

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. ER20080557,
CERTIFICATE PROGRAM FOR	]	ER20080558 & ER20080557
ELIGIBLE NUCLEAR POWER PLANTS	]	

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TESTIMONY OF MAXIMILIAN CHANG  
ON BEHALF OF THE  
NEW JERSEY DIVISION OF RATE COUNSEL

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STEFANIE A. BRAND, ESQ.  
DIRECTOR, DIVISION OF RATE COUNSEL

Division of Rate Counsel  
140 East Front Street, 4<sup>th</sup> Floor  
P.O. Box 003  
Trenton, New Jersey 08625  
Email: [njratepayer@rpa.state.nj.us](mailto:njratepayer@rpa.state.nj.us)

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**PUBLIC VERSION**

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1 **I. Introduction**

2 **Q. Please state your name and business address.**

3 A. My name is Maximilian Chang. I am a principal associate at Synapse Energy Economics,  
4 Inc. (“Synapse”). Synapse is a consulting firm that provides economic and expert advice  
5 to public interest clients on electricity matters. My business address is 485 Massachusetts  
6 Avenue #3, Cambridge, MA 02139.

7 **Q. Please describe your professional experience.**

8 A. I have experience working with public interest clients in the electric utility and natural  
9 gas industries, as well as with private entities. My electric industry work has focused on  
10 regulatory policy, distribution system reliability, and resource economics. I joined  
11 Synapse in 2008. Before that, I was a senior scientist at Environmental Health and  
12 Engineering, Inc., which I joined in 2001.

13 I received an A.B. in classical civilization and biology from Cornell University, and a  
14 S.M. in environmental health and engineering from the Harvard School of Public Health.  
15 I have provided testimony or testified before the public utility commissions of Delaware,  
16 District of Columbia, Hawaii, Illinois, Kansas, Maine, Maryland, Massachusetts, New  
17 Jersey, New Hampshire, and Vermont. In 2018, I submitted comments regarding the first  
18 zero emission certificate (“ZECs”) application filing in New Jersey Board of Public  
19 Utilities (“BPU” or “the Board”) dockets (EO18121338, EO18121339, and  
20 EO18121337). My resume is attached as Attachment MPC-1.

1 **II. Purpose**

2 **Q. What is the purpose of your testimony?**

3 A. PSEG Nuclear LLC (“PSEG”) and Exelon Generation Company, LLC (“Exelon”) or  
4 collectively (“the Applicants”) seek approval from the BPU to receive ZECs for the  
5 second three-year period starting June 1, 2022 under the ZEC Act.<sup>1</sup>

6 The purpose of my testimony is to review and comment on aspects of the Applicants’  
7 materials as it pertains to the ZEC Act. If approved in its current form, the three  
8 applications for Hope Creek, Salem 1, and Salem 2 would continue to transfer  
9 approximately \$270 million per year from New Jersey ratepayers to the Applicants  
10 starting June 1, 2022. That I do not comment on other components of the Applications  
11 does not mean that I necessarily agree with the Applicants.

12 **III. Summary of Conclusions and Recommendations**

13 **Q. Please summarize your conclusions and recommendations.**

14 A. I find the following regarding the Applicants petition for ZECs for the second eligibility  
15 period:

- 16 • PSEG and Exelon have collected [Begin PSEG Confidential] ██████████ [End  
17 PSEG Confidential] from ZEC payments and associated interest for the first ZEC  
18 period. In this proceeding, PSEG and Exelon are seeking an additional \$809 million  
19 from NJ ratepayers. Between the two ZEC eligibility periods, PSEG and Exelon are  
20 seeking [Begin PSEG Confidential] ██████████ [End PSEG Confidential] from  
21 New Jersey Ratepayers.

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<sup>1</sup> N.J.S.A. 48:3-87.3 to -87.7.

- 1           • Even if the Board grants ZEC payments to the three plants, PSEG may still shut down  
2           the plants.
- 3           • PSEG’s application understates future energy revenues by at least **[Begin PSEG**  
4           **Confidential]** ██████████ **[End PSEG Confidential]** over the next five calendar  
5           years for the three plants. On an energy year basis, I find that for the second ZEC  
6           eligibility period starting on June 1, 2022, the September 30<sup>th</sup> energy price forwards  
7           result in an aggregate increase in energy revenues of **[Begin PSEG Confidential]**  
8           ██████████ **[End PSEG Confidential]** compared to energy revenues using the May  
9           29<sup>th</sup> energy price forwards.
- 10          • For energy revenues, the Board should rely on recent or a time-series of recent energy  
11          price forwards that reflect the upward trends in energy price forwards. The Board  
12          should not rely upon the low energy price forwards provided by the Applicants.
- 13          • PSEG’s application understates future capacity revenues by at least **[Begin PSEG**  
14          **Confidential]** ██████████ **[End PSEG Confidential]** million over the next five calendar  
15          years for the three plants with the use of capacity price projections that are too low.
- 16          • For capacity revenues, the Board should rely on capacity price proxies or capacity  
17          price projection used in other proceedings before the Board. Both the Basic  
18          Generation Supply (“BGS”) proceeding and Offshore Wind Solicitation capacity  
19          price proxies are higher than capacity price proxies used by the Applicants.
- 20          • The Board should not discount the plants’ expected capacity revenues because of  
21          concerns regarding the FERC’s Minimum Offer Price Rule (“MOPR”) because PSEG

1 assumes that the plants will continue to clear the PJM capacity market under MOPR.  
2 PSEG's estimates of the default offer floor prices for the three units are below  
3 PSEG's estimate for future capacity prices. If the Board rejects the ZEC applications,  
4 then MOPR will not apply to the plants.

- 5 • Combined, PSEG understates total energy and capacity revenues by at least **[Begin**  
6 **PSEG Confidential]** [REDACTED] **[End PSEG Confidential]** over the next five  
7 calendar years.
- 8 • The New Jersey Energy Master Plan demonstrates that New Jersey can meet its 2050  
9 clean energy target with the orderly retirement of the three nuclear plants in an energy  
10 modeling scenario that only includes New Jersey's old offshore wind goal of 3,500  
11 MW by 2035 rather than the more current offshore wind commitment of 7,500 MW.<sup>2</sup>
- 12 • The three nuclear units will likely benefit from the Biden Administration's potential  
13 future clean energy policies to meet the United States' renewed commitment to the  
14 Paris Climate Accords.
- 15 • While I do not think it is necessary for the Board to award ZECs to the three nuclear  
16 units, should the Board decide to award ZECs then the Board should use my social  
17 cost of carbon ("SCC") calculation of **[Begin PSEG Confidential]** [REDACTED] **[End**  
18 **PSEG Confidential]** as the upper limit to any ZEC award. ZEC awards may be lower  
19 than my SCC value, but should not be higher.

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<sup>2</sup> New Jersey Energy Master Plan. 2020. Page 275. Available at [https://nj.gov/emp/docs/pdf/2020\\_NJBPU\\_EMP.pdf](https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf)

#### 1 **IV. Background on ZEC Act and First ZEC Eligibility Period**

2 **Q. Please describe the background of the ZEC Act with regards to the second eligibility**  
3 **period.**

4 A. On May 23, 2018, Governor Phil Murphy signed into law the ZEC Act.<sup>3</sup> The Act requires  
5 the Board to create a program and mechanism for the issuance of ZECs for nuclear units.  
6 Each ZEC represents the fuel diversity, air quality, and other environmental attributes of  
7 one megawatt hour (“MWh”) of electricity generated by eligible nuclear unit(s) selected  
8 by the Board.<sup>4</sup> The ZEC Act states that applicants need to provide to the Board:

9 [C]ertified cost projections over the next three energy years, including  
10 operation and maintenance expenses, fuel expenses, including spent  
11 fuel expenses, non-fuel capital expenses, fully allocated overhead costs,  
12 the cost of operational risks and market risks that would be avoided by  
13 ceasing operations, and any other information, financial or otherwise,  
14 to demonstrate that the nuclear power plant’s fuel diversity, air quality,  
15 and other environmental attributes are at risk of loss because the  
16 nuclear power plant is projected to not fully cover its costs and risks, or  
17 alternatively is projected to not fully cover its costs and risks including  
18 its risk-adjusted cost of capital.<sup>5</sup>  
19

20 On December 19, 2018, the Applicants filed applications for Salem Unit 1 and Salem  
21 Unit 2 for the first three-year period starting June 1, 2019 through May 31, 2022. On  
22 April 18, 2019, the Board approved ZECs for all three units.<sup>6</sup>

23 Unlike the first proceeding, where the Board found that it had no authority to adjust the  
24 ZEC rate, the Board has an opportunity to review and adjust the ZEC charge to be lower  
25 than 0.0004/kWh in this proceeding. As stated in the Act:

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<sup>3</sup> Office of Governor Murphy. *Governor Murphy Signs Measures to Advance New Jersey’s Clean Energy*. (May 23, 2018)(available at [https://www.nj.gov/governor/news/news/562018/approved/20180523a\\_cleanEnergy.shtml](https://www.nj.gov/governor/news/news/562018/approved/20180523a_cleanEnergy.shtml))

<sup>4</sup> N.J.S.A. 48:3-87.3(3)(a)

<sup>5</sup> N.J.S.A. 48:3-87.3(3)(a)

<sup>6</sup> 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 Nos. EO18080899, EO18121338, EO18121339, and EO18121337 (Apr. 18, 2019).

