Advanced Nuclear Power Technologies in Hawaiʻi

Report to the Hawaiʻi State Legislature, Regular Session of 2026

Completed in Accordance with S.C.R. 136 S.D.1 H.D. 2, of the Thirty-Third Hawaiʻi State Legislature, 2025

HAWAIʻI STATE ENERGY OFFICE

Contents

Acknowledgements

The Hawaiʻi State Energy Office (HSEO) would like to thank the following working group members and organizations for their participation in the working group and their contributions and assistance in this report.

- The Hawaiʻi State Department of Health
- The Department of Land and Natural Resources
- The Hawaiʻi Public Utilities Commission
- Hawaiian Electric Company
- University of Hawaiʻi at Mānoa
- A representative from the U.S. Navy

The following working group members were considered representatives with expertise in nuclear energy generation or nuclear waste disposal:

- Nuclear Energy Institute
- POWER Engineers
- Burns & McDonnell

The following working group members were considered representatives of environmental organizations:

- Earthjustice
- Life of the Land
- 350 Hawaiʻi

HSEO also thanks the Chairs of the Senate Committee on Energy and Intergovernmental Affairs and the House Committee on Energy and Environmental Protection for attending the working group sessions and providing direction for this report.

HSEO notes that the statements and conclusions presented in this report do not necessarily reflect the views of all working group members.

Executive Summary

The Hawaiʻi State Energy Office (HSEO) convened a nuclear energy working group, as requested by SCR 136, to study the feasibility of using advanced nuclear power technologies.

The working group was requested to:

(1) Study the feasibility of using advanced nuclear power technologies in the State;

(2) Evaluate the benefits, risks, and barriers to developing and using advanced nuclear power technologies in the State, including regulatory, statutory, financial, social, and environmental factors; and
(3) Identify potential short-term and long-term nuclear energy goals for the State.

The Hawaiʻi State Energy Office submits this report of the working group's findings and recommendations to the legislature in accordance with SCR 136.

The working group largely concurred that Hawaiʻi should not serve as a test case for any advanced nuclear demonstration projects, given the current lack of specific information and uncertainty regarding related costs of the technology, the state's geographic isolation, permitting challenges, and the various logistical challenges and safety needs associated with transporting and managing nuclear waste. The report outlines unanswered questions associated with advanced nuclear reactors most applicable to Hawaiʻi. Until these questions are resolved within the industry, the working group considers any constitutional or regulatory changes to be premature.

Key issues associated with the development of advanced nuclear technologies are identified below, and some issues lack sufficient information to inform decision-making:

1) Commercial viability and technical readiness: Advanced nuclear technologies such as SMRs are not yet commercially viable or technically proven, although substantial investments are being made. There is no reliable timeline for when options suitable for Hawaiʻi's grid might become available.
2) Uncertain costs and finance structures: To date, there are no SMRs in commercial operation, that is, no units operating as revenue-generating power plants under standard regulatory, licensing, and market conditions. Existing SMR projects are demonstration facilities, which operate primarily to validate technology, safety performance, and cost assumptions rather than to provide full-scale commercial service. Because comparable market data is unavailable, cost estimates are based on forecasts, and estimated costs and market-availability timelines remain highly uncertain and variable. Nuclear demonstration projects are heavily subsidized.
3) Reliability, operability, and grid integration: Until technical specifications and operational characteristics of advanced reactors exist in the market, there is no viable way to understand how to interconnect these technologies to Hawaiʻi's isolated electrical grids or how to model and predict operational performance.
4) On-island handling and interim storage of radioactive waste: Hawaiʻi currently lacks the facilities, workforce expertise, regulatory framework, and emergency-response capabilities needed to safely handle, process, and store the radioactive waste on-island. The systems and infrastructure that would be required for even interim management

remain unknown, in part because the volume and specific types of waste associated with advanced nuclear technologies are not yet fully defined.

   a. While the U.S. Nuclear Regulatory Commission (NRC) would regulate many aspects of waste handling, the State would likely require complementary oversight and capacity that does not currently exist.
   b. There was a broader discussion on safety that could not be answered because the isotopes to be used in SMR brought to Hawaiʻi are not known. There were also concerns about security during the operation and during the lengthy cool-down of spent fuel.

5) Availability of compliant transport vessels and coordination with receiving jurisdictions: While transport requirements are known and regulated by NRC and DOT, it is unclear what volumes or forms of waste would need to be transported, making it difficult to assess feasibility, costs, and risks.
6) There is currently no long-term storage option for spent fuel and radioactive waste; a permanent repository does not exist. Without an available long-term storage site, it is difficult to determine how long spent fuel would need to be stored in temporary locations, or where it would be stored safely in the short and long term.
7) It is unknown if any locations in Hawaiʻi meet NRC siting criteria, as established in 10 CFR Part 100; certain siting criteria are dependent upon the technology to be adopted.

Recommendations

Modifications would be required to two key state laws that currently restrict nuclear development: 1) Article XI, Section 8 of the Hawaiʻi Constitution, and 2) Hawaiʻi Revised Statutes §269-91, the state's Renewable Portfolio Standard definitions.

- Since both law changes would be subject to approval by the State Legislature, HSEO advises that advanced nuclear technology should be demonstrated to be commercially viable with facilities operational in the continental U.S. prior to substantial resources being allocated to its development in Hawaiʻi.
- Consequently, HSEO does not recommend any amendments to the State Constitution or the Renewable Portfolio Standard to accommodate nuclear energy at this time.[1]

No proposed legislation is included in this report, as HSEO believes existing State laws are adequate to address current concerns associated with nuclear energy. While advanced nuclear designs are not yet commercially demonstrated and are not yet mature enough to pursue due

[1] While this is the recommendation of HSEO, some working group members asserted that moderate effort should be continued, and stated funding should be provided to conduct initial studies, such as determining knowledge levels, surveying to understand community perception, and conducting a technical and geological viability for siting.

to uncertainties in terms of cost, technical readiness, and potential health and environmental impact, HSEO recognizes the potential long-term benefits associated with nuclear energy, including the ability to provide baseload power, potential lower land use impacts, and near-zero operational carbon emissions. Accordingly, HSEO and the Working Group recommend that the State continue to monitor advancements and consider an update to this report once the advanced nuclear designs have been built, and the costs and operation performance are known, which is expected in the next three to five years based on current developments.

If desirable advances are made, including answers to the questions and challenges identified herein, long-term goals for implementation can then be considered, if appropriate. HSEO is a member of the National Association of State Energy Officials (NASEO), which has a nuclear energy working group, and can and will continue to track advancements in technology through that forum.

