



Nuclear Information and Resource Service

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**Testimony of the Nuclear Information and Resource Service
Before the Connecticut General Assembly - Energy and Technology Committee**

**Public Hearing on Proposed S.B. No. 106
An Act Concerning Zero-Carbon Electric Generating Facilities and Achieving
Connecticut's Greenhouse Gas Emissions Mandated Levels**

Thank you for providing the public with an opportunity to be heard on proposed Senate Bill No. 106, and for accepting the testimony of Nuclear Information & Resource Service (NIRS) on it. NIRS is a national, nonprofit environmental organization, with 500 members in Connecticut. We are headquartered in Takoma Park, Maryland, and were founded in 1978 to provide the public and state and local communities with independent, non-partisan, scientifically and technically accurate information on nuclear power, radioactive waste, and sustainable energy, and it is in that spirit we offer our testimony today.

As NIRS's Executive Director and the preparer of these comments, I have over eighteen years experience monitoring the energy and utility sectors, with a particular focus on the U.S. nuclear industry, merchant nuclear power generation, and utility restructuring. I have monitored the Millstone nuclear power station in Connecticut throughout that time, including Dominion's purchase of the plant from Northeast Utilities in 2000. Most recently, over the last three years, I have also monitored a variety of state-level and national proposals to provide subsidies to merchant nuclear power generators.

While the precise measures by which SB 106 would address Connecticut's generation portfolio and emissions of greenhouse gas emissions are as yet unclear, the Honorable Senator Formica and others have been quoted in numerous media reports stating that the intent is specifically to provide Millstone's owner, Dominion, with the ability to enter into power purchase contracts with Connecticut utilities, namely Eversource and United Illuminating.

Status of State Nuclear Subsidy Proposals

We encourage the committee to take a broad view of state energy planning and policy, rather than adopt measures that could direct the state to put its eggs in the wrong basket. Connecticut's economic and environmental goals are far more important than the fate of any one power generator. In addition, Connecticut is not the only state considering measures to create incentives and financial supports for aging nuclear power plants. At least three other states have entertained such proposals since 2014, with widely varying results:

- In Ohio, a proposal to provide subsidized power contracts were challenged before the utility commission and the Federal Energy Regulatory Commission (FERC) before being abandoned in 2016.

- In New York, a temporary subsidy for the Ginna Nuclear Power Plant was shortened from 3.5 years to two years, in favor of more affordable transmission system upgrades. A long-term, expensive nuclear subsidy program for Ginna and three other reactors was then adopted in August 2016, to be implemented beginning in April 2017.
- In Illinois, legislation to subsidize unprofitable reactors failed through two legislative sessions, before a compromise bill was enacted late last year; the latter included a subsidy for two nuclear power plants, based on the structure of the New York program, but with greater cost controls.

Neither the New York nor Illinois subsidies have been fully implemented to date, and both are subject to legal and regulatory challenges that will not be resolved for several months.

The New York Subsidy Model

In New York, the state started a proceeding last year to create a nuclear subsidy program similar to that being contemplated by the General Assembly. The New York Public Service Commission initially estimated that the program would only cost \$58-\$650 million in subsidies over the first seven years, with a similar intent to that which appears to undergird SB 106: to ensure the continued operation of nuclear reactors, and to preserve their purported economic and environmental attributes. However, the commission did not consider alternatives to the continued operation of nuclear power plants, and created a program at least ten times more expensive than originally contemplated. In the end, financial supports to nuclear power in New York are likely to total \$7.6 billion over the next twelve years, and will be four times less cost-effective in meeting the state's energy and climate objectives than the expansion of renewable energy under the state's new 50% renewable energy standard.

Under the CES, the state is entering into a twelve-year contract to purchase "Zero-Emissions Credits" from the four reactors designated by the PSC as publicly necessary. The ZECs will be priced through a non-competitive formula, based on the U.S. Environmental Protection Agency's Social Cost of Carbon. The SCC is a metric used to estimate the global impact of carbon dioxide emissions, not the cost of subsidies to reduce those emissions. The SCC increases substantially over time, and because of that, the cost of New York's nuclear subsidies will increase by over 50% over the course of the program, through biennial price adjustments. The New York PSC projects the cost of subsidies will be \$482 million per year for the first two years, which will increase to over \$800 million per year in the final two years (2027-2029). Thus, ratepayers will be called on to make increasingly large and costly payments for reactors in the final years before they cease generating any power, and with no plans or investment in those reactors' ultimate replacement. This is the opposite of a wise investment, and a highly inefficient use of energy consumers' dollars.