1 Notwithstanding the provisions of paragraph (1) of this subsection, and  
2 to ensure that the ZEC program remains affordable to New Jersey retail  
3 distribution customers, the board may, in its discretion, reduce the per  
4 kilowatt-hour charge imposed by paragraph (1) of this subsection  
5 starting in the second three year eligibility period and for each  
6 subsequent three year eligibility period thereafter, provided that the  
7 board determines that a reduced charge will nonetheless be sufficient to  
8 achieve the State's air quality and other environmental objectives by  
9 preventing the retirement of the nuclear power plants that meet the  
10 eligibility criteria established pursuant to subsections d. and e. of this  
11 section.<sup>7</sup>  
12

13 On August 12, 2020, the Board established the application process for ZEC applications.<sup>8</sup>

14 On October 1, 2020, the Applicants filed applications for Salem Unit 1 and Salem Unit 2  
15 for the second three-year period, starting June 1, 2022 through May 31, 2025.

16 The ZEC Act states that the Board will select eligible nuclear units until the combined  
17 MWhs produced in the energy year immediately prior to the date of the enactment  
18 reaches 40 percent of the total MWhs distributed by the electric public utilities in the  
19 same energy year.<sup>9</sup>

## 20 **V. Total Revenues Collected by the Three Plants**

### 21 **Q. Please summarize the historical revenues of the three plants.**

22 A. Total revenues, including ZEC payments, received by the three plants in the last ten years  
23 through November 2020 are shown in the figure below:  
24

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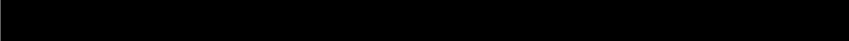
<sup>7</sup> N.J.S.A. 48:3-87.5(j)(3)(a)

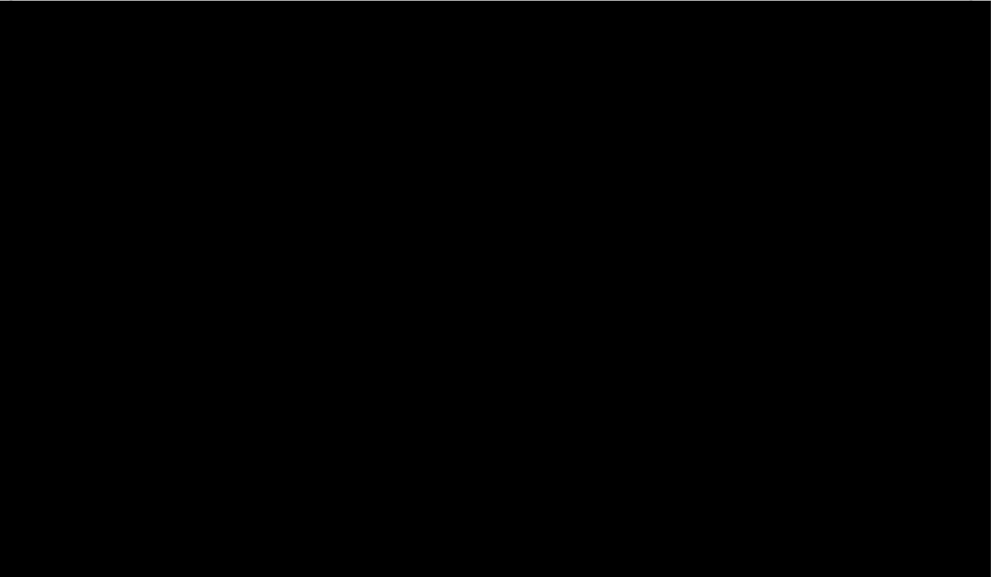
<sup>8</sup> I/M/O the Implementation L. 2018 c. 16 Regarding the Establishment of a Zero Emission Certificate Program for Eligible Nuclear Power Plants. BPU Docket No. 18080899 (Aug. 12, 2020).

<sup>9</sup> N.J.S.A. 48:3-87.5(g) (1).



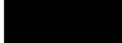
1        **[Begin PSEG Confidential]**

2        

3        

4          
5        

9        **[End PSEG Confidential]**







11       In aggregate, the three units have generated **[Begin PSEG Confidential]**  **[End PSEG Confidential]** in revenues when excluding the ZEC payments for the Applicants.





13       The figure shows a drop in total revenues that starts in 2014 and reaches a low point in  
14       2016. As I discuss in more detail below, the PSEG energy revenue projections for the  
15       next five years show improved prospects relative to recent history. On a net income view,  
16       when including the reported fuel and non-fuel capital expenditures

1 and operations and maintenance expenses, the historical net income for the three plants,  
2 through 2019, are shown in the figure below.<sup>10</sup>

3 **[Begin PSEG Confidential]**



6   
7   
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11   
12 **[End PSEG Confidential]**

13 By the net income metric, the Applicants reported negative net income in **[Begin PSEG**  
14 **Confidential]**  **[End PSEG Confidential]**. The **[Begin PSEG**  
15 **Confidential]**  **[End PSEG Confidential]** from ZEC payments in 2019  
16 allowed the three plants to report a net income of **[Begin PSEG Confidential]**   
 **[End PSEG Confidential]** for 2019.

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<sup>10</sup> PSEG’s response to PS-Staff-0017 did not include expenses through November 2020.

1 In this proceeding, the Applicants claim that the same three nuclear units are at risk of  
2 becoming unprofitable without the ZEC over the next three-year eligibility period. Rate  
3 Counsel witness Andrea Crane addresses the merits of the cost components claimed by  
4 the Applicants. My analysis focuses on the revenues reported and projected by the  
5 Applicants.

## 6 **VI. Revenue Components of the Three Plants**

7 **Q. Please describe the revenue components of the three plants.**


8 A. In this section, I discuss three of the most significant components of revenue for the three  
9 plants. These include historical and projected ZEC payments, energy revenues, and  
10 capacity revenues. The plants receive ancillary and other revenues, but these revenues are  
11 generally less than [**Begin PSEG Confidential**] [REDACTED] [**End PSEG Confidential**]  
12 of total annual revenues for any given year.

### 13 **A. Amount of ZECs Collected and Anticipated to be** 14 **Collected from Ratepayers**

15  
16 **Q. What amount has been and will be collected from ratepayers through ZEC**  
17 **payments?**

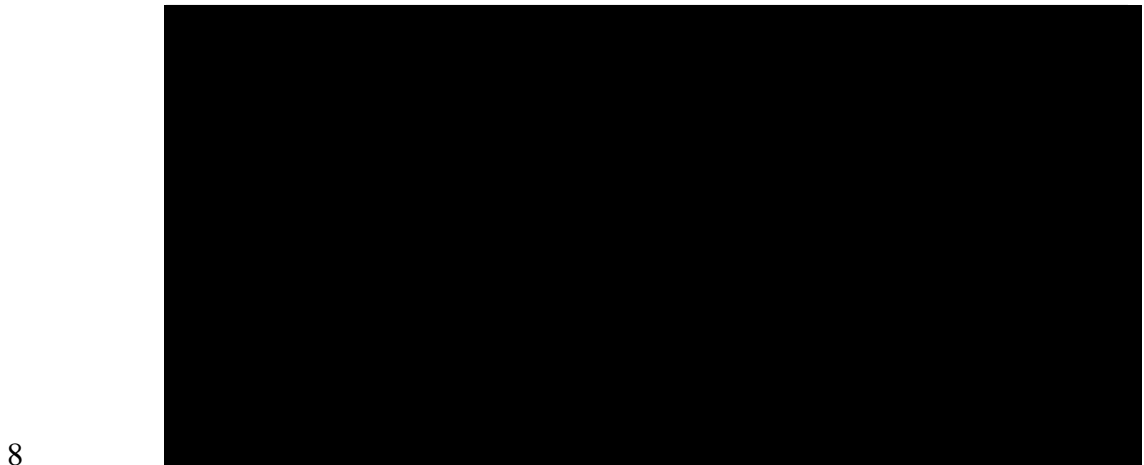
18 A. Should the Board approve the second eligibility period ZEC applications for the three  
19 plants at the existing charge of \$0.0004/kWh or \$10/MWh, then the Board could be  
20 providing approximately [**Begin PSEG Confidential**] [REDACTED] [**End PSEG**  
21 **Confidential**] to the Applicants from ratepayers over the two ZEC periods.

