



November 8, 2024

Doreen Harris, President and CEO
New York State Energy Research and Development Authority
17 Columbia Circle
Albany, NY 12203

Re: Comments on the “Draft Blueprint for Consideration of Advanced Nuclear Technologies”

Dear President and CEO Harris:

These comments are submitted on behalf of Nuclear Information and Resource Service (NIRS) and Alliance for a Green Economy (AGREE) in response to the release of the [“Draft Blueprint for Consideration of Advanced Nuclear Technologies”](#) (Draft Nuclear Blueprint or Blueprint), prepared by the Brattle Group for the New York State Energy Research and Development Authority (NYSERDA).

NIRS is a non-profit environmental organization founded in 1978 to serve as an information and networking center for grassroots organizations and communities impacted by nuclear energy and the uranium fuel chain. We have over 4,000 supporters in New York, and have been an advocate for nuclear safety, public health, and environmental justice in the state throughout that history. We have been one of the principle watchdogs of the 40+-year clean-up of the West Valley nuclear reprocessing and radioactive waste site, all of the commercial nuclear power plants built and operated in the state, new reactor construction proposals, subsidy and bailout programs, and remediation of Manhattan Project and other nuclear production sites and laboratories.

Alliance for a Green Economy (AGREE) is a nonprofit headquartered in Syracuse with over ten years of experience in watchdogging the four nuclear reactors in Central & Western New York while supporting an equitable energy transition in New York. AGREE was launched in 2012, on the one-year anniversary of Japan’s Fukushima nuclear disaster with the goal of promoting and educating the public around a carbon-free and nuclear-free future. Since then, AGREE has been working to center our energy system around safety and health, preserve our precious ecosystems, and ensure affordable access to the sustainable energy needed to live healthy, connected, and fulfilling lives.

Introduction

The Draft Nuclear Blueprint in no way lives up to its billing, providing no recommendations for how New York State (NYS) might pursue construction of new nuclear power plants. The only actionable steps the Blueprint recommends are to publish the document and to monitor “current federal policies and programs” to identify potential “opportunities for demonstrations supporting economic development or supply chain growth.” If the state is contemplating moving forward

with a policy to support financing and/or construction of new nuclear reactors, this Blueprint and the comments collected in response cannot be used to check the box of public participation.

The Blueprint correctly observes that there are too many unanswered questions about the feasibility of new reactors, from the cost, construction timeline, availability of fuel supply, financing mechanisms, environmental justice concerns, and other key factors. However, the report is rife with demonstrably flawed and inaccurate observations and statements.

The broad application of the term “advanced” is misleading and inaccurate

As a general matter, the Brattle Group’s extensive use of the present tense and declarative statements about “advanced” reactor designs is misleading, and it provides a shallow and uncritical presentation of the issues this nascent technology presents. No such reactor designs have been approved, constructed, and operated in the United States, so there is no evidentiary basis for claims about the safety, performance, or feasibility of the broad range of nuclear technologies loosely characterized as “advanced” reactors. The Blueprint’s declarative statements claiming that “advanced” reactors “do” or “perform” or “operate” in any particular way are misleading, as no reactors of the designs being addressed have been built or operated yet. In fact, they are all years away from being built or operated. To the extent that small reactors, high-temperature gas-cooled reactors (HTGRs), molten-salt reactors (MSRs), liquid-sodium-cooled fast-spectrum reactors (LSRs), and other proposed technologies have previously been built, they have faced significant technical, safety, and cost problems. And nearly all such designs were abandoned because experience determined that large light water reactors (LWRs) were the most technically and commercially feasible. Yet the construction of large LWRs remains economically uncompetitive, and there is no evidence to support the idea that previously tried and discarded designs will fare better.

The terms “advanced nuclear” and “advanced reactor” are so broad that they confuse discussions of the topics taken up in the Blueprint. The Blueprint uses them to categorize any new reactor design that differs from the large LWRs – ranging from 500-1600 MW of generation capacity — that predominate in the nuclear industry today. “Advanced” is neither useful nor descriptive, and it is too often used interchangeably with other inconsistently-defined terms like Small Modular Reactors (SMRs). Some large LWR designs (e.g., the Westinghouse AP1000 and the French EPR) are often referred to as “advanced” simply because they are “newer” and have some different features from the 1960s-to-1970s-vintage reactors that the public is more familiar with. Table 1 on page 7 of the Blueprint illustrates this problem. Titled “Advanced Reactor Technology Types and Example Company Technologies,” the table appropriately breaks down the various types and sizes of reactor designs to be considered, but it is unclear what grouping them broadly as “advanced” achieves, except to imply that they were all developed more recently than the 1970s. NYSERDA would do a service to the public and policymakers by referring to them more accurately as “Contemporary” or “Recently Designed” reactors, or else use truly descriptive terminology: non-light water reactors (non-LWRs), small modular LWRs, microreactors, fusion reactors, etc. The fact that most of the designs being discussed as “advanced” do not have all of the same technical features of large LWRs does not make their design features relevantly similar to each other, nor more technologically “advanced.”

We exclude from the above discussion the Westinghouse AP1000 and the NuScale SMR 600 reactor designs:

- The AP1000 has been approved and recently built, with six reactors that started operation worldwide since 2016, but classifying the design as an “advanced” reactor is inaccurate. The AP1000 is a large pressurized water reactor, essentially the same technology as the rest of those currently operating in the US. It is often classified, according to another vaguely-defined system, as a Generation III+ reactor, whereas “advanced” reactors generally fit into the Generation IV class. Design features of the AP1000 that are claimed to be significant “advancements” or “improvements” from prior-generation LWRs are yet unproven. For instance, the AP1000’s “passive containment cooling system” essentially replaces the thick concrete and steel containment structures common to pressurized water reactors (PWRs) with a 1.75”-thick steel shell and an open reactor building structure with a large tank of water on top. (The tank of water would drain onto the metal containment shell in a meltdown scenario.) Notwithstanding the potential for containment failure in older PWR designs, the AP1000’s containment provides no barrier to radiation releases if the steel shell develops a leak, and may even accelerate releases through a “chimney effect”: depressurization of the containment interior and dispersal of fission products through open, unfiltered ventilation holes in the reactor building structure.¹ Similar to the pressure suppression containment design of General Electric Boiling Water Reactors, the AP1000 containment design was alleged to decrease construction costs while maintaining safety margins. The claimed economic benefit has not borne out with either the AP1000 or older GE BWRs (e.g., both the Nine Mile Point 2 and Shoreham BWRs exceeded original cost estimates by nearly an order of magnitude and the cost of Vogtle 3&4 AP1000s increased by 250% to \$36 billion). The BWR pressure suppression containment system was known since the 1970s to have significant vulnerabilities, which were demonstrated catastrophically in March 2011 in the loss of coolant accidents, hydrogen explosions, and massive radiation releases from all three of the reactors at the Fukushima Dai-Ichi Nuclear Power Plant that were operating at the time of the Tohoku earthquake and tsunami. We can only hope that no such real-world test of the AP1000 passive containment cooling system is ever necessary.
- The NuScale US600 (a plant with twelve 50-MW light water reactor modules) received design certification by the Nuclear Regulatory Commission in 2020. However, NuScale no longer markets the design, having shifted its focus to an “uprated” version that has not been approved: the US460, a plant with six 77-MW reactors. The US600 is the only SMR design to be certified by NRC, but it is also the only reactor design of any type that NRC has certified with significant exceptions. NRC issued its approval of the US600 without approving three aspects of the design. The agency’s regulation notes that any

¹ Fairewinds Associates, Inc. “Nuclear Containment Failures: Ramifications for the AP1000 Containment Design.” December 21, 2010.

<https://static1.squarespace.com/static/54aac5e4e4b0b6dc3e1f6866/t/5c7848a5ee6eb07f94a0d1ba/1551386806660/AP-1000-NUCLEAR-CONTAINMENT-FAILURES.pdf>

license applicants seeking to build the US600 would have to amend NuScale's design and resolve the three deficiencies through a full safety evaluation. Most notably, NRC did not approve the design of the steam generators, based on findings by the agency's Advisory Committee on Reactor Safeguards that the steam generator tubes could be vulnerable to vibration-induced damage and rupture, which could lead to a loss of coolant accident (LOCA).² NuScale is currently pursuing Standard Design Approval for the US460, with an application under review by NRC. However, NuScale's flagship project through which it intended to demonstrate the US600 and then the US460 was canceled in November 2023, due to significant increases in cost projections and a lack of customers subscribed to purchase the power. In light of these facts, the Brattle Group's characterization of the NuScale US600 is misleading and unfathomably inaccurate: "One water-cooled SMR design in the U.S., NuScale's US600, has received design approval from the Nuclear Regulatory Commission (NRC), making it the closest to commercial operation of all options other than advanced full-scale LWRs."³

Characterizing a reactor design that has not been fully approved, and for which there are no active projects or even proposals to build, as "the closest to commercial operation" only does a disservice to the people and policymakers of New York and prevents a clear understanding of the state of these designs.

