



Before the State of New Jersey
Senate Budget and Appropriations Committee and the Assembly Telecommunications and Utilities
Committee

Testimony Regarding S.877/A. 2850

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My name is Armond Cohen and I am Executive Director of 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 submit this testimony today regarding SB 877/A 2850, 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, and that would promote other forms of zero-carbon energy.

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 in principle appropriate to enact policies to keep them operating in the coming decade. (I will not address the non-nuclear portions of the bill, other than to say that we think it is important to advance all feasible measures to increase low carbon energy, for reasons stated below).

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

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/spmsspmp-understanding-and.html

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

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 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

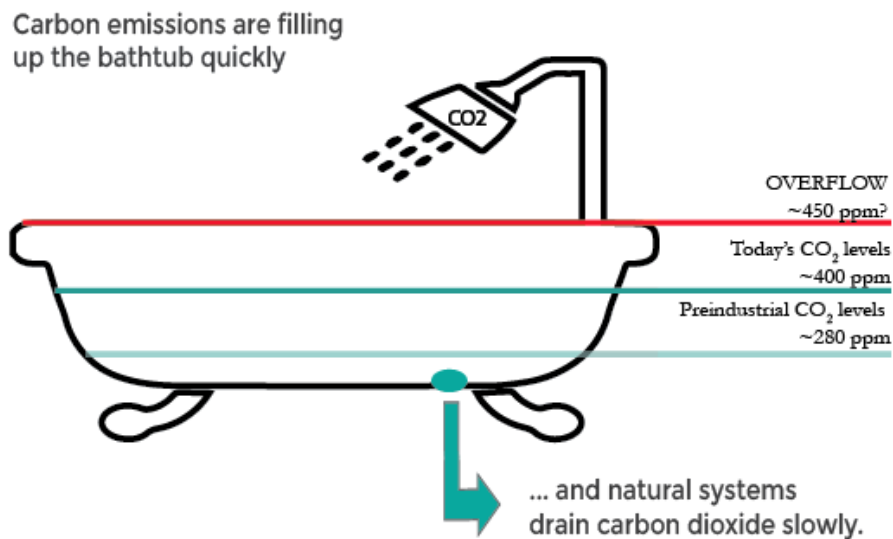


Figure 1: Carbon accumulates and disappears very slowly. Illustration source: Center for Carbon Removal.

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.

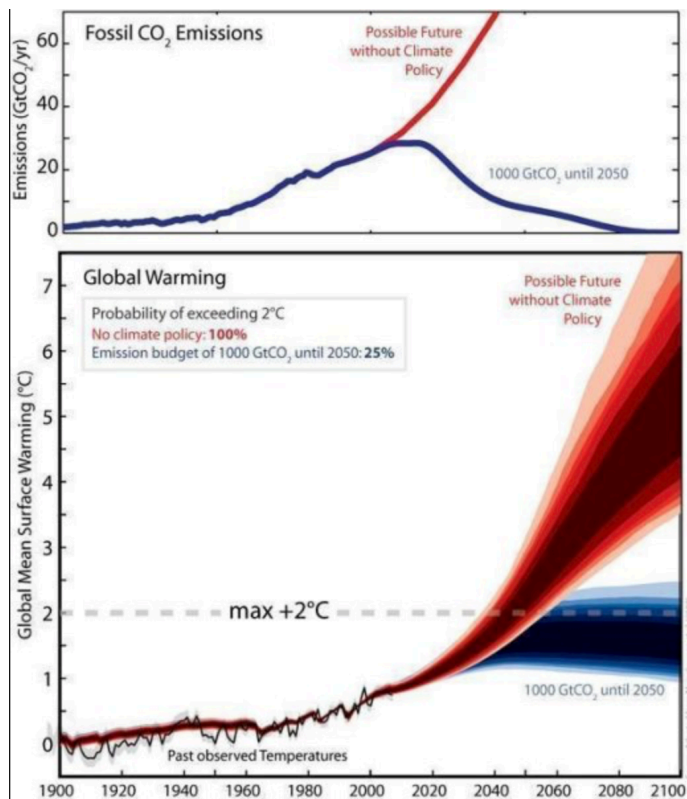


Figure 2: The century's “carbon budget” of 1 trillion tons: the bathtub only has so much space. Illustration source: Science Daily.

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, and in fact the present legislation contains very ambitious targets to do so, 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.