22 Since April 2019, electric distribution companies (“EDCs”) have collected approximately  
23 [**Begin PSEG Confidential**] [REDACTED] [**End PSEG Confidential**] through the  
24 “non-bypassable, irrevocable charge” for ZECs of \$0.004/kWh on the electric utility

1 retail distribution customers.<sup>11</sup> At the end of the first eligibility period (i.e., May 31,  
2 2022), PSEG and Exelon will have received **[Begin PSEG Confidential]**   
3 **[End PSEG Confidential]** in ZECs revenues in payments from New Jersey ratepayers  
4 and interest earned. These amounts are displayed in the figure below, by calendar year.<sup>12</sup>

5 **[Begin PSEG Confidential]**

6   
7 



8

9   
10 

11 **[End PSEG Confidential]**

12  
13 As part of the second ZEC application process, each unit provided an estimated rate  
14 impact analysis at the \$10/MWh rate for the second ZEC eligibility period. I show the  
15 projected ZEC payments for all three plants in Figure 4 below. Unlike the previous  
16 figures, this one is presented by Energy Year (June 1<sup>st</sup> through May 31<sup>st</sup>).

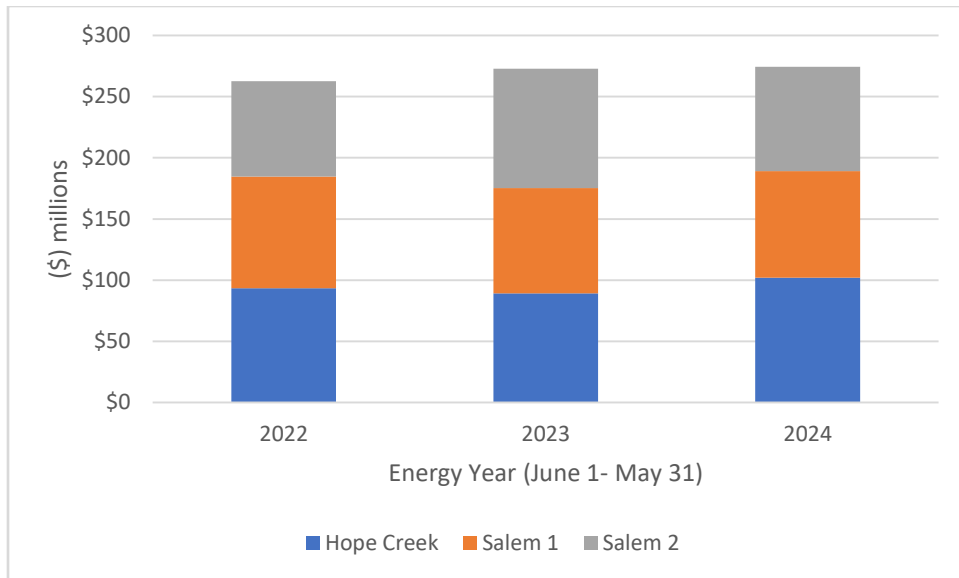
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<sup>11</sup>RCR-PS-HC-E-12, RCR-PS-S1-12, and RCR-PS-S2-12

<sup>12</sup>RCR-PS-HC-E-12. PSEG includes interest collected generated from the ZEC payments. On an energy-year basis, the revenues collected appear more evenly distributed (June through May).

1  
2

*Figure 4 Projected ZEC Payments Collected from Ratepayers for Second ZEC Period by Energy Year*



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4  
5  
6  
7

**Source:**  
HC-SSA\_0002\_ZEC Rate Class Impacts final.xlsx

8  
9  
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13

If the Board were to approve a ZEC for a second eligibility period and at the full \$10/MWh ZEC rate, then the Applicants will be able to collect approximately \$809.5 million from ratepayers. Combined with the amounts collected from ratepayers in the first ZEC eligibility period, the total amount in ZEC payments could be as much as [Begin PSEG Confidential] [redacted] [End PSEG Confidential] for the three plants.

14  
15  
16  
17  
18

- Q. Does PSEG consider ZEC payments sufficient to keep the plants operating?**
- A. It depends. While PSEG does not guarantee that, even if it receives the full ZEC payment for the second eligibility period, it will keep the plants operating, PSEG is not being forced to retire any of the three plants either. In the Company’s 10-Q filing for the quarter ending September 30, 2020, the Company stated:

1 [I]f all of the Salem 1, Salem 2 and Hope Creek plants are selected to  
2 continue to receive ZEC payments but the financial condition of the plants  
3 is materially adversely impacted by changes in commodity prices, FERC's  
4 changes to the capacity market construct (absent sufficient capacity  
5 revenues provided under a program approved by the BPU in accordance  
6 with a FERC-authorized capacity mechanism) ... PSEG Power will take all  
7 necessary steps to cease to operate all of these plants. Ceasing operations of  
8 these plants would result in a material adverse impact on PSEG's and PSEG  
9 Power's results of operations.<sup>13</sup>

10 The statement suggests that New Jersey ratepayers could commit to pay nearly **[Begin**  
11 **PSEG Confidential]** [REDACTED] **[End PSEG Confidential]** to the Applicants without a  
12 firm commitment that the plants would continue to be in operation at the end of the ZEC  
13 eligibility period.  
14

## 15 B. Energy Revenues

16 **Q. Please summarize your findings regarding energy revenues of the three plants.**

17 A. The Applicants understate projected energy revenues for the three nuclear plants. When I  
18 use updated energy price forwards provided by PSEG, I find that projected energy  
19 revenues for the three plants increase by **[Begin PSEG Confidential]** [REDACTED]  
20 **[End PSEG Confidential]** That roughly translates to an impact of **[Begin PSEG**  
21 **Confidential]** [REDACTED] **[End PSEG Confidential]** based on projections of energy  
22 generation provided in this Application. In its application, PSEG estimates future  
23 revenues for the three plants for the next five years to be **[Begin PSEG Confidential]**  
24 [REDACTED] **[End PSEG Confidential]** based on energy price forwards from May 29,  
25 2020. When using energy price forwards from September 30, 2020, I find projected

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<sup>13</sup> Public Service Enterprise Group Incorporated. Form 10Q for the Quarterly Period Ended September 30, 2020, Page 79 (available at [https://s24.q4cdn.com/601515617/files/doc\\_financials/2020/q3/0883a31d-6c78-4a9e-928f-33e7b73a6455.pdf](https://s24.q4cdn.com/601515617/files/doc_financials/2020/q3/0883a31d-6c78-4a9e-928f-33e7b73a6455.pdf)).

1 energy revenues for the three plants to be [Begin PSEG Confidential] [REDACTED]. [End  
2 PSEG Confidential]

3 **Q. Please describe how PSEG estimated future energy revenues.**

4 A. The Applicants base their projections of energy revenues on projections of energy price  
5 forwards that change over the year. The Applicants' initial projection of Energy  
6 Revenues for the three plants over the next five years (calendar and energy year) is  
7 presented below.

8 [Begin PSEG Confidential]

9 [REDACTED]  
10 [REDACTED]

[REDACTED]

11  
12  
13 [End PSEG Confidential]

1 The table shows that the Applicants’ initial projections for energy revenues for the next  
2 five calendar years result in a total energy revenue projection of [Begin PSEG  
3 Confidential] [End PSEG Confidential] billion, or an annual average of [Begin  
4 PSEG Confidential] [End PSEG Confidential] over the five-year period.  
5 On an energy year basis for the second ZEC eligibility period of June 1, 2022 through  
6 May 31, 2025, the total energy revenue projection is also approximately [Begin PSEG  
7 Confidential] [End PSEG Confidential] billion. I note that the PSEG projected  
8 five-year annual average energy revenue is higher than the PSEG historical annual  
9 average (2016-2019) of [Begin PSEG Confidential] [End PSEG Confidential]  
10 million, but lower than the 2010-2019 annual average of [Begin PSEG Confidential]  
11 [End PSEG Confidential] million.

12 **Q. What factor will influence energy revenue projections?**

13 A. Energy revenue projections are sensitive to the Applicants’ assumptions for  
14 energy prices in the PECO zone. The following table shows the PECO Zone forwards  
15 from the application filed in October, based on May 29, 2020 energy forwards and the  
16 PEC Zone forwards from September 30, 2020, as requested in Staff PS-0009.