Environmental injustices from the nuclear fuel chain

NIRS and AGREE adopt and incorporate by reference the comments of Citizen Action of New York (CANY) on the Blueprint's consideration of the impacts of new reactors on the climate justice provisions of the Climate Leadership and Community Protection Act (CLCPA).⁴

We also encourage NYSERDA to incorporate the findings of the 2020 red paper, *Nuclear Reactors are not "Green"*, published by the Onondaga Nation, Haudenosaunee Environmental Task Force, and the Native American Law Alliance, which details impacts of nuclear energy and the uranium fuel chain on Indigenous peoples within the territorial boundaries of New York State and beyond.⁵ The Draft Blueprint notes that, "If new nuclear plants of any size are sited in New York, environmental and climate justice issues will be extremely important to assess and prioritize for the communities surrounding the plant." The Red Paper is one of the best and most comprehensive compilations of the environmental injustices that are inflicted throughout the

² A loss of coolant accident is defined as a scenario in which "a breach in a reactor's pressure boundary causes the coolant water to rush out of the reactor faster than makeup water can be added back in. Without sufficient coolant, the reactor core could heat up and potentially melt the zirconium fuel cladding, causing a major release of radioactivity."

U.S. Nuclear Regulatory Commission. "Glossary: Loss of coolant accident (LOCA)." Wednesday, February 15, 2023. <https://www.nrc.gov/reading-rm/basic-ref/glossary/loss-of-coolant-accident-loca.html>

³ Blueprint at page 8 (emphasis added).

⁴ Citizen Action of New York. "Citizen Action Comments on DRAFT Nuclear Blueprint." October 11, 2024. Transmitted via electronic submission through NYSERDA comment portal.

⁵ Onondaga Nation, Haudenosaunee Environmental Task Force, and Native American Law Alliance. *Nuclear Reactors are not "Green."* January 30, 2020. <https://storage.googleapis.com/wzukusers/user-28491011/documents/3d6172a81ffc4c5ab8c805800face0e3/NukeRedPaper1-30-20-haudenosaunee.pdf>

nuclear fuel chain. We highly recommend that any staff member working on the Draft Blueprint process read it to gain a better, more holistic, understanding of the current problems and injustices.

Additionally, we note that the Blueprint acknowledges the environmental justice impacts of new reactors must be addressed before undertaking further planning:

Yet advanced nuclear technologies raise a host of questions that would have to be addressed before planning on it, regarding technological readiness, costs and cost risks, environmental justice, among other factors.⁶

The Blueprint further identifies the need to include environmental justice impacts in evaluating the siting of new reactors:

Consistent and deliberate engagement with communities in areas for potential new nuclear facilities is an essential component of sound energy planning and environmental justice.⁷

Nevertheless, the Blueprint's examination of environmental justice impacts of nuclear energy is extremely shallow and limited. Brattle only includes a brief discussion of one known environmental justice impact of the nuclear energy industry: that open pit uranium mining exposes miners and nearby communities to radiation and toxic chemicals, and that mining "occurs predominantly on Indian Nations/Indigenous Nations land, sometimes disrupting sacred sites."

The Blueprint goes on to raise what is, on the surface, an important question about environmental justice impacts, but in a way that suggests the state may be powerless to address it:

"What role should the State play in promoting environmental and climate justice in the fuel cycle of advanced nuclear facilities in view of the fact that almost all of this activity will occur out-of- state?"⁸

The state is not a passive bystander when it comes to known and reasonably anticipated environmental justice impacts resulting from activities the state promotes through its policies and investments. The purpose of evaluating environmental justice impacts ahead of time is to prevent them to the greatest extent possible. If there are environmental justice impacts of nuclear power generation that cannot be mitigated through measures that are within the jurisdiction and authority of New York State to implement, the state must consider them as unmitigated environmental justice impacts. Pollution of Indigenous and environmental justice communities that is the direct and inevitable result of policy decisions, activities, and

⁶ Blueprint at page 2.

⁷ Blueprint at page 15.

⁸ Blueprint at page 16 (emphasis added).

investments undertaken by New York State are the responsibility of New York State. Uranium mined to fuel reactors in New York would not have been mined except for the operation of those reactors to generate electricity.

Nevertheless, the Blueprint's consideration of the environmental justice impacts of nuclear energy is far too narrow. The topic deserves a far more extensive evaluation than the one example of open pit uranium mining. There are three other common methods of uranium extraction, shaft mining, heap leaching, and *in situ* leaching (ISL). The environmental impacts of each are extensive.⁹ All involve contamination of groundwater and drinking water sources, and significant public health impacts to affected communities,¹⁰ which, as the Blueprint notes, are predominantly Indigenous communities.

There is no uranium mining in New York State, so wherever the fuel for new reactors in New York is derived from, uranium is extracted under conditions outside of the state's jurisdiction. Hard rock mining for uranium in the U.S. is still governed by the archaic Mining Act of 1872, which includes no regulations on environmental standards, nor for reclamation and cleanup of mining sites. As a result, the U.S. Environmental Protection Agency has acknowledged over 15,000 abandoned uranium mines (AUMs) nationwide.¹¹ ISL mining directly contaminates groundwater sources with radioisotopes and heavy metals, and is poorly regulated at the federal level.¹² Under the Trump administration, the EPA failed to implement uranium mining regulations drafted in 2016 and it entered into an agreement with NRC in 2020 that cedes most of its authority to enact standards.¹³ It has now been eight years since EPA developed uranium mining regulations, yet the EPA has failed to act, allowing the impacts of ISL uranium mining to continue, unabated

For decades, the vast majority of uranium mining for U.S. nuclear power reactors has occurred in other countries, where it is regulated no better than it is by the U.S.. It typically harms Indigenous and colonized peoples in those countries, including Australia, Canada, Namibia, and Niger. But uranium mining is now increasing within the borders of the U.S., due to a sharp increase in uranium commodity prices that has made previously unprofitable mining sites highly profitable. This year, uranium prices have surged to a 17-year high,¹⁴ largely due to speculation

⁹ Diehl, Peter. "Uranium Mining and Milling Wastes: An Introduction." World Information Service on Energy. May 18, 2011. <http://www.wise-uranium.org/uwai.html>

¹⁰ Fettus, Geoffrey H., and Matthew McKinzie. Nuclear Fuel's Dirty Beginnings: Environmental Damage and Public Health Risks from Uranium Mining in the American West. Natural Resources Defense Council. March 2012. <https://www.nrdc.org/sites/default/files/uranium-mining-report.pdf>

¹¹ U.S. Environmental Protection Agency. *Uranium Location Database Compilation*. August 2006. <https://www.epa.gov/sites/default/files/2015-05/documents/402-r-05-009.pdf>

¹² Fettus and McKinzie.

¹³ Fettus, Geoffrey. "Uranium Mining Protections Needed Across the West: The Biden administration needs to protect communities and water supplies across the West from the dangers of uranium mining.." Natural Resources Defense Council. August 22, 2023.

<https://www.nrdc.org/bio/geoffrey-h-fettus/uranium-mining-protections-needed-across-west>

¹⁴ Markets Insider. Uranium Commodity Prices. Access November 3, 2024.

<https://markets.businessinsider.com/commodities/uranium-price>

on projections of nuclear reactor construction and restarts.¹⁵ This is typical of trends in the uranium commodities market. The last time uranium prices were as high as they are today was in the 2006-2008 period, when U.S. utilities placed orders for 28 new reactors. It would be 15-16 years before any of those reactors began operating (Vogtle 3&4), and all but two of them were canceled by 2017, but mere proposals or promotion of nuclear reactor construction were enough to move uranium markets and uranium mining activity. The same is happening today, with nearly weekly announcements of feasibility studies, corporate agreements, and programs for new reactor construction, but no actual construction occurring since the completion of the Vogtle reactors.

New York State must consider whether promoting construction of nuclear reactors will induce harms to Indigenous peoples in and of itself, whether or not any new reactors are ever built in our state. The manner in which state agencies and elected officials take up consideration of new reactors must be evaluated for environmental justice impacts. At the very least, if the state feels a serious assessment to determine whether the role, if any, of nuclear is necessary, it should be done soberly.

