impact on energy prices and loads.[44] This policy change was not explicitly analyzed by the Applicants or their consultants.

4. Renewable Portfolio Standards ("RPS") Changes

In May 2018, Governor Murphy signed legislation to increase New Jersey's renewable portfolio standards ("RPS").[45] The legislation requires New Jersey to achieve 50 percent renewables by 2030. **[Begin PSEG Confidential]** [redacted].[46] **[End PSEG Confidential]** This legislation will

[42] https://nj.gov/bpu/pdf/boardorders/2018/20180917/9-17-18-8G.pdf
[43] https://www.pressofatlanticcity.com/news/breaking/bpu-planning-for-full-megawatts-of-offshore-wind-by/article_534317d7-6441-5b70-8c5c-64bd94cc3332.html
[44] RCR-PS-S1-E-0014
[45] https://www.nj.gov/governor/news/news/562018/approved/20180523a_cleanEnergy.shtml
[46] RCR-PS-S1-E-0015

have impacts for the state in terms of emissions and fuel diversity outside PA Consulting's narrow three-year analysis period.

VIII. Electric System Modeling Deficiencies

We note several deficiencies in the Applicants' emissions and fuel diversity modeling analysis.

- The Applicants modeled a very narrow time window that skews the results and ignores medium to long-term policy initiatives that would impact emissions and fuel diversity.
- The Applicants incorporated unrealistic retirement dates that skew the results.
- The modeling analyses did not quantify the interactive price effects of how shutting one unit would impact the remaining units. The shutdown of one unit may improve the profitability of the remaining two units, yet the Applicants failed to analyze this impact in their analyses.
- The Applicants failed to validate any of their revenue assumptions with assumptions or outputs from its energy modeling consultant, PA Consulting. The lack of concordance in inputs and outputs across the application is not reasonable.

PSEG engaged PA Consulting to prepare an independent analysis based upon its own views regarding energy prices and other factors that could affect the dispatch of resources to replace Hope Creek, Salem 1, and Salem 2 in the event of their retirement. The PA Consulting analysis was focused on determining the effect on emissions and fuel diversity caused by the retirement of Hope Creek and/or the Salem units.[47] Specifically, PA Consulting modeled scenarios of a Hope Creek retirement in June 2019 and a scenario with all three units retired.

We note that there are deficiencies to the modeling analysis. For one, the modeling period is limited to only June 1, 2019 through May 2022. This near-term timeframe limits the modeling to merely a short-term forecast with or without the nuclear units. By design, the modeling exercise

[47] RCR-PS-S2-E-0018

limits the replacement resources to either existing generation and/or known capacity builds. The limited timeframe of the analytical period also precludes the medium- and long-term trends in New Jersey: most notably, how the inclusion of 1,100 MW of offshore wind in increments up to 3,500 MW would affect medium and long-term emission and fuel diversity trends. Other changes in New Jersey that PA Consulting ignored include increased RPS requirements that would result in increased renewables that may help offset some loss of carbon-free emissions should one or more of the nuclear units retire. On the demand side, the PA Consulting modeling exercise did not incorporate the increased energy efficiency requirements. This increase will help reduce demand and may also help offset some loss of carbon-free emissions should one or more of the nuclear units retire.

Another modeling deficiency is that PA Consulting modeled both retirement scenarios as if the units retired on June 1, 2019 and assumed that the Hope Creek retirement scenario also served as a proxy for the retirement for Salem 1 and 2. The timing of the unit retirements is not a realistic assumption. Each of the three nuclear units has a different refueling outage date as indicated by the Applicants. **[Begin PSEG Confidential]** [redacted][48] **[End PSEG Confidential]** This is close to the scenario modeled by PA Consulting, but not precisely the same. **[Begin PSEG Confidential]** [redacted][49] [redacted] **[End PSEG Confidential]**.[50] In addition, Exelon has stated that its retirement decisions are based on the end of obligations and scheduled refueling as stated below:

[48] HC-IUD-0004 Confidential
[49] S1-IUD-0004 Confidential
[50] S2-IUD-0004 Confidential

> However, the earliest retirement date for any plant would usually be the first year in which the unit does not have capacity or other obligations, where applicable, and just prior to its next scheduled nuclear refueling outage.[51]

The simplified methodological retirement assumption made by PA Consulting skews the emission and fuel diversity impact that the retirement of either one or all three of the nuclear units may have on New Jersey.

