

Before the New Jersey Senate Environment and Energy Committee and the
Assembly Telecommunications and Utilities Committee

Testimony Regarding
A5330 and S3560

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Good morning. My name is Brett Rampal, and I represent the Clean Air Task Force, or CATF. CATF is a non-profit environmental organization¹ founded in 1996 to advocate for policies to fight air pollution and climate change. We have worked closely for two decades with leading environmental groups in New Jersey and other states to promote state and federal policies to curb harmful air emissions from power plants.

Thank you for the opportunity to testify today regarding A5330 and S3560, legislation that would enable New Jersey's existing nuclear plants to continue to operate in the face of competition from carbon-emitting fossil fuel plants.

Today, I will focus on the role that New Jersey's power plants play in avoiding carbon emissions and climate change, and why it is appropriate to enact policies to keep them operating in the coming decade.

Let's start with this fact: the world's climate, and New Jersey's, is changing rapidly. Superstorm Sandy, and this Fall's tropical storms Harvey and Irma, are examples of the kind of intensified weather events we can expect from our warming of the oceans. Global warming has increased the probability and severity of extremely hot and wet weather worldwide.² At present rates of change, half the world's population can expect, by 2030, to experience much different climates than we experienced in the late 20th century.³

While political debate continues, there is a broad scientific consensus that these climatic changes are driven by the heating of Earth's atmosphere from carbon dioxide released by the burning of fossil fuels: oil, gas and coal.⁴ If we are going to limit extreme climate change, we need to make every effort to utilize every non-fossil energy source we have today. And timing matters.

Every molecule of carbon dioxide put in the atmosphere today will continue to warm the earth for centuries. Every molecule we emit today matters - essentially forever. And because carbon simply accumulates in the atmosphere, accelerating warming, the only way to avoid the worst climate change scenarios is to avoid emitting carbon altogether. We need a zero carbon energy system by 2050 or soon after and maximum feasible reductions possible until then.⁵

Figure 1 illustrates this point. Consider the atmosphere as a bathtub. We are filling it quickly with carbon, approaching the spillover limit at which the atmosphere changes in ways that may alter Earth's climate beyond human experience – a limit generally reckoned to be two degrees Celsius increase above pre-industrial levels; this temperature correlates to about 450 parts per million of

¹ See www.catf.us. CATF is financed entirely by charitable donations, and receives no funds from private sector companies or the U.S. government.

² See Trenberth, Kevin E., John T. Fasullo, and Theodore G. Shepherd. "Attribution of climate extreme events." *Nature Climate Change* 5.8 (2015): 725-730.

³ See Diffenbaugh, Noah S., et al. "Quantifying the influence of global warming on unprecedented extreme climate events." *Proceedings of the National Academy of Sciences* 114.19 (2017): 4881-4886.

⁴ See Intergovernmental Panel on Climate Change, *Understanding and Attributing Climate Change* (2007), http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspm-understanding-and.html

⁵ See Rockström, Johan, et al. "A roadmap for rapid decarbonization." *Science* 355.6331 (2017): 1269-1271.

carbon dioxide in the atmosphere (we are at roughly 400 parts per million today). There is some draining of carbon through uptake in trees and the oceans, but it is occurring at a far slower rate than we are putting carbon in. There is even some evidence that these “sinks” are becoming saturated and therefore the drain is becoming smaller or non-existent.⁶