The radioactive and toxic pollution and environmental justice impacts of nuclear energy extend to every stage of the nuclear fuel chain and the operations of nuclear power plants:

- **Uranium milling:** Mills have historically been sited near hard rock mines, on Indigenous lands, where uranium ore is chemically refined, producing large volumes of tailings consisting of radioactive and chemical wastes that are stored in open-air ponds and piles. The Church Rock uranium spill is still the largest radiological disaster in U.S. history, contaminating Diné communities for dozens of miles along the Puerco River. The sole mill operating today is the White Mesa Mill, on lands of the Ute Mountain Ute Tribe. Tribal members' health is affected by radioactive gases and dust the mill tailings emit; dust and debris from uranium ore and wastes sent to the mill on roads and highways; and pollution of groundwater.¹⁶
- **Uranium enrichment:** Enrichment plants emit radioactive pollutants and generate depleted uranium as the principal waste product. Nearby communities have been polluted. For instance, radioactive contamination was found within miles of the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio, including in a middle school that was permanently closed in 2019 due to extensive contamination and several cases of cancer among students who attended it.¹⁷ The vast majority of the U.S.'s 800,000 metric ton depleted uranium stockpile has remained in a chemical form that becomes increasingly unstable over time. The only uranium enrichment plant now operating in the

¹⁵ Bloomberg. "What the Nuclear Power Revival Means for the Price of Uranium." November 1, 2024. <https://www.bloomberg.com/news/audio/2024-11-01/how-uranium-prices-are-reacting-to-latest-nuclear-power-news>

¹⁶ Grand Canyon Trust. "White Mesa Uranium Mill." <https://www.grandcanyontrust.org/white-mesa-uranium-mill>

¹⁷ *Scioto Valley Guardian*. "Pike Co. school closed due to radiation may become another school." July 19, 2024. <https://sciotovalleyguardian.com/2024/07/19/pike-co-school-closed-due-to-radiation-may-become-another-school/>

U.S. is located in Eunice, NM, a majority Hispanic/Latino community with multiple environmental health burdens from oil and gas extraction and other industrial activities. Most of the reactor designs evaluated in the Blueprint would use even more highly enriched uranium – several up to 20% – thereby increasing risks of nuclear criticality, as well as nuclear weapons proliferation.

- **Fuel production:** Fuel for nuclear power reactors is currently produced by deconverting enriched UF₆ gas to solid UO₂, which is formed into ceramic pellets and encased in zircaloy tubes to make fuel rods. Fuel production plants in Columbia, SC; Wilmington, NC; Lynchburg, VA; Richland, WA; Erwin, TN, have leaked and spilled radioactive materials, had criticality incidents, and contaminated workers.¹⁸ Residents of the Lower Richland County community have complained of health impacts from Westinghouse's Columbia Fuel Fabrication Facility,¹⁹ opposed the plant's license extension, and requested that NRC and Westinghouse recognize and avoid "unjust and disparate impacts of facility operations on communities of color and low income."²⁰ New fuel production facilities will be needed for most of the new reactor designs reviewed in the Blueprint, but will entail similar operations.
- **Reactor operations:** Reactors release gaseous and liquid effluents as part of routine operation. They also produce solid and liquid wastes that must be collected, stored, and shipped for processing and disposal. Contaminated reactor components and materials are also sent for processing and disposal. Workers' contaminated uniforms and protective gear are sent to nuclear laundries, where more contaminated water and solid waste are generated. All of the low-level radioactive waste (LLRW) sites licensed for commercial waste in the U.S. have significant environmental justice impacts: Andrews County, TX (56% Hispanic/Latino); Barnwell, SC (51% African-American); Clive, UT (Tooele Valley Goshute land); and Richland, WA (Walla Walla, Wanapum, and Yakama land).
- **Decommissioning and decontamination:** After reactors close, the decommissioning and decontamination of the sites produce enormous volumes of solid and liquid radioactive wastes. As New York has witnessed with Indian Point, it is standard practice for companies performing decommissioning to continue dumping radioactive waste into local waterways (the full effects of which our scientific community are still uncovering - for example, tritium in our waterways poses a much greater threat than our current federal standards acknowledge²¹). Contaminated components, materials, and soil are sent to LLRW dumps located in disadvantaged communities. A 2022 study published in the *Proceedings of the National Academy of Sciences* found that SMRs and non-LWRs

¹⁸ World Information Service on Energy-Uranium. "Nuclear Fuel Fabrication - Current Issues (USA)." October 31, 2024. <https://wise-uranium.org/eopusaf.html>

¹⁹ Virginia Sanders. Public comment to the Nuclear Regulatory Commission. November 21, 2021. <https://www.nrc.gov/docs/ML2132/ML21326A223.pdf>

²⁰ South Carolina Chapter of the Sierra Club. "NRC Environmental Justice Panel listening session and policy discussion." September 2021. <https://www.sierraclub.org/south-carolina/environmental-justice>

²¹ Mecklin, J. (2023, June 23). "Exploring Tritium's Danger": A book review. Bulletin of the Atomic Scientists. <https://thebulletin.org/2023/06/exploring-tritiums-danger-a-book-review/>

will produce significant higher volumes of radioactive waste, due to their design features, fuel types, and greater degrees of neutron leakage and activation.²²

- **Irradiated Fuel and High-Level Wastes:** All of the nuclear power plants in New York have been sited on Indigenous lands: Indian Point is on land of the Munsee Lenape; FitzPatrick and Nine Mile Point are Onondaga Nation land; and Ginna is on Seneca Nation land. Due to the operation of nuclear power plants, there are over 5,000 metric tons of commercial irradiated fuel stored at New York reactor sites, more than all but three states (Illinois, Pennsylvania, and North Carolina), sitting near the shores of Lake Ontario and the Hudson River. That volume will grow as long as reactors continue to operate. Reactor sites in Oswego and Wayne counties affect disadvantaged, rural populations that suffer from high unemployment and low median and per capita incomes. Irradiated fuel produced by nuclear power plants is expected to remain there for the foreseeable future. The federal government and the nuclear industry have repeatedly targeted Indigenous peoples and environmental justice communities for storage and disposal of irradiated nuclear fuel and high-level radioactive wastes.
- **Nuclear reprocessing:** Some new reactor designs would require reprocessing of nuclear fuel, such as molten salt reactors. Reprocessing is an extremely polluting process of chemically separating fissile isotopes like U-233, U-235, Pu-239, and Pu-241 from other fission and activation products, typically releasing gaseous radioisotopes and leaving behind large volumes of extremely radioactive liquid and solid wastes.²³ As a result, every nuclear reprocessing facility in the world has left intractable radioactive waste problems and high levels of radioactive contamination. In addition, because reprocessing is the means for recovering Pu-239 and isotopes suitable for nuclear warheads, commercial use of reprocessing poses proliferation risks. Of all states, New York, and of all agencies, NYSERDA, should be well aware of the enormous environmental and economic danger that reprocessing poses to our residents, resources and budget. The West Valley reprocessing site is on Seneca Nation land in Cattaraugus County, making its cleanup a major environmental justice issue. The latest estimate for full clean-up of the West Valley site, owned by NYSERDA, was nearly \$10 Billion in 2010. The plant reprocessed over 625 metric tons of irradiated fuel and disposed of waste from reactors across the continental U.S. and Puerto Rico over a period of 6 years, from 1966-1972.²⁴ The site remains severely contaminated, after more than 40 years of decommissioning and cleanup, with no end in sight. New York must regularly pay for and plead for federal support to keep the site from degrading and for efforts to “clean up” radioactive waste and contamination of the site. Because NYSERDA is so

²² Krall, Lindsay M., Allison M. Macfarlane, and Rodney C. Ewing. “Nuclear waste from small modular reactors.” Proceedings of the National Academy of Sciences, 119 (23) e2111833119. May 31, 2022. <https://www.pnas.org/doi/10.1073/pnas.2111833119>

²³ Union of Concerned Scientists. “Reprocessing and Nuclear Waste: Reprocessing increases the total volume of radioactive waste.” July 16, 2009; updated March 21, 2011. <https://www.ucsusa.org/resources/reprocessing-nuclear-waste>

²⁴ Office of Defense Programs, U.S. Department of Energy. “Plutonium & Uranium Recovery from Spent Fuel Reprocessing by Nuclear Fuel Services at West Valley, New York from 1966 to 1972.” November 1999 (revised).

reliant on the U.S. Department of Energy (DOE) for cleanup efforts, the state reduces its own standards, just so an appearance of movement on paper continues toward cleanup. Despite active containment, the massive inventory of long-lasting and intensely radioactive waste threatens the Great Lakes and sole source aquifer.