17 [Begin PSEG Confidential]

18 [Redacted]

19 [Redacted]

20






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**[End PSEG Confidential]**

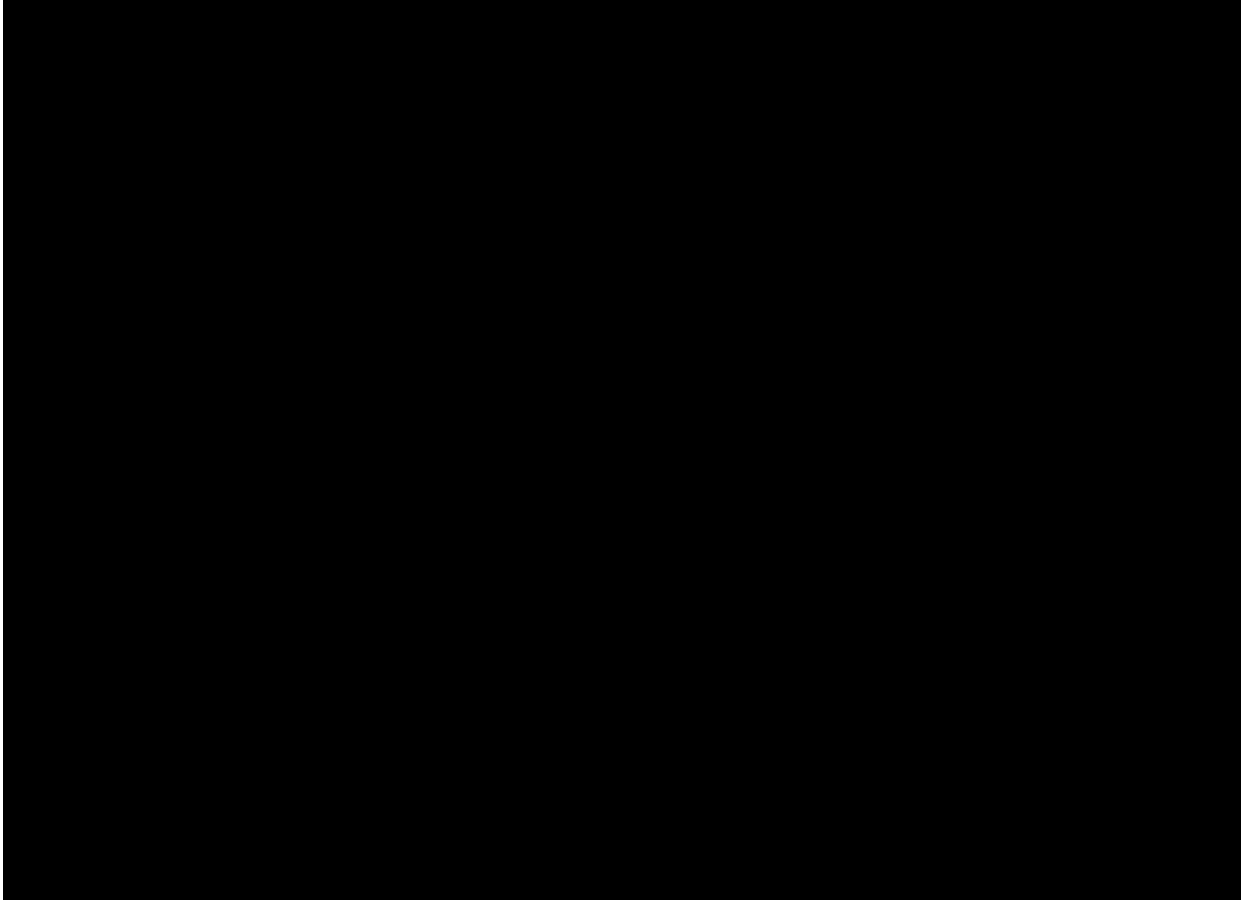
**Q. What is the impact of the change in energy price forwards on projected energy revenues?**

A. Table 2 above shows that energy price forwards as of September 30, 2020 are higher than the May 29, 2020 energy price forwards used by the Applicants. The percent change in energy prices range from **[Begin PSEG Confidential]**  **[End PSEG Confidential]**. I then multiplied the updated energy prices with PSEG’s projected generation for the three plants to calculate updated energy revenue projections. The resulting annual and total difference in energy revenues between the May 29, 2020 and September 30, 2020 energy price forwards is shown below.

1 **[Begin PSEG Confidential]**

2 [Redacted]

3 [Redacted]



4  
5  
6  
7 **[End PSEG Confidential]**

8 The September 30<sup>th</sup> energy price forwards result in an aggregate increase in energy  
9 revenues for the period 2021 through 2025 for the three units of **[Begin PSEG**  
10 **Confidential]** [Redacted] **[End PSEG Confidential]** compared to energy revenues  
11 using the May 29<sup>th</sup> energy price forwards. On an energy year basis the change in energy  
12 revenues over the next five energy years is **[Begin PSEG Confidential]** [Redacted]

1 [End PSEG Confidential].<sup>14</sup> For the second ZEC eligibility period starting on June 1,  
2 2022, the September 30<sup>th</sup> energy price forwards result in an aggregate increase in energy  
3 revenues of [Begin PSEG Confidential] [REDACTED] [End PSEG Confidential]  
4 compared to energy revenues using the May 29<sup>th</sup> energy price forwards.

5  
6 **Q. What is your recommendation for the Board?**

7 A. I recommend that the Board rely on more recent energy price forwards when evaluating  
8 future energy revenue projections for the three nuclear plants. It is clear that May 29,  
9 2020 energy price forwards are out of date and understate future energy revenues for the  
10 three plants.

11 **C. Capacity Revenues**

12 **Q. Please summarize your concerns regarding the Company's capacity revenues**  
13 **projections.**

14 A. PSEG understated the capacity revenues attributable to the three plants. In its application,  
15 the Company assumed a forward capacity price of [Begin PSEG Confidential]  
16 [REDACTED] [End PSEG Confidential] for the 2022/23 and 2023/2024 energy years.  
17 These assumptions are lower than the proxy capacity prices approved by the Board for  
18 the BGS auction.<sup>15</sup> When I change the values to the proxy price that represents the  
19 EMAAC zone, the capacity revenues for the three plants increase by [Begin PSEG  
20 Confidential] [REDACTED] [End PSEG Confidential] In addition, future actions by the  
Board to address the FERC MOPR order may result in

<sup>14</sup> The difference in projected energy revenues between calendar and energy year is partly due to the fact that the energy year prices include historical 2020 prices, since the 2020-21 energy year started on June 1, 2020.

<sup>15</sup> I/M/O the Provision of Basic Generation Service for the Period Beginning June 1, 2021. Docket No. ER20030190. Proposal for Basic Generation Service Requirements to be Procured Effective June 1, 2021. Page 12.

1 reducing uncertainty regarding future capacity revenues for the three plants. This is  
2 because the plants are likely to clear in the capacity market even with MOPR if New  
3 Jersey chooses to stay in the PJM capacity market. Alternatively, should NJ choose to  
4 exit the PJM capacity market, via a Fixed Resource Requirement (“FRR”), the plants will  
5 almost certainly receive capacity payments under that scenario as well,  
6 as described in more detail below.

7 **Q. Please describe the contribution of capacity revenues for the three plants.**

8 A. Capacity revenues are the second largest component of the nuclear unit revenues.  
9 Historical capacity revenues as a percentage of total revenues for each of the three units  
10 for the last 10 years are presented in the following table:

11 **[Begin PSEG Confidential]**

12 [Redacted]  
13 [Redacted]

[Redacted]

14

15 Sources  
16 Staff PS-0017

1 [Redacted]  
2 [Redacted]  
3 [Redacted]

4 [End PSEG Confidential]

5 The figure shows that during the period from 2010 through 2018, or pre-ZEC, capacity  
6 revenues from the three units represented [Begin PSEG Confidential] [Redacted] [End  
7 PSEG Confidential] of total revenues for the three units. In aggregate, the three units  
8 generated [Begin PSEG Confidential] [Redacted] [End PSEG Confidential] between  
9 2010 and 2018. With the advent of the first ZEC period, capacity revenues comprised  
10 approximately [Begin PSEG Confidential] [Redacted] [End PSEG Confidential] of the  
11 units' revenues, amounting to [Begin PSEG Confidential] [Redacted]. [End PSEG  
12 Confidential]

13 **Q. What are the PSEG projections for future Capacity Revenues?**

14 **A.** In response to ZECJ-FIN-13 (13b), PSEG provided its projections of future capacity  
15 revenues by calendar and energy year as summarized in the two tables below:

16 [Begin PSEG Confidential]

17 [Redacted]  
18 [Redacted]

19 [Redacted]  
20 [Redacted]  
21 [Redacted]

22

1 [Redacted]  
2 [Redacted]

[Redacted]

3  
4  
5 [End PSEG Confidential]

6 For the next five years, the three plants are projected to earn capacity revenues of [Begin  
7 PSEG Confidential] [Redacted] [End PSEG Confidential] on a calendar year basis or  
8 [Begin PSEG Confidential] [Redacted] [End PSEG Confidential] on an energy year  
9 basis. The projected capacity revenues are based on the following capacity prices  
10 provided by PSEG:

11 [Begin PSEG Confidential]

[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

14 [Redacted]  
15 [End PSEG Confidential]

16 For the three energy years that the Applicants are seeking ZEC payments, PSEG assumed  
17 a projected capacity price of [Begin PSEG Confidential] [Redacted] [End PSEG  
18 Confidential]. The capacity price for the 2021/22 Energy Year is the EMAAC clearing

1 price from the last Base Residual Auction (“BRA”) held in May 2018.<sup>16</sup> For Energy Year  
2 2025/2026, the year after the second ZEC eligibility period, PSEG assumes a capacity  
3 price of [Begin PSEG Confidential] [REDACTED] [End PSEG Confidential], an  
4 unexplained increase over the three-year prices.