Technology Overview

Nuclear Energy Basics

Nuclear energy is derived from the release of energy within the nucleus—the core of the atom, which contains protons and neutrons. This energy can be produced through two processes, fission and fusion. **Fission** occurs when a nucleus splits into smaller parts (Figure 1). **Fusion** occurs when two nuclei combine to form a single, larger nucleus, releasing energy in the process. Fission is the process that has been used to produce nuclear energy since the 1950s, and it accounts for nearly 19 percent of the electricity and nearly half of the low emission electricity in the U.S.[2] Fusion is not yet viable, and while companies are pursuing commercial applications, fusion is likely several decades away from being able to generate electricity at the commercial scale—fusion was not evaluated in this report.[3]

In fission, a sustained chain reaction occurs under controlled conditions and with the correct amount of fuel, commonly uranium, thorium, and/or plutonium with enriched isotopes. This chain reaction releases neutrons and heat in the form of radiation. Neutrons impact other fuel atoms, which sustains the nuclear reaction. This chain reaction releases heat in the form of radiation, which is captured and used to heat water or other heat transport medium, to then produce steam, which is used to generate electricity or process heat. This basic process applies to both conventional and advanced nuclear technologies, which are distinguished herein.

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[2] Center for Climate and Energy Solutions. (n.d.). *Nuclear Energy*. Retrieved December 1, 2025, from https://www.c2es.org/content/nuclear-energy/

[3] U.S. Energy Information Administration. (2023). *Nuclear explained*. https://www.eia.gov/energyexplained/nuclear/

Radiation is generated in all nuclear fission reactions. Radiation is the primary environmental and health concern associated with nuclear energy, *see Health and Environmental Impacts.*

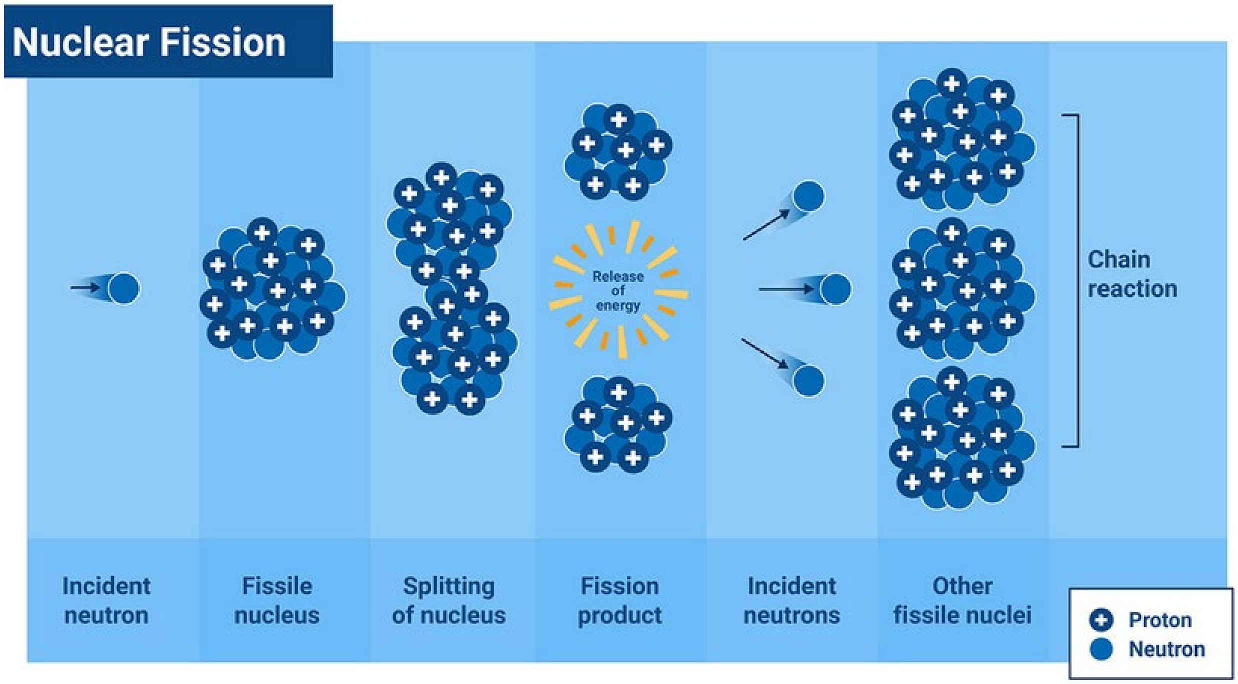

Figure 1 Depiction of nuclear fission. Source IAEA A. Vargas.

Chain reactions caused by the initial split of an atom result in the production of incident neutrons, which induce radioactivity in the fuel, the cooling water, and the structural components of the nuclear reactor.[4] Although nuclear fission results in a chain reaction, the fuel does not last forever and must be replaced with a new fuel. **Spent fuel** is used nuclear fuel that has been removed from reactors when it is no longer efficient to sustain a reaction. In conventional reactors, about one-third of the fuel is replaced every 1.5 to two years; however, advanced designs are working to replace the fuel on longer intervals or less frequently, which would reduce the amount of spent fuel.[5] Although the spent fuel can no longer efficiently produce power, it remains highly radioactive and thermally hot.[6] As a result, the management of spent fuel becomes an essential consideration in evaluating the overall safety and sustainability of nuclear power.

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[4] Committee on the Analysis of Cancer Risks in Populations near Nuclear Facilities-Phase I; Nuclear and Radiation Studies Board; Division on Earth and Life Studies; National Research Council. Analysis of Cancer Risks in Populations Near Nuclear Facilities: Phase I. Washington (DC): National Academies Press (US); 2012 Mar 29. D, Origin of Radioactivity in Nuclear Plants. Available from: https://www.ncbi.nlm.nih.gov/books/NBK201997/

[5] International Atomic Energy Agency. (2009). *Advanced fuel pellet materials and fuel rod design for water-cooled reactors*. IAEA.

[6] International Atomic Energy Agency. (2010). *Management of spent fuel from nuclear power reactors: Safety and sustainability*. IAEA.

Understanding how waste is handled provides important context for weighing the risks of radiation against the potential benefits of nuclear energy, because, despite the risks associated with radiation, nuclear energy provides a potential firm power source that does not emit greenhouse gases during operation and can play an important role in mitigating the climate crisis, see *Nuclear Waste*.