One of the most glaring deficiencies of the PA Consulting analysis is that it does not quantify interactive effects between the retirement of one plant and the profitability of the remaining units. PA Consulting indicated that it did not compare the energy price outputs from its AURORAxmp model with the energy price forwards provided by PSEG.[52] The PJM market is a dynamic system where changes in one unit may impact the prices paid other units. Specifically, if one of the units retires that would impact the profitability of the remaining two units. PA Consulting stated that it modeled the impact on emissions and fuel diversity and did not model the impact of retiring one unit on the remaining two units.[53] This appears to be a critical question since the Applicants are requesting a subsidy for all three units. Nor did the Applicants account for this impact in their energy and revenue forecasts in the application. We believe that the retirement of one or more of the units will have a significant impact on the profitability analysis of the remaining units, however this information is missing in the Applications.

The PA Consulting modeling analysis failed to compare the energy prices generated from its model with the energy prices used by the Applicants. **[Begin PSEG Confidential]** [redacted]

[51] S1-SSA-007-0403
[52] RCR-PS-S1_E-0018.
[53] RCR PS S1 E 00019

[redacted].[54]

[End PSEG Confidential] In conducting its analysis on fuel diversity and emission impacts, PA Consulting generated energy price outputs from its AURORAxmp model. However, neither PA Consulting nor the Applicants compare the model outputs with the energy price forwards presented in the Applications.[55] The Applicants **[Begin PSEG Confidential]** [redacted].[56] [redacted]. **[End PSEG Confidential]**

The following information should have been provided to the Board to analyze the impact of the unit retirement scenarios. The Applicants should have provided capacity and generation by resource over the modeling period. The modeling efforts should have also included system costs to evaluate the impact of various resource options of retiring or not retiring specific nuclear units. In addition, part of the overall system costs, the model efforts should have quantified market revenues and environmental costs. The Applicants should have modeled locational marginal prices (or a reasonable proxy for regional energy price) to evaluate resource impacts. The Applicants' modeling efforts should have addressed reserve margin compliance, curtailment/energy imbalances, and outage schedules. This level of detail was lacking in the information provided by PA Consulting and PSEG has indicated that these concerns were not part of PA Consulting's engagement.[57] This undermines the results of PA Consulting's modeling.

[54] RCR-PS-S1-E-0015 Confidential
[55] S1-ZECJ-FIN-0005
[56] RCR-PS-S1-E-0004
[57] RCR-PS-S1-E-0004

IX. Wholesale Market Changes That Would Impact the Analysis

The PJM wholesale capacity and energy markets are considering significant changes that may upend current market structures and/or obviate the need for effects of any ZEC subsidy. These market construct changes will impact—and likely increase—capacity and energy prices paid to the nuclear units. Those increases, pursuant to Section 3(i)(3) of the Act, must be quantified and deducted from any award of ZEC revenues.[58] These potential changes are not quantified at all in the Applicants' analysis.

PJM relies on the energy and capacity markets to ensure reliable electrical service throughout the RTO. To that end, PJM is constantly reviewing clearing prices of the Capacity and Energy Markets to determine if those prices are enough to fully compensate generators in PJM. As explained more fully below, because of its concerns, PJM has taken action to modify rules in the Capacity and Energy Market and continues to do so. Indeed, some of that action is in direct response to the very issues raised by PSEG and others seeking subsidies for nuclear and other units. In response to calls from resources such as the nuclear plants that claim they are not being appropriately valued in the current energy markets, PJM is considering changes to energy price formation.[59] PJM has conducted modeling of some of the proposed changes to the energy and reserve markets that result in an increase in energy and reserve market revenues of $1.9 billion.[60] Any price increases and corresponding additional revenues that result from changes in the energy markets should also be deducted from the ZEC revenues to avoid windfall payments. In early December, PJM has notified stakeholders that the proposed energy price formation

[58] N.J.S.A 48:3-87.3 (3)(i)(3)
[59] https://www.pjm.com/committees-and-groups/task-forces/epfstf.aspx
[60] https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/20181214/20181214-item-04-price-formation-paper.ashx

changes must be resolved by January 31, 2019. Should stakeholders fail to resolve the issue, PJM plans to file a Section 206 filing to FERC.[61] On January 29, 2018, the chief executives of the Applicants signed a joint letter supporting PJM's proposed path to address price formation issues.[62]