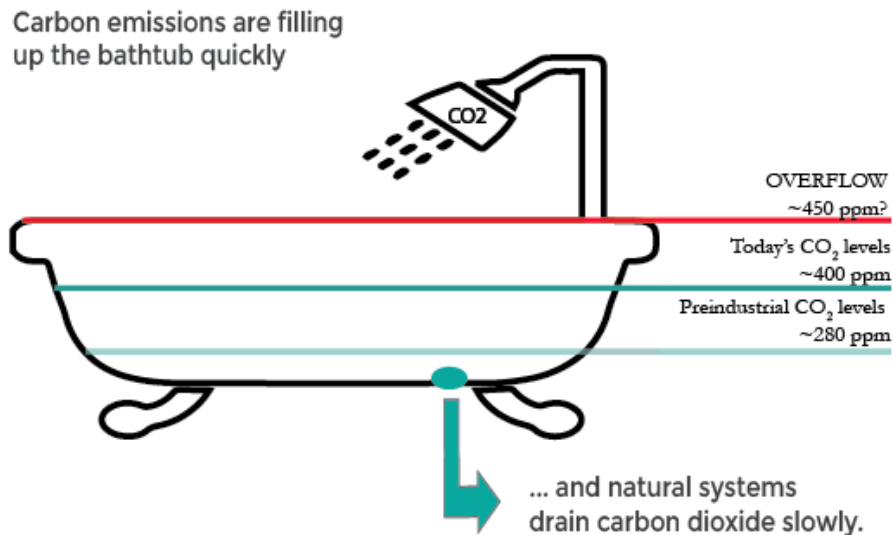


Figure 1: Carbon accumulates and disappears very slowly. Illustration source: Center for Carbon Removal.

The consequence is that to stabilize atmospheric temperature at 2 degrees Celsius above pre-industrial levels, we will need to effectively cut off the spigot, and limit our emissions during this century to no more than 1 trillion additional tons of carbon, as illustrated in Figure 2 below. The lesson: ***we must avoid any emissions we can today to have any hope of stabilizing the planet's climate.***

⁶ See, e.g. Baccini, A., et al. "Tropical forests are a net carbon source based on aboveground measurements of gain and loss." *Science* 358.6360 (2017): 230-234.

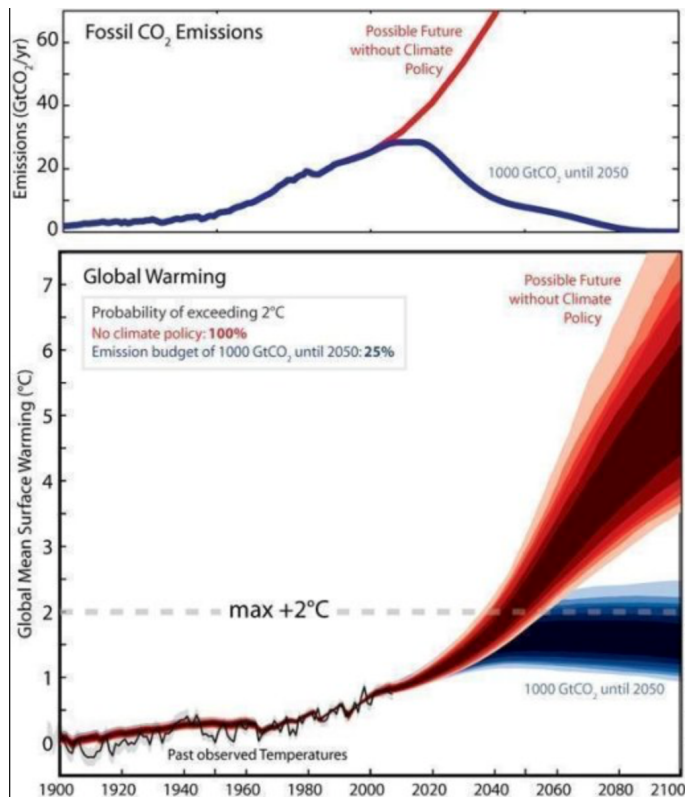


Figure 2: The century's “carbon budget” of 1 trillion tons: the bathtub only has so much space. Illustration source: Science Daily.

What does this have to do with New Jersey's nuclear plants? A lot.

Electricity production is the single largest industrial source of carbon dioxide emissions in New Jersey and the world. And, fortunately, today, about 40% of New Jersey's electricity comes from a carbon dioxide-free source: nuclear power. That put New Jersey among the top three states in zero-carbon electricity share among those that lack large hydroelectric dams. Turning these plants off prematurely would substantially accelerate rather than slow the rate at which the atmospheric bathtub is filling with carbon.