Advanced Nuclear Power Technology

SCR 136 requested HSEO to study the feasibility of using *advanced nuclear power technologies* in the state. Advanced nuclear power technologies are defined by the Energy Act of 2020 as "a fission reactor with significant improvements compared to reactors operating on the date of enactment [2020] or a reactor using nuclear fusion." [7] Significant improvements listed in the Energy Act include, but are not limited: additional inherent safety features; lower waste yields; improved fuel and material performance; greater reliability; increased resistance to nuclear weapons proliferation; increased thermal efficiency; reduced consumption of cooling water; ability to integrate electricity generation; operational flexibility to change output to match demand and complement intermittent renewable energy output or energy storage; and modular sizes to match electricity demands and other energy requirements.[8]

Advanced fission technologies can generally be divided into two categories, primarily based on capacity, or the size of the systems: small modular reactors (SMRs) and microreactors. SMRs are reactors with electric generating capacity of up to 300 megawatts, as defined by the International Atomic Energy Agency (IAEA). Microreactors are small-capacity SMRs, defined by the US Department of Energy as producing 1 to 20 MW of thermal energy (MWth), which could be used for industrial processes or to generate electricity.[9]

Reactor Type	***Power Output***	***Application***	***Deployment***
SMR	20-300 MW	Grid-scale power	Factory-built, onsite installation and assembly, or onsite construction
Microreactor	1-20 MW	Backup and remote power	Arrives assembled, easily transported

Advanced nuclear power technologies differ from conventional nuclear power in that these technologies can operate at electric capacities less than 300 MW, making them more viable to serve as a baseload for smaller island grids, like those in Hawaiʻi. Conventional nuclear power

[7] Congressional Research Service. (2023, February 17). *Advanced nuclear reactors: Technology overview and current issues*. https://www.congress.gov/crs-product/R45706
[8] Id.
[9] Id.

plants are not a viable option for Hawaiʻi for several reasons, including system size (a single nuclear reactor would be far too large, with many over 1,000 MWe, relative to system demand and capacity, resulting in stability and reliability risks), high upfront capital costs, and land use constraints.

While advanced nuclear technologies may show more promise than conventional nuclear for Hawaiʻi, the technology is still very nascent and has not been commercially deployed—none are operating as fully commercial, grid-integrated facilities. Only three demonstration SMRs are operating globally in China, Russia, and Japan.[10] The only two designs operating are the KLT-40S in Russia, which has been operating since 2020, and HTR-PM in China, which has been operating since 2023; both operate with significant state support and subsidy.[11]

Size and Land Use Requirements

One of the primary advantages of many SMR designs is modular construction: major components and modules can be factory-assembled, transported by truck/rail/barge, and installed on site. This factory fabrication approach shortens on-site construction time, can reduce schedule risk, and makes deployment to constrained islands, like Hawaiʻi, more feasible than building large reactors entirely on site.

Typical SMR site footprints for plants in the 100 to 200 MW range are on the order of 10 to 50 acres, dependent on site and design. This is a huge advantage over utility-scale solar, which typically requires about 5 to 10 acres per MW.[12]

Reactor Concepts and Fuel Types

There are several SMR reactor concepts currently under development internationally, with only one design in the United States having received NRC design approval, and three others currently under review for construction permits, see *Landscape Analysis*. Advanced reactor concepts and applications will vary as technology progresses; progress should be monitored and reassessed to see if applications suited for Hawaiʻi's unique considerations become available, and logistical considerations for use in Hawaiʻi outlined herein have been addressed.

Nuclear technology can be divided into different generations:

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[10] Nuclear Energy Agency. (2024). *The NEA Small Modular Reactor Dashboard: Second Edition*. OECD Publishing. https://www.oecd-nea.org/jcms/pl_90816/the-nea-small-modular-reactor-dashboard-second-edition

[11] Stanford University. (2025, September 30). *Understand small modular reactors*. https://understand-energy.stanford.edu/news/understand-small-modular-reactors

[12] International Atomic Energy Agency (IAEA). *Small Modular Reactors Catalogue 2024 / SMR technical materials* (2024). IAEA.

- Generation I – These were the first commercial nuclear reactors built in the 1950s and 1960s. They demonstrated that nuclear energy could generate electricity but had limited safety systems and efficiency. None are operational today.
- Generation II – These are the most common type of conventional nuclear reactors operating today, with most built from the late 1960s through the 1990s. They include light water reactors (LWRs), which use water as both a coolant and a moderator, a material that slows down neutrons to sustain the nuclear reaction.
- Generation III – These are improved versions of Generation II reactors, designed to be safer, more efficient, and longer-lasting. They use upgraded materials and digital controls. Some include passive safety systems that rely on natural forces like gravity and convection instead of pumps or human intervention to keep the reactor cool in an emergency.
- Generation III+ – These are further refinements of Generation III designs with additional safety and efficiency upgrades. Many are modular for easier construction and operation. The NuScale US460 SMR, approved by the NRC, belongs to Generation III+.
- Generation IV – These are next-generation advanced reactors, all in the research and development stage. They are designed to use fuel more efficiently, produce less long-lived radioactive waste, and use less water. [13]

Both Generation III+ and Generation IV could be considered *advanced nuclear technologies*. A key design feature is that they can maintain safe conditions by removing heat without external power or human actions for longer periods of time. Many SMR designs are advanced reactors.

Generation IV technologies may also use fuels different from the most common nuclear fuel, uranium-235. Alternative nuclear fuel types include uranium-238 (the more common isotope than U-235), thorium, or enriched fuels, including mixed oxide fuel (MOX) (a blend of plutonium oxide and uranium oxide), high-assay low-enriched uranium (HALEU), and uranium-233 bred from thorium.

Generation IV reactors may also utilize coolants other than water. Alternative coolants include liquid sodium, molten salts, helium, and lead, each offering potential advantages such as higher thermal efficiency, improved safety margins, and reduced water dependency compared to conventional water-cooled systems.

It is difficult to predict which of these technologies, if any, will achieve commercial success or widespread operations.

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[13] Gragg, D., Woodward, J., Cornwell, H., Schraeder, B., Poore, S., Chang, S., & Yao, A. (2025, September 30). *Understand Small Modular Reactors*. Stanford University. https://understand-energy.stanford.edu/news/understand-small-modular-reactors

Nuclear Waste

All nuclear fission power plants, including small modular reactors (SMRs), generate radioactive waste and spent nuclear fuel, making careful management essential. Current practices rely on on-site storage, initially in shielded spent fuel pools and, after sufficient cooling, in dry cask storage systems with continuous monitoring.

Composition of Fuel

Spent nuclear fuel consists of solid ceramic fuel pellets encased in long metal tubes, known as fuel rods. Typically, several hundred fuel rods are bundled together into a rectangular fuel assembly that is used to generate energy inside a nuclear reactor.