- **Radioactive waste transportation:** All of the above phases of the nuclear fuel chain require transportation of radioactive waste and nuclear materials, which entails risks of accidents and radiation exposures. For these reasons, the Onondaga Nation and the Navajo Nation prohibit transportation of radioactive materials through their territories. Many local jurisdictions in the U.S. have enacted local ordinances or adopted resolutions opposing some or all types of radioactive waste from being transported through their jurisdictions. Some forms of waste are intensely radioactive, so much so that members of the public can receive doses of radiation from transport shipments passing nearby.

The Analysis of the CLCPA is Deficient

The central premise of the Blueprint's premise is defective: that New York state must begin planning to build nuclear power plants now, based on modeling of New York's electricity system in 2040, before the state has made significant progress toward the CLCPA's targets for 2030. This would have the counterproductive effect of shifting time, resources, and focus away from what can and must be done to expand renewable energy and reduce greenhouse gas emissions in New York in the immediacy. Now is not the time to redirect the state's limited capacity and investments toward developing resources that are as yet unknown, undefined, and unproven: the category of Dispatchable Emissions Free Resources (DEFERs) supposedly needed for 2040.

This approach is a prime example of "paralysis by analysis": deferring actions that are necessary and feasible today to focus on speculative conditions that might only arise far down the road. This will only benefit the major incumbent generators in the NYISO market; that is, the owners of gas and nuclear power plants that stand to lose market share from the transition to 70% renewable electricity that the CLCPA mandates by 2030. NYSERDA and the rest of New York State agencies and authorities should be focused on making up the ground on the 2030 target, not punting that goal while worrying about the next challenge.

Additionally, while the CLCPA's 2040 mandate—i.e., 100% reduction in emissions in the electricity sector—does not require *all* of the electricity generation to be from *renewable* sources by 2040, it does not preclude such a future. Some have interpreted the distinct 2040 goal to mean that the electricity supply should *not* be 100% renewable, and propound the idea that there is a 30% gap in the CLCPA targets that needs to be filled with other, unspecified resources, namely DEFERs.

That interpretation is fundamentally flawed. When the CLCPA was enacted in 2019, total renewable electricity generation in New York State was 37,294 GWh, or 23.9% of total NYISO electricity demand. However, NYISO counts a number of energy sources (landfill methane, solid waste incineration, and woody biomass) as renewable generation, in a category of "other" fuel types. Those sources are not considered as renewable energy resources in New York, under

Public Service Law § 66-P. It is unclear why NYISO continues to categorize as renewable fuels a number of energy sources which therefore cannot count toward satisfying the CLCPA requirements. Correcting for that definitional incongruence, there were 34,646 GWh of actual renewable generation in 2019, or 22.2% of statewide load. The vast majority of renewable generation in 2019 (87%) was produced by hydropower resources built several decades earlier; wind and utility-scale solar PV comprised only 4,506 GWh in 2019, serving less than 3% of statewide electricity demand. To reach the CLCPA target of 70% renewable electricity in 2030 would require increasing the share of renewables by 47.8%, more than tripling the share of New York's electricity in 11 years. To meet the CLCPA target under NYISO's current baseline energy forecast for 2030 (159,050 GWh), renewable generation would have to be 111,335 GWh, a net increase of 76,689 GWh. Given that the increase in renewables will consist almost entirely of wind and solar PV, that would entail a seventeen-fold increase in those resources through 2030. To build out that much solar PV and wind capacity requires significant workforce and economic development, which will greatly benefit the statewide and local economies, and create employment for thousands of New Yorkers.

It would be foolish to think that most of the economic, workforce, and industrial capacity would be set aside after 2030 because the 2040 target specifies zero-emissions electricity, not specifically renewable. There is a good reason why the 2040 target was left open to non-renewable, "zero-emissions" resources: the future operation of existing nuclear generation capacity was uncertain in 2019, and still is. The current licenses for three of the four operating reactors in Central and Western New York expire before 2040, but Nine Mile Point unit 2 is licensed to operate until 2046.

Reliance on the DEFR Concept and its Application to Nuclear Power Plants are Flawed and Counterproductive

The Blueprint begins by citing two studies forecasting resource adequacy in 2040 under the CLCPA. Brattle claims, "studies identify a critical need in the path to a zero emissions grid in New York: controllable clean electricity technologies that can reliably meet the demand for power throughout the year, even when onshore and offshore wind and solar energy are less available." The studies that Brattle refers to are a 2022 report commissioned by NYSERDA and the NYS Department of Environmental Conservation (DEC)²⁵ and a July 2024 report by NYISO.²⁶ However, the concept of DEFRs originates from a 2020 report NYISO commissioned from a consulting firm, Analysis Group, which coined the term as "dispatchable and emissions-free resources (DE Resources)."²⁷ NYISO has continued to rely on the concept in its

²⁵ Energy and Environmental Economics (E3) and Abt Associates. "Integration Analysis Technical Supplement." NYSERDA and DEC. December 2022.

<https://climate.ny.gov/resources/scoping-plan/-/media/project/climate/files/Appendix-G.pdf>

²⁶ NYISO. "2023-2042 System & Resource Outlook (The Outlook): A Report from the New York Independent System Operator." July 23, 2024.

<https://www.nyiso.com/documents/20142/46037414/2023-2042-System-Resource-Outlook.pdf>

²⁷ Hibbard, Paul J., Charles Wu, Hannah Krovetz, Tyler Farrell, and Jessica Landry. *Climate Change Impact and Resilience Study – Phase II: An Assessment of Climate Change Impacts on Power System Reliability in New York State*. Analysis Group, for NYISO. September 2020. See page 7.

annual System & Resource Outlook reports, and NYSERDA adopted it in commissioning the E3 report and, now, the Blueprint. The concept was also referred to in a legislative memorandum on a bill Senate Energy Committee Chair Kevin Parker introduced in 2021, citing the NYISO and NYSERDA studies.²⁸

There are fundamental flaws with the DEFR concept and in its subsequent application to nuclear and the modeling conducted with it. The Analysis Group study created the DEFR²⁹ concept for modeling the grid under a range of extreme weather conditions and events:

Analysis Group's approach to the analysis is presented in detail in Section II. In summary, it consists of the following steps (depicted in Figure ES1): ...

- Include in the resource sets a generic resource, the role of which is to identify the attributes of any additional resources that may be needed to avoid or reduce Loss of Load Occurrences (LOLO). These resources - identified as dispatchable and emissions-free resources ("DE Resources") - are described in more detail below ...
- Generate results with respect to potential loss of load occurrences (LOLO) and reliance on DE resources, and draw observations related to power system operations based on the comparison of results across cases.

Analysis Group specifies that the LOLOs which DEFRs are intended to address "are not meant to be equivalent to Loss of Load Expectation in a resource adequacy context." Rather, they are weather conditions and events which cause sustained reductions in renewable generation or transmission system outages. The report does not provide a clear definition of the term, so its application and the relationship to the operation of DEFRs are not evident. For instance, in a table of Case Result Summaries (excerpted below), Analysis Group shows that LOLOs range in duration from 2 to 45 hours for different types of events, with aggregate losses of load ranging from 88 MWh to 22,146 MWh. However, DEFRs are deployed for many more hours in relation to each type of event, and at far greater levels of generation and capacity than the associated LOLOs.

<https://www.nyiso.com/documents/20142/10773574/NYISO-Climate-Impact-Study-Phase-2-Report.pdf/209bc753-3f69-8ab9-37b5-eae3698b0ed1>

²⁸ Senate Bill S6497A, 2021-2022 Legislative Session.