5 **Q. Are there capacity price proxy values accepted by the Board higher than the**  
6 **estimates provided by PSEG?**

7 A. Yes, in the most recent BGS proceeding (BPU Docket ER20030190), the Board approved  
8 a capacity proxy price for suppliers to incorporate into their bids for the upcoming BGS  
9 auction.<sup>17</sup> The capacity proxy price for the 2022/23 and 2023/24 delivery years for the  
10 ACE, JCPL, and RECO zones are \$152.06/MW-day and \$146.51/MW-day  
11 respectively.<sup>18</sup> I note that PSEG’s estimates for capacity revenues are based on EMAAC  
12 prices, even though the three nuclear units are classified under the PSEG zone. To be  
13 consistent with EMAAC prices, I use the capacity proxy values for the other EDCs,  
14 rather than the PSE&G proxy capacity prices of \$162.13/MW-day and \$166.64/MW-day.  
15 The BGS proxy capacity prices are [Begin PSEG Confidential] [REDACTED]  
16 [REDACTED] [End PSEG Confidential] higher than the PSEG price for the 2022/2023  
17 deliver year, and [Begin PSEG Confidential] [REDACTED] [End  
18 PSEG Confidential] higher than the PSEG price for the 2023/2024 deliver year. I extend  
19 the \$146.51/MW-day BGS proxy capacity price for the 2024/25 delivery year as well.

<sup>16</sup> PJM, 2021/2022 RPM Base Residual Auction Results, available at <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx> (last visited Jan. 27, 2021).

<sup>17</sup> BPU Docket No. EO20030203. Order November 18, 2020. Page 8. Available at [http://www.bgs-auction.com/documents/BPU\\_Order\\_Approving\\_2021\\_Auction\\_Process\\_\(November\\_18\\_2020\).pdf](http://www.bgs-auction.com/documents/BPU_Order_Approving_2021_Auction_Process_(November_18_2020).pdf)

<sup>18</sup> Proposal for Basic Generation Service Requirements to be Procured Effective June 1, 2021. July 1, 2021. Page 12. Available at [http://www.bgs-auction.com/documents/Front\\_Part\\_of\\_Filing\\_01\\_JUL\\_2020\\_\(posted\).pdf](http://www.bgs-auction.com/documents/Front_Part_of_Filing_01_JUL_2020_(posted).pdf)

1 **Q. What are your adjusted capacity revenues when you use the BGS proxy capacity**  
2 **prices?**

3 When I make these adjustments to the capacity price forecast, I arrive at an adjusted  
4 capacity revenue of the three plants that is **[Begin PSEG Confidential]** [REDACTED] **[End**  
5 **PSEG Confidential]** higher than the forecasted capacity revenues provided in the  
6 application for the 2021-2025 period. The table below shows the annual change in  
7 capacity revenues using the BGS proxy capacity price.

8 **[Begin PSEG Confidential]**

9 [REDACTED]  
10 [REDACTED]  
11 [REDACTED]

12 **[End PSEG Confidential]**

13 Thus, in their application, the Applicants appear to understate future capacity revenues by  
14 using a capacity price projection that is even lower than the BGS proxy capacity price  
15 approved for the upcoming BGS auction.

16 **Q. Would you please comment on PSEG’s suggestion that future capacity revenues are**  
17 **at risk due to the FERC MOPR?**

18 **A.** Such risks are minimal, and this assessment is supported by PSEG’s own analysis. PSEG  
19 believes that the three nuclear units will continue to receive capacity revenues with or  
20 without the FERC’s MOPR in place.



1 **Q. Please summarize the FERC's Minimum Offer Price Rule.**

2 A. The MOPR sets price floors below which resources cannot offer capacity into the PJM  
3 Base Residual Auction, which determines capacity prices and obligations in the PJM  
4 capacity market. As originally established, the MOPR was designed to ensure that net  
5 buyers of capacity were not able to use market power to artificially drive down the  
6 capacity prices and distort the market. In December 2019, FERC ordered PJM to extend  
7 the MOPR to all new and existing capacity resources that receive state subsidies,  
8 including and specially referencing the New Jersey nuclear ZECs.<sup>19</sup>

9 **Q. Are the nuclear units subject to the MOPR?**

10 A. Currently, yes. Although the FERC order exempts most existing resources from the  
11 MOPR,<sup>20</sup> the exemptions do not apply to nuclear units. Thus, as long as the nuclear units  
12 receive ZECs, PSEG has indicated that it will be required to bid the avoidable cost rate at  
13 the MOPR floor prices for the three nuclear units.<sup>21</sup>

14 **Q. Is it appropriate for the Board to consider risks related to the MOPR for the  
15 nuclear units?**

16 A. No. Since the MOPR applies only to state-subsidized units, the MOPR will not apply if  
17 the units do not receive ZECs. The purpose of this proceeding is to determine whether the  
18 units require a state subsidy. This determination must be based on the units' profitability  
19 without ZECs (i.e., under circumstances where the MOPR would not create any risk for  
20 the Applicants).

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<sup>19</sup> The FERC's December 19, 2019 Minimum Offer Price Rule (MOPR) Order Docket Nos. EL16-49-000 and EL18-178-000 (Consolidated), Paragraph 8.

<sup>20</sup> For example: existing renewables, demand response, energy efficiency, storage resources, and self-supply resources (owned by vertically integrated utilities).

<sup>21</sup> HC-SSA-004

1 **Q. Will the MOPR affect the nuclear units if they do receive ZECs?**

2 A. This is unlikely. Based on PSEG’s own analysis, it appears highly unlikely that the  
 3 MOPR would cause the units to fail to clear the capacity market, even assuming they  
 4 continue to receive ZECs.

5 **Q. Would you please explain?**

6 A. In March 2020, PJM submitted a compliance filing to FERC describing how it proposed  
 7 to implement FERC’s MOPR order.<sup>22</sup> The filing included illustrative net cost of new  
 8 entry (“Net CONE”) values for each resource type and avoidable cost rates for existing  
 9 units. These values are used as each technology’s floor price under the MOPR.<sup>23</sup> As part  
 10 of its ZEC application, PSEG provided its estimate for the default offer floor price for the  
 11 three units, which is summarized below:

12 *Table 8 Assumed Default Offer Floor Price for Nuclear Units*

	\$/MW-day
Hope Creek	\$68.36
Salem 1	\$74.32
Salem 2	\$74.29

13 Notes  
 14 HC-SSA-0004  
 15 S1-SSA-0004  
 16 S2-SSA-0004

17  
 18 These floor prices are lower than the capacity price forecast, provided by PSEG, of

19 **[Begin PSEG Confidential]** [REDACTED] **[End PSEG Confidential]**.<sup>24</sup> At the PSEG

<sup>22</sup> PJM, *Compliance Filing Concerning the Minimum Offer Price Rule, Request for Waiver of RPM Auction Deadlines, and Request for an Extended Comment Period of at Least 35 Days*. (March 18, 2020)(available at <https://pjm.com/directory/etariff/FercDockets/4443/20200318-er18-1314-003.pdf>).

<sup>23</sup> Whether FERC accepts these offer floors will affect the ability of renewable resources to participate in the RPM, as well as RPM clearing prices.

<sup>24</sup> HC-ZECJ-FIN-14 Parts14andABC-Confidential.xls.

1 projected capacity price, all three units would clear the capacity auction since the PSEG  
2 capacity price is above the default offer floor prices.