Short-term post-discharge storage

Immediately after discharge from a reactor, used nuclear fuel is placed in water-filled pools inside reactor buildings. The water cools the fuel, as many of the radioactive byproducts also generate heat, and shields workers in the plant from its radioactivity. According to the NRC, approximately 20 feet of water above the top of the fuel stops most harmful radiation from reaching a person standing above the pool.[14] The need for water cooling is short-lived, as decay heat declines significantly over time.[15] The minimum period for storing spent fuel under water is 9 to 12 months, after which cooling requirements have dropped enough that dry storage can be considered.[16]

Longer-term on-site storage (dry cask storage)

Once water cooling is no longer required, fuel assemblies are transferred to dry cask storage. In dry cask storage, fuel is sealed inside steel canisters and surrounded by additional layers of steel, concrete, or other materials to provide radiation shielding and physical protection. The Nuclear Regulatory Commission (NRC) has renewed licenses for most dry cask storage systems for 40-year terms, extending into the 2040s and 2060s, with the option for additional

[14] U.S. Nuclear Regulatory Commission. (n.d.). *Spent fuel pools*. https://www.nrc.gov/waste/spent-fuel-storage/pools

[15] Radioactivity.eu. (n.d.). *Spent fuel heat*. https://radioactivity.eu.com/articles/radioactive_waste/spent_fuel_heat

[16] International Atomic Energy Agency. (2006). *Spent fuel management options and the implementation of the joint convention on the safety of spent fuel management and on the safety of radioactive waste management: Report of the International Atomic Energy Agency (GC-50/INF/3 Annex 5)*. https://www.iaea.org/sites/default/files/gc/gc50inf-3-att5_en.pdf

renewals.[17] In 2014, the NRC concluded that repackaging of used fuel would not be necessary for at least 100 years.[18] [19] [20]

Transportation of spent fuel

Two common reasons for transporting used fuel are to consolidate storage at fewer sites and to support recycling. In Hawaiʻi, eventual water vessel transport off-island will be necessary. Transport of radioactive material is highly regulated by the U.S. Department of Transportation (USDOT), while the NRC establishes requirements for the design and manufacture of transport packages. In addition, the NRC establishes the requirements for the design and manufacturing of packages for radioactive materials, see *Policy and Governance* section. Most dry cask systems are designed to be transportable. There is experience with transporting used nuclear fuel in the United States and internationally, with more than 3,000 shipments completed in the U.S. and over 25,000 worldwide.[21]

Long-term challenges and the absence of permanent disposal.

The United States has not established a permanent disposal facility for high-level radioactive waste. The only proposed long-term repository was Yucca Mountain in Nevada. Plans for storing high-level radioactive waste within Yucca Mountain raised longstanding concerns regarding environmental impacts, cultural preservation, and tribal sovereignty—concerns that are not likely unique to the proposed long-term geologic storage site. Amongst other concerns, pushback over the long-term centralized storage sites in the U.S. has resulted in ongoing battles and litigation. The proposal for Yucca Mountain was effectively abandoned in 2010–2011, and the NRC license application for construction was cancelled in 2011.[22] A 2012 retrospective study concluded that a more open and collaborative approach should be applied to gain acceptance of such facilities.[23] Permanent disposal facilities, selected with a more collaborative,

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[17] U.S. Nuclear Regulatory Commission. (n.d.). *10 C.F.R. Part 72*. https://www.nrc.gov/reading-rm/doc-collections/cfr/part072/full-text

[18] U.S. Nuclear Waste Technical Review Board. (2022). *Commercial Spent Nuclear Fuel: review fact sheet*.

[19] U.S. Nuclear Regulatory Commission. (2014). *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel: Final Report (NUREG-2157), Vol. 1*. https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2157/v1/index

[20] Regulatory Basis for Dry Spent Nuclear Fuel Storage Canister Inspections, Transactions of the American Nuclear Society, Vol. 115, Las Vegas, NV, November 6–10, 2016.

[21] U.S. Department of Energy. (2017). *Enhanced safety record report*.

[22] World Nuclear Association. (2024, April 30). *Storage and disposal of radioactive waste*. https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/storage-and-disposal-of-radioactive-waste

[23] U.S. Department of Energy. (2012). *Blue Ribbon Commission on America's Nuclear Future: Final report*.

consent-based processes are under construction in Finland[24] and Sweden[25], while Canada[26], Switzerland[27], and France[28] have disposal sites undergoing regulatory review.

Since there is no permanent storage site in the U.S., spent nuclear fuel (estimated at more than 90,000 metric tons nationwide) remains stored at reactor sites or temporary storage locations across the country. [29] Nuclear waste today is stored on site, in dry cask storage, or temporary storage locations throughout the U.S. The U.S. is estimated to have over 90,000 metric tons of spent nuclear fuel from commercial nuclear power plants.[30]

Consolidated Storage and Recycling

While the U.S. does not currently recycle spent nuclear fuel, recycling has been practiced in France, and Japan is expected to begin operations soon. The U.S. Department of Energy is revisiting the potential role of recycling, and several private companies are pursuing commercial recycling technologies.

Two of the most common reasons for transporting used nuclear fuel are: 1) To consolidate storage at fewer sites,[31] and 2) To take the fuel to a reprocessing facility where it is disassembled so reusable constituents can be recycled back into new fuel to produce more energy while radioactive byproducts are placed into longer-term storage at the same facility.[32] There is currently no commercial recycling capability in the US, although there are a number of companies working on developing it.[33] [34] [35]

While the practices described herein are designed to contain, cool, and isolate spent fuel safely, these measures are not without long-term challenges. Although existing storage and transportation practices have strong safety records, transportation and storage systems, including short-term, long-term, and permanent, require ongoing maintenance, regulatory

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[24] Posiva Oy. (n.d.). *Homepage*. https://www.posiva.fi/en/

[25] Svensk Kärnbränslehantering AB (SKB). (n.d.). *Homepage*. https://skb.com/

[26] Nuclear Waste Management Organization (NWMO). (n.d.). *Homepage*. https://www.nwmo.ca/#

[27] Kamen Kraev. (2024). *Nagra submits application for construction of deep geological repository*. NucNet. https://www.nucnet.org/news/nagra-submits-application-for-construction-of-deep-geological-repository-11-1-2024

[28] Agence nationale pour la gestion des déchets radioactifs (ANDRA). (n.d.). *Homepage*. https://international.andra.fr/

[29] Yucca Mountain is located on the ancestral lands of the Western Shoshone, Southern Paiute, and Owens Valley Paiute peoples. The area contains significant archaeological and ethnobotanical resources that are culturally and historically important to the Indigenous communities.

[30] U.S. Government Accountability Office. (n.d.). *Nuclear Waste Disposal*. Retrieved November 10, 2025, from https://www.gao.gov/nuclear-waste-disposal

[31] Steve Edwards. (2008). *Progress Energy Transportation Experience (Presentation to NWTRB)*. Progress Energy.