<https://www.nysenate.gov/legislation/bills/2021/S6497>

²⁹ For purposes of consistency and clarity, from this point on, we use DEFR in reference to its

Table ES-2: Case Result Summaries, CCP2-CLCPA Case

	Loss of Load		DE Resource Generation				
	Total Hours with	Aggregate LOLO	Max Consecutive	Total Hours with	Aggregate DE	Max DE Resource	Max 1-hr. DE
	LOLO in at least		Hours with DE	DE Resource	Resource Gen.		Resource Gen.
	one Load Zone	(MWh)	Resource Gen.	Gen.	(MWh)	Gen. (MW)	Ramp (MW)
CLCPA Summer Scenario - Climate Impact Phase II Resource Set							
Baseline Summer	0	0	36	145	847,589	22,081	9,170
Heat Wave	0	0	36	147	964,668	22,081	8,642
Wind Lull - Upstate	0	0	37	179	1,171,656	23,361	9,447
Wind Lull - Off-Shore	0	0	40	196	1,116,165	23,170	9,170
Wind Lull - State-Wide	0	0	40	235	1,697,161	24,440	11,605
Hurricane/Coastal Wind Storm	26	20,168	171	322	1,892,046	22,081	8,642
Severe Wind Storm – Upstate	8	1,620	87	283	2,002,682	22,081	8,642
Severe Wind Storm – Offshore	0	0	36	167	1,079,462	22,163	10,015
Drought	0	0	36	166	1,148,649	23,595	10,610
CLCPA Winter Scenario - Climate Impact Phase II Resource Set							
Baseline Winter	0	0	62	255	2,866,203	32,135	11,716
Cold Wave	0	0	62	259	2,879,947	32,135	11,716
Wind Lull - Upstate	5	2,373	62	259	3,076,530	32,135	12,707
Wind Lull - Off-Shore	10	7,184	104	274	3,350,666	32,135	11,715
Wind Lull - State-Wide	13	14,404	105	278	3,653,404	32,135	12,403
Severe Wind Storm – Upstate	45	22,146	81	369	3,822,059	31,419	12,850
Severe Wind Storm – Offshore	9	4,203	103	304	3,609,785	32,135	11,715
Icing Event	2	88	62	273	2,909,437	32,135	11,716

With respect to wind lull events, Analysis Group posits sustained periods in which wind speeds are suppressed statewide, from Western New York to the North Country to Long Island, for both land-based and offshore wind. It defined a wind lull event as a period of suppressed winds during which windmills operate at less than 15% capacity in the summer and less than 25% in the winter. While it is worthwhile to model the grid’s resilience to extreme conditions, some of these scenarios are extremely speculative. For instance, Analysis Group does not say whether, in the NREL wind data it utilized, there has ever been such a statewide wind lull event, how frequently, or for what duration. Weather patterns vary significantly across New York’s geography, and wind patterns in the Atlantic Ocean are quite different from those in Western New York and the North Country, both temporally and in the weather systems that drive them.

In addition, the hurricane and wind storm events that Analysis Group models generally cause losses of load due to damage to transmission lines and substations. When the transmission system is down, generation from sources in the affected area are suppressed, but so is electricity demand. Wind turbines are curtailed at extreme wind speeds to prevent damage to the turbines, but those conditions are tied to the duration of the event, much less time than it takes for transmission infrastructure to be restored. So it is not clear that sustaining the full generation supply is needed in those scenarios.

The Analysis Group report states:

[E]ven with all these additions, the variability of renewable resource output leads to circumstances where ... there are periods of time that our resource mix is insufficient to meet load in all Zones. For these reasons, a DE resource is included to fill in the gap.

The report states that DEFRs are an undefined resource type possessing specified attributes, but it did not include nuclear energy as a potential DE resource:

The analysis does not identify exactly what the resource is. It could be thermal generating resources that looks like the combustion turbines in operation today, but operating on a fuel that is at least net zero from a GHG emission perspective, such as turbines running on renewable natural gas or hydrogen. It could be some form of demand response. It could represent the emergence of a long-term economic storage technology. Or, of course, some combination of all of the above. There is no way to know how advances in power system technologies, costs, policies, and consumer behavior can change the way the system meets demand twenty years hence. ... The DE resources are assumed to meet any remaining instantaneous power needs in the modeling period. They are modeled as able to dispatch on demand without any operational or duration restrictions.

The Analysis Group is very clear that dispatchability of the resource requires rapid ramping on demand. The table of LOLO events and dispatch of DEFRs also makes it clear that these resources would operate at low capacity factors, around 13.5% on average between the winter and summer seasons. Nuclear generation is neither technically nor economically feasible to satisfy these technical specifications. No advanced reactor designs possess that type of ramping capability. They are designed and function most efficiently and safely as baseload units, at constant 100% capacity. One new nuclear power plant design that possesses some degree of fast ramping capability is the Terrapower Natrium project proposed in Wyoming. If ever built, that reactor would operate as a 340 MW baseload generator, but some of its waste heat would be stored in a molten salt medium, which could be used to generate up to 145 MW of power for a few hours. In effect, the Natrium plant, if built and operated as designed, could provide a limited amount of ramping, but only in one direction. The 340 MW reactor itself would not be able to ramp down or start up rapidly. What is more, nuclear reactors require continuous offsite power to operate cooling pumps, motor-operated valves, and other safety systems. Operators must shut them down during transmission system outages.

On an economic basis, it would be extremely uneconomical to operate reactors in a DEFR mode as Analysis Group defines the resource type. The high capital cost of nuclear generation makes them exceedingly uneconomical to operate at low capacity factors. For instance, Lazard projects the levelized cost of energy for new reactors at \$142-\$222/MWh, based on operation at 97% capacity factors. For a reactor to operate at 13.5% capacity factor would increase the LCOE by 720%, to \$1,020-\$1,600/MWh.

In the *2024 System and Resource Outlook*, NYISO continues to define DEFRs similarly to the Analysis Group:

In the Outlook, DEFRs are added to the postulated future resource mix to supply essential characteristics, such as dispatchability and flexibility capabilities to support a high renewable system.

However, NYISO then states that “advanced small modular nuclear reactors” are one of two “technology pathways” that could serve as DEFRs (the other being hydrogen combustion

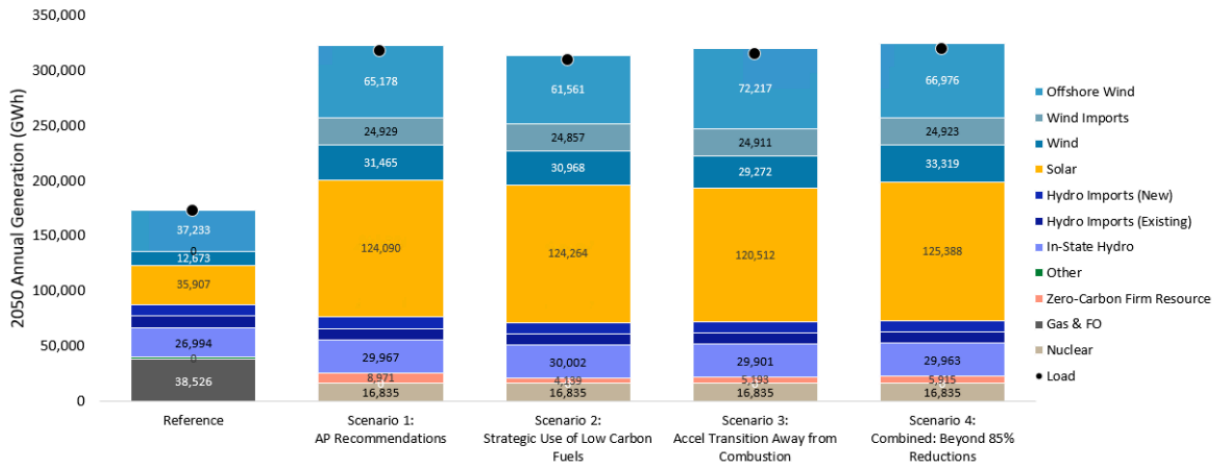
turbines or fuel cells). However, none of the reactor designs reviewed in the Blueprint have been demonstrated to operate flexibly or “controllably,” nor can they be dispatched on-demand. To operate them in such modes would raise their unit cost of generation dramatically, not to mention the potential safety issues caused by such operation. As indicated above, the Terrapower Sodium plant would include a thermal storage loop that could, theoretically, ramp quickly and generate power for a few hours a day, but that feature of its design is similar to solar and wind plants paired with on-site battery storage, which are far more economical with LCOEs of \$29-\$92/MWh for solar and \$45-\$133/MWh for wind, compared to \$142-\$222 for new reactors.

The E3 report commissioned by NYSERDA and DEC and included as Appendix G of the Climate Action Council (CAC) Scoping Plan does not use the term DEFR. The resource type that Brattle refers to as DEFR, depicted in the figures excerpted from the E3 report on page 1 of the Blueprint, is “zero-carbon firm capacity.” E3 does not define the attributes of this resource type with any degree of specificity, so it is not clear what attributes it represents. The report says that the modeled resources are hydrogen-fueled turbines and fuel cells, but that “[f]irm zero-carbon capacity needs could be met by a number of different technologies,” including nuclear. However, the model scenarios that E3 provides suggest that its zero-carbon firm resources would operate at very low capacity factors, ranging from 2.6% to 4.5%. (See the figures excerpted from the report below.) To operate at such low capacity factors, these resources would have to operate with high degrees of intermittency. Using nuclear generation as such a resource would raise the unit cost of generation by more than a factor of 20, making it thoroughly uneconomic as a DEFR or source of zero-carbon firm capacity.