Looking ahead, we can envision a future in which nuclear energy in New Jersey is joined at scale by other zero carbon electric sources such as wind, solar, and carbon capture and storage. But that will take time. Today, wind and solar account for about 5 percent of the state's electricity mix. They can and should be expanded, but this cannot be done overnight.

Consider that, just to **replace** the electricity output of the Hope Creek and Salem nuclear plants with other carbon-free electricity, and not even lower emissions from today, New Jersey would need to site and operate 10 of the largest offshore windfarms operating in the world today, or 10 inshore windfarms equal in size to California's largest onshore wind farms. (See Figure 3 below). (It is worth noting that America's only offshore wind farm operating today, off Rhode Island, would produce less than 1 percent of the electricity as the Salem plant). Or the state would need to increase solar energy output by 15 times present levels, which took more than two decades to reach. And, on top of that, to provide electric reliability from those sources equivalent to Salem and Hope Creek would

require billions of dollars of storage or other balancing energy sources. There will be substantial siting, financial and other challenges to achieving this level of wind and solar buildout, lasting a decade or more.

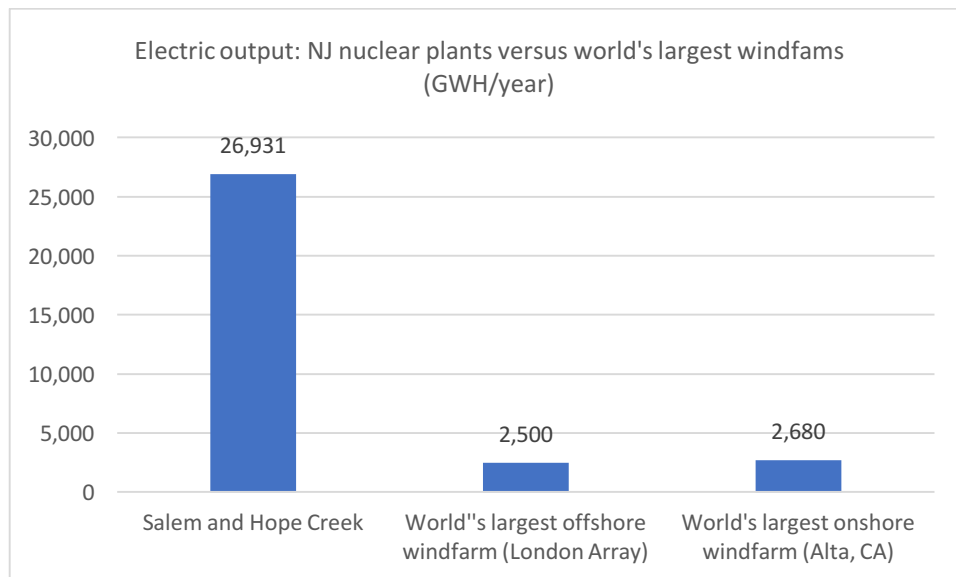


Figure 3: NJ plant output compared to world's largest windfarms

And, again, all of that that would be just hold New Jersey's carbon dioxide emissions to current levels. It would not decrease them dramatically towards zero, as we need to. Meanwhile, as this lengthy buildout occurs, without New Jersey's nuclear plants, carbon dioxide will pour into the atmosphere from gas and coal plants that replace them.

The magnitude of this problem can be seen in Figure 4. Governor-elect Murphy has indicated his intent⁷ to have New Jersey join the Regional Greenhouse Gas Initiative (RGGI), a regional compact that today includes the six New England states plus New York, Maryland and Delaware. RGGI is committed to a relatively modest 10% reduction in CO2 emissions by 2020 from present levels. But retiring Salem and Hope Creek, and optimistically replacing them only with gas fired energy and no coal, regional emissions would grow by about 11 million tons annually. This increase **from New Jersey plant retirements** will substantially increase the difficulty of **meeting the entire regional 2020 cap**, even if the regional cap baseline is adjusted to incorporate the state's current CO2 emissions.