Implications for Connecticut and SB 106

New York's decision to provide subsidies and incentives to delay the closure of four reactors should therefore be a cautionary tale for Connecticut. Because the New York program is being promoted in other states, NIRS published a report in November, "Too Big to Bail Out: The

Economic Costs of a National Nuclear Power Subsidy."¹ In this report, we estimated the state and national cost of subsidies to nuclear power plants based on New York's program. Should Connecticut adopt a similar measure to support Millstone, the cost to consumers would be proportionally much greater than in New York. The costs of subsidies to Millstone would be approximately \$4.95 billion from 2019 to 2030, or over \$400 million per year, based on the same formula used in New York. However, those costs would be distributed across a much smaller customer base in Connecticut than in the Empire State. Whereas the subsidized New York reactors represent only 15% of statewide electricity demand in 2017, Millstone generates close to 50% of the amount of electricity consumed in Connecticut. Because the state only has the authority to regulate utility companies within its borders, the entirety of the cost would be borne by residents and businesses here.

Alternatives to Nuclear Subsidies

The legislature should, therefore, fully examine alternatives, and not pre-determine that utilities should enter into long-term power purchase agreements for Millstone's power. The cost and potential of renewables and efficiency are changing too rapidly to warrant locking consumers into a long-term commitment to purchase power from Millstone. For instance, a 2016 study by Synapse Energy Economics, "Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York," shows that adopting electric utility efficiency standards in line with leading states like Rhode Island, Massachusetts, and Vermont would enable states to reduce electricity demand by about 26% between 2020 and 2030--roughly 50% of Millstone's output, or more than the equivalent of Millstone unit 2. Based on the experience in other states, the cost of such measures would be comparable to or less than the average wholesale market price of electricity, while creating large net savings to consumers by reducing their total amount of electricity consumption.

In addition, Connecticut could join its neighboring states of New York, Massachusetts, and Rhode Island in developing offshore wind resources. Last summer, Massachusetts passed a law requiring utilities to purchase 1,600 MW of offshore wind by 2027. Last month, NY Governor Cuomo set a goal to develop 2,400 MW of offshore wind near Long Island by 2030. Transmission lines already connect Connecticut to Long Island, and the federal Bureau of Ocean Energy Management has made a lease area off the coast of Long Island available with up to 18,000 MW of offshore wind potential. Doing so could not only promote economic development in new and expanding clean energy industries in Connecticut, but help revitalize the coastal and maritime economy.

The legislature should, therefore, consider whether a portfolio of energy efficiency and renewables would be more cost-effective at addressing the state's energy, environmental, and economic development needs than locking in long-term, expensive subsidies or above-market power contracts with Millstone.

Environmental Impacts of Millstone

¹ Judson, Tim. "Too Big to Bail Out: The Economic Costs of a National Nuclear Power Subsidy." Nuclear Information and Resource Service. November, 2016.
<https://www.nirs.org/big-bailout-economic-costs-national-nuclear-power-subsidy/>

In conducting that assessment, the legislature should also take into account the environmental impacts of nuclear energy. Greenhouse gas emissions are only one type of environmental impact of electricity generation. While nuclear power plants do not directly consume large quantities of fossil fuels in order to generate electricity, reactors nevertheless have massive environmental impacts and their operations entail extensive environmental risks.

For instance, the cooling systems for Millstone's reactors consume vast quantities of water from Long Island Sound, and eject superheated water back in. These operations have had an appreciable impact on the ecology and fish population of the sound, and a corresponding impact on Connecticut's fishing industry--harms that could be remedied with the reactors' eventual closure.² In fact, Millstone's operations have been affected by rising water temperatures due to global climate change more than any other nuclear power plant in the U.S. Warm water temperatures have forced Dominion to reduce power at Millstone on a number of occasions in order to ensure adequately cooling. So global climate change is likely to make it a less productive power plant as Millstone ages.

In addition, nuclear power entails enormous radioactive waste and environmental justice impacts. The mining and processing of uranium to produce nuclear reactor fuel is both very fossil fuel intensive, and produces vast amounts of long-lived radioactive and toxic wastes--most of which are deposited in the open air Native American and other indigenous communities in the North America and around the world. Producing one pound of nuclear reactor fuel results in over 25,000 pounds of uranium waste, before a single kilowatt of electricity is generated. Millstone requires approximately 20 tons of fuel per year, resulting in 1 billion pounds of uranium waste rock and mill tailings strewn about indigenous communities in the U.S., Canada, Australia, Kazakhstan, South Africa, and elsewhere. The United States alone has 15,000 abandoned, unremediated uranium mines, disproportionately located in Native American communities, with dire impacts on public health, drinking water, livestock and agriculture.