Figure 30. Installed Capacity in 2050, All Scenarios³⁵



Figure 31. Annual Generation in 2050, All Scenarios



Nuclear generation is incompatible with the resource attributes of DEFRs identified in each of the studies the Blueprint cites. There are also inconsistencies in the ways the studies define the resource. The reliance in the studies' models of such a poorly defined and, in each case, as-yet unavailable resource is also questionable. Other studies modeling zero-emissions electricity systems with high amounts of renewable generation capacity have identified resource mixes that yield high degrees of reliability, using resources that are available and well-known today. For instance, a series of state-based studies conducted by the Institute for Energy and Environmental Research from 2010-2016, thoroughly investigated the integration of high levels of renewable generation (up to 100%) to identify the system design features and resource attributes needed to assure high levels of reliability.³⁰

The final report in the series modeled the feasibility of a statewide energy transition in Maryland in compliance with the state's climate law, requiring a 90% reduction in energy sector CO2 emissions by 2050. The *Prosperous, Renewable Maryland* study modeled the grid on an hourly basis, using NREL wind and solar data, and determined an optimal resource mix in a Climate Protection Scenario, with maximal electrification of buildings and transportation, as well as a doubling of the state's economy and population increases based on demographic projections. The study found that a balanced mix of wind and solar, with existing hydro and a mix of storage resources, demand response, and flexible and smart grid systems can achieve a high degree of reliability, at lower cost than the 2050 business as usual (BAU) scenario. The report summarized essential features of the transition in the energy sector as follows:

³⁰ Makhijani, Arjun. *eUtah: A Renewable Energy Roadmap*. Institute for Energy and Environmental Research. December 2010. <https://ieer.org/wp/wp-content/uploads/2010/12/eUtah2010.pdf>

-. *Renewable Minnesota: A technical and economic analysis of a 100% renewable-energy based electricity system for Minnesota*. Institute for Energy and Environmental Research. March 2012. <https://ieer.org/wp/wp-content/uploads/2012/03/renewableminnesota.pdf>

-. *Prosperous, Renewable Maryland: Roadmap for a Healthy, Economical, and Equitable Energy Future*. Institute for Energy and Environmental Research. November 2016. <https://ieer.org/wp/wp-content/uploads/2016/11/RenewableMD-Roadmap-2016.pdf>

- Continuation of increases in efficiency of electricity use and of weatherization of existing structures;
- Electrification of 90 percent of direct fossil fuel use for space heating in buildings, including conversion of buildings using natural gas;
- Complete electrification of the on-road transportation sector;
- Electrification of most of the non-road transportation sector, except boats and aircraft;
- Hydrogen production via electrolysis for use in industry, combined heat and power plants, as well as combined cycle and gas turbine generation; fuel cells could also be used;
- All generation would be wind and solar, except for a small amount of existing hydropower from the Conowingo dam;
- Battery storage;
- Automated demand response capability – meaning that certain appliances like clothes washers, dishwashers, electric car chargers, water heaters, etc., would operate automatically when electricity was cheap (i.e., supply plentiful relative other hours in the day) and defer operation when there was not enough supply to times when there was. Signing up would be voluntary (as it is with air-conditioner cycling programs at present). In normal times (when the overall system is not under supply stress), consumers could opt out for convenience and pay a higher rate; but at times of the highest relational peaks, opt out would not be available since demand response would be essential for system reliability. From the point of view of the grid (and therefore the ensemble of consumers), the entire point of the demand response payment is realized at those times;
- Sufficient distributed generation and storage to enable essential loads to be met without disruption during grid outages;
- Continued use of a small amount of fossil fuels for limited uses in industry and non-road transportation (like aircraft and boats) with possible replacement by renewable energy if technology and costs permit;
- Overall energy sector reduction of GHG emissions more than 90 percent relative to 2006 and a completely emissions-free electricity sector ...³¹

In terms of storage systems, *Prosperous, Renewable Maryland* modeled the following resources:

- Hydrogen produced from renewable sources ...;
- Combined heat and power systems in the commercial sector that would run on renewably produced hydrogen (either internal combustion engines or fuel cells);
- Light duty fuel cell power plants (or gas turbines) using renewably produced hydrogen for meeting relational peaks;
- Battery storage (not including electric vehicle batteries);³²

The report also described other complementary technologies that could be integrated into the system to bolster reliability, resilience, and overall system efficiency, but were not included in the hourly modeling:

³¹ Makhijani 2016 at pages 124-125.

³² Ibid at pages 115-116.

- Microgrids;
- Seasonal thermal storage;
- Compressed air storage and generation; the air would be reheated by renewably produced hydrogen before it is passed through the turbine to generate electricity ...
- Vehicle-to-grid (V2G) storage and demand response

In a subsequent analysis using the study data, the study's author, Dr. Arjun Makhijani, summarized the model for achieving grid reliability.³³ In short, the balanced mix of solar and wind with other generation sources satisfies Maryland load reliably in 68% of hours in a year; 5.5-hour battery storage increases coverage to 96% of hours; and demand response and smart grid systems provide load-balancing for the remainder of all hours in the year. The analysis also illustrates the capabilities that V2G storage and demand response could provide at scale, through deploying those systems in long-duration parking lots at airports:

Take long-term parking lots at airports. With suitable equipment, each could function as a sizable power plant. For example, the Thurgood Marshall Baltimore-Washington International Airport has more than 10,000 long-term parking spots. If three-quarters full, the cars parked and plugged in could supply the power equivalent of a large nuclear reactor for a short time (which is the nature of the residual peak load need). The daily lots could supply more. ... An overview number: the combined horsepower of today's vehicles is more than 50 times the combined capacity of all electric generation stations.

None of the reports cited in the Blueprint provide a comparably detailed analysis and research on system design under the CLCPA targets, using well-understood, available technologies. Demand response is modeled only at small levels by Analysis Group, E3, and NYISO; and the terms microgrid and smart grid/appliances are not to be found at all. Furthermore, the Analysis Group report which originated the DEFR concept, modeled grid reliability in 2040 with a zero-emissions resource mix per the CLCPA, but it is not clear that the resource mix the report projected is actually optimal or even practical. See the table excerpted from the report below, which details types of grid resources and capacity in each NYISO zone, including the modeled amounts of DEFRs.

³³ Makhijani. "Getting to a 100% renewable electricity sector." Institute for Energy and Environmental Research. May 2021. <https://ieer.org/news/getting-to-a-100-renewable-electricity-sector/>

Table ES-1: Generation Capacity, CCP2-CLCPA Resource Set

Nameplate Capacity by Zone, MW	A	B	C	D	E	F	G	H	I	J	K	Total
Land-based Wind	10,815.9	1,566.9	7,726.2	7,774.5	7,316.4	-	-	-	-	-	-	35,200.0
Offshore Wind	-	-	-	-	-	-	-	-	-	14,957.8	6,105.2	21,063.0
Solar (Behind-the-meter)	1,408.5	436.4	1,192.8	138.2	1,345.5	1,653.4	1,367.3	121.2	179.4	1,343.1	1,692.2	10,877.8
Solar (Grid Connected)	11,496.0	1,312.0	7,170.0	-	4,536.0	9,322.0	5,272.0	-	-	-	154.0	39,262.0
Hydro Pondage	2,675.0	-	-	856.0	-	-	41.6	-	-	-	-	3,572.6
Hydro Pumped Storage	-	-	-	-	-	1,170.0	-	-	-	-	-	1,170.0
Hydro Run-of-River	4.7	63.7	70.4	58.8	376.2	282.5	57.1	-	-	-	-	913.4
Nuclear	-	581.7	2,782.5	-	-	-	-	-	-	-	-	3,364.2
Imports	-	-	-	1,500.0	-	-	-	-	-	1,310.0	-	2,810.0
Storage	4,232.0	20.0	3,160.0	4,168.0	2,296.0	292.0	84.0	-	-	1,096.0	252.0	15,600.0
Price Responsive Demand (Summer)	949.9	205.2	510.1	357.7	211.1	433.9	246.3	58.6	134.9	1,940.8	187.6	5,236.0
Price Responsive Demand (Winter)	619.0	133.7	332.4	233.1	137.5	282.7	160.5	38.2	87.9	1,264.7	122.3	3,412.0
DE Resources	465.4	674.2	1,513.4	370.0	312.7	3,390.4	6,887.2	79.8	-	11,848.1	6,595.4	32,136.6

Several features of this resource mix and its geographic distribution are questionable:

- The amounts of storage (1,096 MW), distributed solar (1,343 MW), and utility-scale solar (0 MW) in New York City (Zone J) are small relative to the potential. For instance, in 2012, CUNY’s Center for Advanced Research of Spatial Information (CARSI) at Hunter College identified 5,800 MW of distributed solar potential in the city, through a LIDAR aerial survey of buildings.³⁴ A 2021 report by Strategen for the PEAK Coalition identified a combination of 5,600 MW of solar and 4,200 MW of storage capacity, along with energy efficiency and offshore wind resources could be implemented by 2030.³⁵
- There is no land-based wind in the Hudson Valley (Zones F-I) or Long Island (Zone K), but 7,775 MW in Zone D, most of the land in which is the Adirondack State Park.
- 70% of offshore wind capacity is connected in Zone J and 30% in Zone K, when the balance is more or less reversed in the state’s planned development of the resource.
- The amounts of distributed and utility-scale solar and storage in Long Island (Zone K) are minimal compared to the resource potential. Solar canopies on parking lots alone would provide a sizable resource, as well as optimal locations for V2G systems.

