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Secretary of the Board of Public Utilities
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Attn: Aida Camacho-Welch
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Subject: Comments on NJBPU ZEC Proceedings

My name is Toby Hanna. I am a Partner at ERM, a global environmental consulting firm, where I lead ERM's Air Quality and Climate Change practice. I am submitting comments today to provide my endorsement that retaining nuclear generation of electricity is one of the most significant and economical options for avoiding greenhouse gas emissions available at present. These written comments supplement my testimony at the September 4, 2019 NJBPU - ZEC- Stakeholder Meeting in New Brunswick, New Jersey.

As a licensed professional engineer helping companies manage air pollutant and greenhouse emissions for nearly 30 years, and a member of the New Jersey Clean Air Council since 2005, I recognize the necessity of balancing economic and technical feasibility when considering emission reduction choices. If a pathway to lower emissions is technically viable, but not affordable, it cannot be implemented in a sustainable manner.

The tool that is commonly used to evaluate this balance of technical versus economic feasibility is a simple cost-benefit analysis. There are a number of benefits associated with the preservation of New Jersey's nuclear reactors: affordable energy, jobs, better air quality and lower greenhouse gas (or carbon) emissions. My comments are specific to the carbon benefit: preventing the increased carbon emissions that would result from decommissioning New Jersey's nuclear fleet.

More and more studies are documenting the enormous costs associated with a changing climate that is caused in part by rising carbon or greenhouse gas emissions. A recent study by the National Resources Defense Council and the University of California analyzed 10 climate-sensitive events from 2012 and estimated that health-related costs across the country totaled $10 billion (in 2018 dollars).[1] Those costs resulted from about 900 deaths, 21,000 hospitalizations and 18,000 emergency-room visits. Hurricane Sandy, the super storm that devastated New Jersey and New York, resulted in 273 deaths and $3.1 billion in health care costs, alone, the study said. This study was only evaluating the health impacts. Costs from property damage, crop damage, infrastructure damage and business disruption make the overall cost significantly higher.

If we look at benchmarks for acceptable cost benefit values for carbon mitigation options, we will find values backed by credible scientific and accounting principles that range from $23 to $175 per metric ton of carbon dioxide equivalents (CO2e) for the 2020 to 2030 timeframe. These cost benefit figures are commonly known as the "social cost of carbon." They represent the value to society of avoiding the adverse impacts associated with higher levels of CO2e in the atmosphere which largely relate to climate change. Based on research that ERM conducted in 2019 we found the following benchmarks for valuing carbon emission reductions or avoidance.

[1] *See* https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019GH000202

- The average cost of greenhouse gas allowances in active carbon cap and trade programs across the world is $23 per metric ton of CO2e.
- International development banks, such as The World Bank, apply carbon prices when they approve financing for large capital and infrastructure projects in developing countries. ERM's research documented that these banks are currently using carbon prices ranging from $36 to $100 per metric ton of CO2e for their investment decisions.
- Global corporations also incorporate the cost of carbon into their investment decisions. ERM's research documented that these "shadow prices" of carbon can be as high as $175 per metric ton of CO2e for some companies.

The study performed by the United States Interagency Working Group on the Social Cost of Carbon, expressly identified in ZEC Act findings as support for the law, for 2020, calculated an average value for the social cost of carbon as $59.75 per metric ton of carbon.[2] Moreover, a study released by the United Nations a few days ago states that "There *is limited evidence*, but *high agreement* that present costs of carbon are clearly underestimated."[3] The report indicates that, with consideration of "multiple interacting tipping points," the social cost of carbon should be $116 per ton of CO_2.[4]

As a coastal state, located in the northeastern United States, New Jersey could be particularly susceptible to the impacts of climate change and associated rise in sea levels that could occur, thereby justifying a higher social cost of carbon for investment decisions related to New Jersey. Historical climate data indicate that New Jersey and Rhode Island are the fastest warming states in the lower 48 United States. In those two states, temperature rise in many counties already exceeds the 2015 Paris Accord's 2 degrees Celsius goal for temperature rise since pre-industrial periods. These counties have experienced temperature increases that are double the global average temperature rise of approximately 1 decree Celsius.

Warming has cost impacts. Warmer winters mean that lakes do not freeze as often, snow melts more quickly, and insects and pests do not die off in the winter as they should. Ecosystems change, causing public health impacts that require adaptive measures that introduce new costs to New Jersey residents. Warmer summers result in increased air pollution as more ozone and particulate forms in the lower atmosphere due to higher temperatures. New Jersey has improved air pollution, which is almost down to healthy levels, but New Jersey has exhausted nearly all of its options for further improvements in ozone and particulate air pollution. Any worsening of ozone and particulate air pollution, caused by higher summer temperatures, will be very difficult (expensive) to reverse. The temperature rise also results in warmer water bodies, creating unhealthy situations like this year's Lake Hopatcong blue-green algae bloom that caused health concerns, swimming bans and local business impacts.

Sea level rise and stronger coastal storms caused by changing climate conditions is also a bigger threat for New Jersey than for other locations in the United States. Land subsidence and heavy coastal development put the costs and risks associated with coastal flooding well above national averages. These greater New Jersey-specific risks and their associated costs to society mean that New Jersey stands to benefit from carbon emission avoidance more than most other areas around the world. In other words, New Jersey warrants a higher social cost of carbon.

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[2] *See* Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, August 2016 , p. 4 Table ES-1 (https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf)

[3] "The Ocean and Cryosphere in a Changing Climate," Intergovernmental Panel On Climate Change, September 24, 2019, p. 6-54 (https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_FullReport.pdf).

[4] *Id.*

In the case of New Jersey's nuclear electricity generation fleet, which presently consists of PSEG's three nuclear reactors, we can calculate a cost of carbon by assuming that all of the $0.004/kWh ZEC goes solely to avoiding the carbon associated with 1 kWh of consumption. Note that this entails the conservative assumption that no other added benefits result from that ZEC, when arguably other incremental benefits such as, avoidance of other air pollutants, reliable/resilient energy, overall lower cost for energy, and the retention of high quality jobs are also funded by each ZEC. Discounting for those benefits when calculating the cost of avoided carbon would reduce the cost of avoided carbon associated with the ZEC program to a lower level, but to simplify the analysis we can put aside that discount. The total amount of ZEC payments to the nuclear plants is expected to be approximately $300M/yr. From the analysis provided with PSEG's original ZEC application, the total expected carbon avoided by continued operation of New Jersey's three nuclear reactors would be about 15 million metric tons of carbon dioxide equivalent (MMT) per year. $300M divided by 15 MMT equals $20 per metric ton of carbon avoided. Even with the conservative assumption that all of the ZEC cost goes solely to preventing increased carbon emissions, this is far below the documented social cost of carbon values in the most widely accepted scientific studies, and well below the higher social cost of carbon that New Jersey investments warrant due to the higher risks and costs that climate change poses for the State.

In comparison, according to the PJM Market Monitor, in 2018, the social cost of carbon implied by the Renewable Energy Credit prices paid to solar power in New Jersey was $439 per metric ton of carbon. Further, depending on realized energy and capacity prices, the social cost of carbon implied by the support amount that will be paid to New Jersey's Ocean Wind offshore wind project is expected to be approximately $120 per metric ton of carbon. Accordingly, the implied social cost of carbon associated with $0.004/kWh charge under the ZEC Act is substantially more cost-effective in providing carbon free electricity to New Jersey consumers than the New Jersey programs designed to support solar and offshore wind generation.

This concludes my comments. Please feel free to contact me if you have any questions.

Sincerely,

William M. Hanna, P. E.
Partner