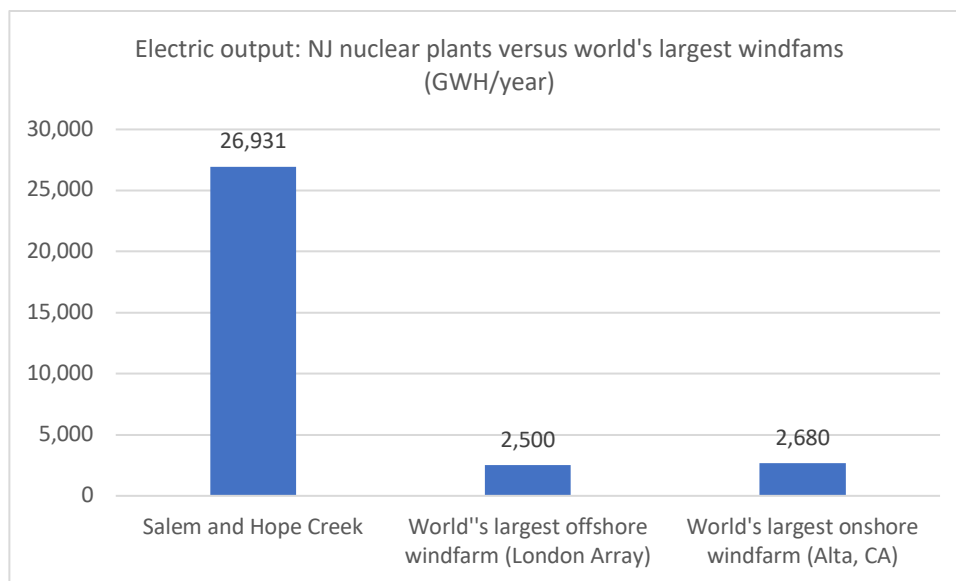


Figure 3: NJ plant output compared to world's largest windfarms

And, again, all of that effort would be to 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. New Jersey has recently joined 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 alone* 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.