PJM can take other actions to protect the reliability of its system. First, as explained above, any unit that clears the PJM BRA is committed three years in the future. Thus, PJM has already ensured that it has enough capacity three years from the current energy year. PJM has also established penalties to ensure that committed units produce energy when needed. After the poor performance by generation units during the 2014 Polar Vortex, PJM instituted Capacity Performance. Capacity Performance imposes significant penalties for units failing to provide energy when called upon in the Energy Year in which they committed through the Capacity Market. Finally, PJM can enter into a "reliability must run" ("RMR") contract with any unit within PJM. Before retiring any unit, the owner of the generator must inform PJM of its intentions to close. If PJM decides that the generating unit is needed for reliability, PJM can require the unit to remain in operation beyond its proposed retirement date—typically until system upgrades can make the unit unneeded by PJM. The generator owner is compensated through the RMR contract. The Applicants have indicated that they do not currently have an RMR contract for the nuclear units.[63]

[61] https://www.pjm.com/-/media/about-pjm/who-we-are/public-disclosures/20181205-pjm-board-letter-re-price-formation.ashx?la=en

[62] https://www.pjm.com/-/media/about-pjm/who-we-are/public-disclosures/20190130-final-joint-letter-to-pjm-board.ashx?la=en

[63] S1-GAIO-0021

X. Critiques of the Applicants' Environmental Modeling

As noted earlier, PSEG Nuclear retained PA Consulting to conduct emissions modeling for the ZEC Application. PA Consulting modeled three scenarios: reference case of the *status quo*, Hope Creek retirement, and all three units retired. For the air dispersion modeling, PSEG retained ERM to conduct dispersion modeling for the ZEC Application. ERM modeled the same three scenarios: reference case of the *status quo*, Hope Creek retirement, and all three units retired. ERM incorporated outputs from PA Consulting as inputs for the air dispersion models for ozone and NO_X emissions. ERM conducted a separate analysis focused on greenhouse gas ("GHG") emissions compared to the 2020 targets established under the New Jersey Global Warming Response Act ("GWRA").

The ERM GHG modeling results indicate that the retirement of all three nuclear units would increase GHG emissions, but that statewide GHG emissions would still remain below the statewide 2020 GWRA limit of 125.6 million metric tons (MMT). ERM found that the closure of the three nuclear units would result in an increase of 12.92 MMT of GHG, but overall statewide emissions would be 121.6 MMT. The retirement of a single nuclear unit results in an increase of 6.85 MMT of GHG, but at 114.6 MMT overall statewide emissions would still be below the statewide 2020 GWRA limit of 125.6 MMT.

The ERM ozone modeling results indicate that the retirement of three nuclear units would increase ozone emissions by a maximum of 0.57 parts per billion (ppb) based on an increase in NO_x emissions of 18.3 tons/day.[64] New Jersey's 8-hour ozone standard is 70 ppb. In other words, ERM found that the three nuclear units would result in an increase of ozone representing 0.8

[64] S1-ZECJ-ENV-0001-0029

percent of the state's ozone standard. The ZEC Act expresses a specific concern about the potential impact of a nuclear unit shut-down on the State's attainment of the Federal Ozone National Ambient Air Quality Standard. N.J.S.A. 48:3-87.3(b)(2). These results suggest that even in the event that all three units are shutdown, there would be some, but not significant impacts on air quality. That said, we also believe that ERM's environmental model results have several deficiencies that skew the results toward an even higher environmental impact.

Namely, ERM replicates all of the deficiencies cited with the PA Consulting emissions and fuel diversity analysis. Specifically, ERM limited the modeling period to June 1, 2019 through May 2022. This near-term timeframe limits the replacement resources to either existing generation and or known capacity builds.

The limited timeframe of the analytical period also precludes the medium- and long-term trends in New Jersey that could affect state emissions: most notably, how the inclusion of 1,100 MW of offshore wind in increments up to 3,500 MW would affect medium- and long-term emission and fuel diversity trends. ERM also ignored increased RPS requirements that would result in increased renewables in the state that may help offset some loss of carbon-free emissions should one or more of the nuclear units retire. On the demand side, the PA Consulting modeling exercise did not incorporate the increased energy efficiency requirements, which would help reduce demand and may also help offset some loss of carbon-free emissions should one or more of the nuclear units retire.

In addition, ERM overstates energy sales, which results in a projection that requires more generation than is needed to meet future energy requirements. ERM assumed that 2020 energy sales would be the same as the average energy sales from 2013-2017, which ERM found to be

74,548,082 MWh.[65] This represents an increase of 1.6 percent from the 2017 reported energy sales of 73,382,940 MWh.[66] ERM then applied a 7 percent loss factor to the EIA sales data to arrive at a net sales amount of 80,159,228 MWh for 2020.[67] However, the 2018 PJM load forecast for New Jersey shows net energy sales for New Jersey of approximately 76,181,000 MWh in 2020.[68] This suggests that the ERM data may be overstating future energy sales for New Jersey by 5.2 percent compared to PJM load forecasts.