[32] Orano Group. (n.d.). *Orano La Hague*. https://www.orano.group/china/en/our-stories/orano-la-hague

[33] Oklo. (n.d.). *Fuel recycling*. https://oklo.com/fuel-recycling/default.aspx

[34] Exodys Energy. (n.d.). *Homepage*. https://www.exodysenergy.com/

[35] Curio. (n.d.). *Homepage*. https://curio.energy/#home

oversight, and long-term institutional stability to remain effective. Although many current technologies have demonstrated strong safety records, uncertainties remain regarding the long-term feasibility and location of permanent disposal solutions.

Health and Environmental Impacts

Health impacts of nuclear energy and associated radiation come from the extraction of uranium and fuels, as well as the production of nuclear waste or spent fuel. Radiation is the primary environmental and health concern associated with nuclear energy. If exposed at high levels or for long durations, radiation can damage living cells and DNA.[36] If proper protocol is not followed or an accident occurs that results in the release of radioactive materials into the environment, it can contaminate soil, water, and air for thousands of years. Radiation can damage living cells, enter the food chain, and cause health problems like cancer and genetic mutations.[37] It also harms ecosystems and biodiversity, particularly if there is prolonged exposure to plants and microorganisms that form the base of food webs, or if radiation impacts a keystone species population.[38] [39] Higher levels or longer periods of exposure increase the likelihood and severity of health effects. Even low levels of radiation can pose risks if exposure continues over time. The overall impact also depends on the type of radiation and whether it comes from an external source or from radioactive materials that enter the body.[40] Ultimately, the extent of damage from radiation exposure depends on both the amount of radiation absorbed and how long a person or animal is exposed.[41]

It is important to recognize that radiation occurs naturally, and everyone receives small amounts of radiation from the environment, such as from the ground, space, and food. This is known as background radiation, and the typical amount a person receives is 620 millirem (mrem) per year,

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[36] World Health Organization. (2023, July 7). *Radiation and health: Questions and answers*. https://www.who.int/news-room/questions-and-answers/item/radiation-and-health

[37] U.S. Environmental Protection Agency. (2025). *Radiation health effects*. https://www.epa.gov/radiation/radiation-health-effects

[38] Beresford, N. A., Copplestone, D., & Barnett, C. L. (2016). Ecological effects of exposure to enhanced levels of ionizing radiation. *Journal of Environmental Radioactivity, 162–163*, 347–357. https://doi.org/10.1016/j.jenvrad.2016.06.012

[39] Møller, A. P., & Mousseau, T. A. (2023). Soil microbes and plant–associated microbes respond to radioactive pollution, altering abundance and species diversity in contaminated areas. *Microbiology*, 12(2), 364. https://doi.org/10.3390/microorganisms12020364

[40] United States Department of Energy (2016) Office of Environment, Health, Safety, & Security. *Radiation in Perspective.*

[41] World Health Organization. (2023, July 7). *Radiation and health: Questions and answers*. https://www.who.int/news-room/questions-and-answers/item/radiation-and-health

with a millirem being the unit of measurement for radiation. Background radiation increases at higher elevations, with more air travel, certain medical procedures, and other factors.[42]

The EPA and NRC set strict limits on allowable radiation from nuclear power operations that are below the determined amount that would have an impact on public health. The limit for radiation exposure to the public during normal operations is 100 millirem above background (for comparison, a full-body CT scan is 1,000 millirem).[43] Note: *A "rem" (Roentgen Equivalent Man) is a traditional U.S. unit used to express the biological effect of ionizing radiation on humans. The "millirem" (mrem) is one-thousandth of a rem. Dose (in rem or mrem) reflects not just the energy deposited in tissue but also the type of radiation and its biological effect; internationally equivalent metrics often use the sievert (Sv).*

Regulatory limits for public exposure to radiation from nuclear-power operations are intended to keep additional exposures well below levels considered likely to cause observable health harm. Despite these safety thresholds, a substantial and growing body of peer-reviewed research demonstrates that even low-dose or chronic exposure to ionizing radiation, at levels sometimes near or modestly above background or regulatory limits, is associated with elevated long-term health risks, particularly cancer, but potentially also non-cancer effects.[44] Complementing that evidence, a recent large pooled-cohort study of more than 100,000 U.S. nuclear-industry workers followed for many decades found that cumulative low-dose exposures to x-rays and gamma-rays, common in occupational radiation, were associated with a higher mortality rate from solid cancers compared with unexposed or less-exposed populations.[45] Further, long-term exposure to radiation at levels above recommended limits can increase the risk of a range of chronic health effects, including endocrine dysfunction, tissue damage, cancer, and heritable genetic changes.

Acute impacts, or health results from high-level exposure over short durations, can include radiation sickness, skin and organ damage, nausea and vomiting, and death. **Acute radiation syndrome is extremely rare, and humans rarely, if ever, experience large doses (~50rem) of radiation**. Radiation syndrome comes from extreme events like a nuclear explosion or accidental handling or rupture of a highly radioactive source, underscoring the need for robust

[42] United States Nuclear Regulatory Commission (2022) Doses in Our Daily Lives. https://www.nrc.gov/about-nrc/radiation/around-us/doses-daily-lives

[43] Id.

[44] Berrington de Gonzalez, A., Daniels, R. D., Cardis, E., Cullings, H. M., Gilbert, E., Hauptmann, M., Kendall, G., Laurier, D., Linet, M. S., Little, M. P., Lubin, J. H., Preston, D. L., Richardson, D. B., Stram, D., Thierry-Chef, I., & Schubauer-Berigan, M. K. (2020). Epidemiological studies of low-dose ionizing radiation and cancer: Rationale and framework for the monograph and overview of eligible studies. *JNCI Monographs, 2020*(56), 97–113. https://doi.org/10.1093/jncimonographs/lgaa00

[45] Richard Wakeford, Solid cancer mortality among US radiation workers, *International Journal of Epidemiology*, Volume 52, Issue 6, December 2023, Pages 1992–1994, https://doi.org/10.1093/ije/dyad131.

safety systems, which are in place around the world at conventional nuclear facilities.[46] [47] Importantly, acute high-dose exposure remains extremely rare for the public, with only a few instances globally meeting acute levels (Three Mile Island in 1979, Chernobyl in 1986, and Fukushima in 2011). While Fukushima met acute levels of radiation, there were no documented cases of acute exposure in people from the incident.[48]

Although regulatory frameworks for nuclear power and radiation protection generally are built on conservative assumptions and safety margins, it is important to recognize that no level of ionizing radiation exposure beyond background can be assumed completely risk-free. Especially in contexts where radiation is released over extended time frames or could lead to internal exposures (through inhalation or ingestion of radioactive materials), the potential for long-term health effects should guide rigorous safety, monitoring, and risk-management practices.