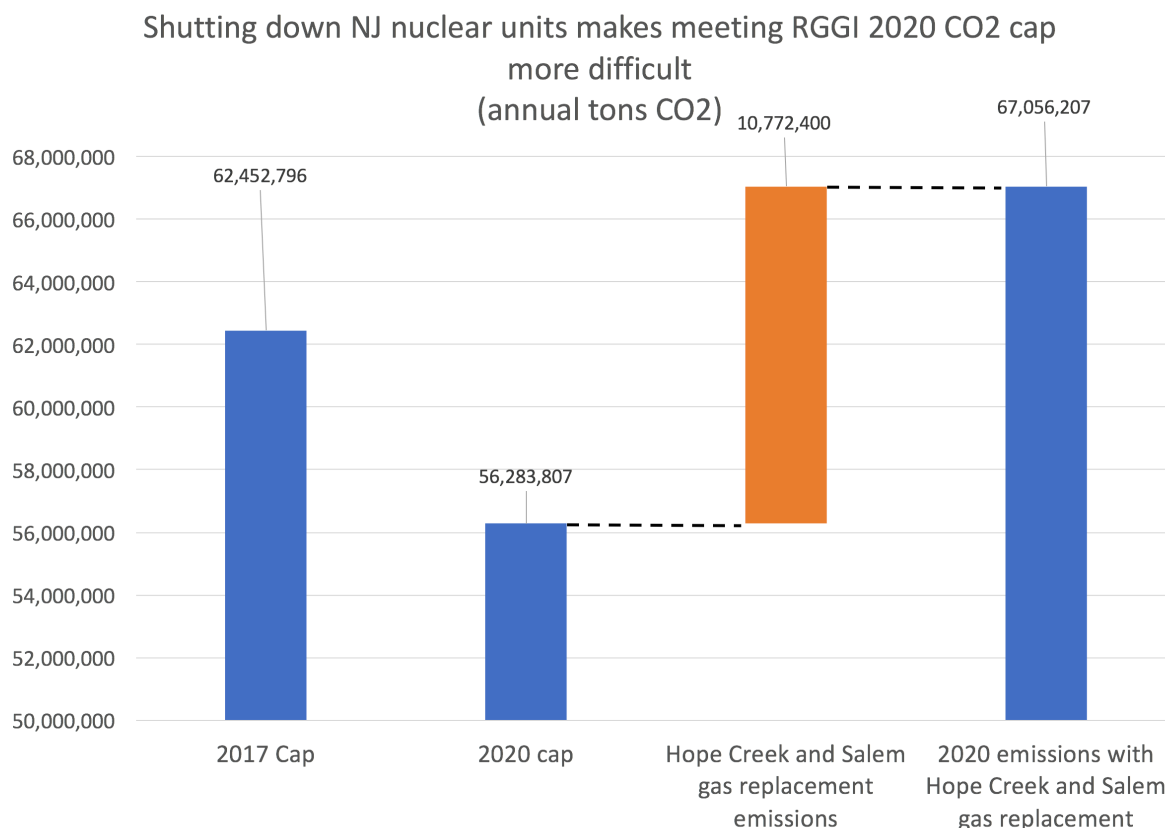


Figure 4: Consequences of turning off New Jersey nuclear plants to achieving CO2 emission caps under the Regional Greenhouse Gas Initiative. Source of figure: CATF, using cap data from RGGI, <https://www.rggi.org/design/overview/cap> and calculations on NJ nuclear output from FERC filings. It is assumed 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 beyond the 50% renewables mandate contained in the present bill. 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.⁷ And advanced nuclear plants that depart radically from today's designs and can be manufactured at lower cost are on the horizon.⁸

But the best approach for the transition, is the one taken in the present bill – maintaining the existing nuclear power base, and building on top of it with renewable energy, rather than replacing

⁷ See <http://www.sciencemag.org/news/2017/05/goodbye-smokestacks-startup-invents-zero-emission-fossil-fuel-power>

⁸ 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>

nuclear. If that can be accomplished, by 2030, New Jersey would have one of the lowest carbon electric systems in the nation – with 90% carbon-free power.

While maintaining New Jersey’s nuclear power capability may require a transitional subsidy,⁹ 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 to the state’s nuclear plants, 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 credit proposed in this legislation.

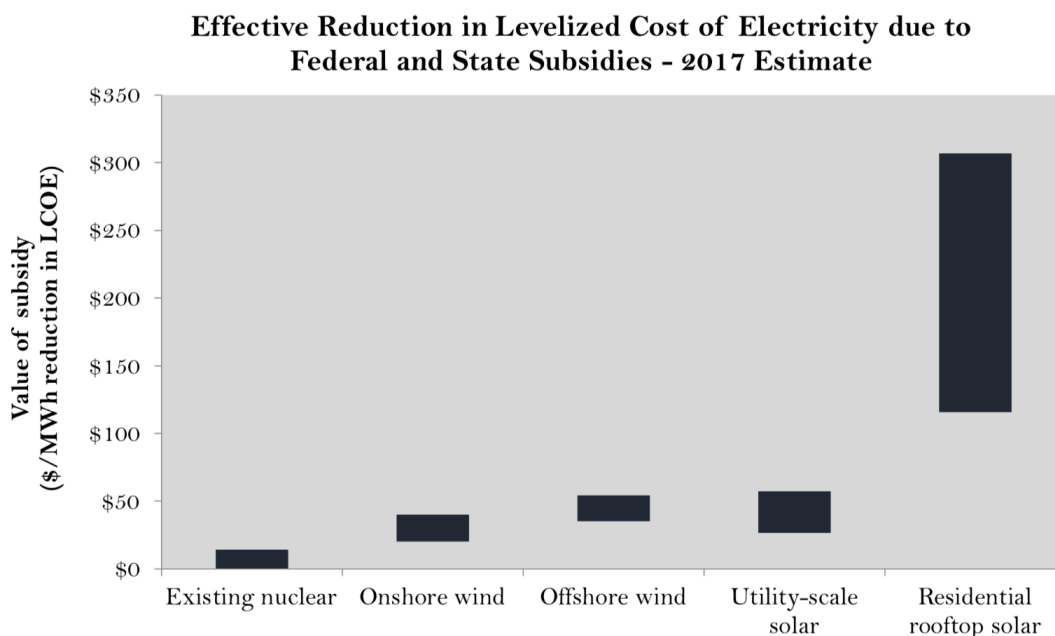


Figure 4 (above): Effective subsidies for nuclear in recent NY and Illinois policies compared with state and federal subsidies for renewable power. Source: CATF calculations, from publicly available data.

In the end, it’s pretty simple. Over the next two decades, every molecule of carbon will matter. Whatever one’s view of the state’s ideal energy mix in 2050, one thing is clear: at least during the transition,¹⁰ New Jersey should find a way to maintain its biggest existing climate protection asset-- nuclear energy.

⁹ 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. CATF believes it would be sound policy also to allow for Rate Counsel and other stakeholders to review the relevant supporting information under appropriate nondisclosure agreements.

¹⁰ Given the dynamic nature of current technology and markets, CATF suggests that the legislature consider a ten-year sunset provision for the present legislation.