3 **Q. Is the Board's consideration of Resource Adequacy pertinent to this docket?**

4 A. Should the Board approve a different capacity mechanism that benefits the three nuclear  
5 plants, the Board's action could further mitigate capacity market uncertainty for the three  
6 nuclear plants. The Board's Resource Adequacy docket is investigating the possibility of  
7 a load serving entity ("LSE") choosing to meet PJM's resource adequacy requirements  
8 through the FRR alternative to PJM's capacity market.<sup>25</sup> If the Board proceeds with an  
9 FRR alternative, then the FRR entity will provide the capacity revenues that otherwise  
10 would have been obtained from the PJM's capacity market. It is likely that a New Jersey  
11 specific FRR would also include the nuclear units.<sup>26</sup>

12 **Q. What should the Board conclude about future capacity revenues?**

13 A. My analysis indicates that the three nuclear units will continue to receive capacity  
14 payments. First, under MOPR, the three nuclear units' avoidable cost rate will continue to  
15 allow the units to clear the capacity auction, and thus receive capacity revenues from the  
16 PJM capacity market. Second, should if the Board rejects the ZEC applications, the units  
17 would not be subject to the MOPR and would presumably not need to bid at the MOPR  
18 default floor price. Finally, if the Board approves a FRR plan to exit the PJM capacity  
19 market, I would anticipate that a FRR plan would include the nuclear units.

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<sup>25</sup> BPU Docket No. EO20030203

<sup>26</sup> PSEG provided an overview presentation of a FRR approach on November 9, 2020. The presentation is available at <https://www.nj.gov/bpu/pdf/ofrp/BPU%20FRR%20Presentation%20Nov092020.pdf>

## 1 **VII. Electric System Modeling Analysis**

2 **Q. Please summarize your findings regarding the electric system modeling analysis**  
3 **provided by the Applicants.**

4 **A.** I find that the limited analysis window of three years constrains the possible options for  
5 generation mix for each retirement case. As a result, the increase in emissions associated  
6 with the retirement of the three nuclear plants is not surprising given the make-up of the  
7 existing generation mix and anticipated new resources. While emissions may rise in the  
8 near term due to nuclear units closing, New Jersey would still be able to meet its  
9 overarching 2050 climate goals.

10 **Q. Please explain the connection between the Energy Master Plan modeling scenarios**  
11 **and the ZEC Application**

12 **A.** The New Jersey Energy Master Plan (“EMP”) modeled six scenarios outlining pathways  
13 for New Jersey to reach the 2050 target of 100% clean energy. In five of the scenarios,  
14 the modeling analysis maintained the three nuclear units through 2050.<sup>27</sup> In one scenario,  
15 Variation 5, the analysis phases the retirement of the three nuclear plants based on the  
16 license expiration for each of the three plants (Salem 1: 2036; Salem 2: 2040; and Hope  
17 Creek: 2046). Accordingly, the EMP modeling then phases out first Salem 1 at 1,170  
18 MW, then Salem 2 at 1,170 MW and finally Hope Creek at 1,309 MW, for a combined  
19 total of 3,649 MW of nameplate capacity.

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<sup>27</sup> The EMP modeling did not address intra-state subsidies such as the ZECs.

1 **Q. Does Variation 5 achieve the State's Clean Energy target by 2050?**

2 **A.** Yes, the modeling results for Variation 5 show that New Jersey can achieve the state's  
3 target with the scheduled retirements of the three nuclear plants.<sup>28</sup> As shown in the EMP,  
4 the state would still be able to achieve its 2050 emissions reduction goals without nuclear  
5 energy as modeled in Variation 5. I note that as part of the application, PSEG retained PA  
6 Consulting to conduct an analysis of the impact of retiring the nuclear plants on  
7 emissions and fuel diversity in New Jersey.<sup>29</sup> The PA Consulting report cites that the  
8 EMP's nuclear retirement scenario is \$8 billion more than the EMP's least cost  
9 scenario.<sup>30</sup> I note that the nuclear retirement scenario only becomes more expensive than  
10 the least cost scenario starting in 2045, due to increased storage and offshore wind  
11 requirements, as shown in Figure Y of the EMP.<sup>31</sup> In fact, the EMP modeling for the  
12 Variation 5 scenario does not incorporate Governor Murphy's announcement to double  
13 the state's offshore wind target from 3,500 MW in 2035 to 7,500 MW by 2035.<sup>32</sup> Thus,  
14 the modeling inputs show 3,548 MW of offshore wind for 2035, not the 7,500 MW  
15 target.<sup>33</sup> Importantly, the difference in offshore wind in 2035 of 3,500 MW is almost  
16 equal to the nameplate capacity of 3,649 MW attributable to the three nuclear plants. The  
17 fact that an EMP modeling scenario that (1) assumes half of the installed offshore wind  
18 capacity target for the state in 2035, and (2) retires the nuclear units, still achieves the

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<sup>28</sup> 2019 New Jersey Energy Master Plan Pathway to 2050. 2020. Page 275. Available at [https://nj.gov/emp/docs/pdf/2020\\_NJBPU\\_EMP.pdf](https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf)

<sup>29</sup> HC-ZECJ-ENV\_0001\_PA – PSEG – Nuclear Retirement Report\_9-25-2020

<sup>30</sup> *Ibid.* page 13

<sup>31</sup> Energy Master Plan. Page 281.

<sup>32</sup> <https://www.nj.gov/governor/news/news/562019/20191119b.shtml>

<sup>33</sup> Evolved Energy Research. New Jersey 2019 IEP Technical Appendix. November 29, 2019. Figure 6: Installed capacity in New Jersey by type and year. Available at [https://nj.gov/emp/pdf/New\\_Jersey\\_2019\\_IEP\\_Technical\\_Appendix.pdf](https://nj.gov/emp/pdf/New_Jersey_2019_IEP_Technical_Appendix.pdf)

1 state's 2050 100% clean energy target goals indicates that the state does have options to  
2 meet its clean energy goals without the nuclear units.

### 3 **VIII. Levitan Report**

4 **Q. Please summarize your findings of the January 19, 2021 Levitan & Associates**  
5 **preliminary reports on ZEC applications.**

6 A. I concur with the report's findings that the energy and capacity revenues for the three  
7 plants are too low and should be adjusted upwards for the same reasons that I have stated  
8 in earlier sections of my testimony. I understand that Rate Counsel Witness Andrea Crane  
9 comments on the cost and risk aspects addressed in the Levitan & Associate preliminary  
10 reports ("Levitan Preliminary Reports") as well.<sup>34</sup>

11 **Q. Are your findings regarding energy price forwards and energy revenues consistent**  
12 **with the Levitan Preliminary Reports.**

13 A. Yes. The Levitan Preliminary Reports use forward energy prices dated December 31,  
14 2020.<sup>35</sup> Footnote 6 of the Salem 2 report indicates that using energy price forwards from  
15 September 28, 2020 would not significantly alter the Levitan and Associates energy  
16 revenues findings.<sup>36</sup> The increase attributable to energy revenues in the Levitan  
17 Preliminary Reports is **[Begin Confidential]** [REDACTED] **[End Confidential]** for the  
18 three energy years versus my findings of **[Begin PSEG Confidential]** [REDACTED]  
19 **[End PSEG Confidential]** when using PSEG's values in response to Staff-PS-0007 and  
20 Staff-PS-0009. I have not had an opportunity to review the detailed calculations used in

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<sup>34</sup> The three Levitan & Associates reports collectively referenced are: (1) *Hope Creek Application Preliminary Report on Eligibility and Finances Confidential Version*, (2) *Salem 1 Application Preliminary Report on Eligibility and Finances Confidential Version*, and (3) *Salem 2 Application Preliminary Report on Eligibility and Finances Confidential Version*.

<sup>35</sup> *Salem 2 Application Preliminary Report on Eligibility and Finances Confidential Version*. Page 2.

<sup>36</sup> *Ibid.* Page 4.

1 the Levitan Preliminary Reports to confirm the increase in energy revenues. My analysis  
2 and the Levitan analysis do show that the energy price forwards have moved upwards,  
3 and that the energy forwards used by the Applicants are too low.