These considerations suggest that while the immediate public health risk under normal operations is very small, the long-term and population-scale risks — especially from chronic or slightly elevated exposures, or from rare accidents — warrant careful assessment, transparent disclosure, and incorporation in lifecycle risk analyses.

Supply Chain Impacts

In addition to the impacts from onsite nuclear power production, many working group members and HSEO assert the importance of considering the environmental and public health impacts of the entire lifecycle and supply chain, particularly for uranium fuel. Radon and its decay products remain the most significant radiation-related hazard for uranium miners; extensive epidemiological research has shown that inhalation of radon progeny, or short-lived, radioactive decay products of radon gas, substantially increases lung-cancer risk.[49, 50]. Although the National Institute for Occupational Safety and Health (NIOSH) identified in 1987 that improved ventilation and exposure controls could reduce these risks, no enforceable Mine Safety and Health Administration (MSHA) or OSHA standard has ever been adopted for radon progeny in mines.

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[46] United States Nuclear Regulatory Commission (2020) High Radiation Doses. Available from: https://www.nrc.gov/about-nrc/radiation/health-effects/high-rad-doses
[47] Centers for Disease Control (2024) Acute Radiation Syndrome. https://www.cdc.gov/radiation-emergencies/signs-symptoms/acute-radiation-syndrome.html
[48] Energy Encyclopedia. (n.d.). *Nuclear accidents*. https://www.energyencyclopedia.com/en/nuclear-energy/the-safety-of-nuclear-power-plants/nuclear-accidents
[49] National Research Council. (1999). *Health effects of exposure to radon: BEIR VI*. National Academy Press.
[50] Samet, J. M., Avila-Tang, E., Boffetta, P., & Vineis, P. (2021). Radon and lung cancer risk: An update. *Journal of the National Cancer Institute, 113*(9), 1131–1139. https://doi.org/10.1093/jnci/djab058

Uranium extraction can also expose workers to alpha and gamma radiation from uranium and its decay chain, as well as heavy metals associated with the ore.[51] Some contamination pathways extend beyond the mine site: airborne dust, waterborne radionuclides, and waste mismanagement can expose nearby communities, particularly when accidental releases or natural disasters compromise containment.[52] [53] A persistent concern is uranium mill tailings, which contain long-lived radionuclides such as radium-226 and can release radon gas or leach into groundwater if not properly controlled.[54] While modern engineering and monitoring can reduce many risks, uranium mining and milling remain upstream stages of the nuclear fuel cycle with significant occupational hazards and potential environmental impacts that require stringent oversight, which goes far beyond any state oversight and control.[55]

In addition to mining and milling, uranium processing and fuel fabrication introduce further occupational and environmental risks within the nuclear fuel supply chain. After milling, uranium concentrate ("yellowcake") is chemically refined, converted, and in some cases enriched, processes that can expose workers to soluble uranium compounds, fluorinated chemicals (such as uranium hexafluoride), and additional radiological hazards. Inhalation or ingestion of soluble uranium can cause chemical toxicity to the kidneys, independent of radiological effects, while external gamma radiation and internal alpha exposure remain concerns.[56]

Processing also generates radioactive and chemically hazardous wastes, including depleted uranium and contaminated effluents that require long-term management. While engineering controls and monitoring can reduce many risks, these upstream stages depend on robust federal oversight, often beyond state control, underscoring that uranium processing has meaningful occupational, public health, and environmental impacts distinct from onsite power

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[51] Brugge, D., & Goble, R. (2002). The history of uranium mining and the Navajo people. *Annual Review of Public Health, 23*(1), 117–135. https://doi.org/10.1146/annurev.publhealth.23.100901.140813

[52] Environmental Protection Agency. (2021). *Technologically enhanced naturally occurring radioactive materials (TENORM): Uranium mining waste*. U.S. Environmental Protection Agency. https://www.epa.gov/radiation/tenorm-uranium-mining-waste

[53] Hoover, J. H., Gonzales, M., Shuey, C., Barney, Y., Lewis, J., & Begay, M. (2017). Elevated radionuclides in abandoned mine waste and contaminated groundwater on the Navajo Nation. *Environmental Science & Technology, 51*(23), 13695–13704. https://doi.org/10.1021/acs.est.7b03964

[54] National Research Council. (2012). *Uranium mining in Virginia: Scientific, technical, environmental, human health, and regulatory aspects of uranium mining and processing in Virginia*. National Academies Press. https://doi.org/10.17226/13266

[55] National Research Council. (2011). *Potential human health effects of uranium mining, processing, and reclamation* (NCBI Bookshelf, Book No. NBK201047). National Academies Press. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK201047/

[56] id

generation.[57] Notably, these upstream supply chain impacts are outside Hawaiʻi's state jurisdiction.

Greenhouse Gas Reduction

Nuclear energy does not emit carbon dioxide or other noxious gases during operations. Nuclear energy also has one of the lowest total carbon footprints over the lifecycle (including fuel supply and used fuel management), on par with wind energy.[58] Nuclear energy also requires the least amount of land per unit of energy generation, which is of particular relevance for Hawaiʻi. These two key features are very important environmental benefits, given the current climate crisis and the need to reduce greenhouse gas emissions. Greenhouse gas reduction is a clear benefit of nuclear energy.

Safety

The nuclear industry is heavily regulated to ensure safety; however, as with all industrial activity, there is an inherent high level of risk associated with nuclear power. The NRC is responsible for regulating nuclear power to minimize safety risks. All U.S. nuclear power plants must have multiple, redundant barriers to contain radioactive material, robust safety systems, well-trained personnel, and ongoing testing and maintenance. NRC inspectors regularly review these measures to ensure compliance. By law, nuclear reactors are required to isolate radioactive material through multiple layers of protection. These protections change based on the design of the reactor; however, generally, the first barrier consists of sealed metal tubes encasing ceramic uranium fuel pellets. The second is the thick steel reactor vessel, with a thickness of nine to twelve inches, and associated piping that circulates cooling water. The third barrier is the reinforced concrete and steel containment building, several feet thick, which surrounds the reactor and is designed to contain radioactivity even in the unlikely event of a serious accident.[59]

Many advanced reactors have passive, or inherent, safety systems that include a simpler design, a reactor core with lower core power, and larger fractions of coolant. In theory, this allows operators to react more quickly to incidents. Many SMR designs rely on natural circulation for cooling the reactor core, which requires limited-to-no operator action in safety response. This also means a lack of components such as valves, pumps, pipes, and cables, therefore limiting

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[57] Id

[58] United Nations Economic Commission for Europe. (2021). *Life cycle assessment of electricity generation options*. https://unece.org/sed/documents/2021/10/reports/life-cycle-assessment-electricity-generation-options

[59] U.S. Nuclear Regulatory Commission. (2024). *Reactor risk*. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/reactor-risk

the risk of failure.[60] Advanced reactors by design require less maintenance and fewer workers.[61] However, as asserted throughout this report, no advanced reactor design has demonstrated these features in commercial operation, and independent safety analyses remain limited.