Like PA Consulting, ERM modeled all of the retirement scenarios as if the plant closings would occur on June 1, 2019 retirement date and assumed that the Hope Creek retirement scenario also served as a proxy for the retirement of any one of the three units. Because PSEG **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** In addition, the Applicants' retirement assumptions are unrealistic. Each of the three nuclear units has a different refueling outage date as indicated by the Applicants. This simple retirement assumption made by ERM skews the emissions impact that the retirement of any one or all three of the nuclear units may have on New Jersey in relation to the 2020 GWRA emissions threshold. However, the ERM modeling exercise did not incorporate this important timing aspect.

XI. Conclusion

The Applicants have not met their burden and have not demonstrated that the Board should award ZECs at this time.

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65 S1-ZECJ-ENV-0002-0011

66 ERM presented their estimated energy sales based on EIA data that is reported in calendar year. This presentation is close, but not the same as the energy year (June 1 to May 31) format that is stated in the Statute.

67 S1-ZECJ-ENV-0002-0011

68 Table E-1 page 93. Available at https://www.pjm.com/-/media/library/reports-notices/load-forecast/2018-load-forecast-report.ashx. The PJM load forecast is based on information provided to PJM that should include losses.

For illustrative purposes, we conducted a sensitivity analysis that incorporates a simple increase in energy revenues of 3 percent and an increase in capacity revenues of 10 percent. In addition, our illustrative analysis incorporates Ms. Crane's recommendation of removing the Applicants' financial and market risk adders. The illustrative 10 percent increase in energy revenues and 3 percent increase in capacity revenues would result in a positive cash flow **[Begin PSEG Confidential]** [redacted]. **[End PSEG Confidential]** A 10 percent increase in energy revenues with the same capacity revenue would result in positive cash flow for **[Begin PSEG Confidential]** [redacted]. **[End PSEG Confidential]**

Thus, we recommend that the Board deny the Application for ZECs for the following reasons:

- The Applicants' reliance on forward energy prices **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** skews the projected energy revenues for the three units. We find that current energy price forwards are **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**, and **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** than the Applicants' forward energy prices.
- The Applicants' capacity price forecast is **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]** lower than current capacity prices for the EMAAC zone.
- The Applicants did not provide any sensitivity analyses of revenues or costs to show either upper or lower bounds of the cash flow for the three units. **[Begin PSEG Confidential]** [redacted] **[End PSEG Confidential]**
- FERC has allowed a delay in the upcoming capacity market auction to give PJM more time to incorporate changes in the capacity market. While the exact nature of the changes

is not known now, there is a general expectation that capacity market prices will be higher, not lower.

- At the very least, the price increases that result from these changes in energy and capacity prices should ultimately be deducted from the ZEC subsidy, if the Board approves the ZEC application.
- The Applicants' use of energy forwards does not account for, but relies on energy traders to implicitly factor policy changes such as: the re-entry of New Jersey into RGGI, New Jersey's procurement of 1,100 MW of offshore wind, increases in the RPS requirements, and implementation of increased energy efficiency requirements.
- The Applicant's emission and fuel diversity modeling contains deficiencies that overstate the units' emission and fuel diversity benefits. The modeling period is limited to the next three years and ignores significant policy initiatives (e.g., offshore wind) that will impact the state's emission and fuel diversity. The modeling also makes unrealistic assumptions about the timing of unit retirements. In reality, the timing of earliest retirement dates is **[Begin PSEG Confidential]** [redacted]. **[End PSEG Confidential]** In addition, the Applicants have market obligations that would result in penalties should the units retire early.
- Even including modeling deficiencies, the Applicants' emissions model results show that New Jersey will continue to meet the 2020 Global Warming Response Act greenhouse gas limit of 125.6 megatons under the three-unit retirement scenario.
- Even including modeling deficiencies, the Applicants' emissions model results show that New Jersey's ozone emissions would only increase by 0.57 ppb under the three-unit retirement scenario. This increase represents 0.8 percent of New Jersey's 8-hour ozone

limit of 70 ppb. The ozone emissions incorporate a modeled increase in NO_x emissions of 18.3 tons per day.

CERTIFICATION

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment.

1/30/2019

Date

Bob Fagan

Vice President,
Synapse Energy Economics

1/30/2019

Date

Maximilian Chang

Principal Associate,
Synapse Energy Economics