Improving the resource mix and system design, particularly with other flexible and resilient infrastructure like microgrids and V2G, could address the needs that the vague DEFR concept is supposed to represent.

Policy and Financing Measures for Reactor Construction

The Blueprint fails to address a foundational question regarding the feasibility of new reactors in New York: who would build and own them? Every nuclear power plant operating in the U.S. today --including all in New York -- was originally built and operated by a utility company of some sort³⁶ that had the authority to recoup its costs from a customer rate base. Given the extremely

³⁴ Sustainable CUNY. “The Bright Lights in New York Could Be Solar.” City University of New York. September 5, 2012.

<https://www1.cuny.edu/sites/sustainable/2012/09/05/the-bright-lights-in-new-york-could-be-solar/>

³⁵ Strategen Consulting. “The Fossil Fuel End Game: A Frontline Vision to Retire New York City’s Peaker Plants by 2030.” PEAK Coalition. March 2021.

https://www.peakcoalition.org/_files/ugd/f10969_e27774865535495598a21be0242560a8.pdf

³⁶ There are primarily three types of utility company ownership in the U.S.: investor-owned; government-owned; and rural electric cooperatives. Generally speaking, investor-owned utilities are

high capital cost and financial risk involved in building nuclear power plants, utilities are able to qualify for financing because they are allowed to set rates to recover their costs.

Even so, states have had to create exceptions to the usual ratemaking practices in order for most nuclear power plants to be built. Many investor-owned utilities, including those in New York, built reactors under a ratemaking policy generally called Construction Work in Progress (CWIP), which permits utilities to recover costs of the project from ratepayers while reactors are being built. Normally, utilities can only recover costs for projects once they have been placed into service and the utility commission has judged them “used and useful” or some other measure of public interest. The long construction times of nuclear reactors add to financial risk, and lenders are not willing to wait for a decade or longer for payments to be made. They typically require utilities to make finance payments until the reactor is placed in service. Georgia Power customers were charged over \$4 billion in CWIP payments before the project was completed and units 3&4 were placed in service this year. Georgia households paid, on average about \$1,000 in CWIP charges since 2009, and now face an aggregate rate increase of 23.7% to cover the full cost of the project.³⁷

This form of ownership and financing is no longer an option in New York, since the state restructured its electric utilities in the 1990s by requiring them to divest their generation assets and limiting their rate-based cost recovery to transmission and distribution system assets and services. Merchant power generation companies have to recover their costs from either market sales or bilateral power purchase agreements (PPAs) with consumers, so their total cost of generation must be competitive. It has not been possible for reactors to be built in restructured/deregulated markets like New York’s because the cost of construction, long build-time, and risks of delays and cost overruns are too great. In 2008, Constellation’s predecessor company was part of a consortium called Unistar that proposed to build a third reactor at Nine Mile Point. At the time, there was some expectation that even new nuclear reactors might be economically viable because of several years of increasingly high prices for gas and electricity generation in merchant power markets. But prices began a sustained and dramatic decline by 2009, due to a number of factors that have largely persisted since then:

- Massive increase in supply of fossil gas since horizontal, high-pressure hydraulic fracturing became widespread around 2008.
- Stagnant electricity demand.
- Significant amounts of new generation capacity and competition for market share.
- Increasing amounts of wind and, later, solar generation, with low-/zero-marginal costs.

Unistar submitted a combined construction and operating license application to the Nuclear Regulatory Commission in 2008, but later canceled plans for the project and withdrew the application in 2013. The same occurred with new reactors proposed in other deregulated states, such as Maryland, New Jersey, and Pennsylvania.

subject to regulation by a state public utility commission, and public power companies (government-owned and cooperatives) set their own rates, with some level of state oversight.

³⁷ Durand, Patty, Kim Scott, Glenn Carroll. “Plant Vogtle: the True Cost of Nuclear Power in the United States.” May 2024. <https://gcvedfund.org/wp-content/uploads/2024/06/Truth-about-Vogtle-report.pdf>

The Blueprint touches on this problem obliquely:

Development concepts for a FOAK [first-of-a-kind] plant would have to consider how best to allocate construction cost overrun and cancellation risk between customers, plant developers, plant construction firms, capital providers to all these parties, the State, and the Federal Government.³⁸

This statement is partly based on a thesis propounded in the Blueprint, that FOAK reactors will be expensive, but there will be reductions in nuclear construction costs as more reactors of the same design are built. There is no evidence in the U.S. and Europe that such cost and financial risk reductions will be realized, nor that construction times will significantly and consistently decrease. But even so, there is no compelling public policy justification for customers and taxpayers to assume such risk with nuclear projects.

A recent report by researchers at the Copenhagen School of Energy Infrastructure³⁹ provides a “synopsis of financing models currently being applied or under development for newly built nuclear power plants,” finding that “Nuclear power plant projects with their specific risk profile largely only become bankable with governments de-risking the investment, thereby exposing taxpayers or ratepayers to the project risks.”

The state has not offered such extraordinary financing measures to assist in executing offshore wind or other renewable resources, and NIRS and AGREE do not argue that the state should. But nuclear power plants have consistently been afforded extraordinary exceptionalism, largely to the detriment of New York consumers and the state’s energy policy. We document at least eight separate financial interventions afforded to nuclear power plant owners in New York, through which ratepayers and taxpayers have been forced to bear billions of dollars in financing, subsidies, and bailouts over the last fifty years. We recite them here, briefly:

1. In 1973, NYPA took over ownership and construction of Indian Point unit 3 from Consolidated Edison (ConEd), due to cost overruns.⁴⁰
2. The construction costs of Nine Mile Point unit 2 (NMP2) and Shoreham each increased dramatically, and the costs were almost entirely borne by ratepayers under CWIP rate recovery. NMP2 became the most expensive reactor in the country, at a total cost of \$6.4

³⁸ Blueprint at page 19.

³⁹ Weibezahn, J., & Steigerwald, B. (2024). “Fission for Funds: The Financing of Nuclear Power Plants.” Copenhagen School of Energy Infrastructure. <https://doi.org/10.22439/csei.rep.2024.1>

Full text.

https://research-api.cbs.dk/ws/portalfiles/portal/108323583/jens_weibezahn_et_al_csei_report_2024_1.pdf

⁴⁰ “History of Indian Point Energy Center.” Indian Point Heritage Project. 2024. <https://ipheritage.org/history-of-indian-point/>

billion when it entered service in 1988.⁴¹ Shoreham cost \$5.6 billion by the time it was completed,⁴² with ratepayers paying over \$1 billion in CWIP charges.⁴³

3. Gov. Mario Cuomo's decision to retire Shoreham before it began commercial operation precipitated the bankruptcy of the Long Island Lighting Company (LILCO). The state reached a settlement with LILCO which resulted in establishing the Long Island Power Authority (LIPA) to take over LILCO's assets and debt in 1997, saddling LIPA customers with a total of \$9.145 billion in debts, which also included LILCO's 18% ownership share in NMP2 (\$1.15 billion).⁴⁴
4. In 2001, Niagara Mohawk and other utilities (except LIPA) sold their ownership interest in NMP1&2 to Constellation.⁴⁵ The sale price of the reactors was \$675 million,⁴⁶ leaving the utilities with \$1 billion in stranded debts, which the PSC allowed Niagara Mohawk to categorize as a regulatory asset for ratemaking purposes. Ratepayers were required to cover the utilities' \$1+ billion stranded debts plus Niagara Mohawk/National Grid's rate of return.
5. Between 2000 and 2001, ConEd and NYPA sold their reactors to Entergy at prices below their market valuation, costing their customers an unspecified value on their previous investments.
6. From 2015-2017, RG&E customers were charged over \$160 million for a reliability support services agreement (RSSA) to support continued operation of Ginna when Constellation Energy Nuclear Group wanted to retire it, but due to delayed transmission upgrade projects, NYISO determined that the reactor would need to remain in service for 2-3.5 years until RG&E's system upgrades were completed.⁴⁷
7. In 2016, Gov. Andrew Cuomo proposed a bailout of the four reactors in Central & Western New York to prevent them from closing. The PSC created the ZEC program as part of the Clean Energy Standard, a 12-year bailout program estimated to cost consumers throughout the state over \$7 billion. Because the price formula for the ZECs is based, in part, on the emissions intensity of electricity generation statewide, the state's failure to meet renewable energy targets under the CES and CLCPA has supported a high cost of the program.