At the other end of the nuclear fuel chain, fuel used in reactors produces plutonium and becomes intensely radioactive, requiring it to be safeguarded for up to hundreds of thousands of years. The waste generated by Millstone will likely have to be stored in Connecticut for at least several decades, because the federal government has failed to develop scientifically viable solutions for the long-term management of nuclear waste.

² Jones, Daniel P. "Justices Hear Millstone Arguments." *Hartford Courant*. May 24, 2000.
http://articles.courant.com/2000-05-24/news/0005240693_1_nu-environmental-violations-settlement

Lara, Al. "Lawsuit: Millstone Hurting Flounder Catch." *Hartford Courant*. August 24, 2001.
http://articles.courant.com/2001-08-24/business/0108240743_1_long-island-sound-power-plant-full-power

Cummings, Bill. "Millstone discharging warmer water into Sound." *Connecticut Post*. October 4, 2014.
<http://www.ctpost.com/local/article/Millstone-discharging-warmer-water-into-Sound-5802027.php>

Miller, Carrie. "Is Millstone power plant killing lobsters in the Sound?" *The Suffolk Times*. November 21, 2014.
<http://suffolktimes.timesreview.com/2014/11/54100/is-millstone-power-plant-killing-lobsters-in-the-sound/>

In addition, the continued operation of the Millstone reactors entails the potential for nuclear accidents, like those at Fukushima, Chernobyl, and Three Mile Island. Reports by the Union of Concerned Scientists (2014³ and 2015⁴) and Greenpeace USA (2016)⁵ have documented at least four near miss events at Millstone since 2004, which could have led to a nuclear accident, including two in 2014. The risk of nuclear disasters is also growing as reactors age and their components wear out and become embrittled--one of the factors driving increases in reactors' operating costs.

The consequences of such an accident in Connecticut would be enormous. A 1982 report Sandia National Labs report commissioned by the Nuclear Regulatory Commission⁶ estimated that a worst-case accident at Millstone unit 3 could result in 23,000 peak early fatalities and \$174 billion in property losses--or \$433 billion in 2016 dollars. Most of the state and Rhode Island fall with the 50-mile emergency planning zone, and the loss of real estate values alone would be enough to cause irreparable harm to the state's economy and tax base. Considering the increases in nuclear safety risk as the Millstone reactors age, it would be unwise for the state to perpetuate that risk through entering into long-term contracts for power or subsidies.

Nearly all of these burdens are subsidized through regulatory and fiscal liability exemptions. A 2011 study by the Union of Concerned Scientists, "Nuclear Power: Still Not Viable Without Subsidies,"⁷ concluded that subsidies for nuclear power have frequently exceeded the value of the energy produced, and that many of those subsidies continue today.

Thank you for accepting our testimony.

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Background: Economic Conditions in the Nuclear Power Industry

The very problems that have led Dominion and other merchant nuclear power corporations to seek assistance from legislatures and regulators mean that nuclear has no significant role to play in addressing energy and emissions reduction needs. Nuclear power plants are becoming

³ Lochbaum, David. "Near Misses at U.S. Nuclear Power Plants in 2015." Union of Concerned Scientists. March 2016. <http://www.ucsusa.org/sites/default/files/attach/2016/03/Near-Misses-US-Power-Plants-2015-full-report.pdf>

⁴ Lochbaum, David. "The NRC and Nuclear Power Safety in 2014: The Tarnished Gold Standard." Union of Concerned Scientists. March 2016. <http://www.ucsusa.org/sites/default/files/attach/2015/03/nrc-2014-full-report.pdf>

⁵ Riccio, Jim. "Nuclear Near Misses: A Decade of Accident Precursors at U.S. Nuclear Plants." Greenpeace. May 24, 2016. <http://www.greenpeace.org/usa/wp-content/uploads/2016/05/nuclear-near-misses-a-decade-of-accidents-at-us-nuclear-energy-power-plants-may-2016-3mb.pdf?f3025c>

⁶ Sandia National Labs, for U.S. Nuclear Regulatory Commission. "Calculation of Reactor Accident Consequences." November 1, 1982. <http://www.ecnr.org/crac.html>

⁷ Koplou, Doug. "Nuclear Power: Still Not Viable Without Subsidies." Union of Concerned Scientists. February 2011. <http://www.ucsusa.org/nuclear-power/cost-nuclear-power/nuclear-power-subsidies-report>

increasingly uneconomical to continue operating, and it is in states' best interests to plan for their closure and replacement, rather than put themselves on the hook to pay hundreds of millions to billions of dollars in above-market energy costs to support aging power plants that are likely to close within the next decade anyway.