The NRC emphasizes that even reactors with passive systems still require multiple engineered and human safety barriers, emergency planning zones (EPZs), and operator training to mitigate accidents. Simplified designs do not necessarily translate to lower overall risk or reduced staffing requirements.[62]

EPZs are an important component of siting a nuclear facility. The EPZ is the distance at which pre-planning of emergency response is needed; it serves as the designated area for which planning is recommended to ensure that appropriate actions can be taken to protect the public in the event of an accident. The EPZ guidance does not change the requirements for emergency planning; it only sets bounds on the planning perimeter.[63] The EPZ for traditional/conventional reactors is about 10 miles in radius around the reactor site, however, the EPZ size and share vary for each plant due to site-specific conditions, unique geographical features in an area, and the area's demographics and population centers. While many advanced reactor designs anticipate an EPZ limited to the site boundary—potentially only a few hundred meters—this reduction has not yet been demonstrated in commercial operations, and its applicability remains uncertain. Notably, the EPZ required for a given technology will significantly affect its feasibility in Hawai'i—particularly on O'ahu—where high population density and limited available land make it challenging to establish adequate emergency planning buffers.

If ever considered, NRC would evaluate the siting requirements and follow all approval requirements for stationary power facilities, as established by NRC Regulations, Title 10, Code of Federal Regulations, Part 100. Factors considered by NRC include, but are not limited to: 1) characteristics of reactor design (currently unknown), 2) intended use of the reactor, including the proposed maximum power level and nature of radioactive materials, 3) safety features integrated into the facilities, and 4) physical site characteristics including the seismology, geology, hydrology, and meteorology as these impact the escape of radioactive material from

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[60] European Commission. (n.d.). *Small modular reactors explained*. https://energy.ec.europa.eu/topics/nuclear-energy/small-modular-reactors/small-modular-reactors-explained_en
[61] U.S. Department of Energy. (n.d.). *Enhanced safety of advanced reactors*. https://www.energy.gov/ne/enhanced-safety-advanced-reactors
[62] Federal Register. (2023). *Emergency preparedness for small modular reactors and other new technologies*. https://www.federalregister.gov/documents/2023/11/16/2023-25163/emergency-preparedness-for-small-modular-reactors-and-other-new-technologies
[63] U.S. Nuclear Regulatory Commission. (2018). Report Document ML18177A386. *Emergency Planning: Emergency Planning Zone Sizing for Small Modular Reactors – Regulatory History & Policy Considerations.*

the facility.[64] All of this would need to be evaluated, and due diligence conducted, but completing this type of siting evaluation may not be valuable until the advanced nuclear technology being implemented is known.

Costs

With the lack of operational data and with so few SMRs deployed internationally at a commercial scale, the costs associated with advanced nuclear power are largely unknown and highly uncertain. However, despite the high costs, many large financial institutions are interested in supporting nuclear R&D, and the current federal administration is also particularly interested in nuclear.[65]

The levelized cost of energy (LCOE) is a metric for comparing different energy sources relative to their cost per unit of energy produced. LCOE is inclusive of all lifetime costs—capital, operations and maintenance, fuel, and decommissioning, divided by total energy produced, with future costs and outputs discounted to present value. Capital costs can include, but are not limited to, many engineering, procurement, and construction (EPC) costs.

LCOE **projected** estimates suggest LCOE can be competitive with alternative firm options viable today.[66] However, today's LCOE estimates are substantially higher than other firm options, with many of the demonstration projects substantially exceeding budgets and heavily relying on government subsidy. Today's LCOE exceeds costs of other alternative firm options. Cost competitiveness depends on many factors, including the location and the LCOE comparison for advanced reactors. The Nuclear Energy Institute (NEI) and other industry analyses suggest that costs could decline substantially as the technology scales and matures. Economies of scale, design standardization, streamlined permitting, improved supply chain logistics, and reduced financing risk are expected to drive future cost reductions. The Nuclear Energy Agency (NEA) notes that capital and financing costs dominate the overall cost structure of nuclear power, which means that any improvement in construction efficiency or financing terms can have a disproportionate impact on lowering total LCOE.[67] Financial costs accumulate during the lengthy construction phase of a nuclear facility, primarily in the form of interest on debt. The NRC and the Congressional Budget Office have shown that delays of even one year can significantly

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[64] U.S. Nuclear Regulatory Commission. (2020). *10 C.F.R. Part 100*. https://www.nrc.gov/reading-rm/doc-collections/cfr/part100/full-text#part100-0010

[65] Nuclear Energy Institute. (2025). *Taking the investment pulse: Q1 2025*. https://www.nei.org/news/2025/taking-the-investment-pulse-q1-2025

[66] World Nuclear Association, "Economics of Nuclear Power", September 29, 2023. https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power

[67] World Nuclear Association, "Economics of Nuclear Power", September 29, 2023. https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power

increase project costs due to compounded interest, inflation, and deferred revenue. Each additional year of construction can also trigger extended land lease payments and expose critical equipment purchases to inflationary pressures. According to NEI, an 18-month delay for a large reactor can increase the final cost of electricity by roughly seven percent. Consequently, controlling construction schedules and financing structures is critical to ensuring ratepayer affordability and project viability.

For resource planning, LCOE is often the standard metric used to determine the appropriate capacity of a resource. Although LCOE remains the most common metric for comparing generation technologies, many analysts and working group members emphasize that it should not be used in isolation, and usually it is not. LCOE measures only the average cost per megawatt-hour over a plant's lifetime and does not reflect the system value or reliability contribution of different resources.[68] For example, nuclear power's ability to provide firm, dispatchable capacity distinguishes it from intermittent renewables such as wind and solar, yet this advantage is not captured by a simple LCOE comparison. Alternative or complementary metrics can provide a more holistic assessment of value. The Levelized Avoided Cost of Electricity (LACE), for instance, measures the avoided cost or market value of generation rather than its production cost, capturing how a resource supports system reliability or reduces the need for other capacity investments. Some analysts advocate for "value-adjusted LCOE" or "net system cost" approaches that incorporate integration costs and system benefits, such as grid stability, firm capacity value, and flexibility. Another approach—cost per ton of carbon dioxide avoided—links economic analysis with decarbonization policy goals, which is especially relevant in jurisdictions like Hawaiʻi, where Act 54 (2023) mandates consideration of lifecycle greenhouse gas emissions in project evaluation, although this consideration remains largely discretionary.