⁷ See <https://www.murphy4nj.com/issues/protecting-the-environment/>

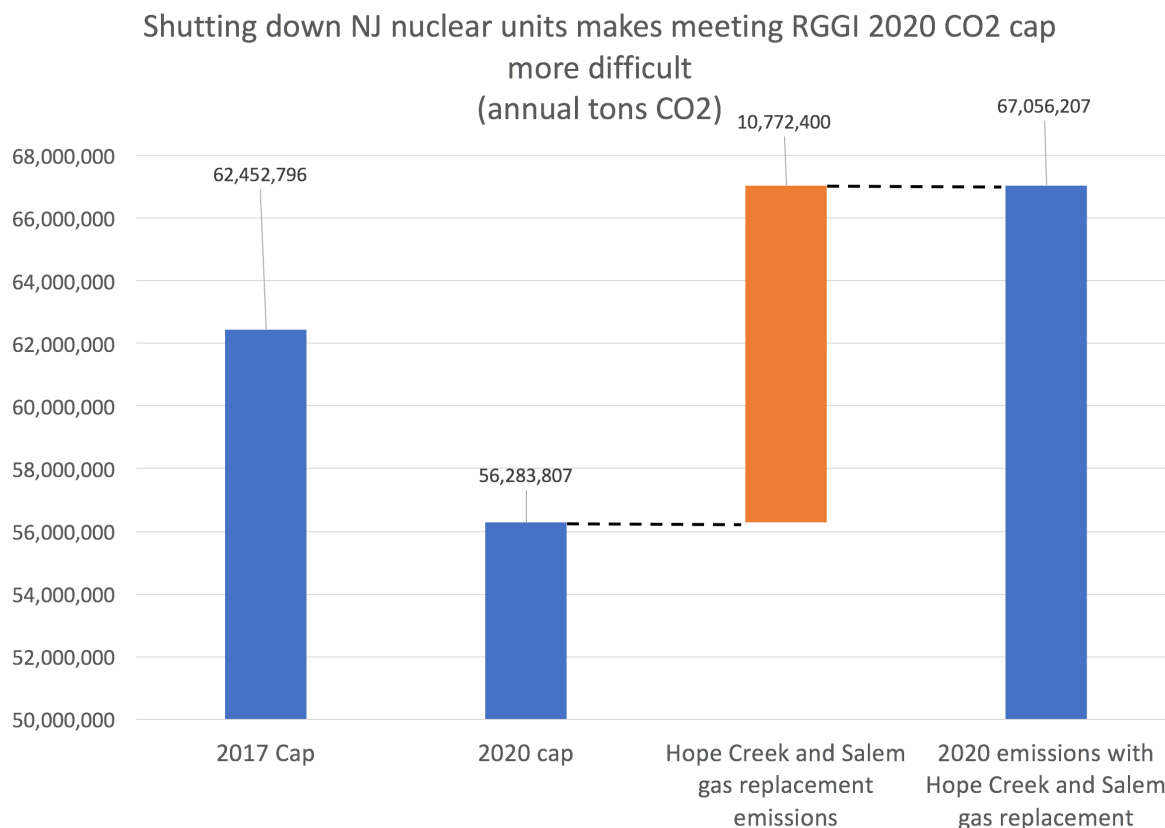


Figure 4: Consequences of turning off New Jersey nuclear plants to achieving CO2 emission caps under the Regional Greenhouse Gas Initiative. Source of figure: CATF, using cap data from RGGI, <https://www.rggi.org/design/overview/cap> and calculations on NJ nuclear output from FERC filings. It is assumed here that gas power plants replace lost nuclear output at an emissions rate of .4 tons CO2 per/MWH.