4 **Q. Are your findings regarding capacity prices and capacity revenues consistent with**  
5 **the Levitan Preliminary Reports.**

6 A. Yes, my analysis and the Levitan Preliminary Reports concur that the Applicant's  
7 assumptions for capacity revenue are too low. Where we differ is that the Levitan  
8 Preliminary Reports assume a capacity price of \$170.64/MW-day for a project  
9 connecting to the PSE&G zone from the Board's second offshore wind solicitation  
10 guidance document.<sup>37</sup> I have used the BGS Auction proxy capacity price for the non-  
11 PSE&G zones to represent an EMAAC price. The increase in capacity revenues in the  
12 Levitan Preliminary Reports is **[Begin Confidential]** [REDACTED] **[End Confidential]**  
13 versus my findings of **[Begin PSEG Confidential]** [REDACTED] **[End PSEG**  
14 **Confidential]** I use the EMAAC price since the PSEG reported capacity revenues are  
15 based on EMAAC prices, not the PSE&G zone prices. My analysis and the Levitan  
16 Preliminary Reports use Board approved capacity price proxies from other proceedings  
17 that are higher than the capacity price projection used by the Applicants. As a result, our  
18 analyses provide a capacity revenue projection that is more consistent with the Board's  
19 direction.

20 **Q. What are your recommendations for the Board.**

21 A. For energy revenues, the Board should rely on recent or a time-series of recent energy  
22 price forwards that reflect the upward trends in energy price forwards. The Board should

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<sup>37</sup> Salem 2 Application Preliminary Report on Eligibility and Finances Confidential Version. Page 16.

1 not rely upon the low energy price forwards provided by the Applicants. For capacity  
2 revenues, the Board should rely on capacity price proxies or capacity price projection  
3 used in other proceedings before the Board. Both the BGS proceeding and Offshore Wind  
4 Solicitation capacity price proxies are higher than capacity price proxies used by the  
5 Applicants.

## 6 **IX. Potential Policy Changes on Climate Change**

7 **Q. Please summarize recent changes at the Federal level that may impact the Board's**  
8 **consideration for ZECs in the second eligibility period.**

9 A. On January 20, 2021, President Biden signed two executive orders that will have bearing  
10 in this proceeding. First, President Biden signed an executive order that allows the United  
11 States to re-enter the Paris Climate Accord, committing the United States to join the other  
12 189 nations on a pathway to limit global warming by reducing global carbon emissions to  
13 2 degree Celsius relative to pre-industrial levels.<sup>38</sup> During the campaign, then-candidate  
14 Biden issued a climate change plan that called for the United States' power sector to be  
15 carbon-free by 2035.<sup>39</sup> The plan explicitly states:

16 It would also mean continuing to leverage the carbon-pollution free  
17 energy provided by existing sources like nuclear and hydropower,  
18 while ensuring those facilities meet robust and rigorous standards for  
19 worker, public, environmental safety, and environmental justice.<sup>40</sup>

20 Coupled with the re-entry of the United States into the Paris Climate Accord, it would be  
21 reasonable to assume that the new administration will refocus attention on new and  
22 existing carbon-free generation, including existing nuclear generation, and other carbon-

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<sup>38</sup> <https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/paris-climate-agreement/>

<sup>39</sup> <https://joebiden.com/clean-energy/>

<sup>40</sup> Ibid.



1 mitigation strategies. While the exact timing and nature of federal action on climate  
2 change is not known right now, the Biden administration's executive action could  
3 brighten the economic prospects of the three nuclear units. This would make it potentially  
4 unnecessary for the state to continue to support the nuclear plants in the second ZEC  
5 eligibility period.

6 **Q. How should the Board consider recent federal actions?**

7 A. The Board should consider that federal action on climate change to be forthcoming  
8 during the period of the second ZEC eligibility period. If so, then the Board should retain  
9 the ability to ensure that the nuclear plants are not being doubly compensated for their  
10 avoided carbon emission benefits either through the state ZECs or through some future  
11 federal response to meet the Paris Climate Accord.

12 **X. Alternative ZEC Amount**

13 **Q. Please summarize your analysis of the Social Cost of Carbon analysis.**

14 A. The Social Cost of Carbon ("SCC") is used to monetize the impact of carbon emissions.  
15 The value for the SCC depends on the scope of impact, the discount rate, and the health  
16 and environmental impacts of carbon emissions. Under the ZEC legislation, the ZEC  
17 program is structured to be "significantly less" than the SCC value of the carbon  
18 emissions avoided through the operation of the nuclear plants.<sup>41</sup> The specific language in  
19 the statute reads:

20 The zero emission certificate program set forth in this act is  
21 structured such that its costs are guaranteed to be significantly  
22 less than the social cost of carbon emissions avoided by the

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<sup>41</sup> N.J.S.A. 48:3-87.3 (1)(b)(8)

1 continued operation of selected nuclear power plants, ensuring  
2 that the program does not place an undue financial burden on  
3 retail distribution customers. The social cost of carbon, as  
4 calculated by the U.S. Interagency Working Group on the Social  
5 Cost of Carbon in its August 2016 Technical Update, is an  
6 accepted measure of the cost of carbon emissions.<sup>42</sup>

7 Thus, the SCC value of the avoided carbon emissions may be considered an upper limit  
8 to the ZEC rate. To calculate the SCC value of the avoided emissions, I analyzed the  
9 following pieces of information.

- 10 • For the avoided emissions, I used the incremental in-state carbon emissions taken  
11 from the full retirement and the Hope Creek retirement scenarios from the PA  
12 Consulting report for the three-year modeling period starting on June 1, 2022 through  
13 May 31, 2025.<sup>43</sup>
- 14 • For the SCC, I use a cost of \$46.60 per short ton in 2020 dollars, which is a  
15 conversion of the 2016 U.S. Interagency Working Group on the Social Cost of  
16 Carbon as referenced in the ZEC Act.<sup>44</sup> From the 2016 Working Group document, I  
17 took the 3% average value of \$42/metric ton in 2007 dollars.<sup>45</sup> A more recent SCC  
18 was reported in the 2020 *Social Cost of Carbon* report by the United States  
19 Government Accountability Office, which reports \$50 per metric ton in 2018 dollars  
20 and a 3 percent discount rate.<sup>46</sup> This value results in a SCC value of \$46.51 per short  
21 ton (2020 dollars), which is very similar to the \$46.60/per short ton from the ZEC  
22 legislation.<sup>47</sup>
- 23 • For the projected generation of the three units over the 2022 through 2025 period, I  
24 use information provided by the Applicants.<sup>48</sup>

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<sup>42</sup> Ibid.

<sup>43</sup> ZECJ-ENV-0001

<sup>44</sup> N.J.S.A. 48:3-87.3 (1)(b)(8)

<sup>45</sup> Interagency Working Group on Social Cost of Greenhouse gases, United States Government. *Technical Support Document: - Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis- Under Executive Order 12866*. August 2016. Available at: [https://www.epa.gov/sites/production/files/2016-12/documents/sc\\_co2\\_tsd\\_august\\_2016.pdf](https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf)

<sup>46</sup> US Government Accountability Office. 2020. "Social Cost of Carbon." June. Available at: <https://www.gao.gov/assets/710/707776.pdf>, page 17

<sup>47</sup> *Application for Zero Emissions Certificates of Salem I Nuclear Power Plant*, Docket No. A-003939-18 (Sept. 18, 2019), page 53

<sup>48</sup> HC-GAIO-0007-Unit Generation-Confidential.

1 The resulting analysis in Table 9 shows the steps taken to calculate value of avoided  
2 emissions per megawatt-hour of generation over the second ZEC eligibility period.

3 **[Begin PSEG Confidential]**

4 [Redacted]  
5 [Redacted]

[Redacted]

11 [Redacted]  
12 [Redacted]  
13 [Redacted]  
14 [Redacted]  
15 [Redacted]  
16 [Redacted]  
17 [Redacted]

18 **[End PSEG Confidential]**

19 **Q. What are your recommendations for the Board with regards to the SCC.**

20 A. As noted, I do not recommend that the Board award a ZEC. However, if the Board does  
21 award a ZEC in the second three-year period, I recommend that the Board use the SCC  
22 value of avoided emissions as the upper limit for ZEC payments for the continued  
23 operation of the three nuclear units from 2022 to 2025. My analysis indicates that the in-  
state value of avoided GHG emissions from not retiring the three units is **[Begin PSEG  
Confidential]** [Redacted] **[End PSEG Confidential]** based on the PA Consulting  
report for avoided emissions, the 2016 SCC value, and projected generation from the  
three plants. This translates to a ZEC value of **[Begin PSEG Confidential]** [Redacted]  
**[End PSEG Confidential]** of nuclear generation over the second eligibility period.

1           Should the Board accept the findings of the Levitan Preliminary Reports, those subsidies  
2           that are lower than **[Begin PSEG Confidential]** [REDACTED] **[End PSEG Confidential]**  
3           should be used. For those unit(s) that require subsidies that are higher than the SCC  
4           value, the Board should limit the subsidy to the **[Begin PSEG Confidential]** [REDACTED]  
5           **[End PSEG Confidential]** value.