⁴¹ Associated Press. "Nine Mile Pt. 2 Nuclear Plant Is Shut by Utility After Leak." *The New York Times*. October 19, 1989.

<https://www.nytimes.com/1989/10/19/nyregion/nine-mile-pt-2-nuclear-plant-is-shut-by-utility-after-leak.html>

⁴² Davis, Will. "Showdown at Shoreham." *Nuclear Newswire*. May 16, 2018.

<https://www.ans.org/news/article-2048/showdown-at-shoreham/>

⁴³ Wald, Matthew L. "How L.I. Will Pay for Shoreham." *The New York Times*. June 19, 1983.

<https://www.nytimes.com/1983/06/19/nyregion/how-li-will-pay-for-shoreham.html>

⁴⁴ New York State Assembly. "Shedding Light on the Financial Structure of the LIPA/LILCO Proposal." September 1997. <https://nyassembly.gov/Reports/Energy/199709/>

⁴⁵ At the time, Constellation was a separate utility holding company with a merchant generation business, until its acquisition by Exelon in 2012.

⁴⁶ "Nine Mile Point sale complete." *Nuclear Engineering International Magazine*. November 26, 2001.

<https://www.neimagazine.com/news/nine-mile-point-sale-complete/>

⁴⁷ Azulay Chasnoff, Jessica, and Tim Judson. "Comments of AGREE and NIRS: Case #15-E-0302: Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard." New York State Public Service Commission. April 22, 2016.

<https://www.nypa.gov/-/media/nypa/documents/document-library/annual-reports/2016-financial-report.pdf>

8. In order to prevent Entergy from closing FitzPatrick in 2017, Gov. Cuomo also negotiated a deal under which Entergy transferred ownership of the reactor to CENG.⁴⁸ A condition of the deal was that NYPA transfer its \$1.5 billion in decommissioning trust fund balances⁴⁹ to Entergy, likely one of the largest privatizations of public assets in state history that also ceded the State's last remaining control over the decommissioning process for those reactors.

Flawed Assumptions Embedded in New York's Nuclear Policies

While the continued operation and subsidies for the existing reactors is not within the scope of the Blueprint, it provides important context for the state's consideration of investments and financing of new nuclear construction. As the adage goes, "what's past is prologue." It is not evident that the premise justifying the ZEC program was correct – i.e., that subsidizing the continued operation of the four reactors in Central & Western New York would be a "bridge" to renewable energy. Total renewable electricity generation was lower in 2023 than in 2019, when the CLCPA was enacted. Wind and solar increased, but in such a small amount (617 GWh in four years) that it could not make up for a 6.2% decrease in hydro generation by 1,866 GWh. To meet the 2030 target, New York must now increase renewable generation by over 76,000 GWh. Absent fundamental changes to the state's approach to renewable development, it may not be possible to achieve that rate of growth in six years, given the slow pace to date. The need for a change in course and rededication to implementation of the CLCPA is urgent.

If the thesis of the ZEC program was to invest in maintaining a baseline of nuclear generation while renewable generation accelerated, that is not what has happened. Ratepayers have been required to pay over \$3.2 billion in ZEC program costs since 2017,⁵⁰ including over \$534 million in the 2023 compliance year alone.⁵¹ By contrast, ratepayers paid only \$18 million toward Tier 1 RECs, and over \$42 million toward Alternative Compliance Payment obligations of utilities and other load-serving entities toward their unfulfilled obligations, due to the shortfall in REC-eligible generation. Ratepayers were, therefore, forced to invest 32 times more for programs that represent the status quo in New York's electricity supply than toward the growth of renewable energy sources that the CES and the CLCPA mandate. New York consumers have no say in how these programs are being run, but clearly the policy structure of incentives and accountability that the PSC and NYSERDA have established has not been working.

⁴⁸ Weiner, Mark. "Inside the hardball tactics to save FitzPatrick: NY threatened to seize the nuke plant." Syracuse.com. August 11, 2016.
https://www.syracuse.com/politics/2016/08/nys_threat_to_seize_fitzpatrick_nuclear_plant_sparked_deal_to_save_615_jobs.html

⁴⁹ New York Power Authority. "Financial Report: December 31, 2016 and 2015." March 21, 2017.
<https://www.nypa.gov/-/media/nypa/documents/document-library/annual-reports/2016-financial-report.pdf>

⁵⁰ NYSERDA. "NYSERDA ZEC Clean Energy Standard report Q1 2024." Filed with NY PSC on May 16, 2024.
<https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={00AA818F-0000-CE99-884F-5375E1BCA185}>

⁵¹ NYSERDA. "CES Financial Status Report for calendar year 2023." Filed with NY PSC on April 1, 2024.
<https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={E04F9B8E-0000-CB5B-AD10-0633A2AF7617}>

New York should reconsider its approach to renewables deployment, especially given its slowness compared to other states, which have demonstrated the rapidity that is possible for renewable energy deployment. For instance, for the last eight years in a row, Texas has increased annual wind and solar generation by huge strides, ranging from a 9,079,415 MWh increase in 2019 to 22,833,960 MWh increase in 2022.⁵² These increases are well more than than a 1,000 MW nuclear plant can produce. In total, Texas has increased renewable energy generation by nearly 103 million MWh from 2015-2023. In the 16 years since 2007, the increase was over 138 million MWh – more than three times the total amount of nuclear generation in the state. Similarly, California increased utility-scale solar generation by 26,186,585 MWh from 2015-2023, and it has deployed 13,000 MW of battery storage capacity—including 3,000 MW in the six months from April to October 2024.⁵³ A recent analysis of California’s electricity system performance in summer 2024 concludes that the large deployments of solar and storage in the last two years have already had a demonstrable effect in improving grid reliability, despite record levels of heat this year.⁵⁴

A study published in 2020 surveyed dozens of countries’ energy policies and investments, and found a definitive pattern of policy-driven technology lock-in, with significant implications for climate policy.⁵⁵ The study reviewed energy resource and GHG emissions outcomes of countries that had adopted policies promoting nuclear power and/or renewable energy, during the period 1990-2014. It found that countries locked into one category of resources or the other (i.e., nuclear or renewables), and were not successful at developing both. It found, further, that countries which opted to pursue nuclear energy did not see significant reductions in GHG emissions. Countries that pursued renewables had significantly lower CO2 emissions. New York’s experience and track record appears emblematic of the report’s findings, warranting reconsideration of the priority our state has placed on nuclear energy since the 1960s.

As detailed above, the Blueprint justifies the development of new reactors on a number of flawed and inaccurate technical analyses and ill-defined concepts, especially its analysis of the CLCPA, modeling of the electricity system in 2040, and the category of dispatchable, emissions-free resources (DEFERs) on which the alleged need to consider advanced reactors is based. And given that Brattle acknowledges the great uncertainties of the economic and technical feasibility of new reactors, the failure to discuss alternative measures for assuring reliability of a decarbonized grid is a major shortcoming. The exigencies of the climate crisis and the mandates of the CLCPA require real solutions, but the Blueprint provides none.

⁵² U.S. Energy Information Administration. “EIA-923 Power Plant Operations Report: Net Generation by State by Type of Producer by Energy Source (EIA-906, EIA-920, and EIA-923).” U.S. Department of Energy. October 4, 2024. https://www.eia.gov/electricity/data/state/annual_generation_state.xls

⁵³ Colthorpe, Andy. “California now has more than 13GW of battery storage.” Energy Storage News. October 18, 2024.

<https://www.energy-storage.news/california-now-has-more-than-13gw-of-battery-storage/>

⁵⁴ GridStatus. “Peak Western Conditions Reveal a Changed CAISO.” September 13, 2024.

<https://blog.gridstatus.io/caiso-beats-the-heat/?ref=grid-status-exports-newsletter>

⁵⁵ Sovacool, Benjamin K., Schmid, P., Stirling, A. et al. “Differences in carbon emissions reduction between countries pursuing renewable electricity versus nuclear power.” Nature Energy (2020). October 5, 2020. <https://doi.org/10.1038/s41560-020-00696-3>

We appreciate the opportunity to submit our comments on the Blueprint.

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