Looking toward 2050, many considerations will drive which mix of technologies can best eliminate carbon from electricity in New Jersey. Wind and solar are, as noted, coming down in price but face many challenges at very high levels of penetration, including the need for some form of on-demand back-up power for the weeks and months when wind and sun are scarce in the Garden State (today's batteries, even at zero cost, won't do the job because they can only store a day's worth of energy at best). Technologies that use gas with no carbon dioxide emissions are being demonstrated today and could well be part of the solution.⁸ And advanced nuclear plants that depart radically from today's designs and can be manufactured at lower cost are on the horizon.⁹

⁸ See <http://www.sciencemag.org/news/2017/05/goodbye-smokestacks-startup-invents-zero-emission-fossil-fuel-power>

⁹ See Clean Air Task Force, *Advanced Nuclear Energy: Need, Characteristics, Projected Costs and Opportunities*, http://www.catf.us/resources/publications/files/Advanced_Nuclear_Energy.pdf; and Energy Innovation Reform Project, *What Will Advanced Nuclear Power Plants Cost?* (July 2017), <http://innovationreform.org/wp-content/uploads/2017/07/Advanced-Nuclear-Reactors-Cost-Study.pdf>

While maintaining New Jersey's nuclear power capability may require a transitional subsidy,¹⁰ that is true of nearly all zero carbon energy sources today, which must all compete against cheap natural gas power. The proposed legislation would provide a subsidy of approximately \$10/MWH, which is substantially less than current effective state and federal subsidies for wind and solar. The federal wind production tax credit alone is \$24/MWH, or roughly two and a half times the value of the Nuclear Diversity Credit proposed in this legislation.

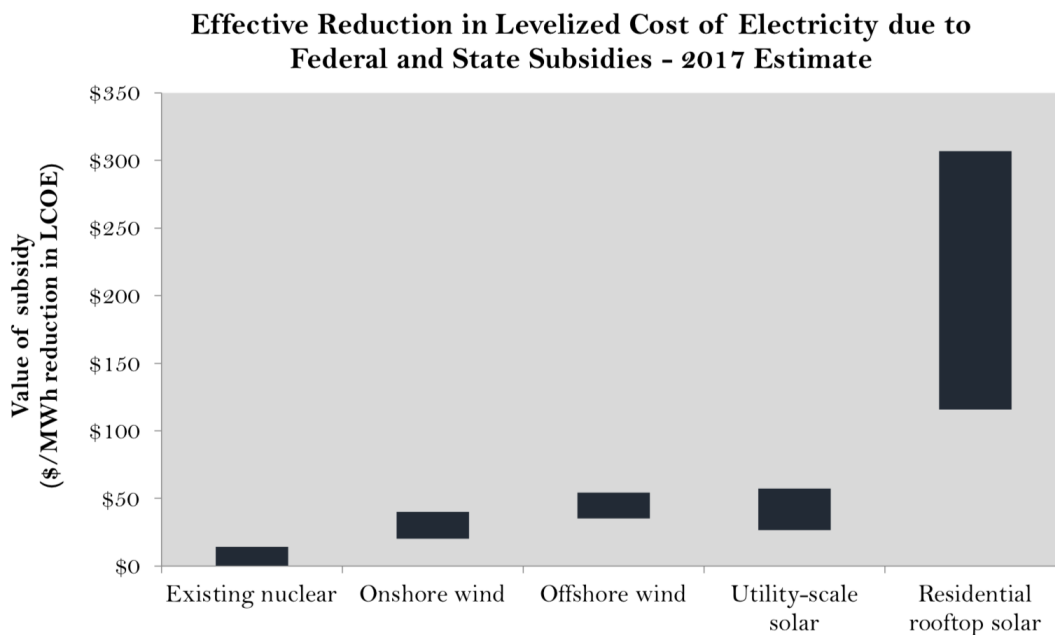


Figure 4 (above): Effective subsidies for nuclear in recent NY and Illinois policies compared with state and federal subsidies for renewable power. Source: CATF calculations, from publicly available data.

A first best policy would be to enact legislation to support not only New Jersey's existing nuclear plants, but other zero carbon sources as well. But that is not the legislation before you today. As New Jersey pursues its low carbon energy future, keeping Hope Creek and Salem online and avoiding millions of tons of annual carbon emissions is a relatively low cost interim and time-limited step to avoid making the serious climate problem worse.

Thank you for your attention, and I look forward to answering your questions.

¹⁰ CATF does not take a position as to whether Salem and Hope Creek actually require a subsidy to continue to operate. That question is to be addressed by the BPU if this legislation is enacted.