## 6 **XI. Conclusions and Recommendations**

### 7 **Q. Please summarize your conclusions and recommendations.**

8 A. I find the following conclusions and make the following recommendations.

- 9           • PSEG and Exelon have collected **[Begin PSEG Confidential]** [REDACTED] **[End**  
10           **PSEG Confidential]** from ZEC payments and associated interest for the first ZEC  
11           period. In this proceeding, PSEG and Exelon are seeking an additional \$809 million  
12           from NJ ratepayers. Between the two ZEC eligibility periods, PSEG and Exelon are  
13           seeking **[Begin PSEG Confidential]** [REDACTED] **[End PSEG Confidential]** from  
14           New Jersey Ratepayers.
- 15           • Even if the Board grants ZEC payments to the three plants, PSEG may still shut down  
16           the plants.
- 17           • PSEG's application understates future energy revenues by at least **[Begin PSEG**  
18           **Confidential]** [REDACTED] **[End PSEG Confidential]** over the next five calendar  
19           years for the three plants. On an energy year basis, I find that for the second ZEC  
20           eligibility period starting on June 1, 2022, the September 30<sup>th</sup> energy price forwards  
21           result in an aggregate increase in energy revenues of **[Begin PSEG Confidential]**

- 1           ██████████ [End PSEG Confidential] compared to energy revenues using the May  
2           29<sup>th</sup> energy price forwards.
- 3           • For energy revenues, the Board should rely on recent or a time-series of recent energy  
4           price forwards that reflect the upward trends in energy price forwards. The Board  
5           should not rely upon the low energy price forwards provided by the Applicants.
  - 6           • PSEG’s application understates future capacity revenues by at least [Begin PSEG  
7           Confidential] ██████████ [End PSEG Confidential] million over the next five calendar  
8           years for the three plants with the use of capacity price projections that are too low.
  - 9           • For capacity revenues, the Board should rely on capacity price proxies or capacity  
10          price projection used in other proceedings before the Board. Both the BGS  
11          proceeding and Offshore Wind Solicitation capacity price proxies are higher than  
12          capacity price proxies used by the Applicants.
  - 13          • The Board should not discount the plants’ expected capacity revenues because of  
14          concerns regarding the FERC’s Minimum Offer Price Rule (“MOPR”) because PSEG  
15          assumes that the plants will continue to clear the PJM capacity market under MOPR.  
16          PSEG’s estimates of the default offer floor prices for the three units are below  
17          PSEG’s estimate for future capacity prices. If the Board rejects the ZEC applications,  
18          then MOPR will not apply to the plants.
  - 19          • Combined, PSEG understates total energy and capacity revenues by at least [Begin  
20          PSEG Confidential] ██████████ [End PSEG Confidential] over the next five  
21          calendar years.

- 1           • The New Jersey Energy Master Plan demonstrates that New Jersey can meet its 2050  
2           clean energy target with the orderly retirement of the three nuclear plants in an energy  
3           modeling scenario that only includes New Jersey’s old offshore wind goal of 3,500  
4           MW by 2035 rather than the more current offshore wind commitment of 7,500 MW.<sup>49</sup>
- 5           • The three nuclear units will likely benefit from potential Biden Administration’s  
6           future clean energy policies to meet the United States’ renewed commitment to the  
7           Paris Climate Accords.
- 8           • While I do not think it is necessary for the Board to award ZECs to the three nuclear  
9           units, should the Board decide to award ZECs then the Board should use my social  
10          cost of carbon (“SCC”) calculation of **[Begin PSEG Confidential]** [REDACTED] **[End**  
11          **PSEG Confidential]** as the upper limit to any ZEC award. ZEC awards may be lower  
12          than my SCC value, but should not be higher.

13 **Q. Does this conclude your testimony?**

14 A. Yes, subject to additional information provided by the Applicants and testimony from  
15 other intervenors.

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<sup>49</sup> New Jersey Energy Master Plan. 2020. Page 275. Available at [https://nj.gov/emp/docs/pdf/2020\\_NJBPU\\_EMP.pdf](https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf)

# **ATTACHMENT MPC-1**

## Maximilian Chang, Principal Associate

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Synapse Energy Economics | 485 Massachusetts Avenue, Suite 3 | Cambridge, MA 02139 | 617-453-7027  
mchang@synapse-energy.com

### PROFESSIONAL EXPERIENCE

**Synapse Energy Economics Inc.**, Cambridge, MA. *Principal Associate*, 2013 – present, *Associate*, 2008 – 2013.

Consults and provides analysis of technologies and policies, electric policy modeling, evaluation of air emissions of electricity generation, and other topics including energy efficiency, consumer advocacy, environmental compliance, and technology strategy within the energy industry. Conducts analysis in utility rate-cases focusing on reliability metrics and infrastructure issues and analyzes the benefits and costs of electric and natural gas energy efficiency measures and programs.

**Environmental Health and Engineering**, Newton, MA. *Senior Scientist*, 2001 – 2008.

Managed complex EPA-mandated abatement projects involving polychlorinated biphenyls (PCBs) in building-related materials. Provided green building assessment services for new and existing construction projects. Communicated and interpreted environmental data for clients and building occupants. Initiated and implemented web-based health and safety awareness training system used by laboratories and property management companies.

**The Penobscot Group, Inc.**, Boston, MA. *Analyst*, 1994 – 2000.

Authored investment reports on Real Estate Investment Trusts (REITs) for buy-side research boutique. Advised institutional clients on REIT investment strategies and real estate asset exchanges for public equity transactions. Wrote and edited monthly publications of statistical and graphical comparison of coverage universe.

**Harvard University Extension School**, Cambridge, MA. *Teaching Assistant*, 1995 – 2002.

Teaching Assistant for Environmental Management I and Ocean Environments.

**Brigham and Women's Hospital**, Boston, MA. *Cancer Laboratory Technician*, 1992 – 1994.

Studied the biological mechanism of tumor eradication in mouse and human models. Organized and performed immunotherapy experiments for experimental cancer therapy. Analyzed and authored results in peer-reviewed scientific journals.

### EDUCATION

**Harvard University**, Cambridge, MA  
Master of Science in Environmental Science and  
Engineering, 2000

**Cornell University**, Ithaca, NY  
Bachelor of Arts in Biology and Classics, 1992



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**New Jersey Board of Public Utilities (Docket No. EO18070728):** Direct testimony on Jersey Central Power and Light Company's petition for an Infrastructure Investment Program. On behalf of the New Jersey Division of Rate Counsel. December 17, 2018.

**New Jersey Board of Public Utilities (Docket No. EO18020196):** Direct testimony on Atlantic City Electric Company's petition for an Infrastructure Investment Program. On behalf of the New Jersey Division of Rate Counsel. September 4, 2018.

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**Illinois Commerce Commission (Docket No. 18-0211):** Direct Testimony regarding Ameren Illinois Company's voltage optimization plan and the importance of prioritizing low-income communities. On behalf of the People of the State of Illinois, represented by the Office of the Illinois Attorney General. March 7, 2018.

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**Maryland Public Service Commission (Docket No. 9418):** Direct testimony on Potomac Electric Power Company's application for a rate adjustment to recover smart grid costs. On behalf of Maryland Office of People's Counsel. July 6, 2016.

**Illinois Commerce Commission (Docket No. 16-0259):** Direct and rebuttal testimony on Commonwealth Edison Company's annual formula rate update and revenue requirement reconciliation on distribution and business intelligence investments. On behalf of the Office of Illinois Attorney General. June 29, 2016 and August 11, 2016.

**Illinois Property Tax Appeal Board (Case Nos. 12-02297, 12-01248)** Direct testimony on history of nuclear deregulation in Illinois and the impact of deregulation on Exelon nuclear units. On behalf of Byron Community School District. April 2016.

**Maryland Public Service Commission (Docket No. 9406):** Direct testimony on Baltimore Gas and Electric Company's application for a rate adjustment to recover smart grid costs. On behalf of Maryland Office of People's Counsel. February 8, 2016.

**New Jersey Board of Public Utilities (Docket No. ER14030250):** Direct testimony on Rockland Electric Company's petition for investments in storm hardening measures. On behalf of the New Jersey Division of Rate Counsel. September 4, 2015.

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**State of New Jersey Board of Public Utilities (Docket No. EM14060581):** Direct testimony on the reliability commitments filed by Exelon Corporation and Pepco Holdings, Inc. in their joint petition for the merger of the two entities. On behalf of the New Jersey Division of Rate Counsel. November 14, 2014.

**District of Columbia Public Service Commission (Formal Case No. 1119):** Direct and answer testimony on the reliability, risk, and environmental impacts of the proposed Exelon-Pepco merger. On behalf of the District of Columbia Government. November 3, 2014 and March 20, 2015.

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*Resume updated April 2020*