The nuclear power plant fleet in the United States is among the oldest in the world, and, as such, the cost of operating them has grown precipitously over the last 10-15 years. While reactors are originally licensed to operate for forty years, over 40% of the reactor fleet is now older than that and the average age is 36 years in the United States. According to biennial reports by the Nuclear Energy Institute, the average operating cost of reactors in the U.S. rose by nearly 60% from 2002-2012, in inflation-adjusted dollars. Increasing capital costs have driven this trend, growing over 340% while fuel and operating costs increased only 30% in real dollars. The most uneconomical nuclear plants--typically, older, smaller, single-reactor facilities--require the most maintenance and generate the least power.

Over the last decade, electricity demand has leveled off or even decreased, while less expensive sources of electricity and energy efficiency have contributed to lower market power prices—a needed relief for power consumers in Connecticut, who have typically be burdened with some of the highest electricity prices in the country. In short, while the cost of operating nuclear reactors is going up, the cost of power from other sources has been going down. This picture is not likely to change for aging nuclear power stations, and the proper question is how best to plan for their eventual closure.

From a climate standpoint, the good news is that carbon-free energy solutions are increasingly becoming the least expensive resources available: already, energy efficiency, wind, and solar power are cheaper than all but the cheapest natural gas plants; and the costs of energy storage to complement renewables are declining similarly, making it possible to envision a transition to a new, modern, flexible clean energy system taking off within the next five years. Some states are taking steps to facilitate this transition by proactively restructuring the utility business to integrate renewable energy, efficiency, and flexible demand management systems, and to animate competitive markets for such energy products and services. California, Massachusetts, Maryland, New York, Hawaii, and Minnesota are among these states, and Connecticut should follow suit.

The reactors at Millstone are no exception to the nuclear industry's downward economic trend: Unit 2 will be 42 years old this year, and is a relatively small nuclear reactor with a less favorable cost profile; Unit 3 will be 32 years old, and is a larger than average size reactor. On the whole, despite these differences, Dominion acknowledges that Millstone is still economically viable today, and the company has made no decision to close either reactor, let alone both of them. The state should, therefore, regard any claims that Millstone requires financial supports in order for the state to meet its energy and environmental needs with skepticism. Proactive planning and consideration of alternatives would enable Connecticut to meet its energy needs.

Such a nuclear subsidy program will be far less effective than renewable energy and efficiency alternatives, in both the near, medium, and long terms. The total cost of nuclear subsidies in New York is more than three times the PSC's \$2.4 billion projected cost of Renewable Energy Credits (RECs) for new renewable energy sources under the state's 50% renewable energy standard (RES).

- By 2030, New York PSC projects renewables will generate 25% more power than the subsidized nuclear reactors can generate on an annual basis. So through 2030, renewable energy incentives will be four times as cost-effective as nuclear toward meeting the state's energy and emissions needs.
- As those renewable energy sources are ramping up over the next thirteen years, we project that they will generate nearly as much total electricity (two-thirds) as the four reactors to be subsidized from 2017 to 2030, making renewables twice as cost-effective as nuclear subsidies.
- In addition, two of New York's subsidized reactors are scheduled to close in 2029 when their licenses expire, leaving only half as much nuclear as new renewables generating power in 2030. Thus, in the long run, the state's renewable energy standard will be more than six times as cost-effective as nuclear subsidies.

Unfortunately, the New York PSC did not consider alternatives to subsidizing nuclear power in deciding to undertake the subsidy program. The PSC only evaluated two options: whether to subsidize and otherwise incent nuclear reactors to remain operational; and whether not to, and allow them to close. In addition, parties to the PSC proceeding presented a study of energy efficiency potential in New York, which showed that increasing efficiency standards could reduce statewide electricity demand by 25 million megawatt-hours (MWh) per year—approximately the same amount of power as the subsidized reactors generate, but at a consumer cost of \$40 per MWh, comparable to or less than the average wholesale price of electricity.

New York's nuclear subsidy program is being challenged in several different jurisdictions, including state and federal courts and the Federal Energy Regulatory Commission. The federal court and FERC challenges allege that subsidizing old nuclear generators is an impermissible intervention into wholesale power markets, which is preempted by the Federal Power Act, as determined by the U.S. Supreme Court in *Hughes v. Talen* last year. The type of power purchase mandate on Connecticut utilities contemplated in the current language of SB 106 may not be viable under the same precedent, as *Hughes v. Talen* overturned Maryland's attempt to incentivize a favored generation facility through power purchase contracts. New York's nuclear subsidy proposal is also increasingly controversial among state legislators, residents, local officials, and employers in the state, who would see significant increases in their electricity costs starting in April of this year.