Finally, total system cost metrics and capital risk indicators account for financing risk, schedule sensitivity, and interest during construction—factors particularly influential for first-of-a-kind (FOAK) reactor designs.

SMRs plan to drive down the cost of building the plants through economies of scale. If enough units of the same design are anticipated to be built, there is a point at which the units become cheaper.[69] The First-of-a-Kind (FOAK) reactor is predicted to cost at least 20% or more to get online, with the cost gradually decreasing over time. As it currently stands, no singular

[68] Clean Air Task Force. (2023). *Beyond LCOE: Advanced nuclear reactors in a changing energy landscape*. https://www.catf.us/resource/beyond-lcoe/

[69] Information Technology & Innovation Foundation, "Small Modular Reactors: A Realist Approach to the Future of Nuclear Energy" April 2025. https://itif.org/publications/2025/04/14/small-modular-reactors-a-realist-approach-to-the-future-of-nuclear-power/

technology is prevailing.[70] Therefore, developing a design that the industry can both standardize and produce at scale will take time and may be many years away.

Funding Options

The current options in the United States for financing nuclear energy projects draw from both private-sector investment and a growing array of public financing mechanisms. In recent years, large technology companies such as Google, Meta, Amazon, and other data-center operators have emerged as major players in the advanced nuclear space. Their interest is driven by the need for 24/7 electricity to power high-growth computing loads such as artificial intelligence, cloud services, and data infrastructure. These firms are increasingly signing long-term power purchase agreements (PPAs), making direct investments in developers, or exploring ownership structures that support deployment of next-generation reactor designs.[71]

On the public side, federal support for nuclear energy has expanded significantly. The current federal administration is spending significant funds to advance U.S. reactor exports and domestic deployment, including major agreements to support developers. As an example, the federal government has agreed to fund $80 billion using Westinghouse nuclear reactor technology to deploy nuclear power across the country.[72] This deal includes profit-sharing mechanisms for the public to participate in long-term financial value.[73]

In addition, the U.S. Department of Energy (DOE) has expanded its Loan Programs Office (LPO) authority to support nuclear projects through loan guarantees and direct loans. The LPO provides access to low-cost capital for first-of-a-kind reactors, small modular reactors (SMRs), and repowering projects at retiring fossil fuel sites. These mechanisms reduce financing risk, improve bankability, and help catalyze private-sector investment that may otherwise be hesitant to enter large, capital-intensive nuclear projects.

International institutions have also shifted their position. The World Bank, which previously maintained restrictions on financing nuclear power, recently reversed that stance, opening the

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[70] Lyons, R.E., & Roulstone, A.RM. (2018). Production leaning in a small modular reactor supply chain. In *International congress on Advances in nuclear power plants*.

[71] Nuclear Energy Institute. (2025). *Taking the investment pulse: Q1 2025*. https://www.nei.org/news/2025/taking-the-investment-pulse-q1-2025

[72] Brookfield Asset Management. (2025). *United States government, Brookfield, and Cameco announce transformational partnership*. https://bam.brookfield.com/press-releases/united-states-government-brookfield-and-cameco-announce-transformational-partnership

[73] Utility Dive. (2025). *Westinghouse, Cameco, Brookfield nuclear partnership*. https://www.utilitydive.com/news/westinghouse-cameco-brookfield-nuclear/803999/

door for international development financing to support nuclear deployment in developing countries as part of global decarbonization strategies.[74]

Policy and Governance

State Policies

Hawaiʻi State Constitution

Nuclear power has been constitutionally restricted in Hawaiʻi since 1978. Article XI, Section 8, of the Hawaiʻi State Constitution states that "no nuclear fission power plant shall be constructed or radioactive material disposed of in the State without the prior approval by a two-thirds vote in each house of the legislature."

Historically, there have been attempts at changing the current State Constitution to allow the construction of a nuclear power plant and the disposal of radioactive material by eliminating Article XI, Section 8 of the Constitution, such as HB 1741, introduced during the 2024 Hawaiʻi State Legislative Session.[75] The bill was only introduced, never heard in Committee, and did not make it through the legislative process.

Constitutional Changes in Other States

Many states have acted in recent years to rescind their restrictions on new nuclear power. Wisconsin was the first state to repeal its ban on new nuclear development in 2016, followed by Kentucky, Montana, West Virginia, Wyoming, and Illinois from 2017-2023.[76] [77] [78] At the time of

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[74] World Bank Group. (2025). *World Bank Group, IAEA formalize partnership to collaborate on nuclear energy for development*. https://www.worldbank.org/en/news/press-release/2025/06/26/world-bank-group-iaea-formalize-partnership-to-collaborate-on-nuclear-energy-for-development

[75] Hawaiʻi State Legislature. (n.d.). *Hawaiʻi energy policy*. https://www.capitol.hawaii.gov/hrscurrent/Vol05_Ch0261-0319/HRS0269/HRS_0269-0092.htm

[76] U.S. Department of Energy. (2023). *What nuclear moratorium?*. https://www.energy.gov/ne/articles/what-nuclear-moratorium#:~:text=Since%20the%201970s%2C%2016%20states,to%20potential%20new%20reactor%20construction.

[77] Nucleation Capital. (2025). *States are lifting bans on nuclear*. https://nucleationcapital.com/states-are-lifting-bans-on-nuclear#:~:text=Illinois%20became%20the%20most%20recent,nuclear%20reactors%20in%20the%20state.

[78] Nucleation Capital. (2025). *U.S. states nuclear initiatives*. https://nucleationcapital.com/us-states-nuclear-initiatives

this report, Massachusetts and Connecticut are in the process of rescinding their constitutional bans.[79] [80]

Connecticut has restricted new nuclear construction since 1979. Their restriction prohibited new nuclear construction until the federal government identifies and approves a demonstrable technology for disposing of high-level nuclear waste. Over recent years, Connecticut has moved in the direction of rescinding this ban. In 2022, Connecticut's legislature passed House Bill 5202, which created an exemption to the new nuclear construction ban. This exemption applied to existing nuclear generating facilities, allowing them to develop advanced nuclear technologies, including SMRs. In 2022, conventional nuclear power made up 87.2% of Connecticut's carbon-free electricity, 37% of its total electricity portfolio.[81] As of September 2025, Connecticut has become the 40th Nuclear Regulatory Commission (NRC) Agreement state, meaning the State entered an agreement with the NRC giving the State authority over the handling of radioactive materials.[82] In 2025, Connecticut passed Public Act No. 25-173, which established a nuclear reactor site readiness funding program. It also allows economic development corporations to use energy or related products from selected nuclear facilities for standard service if doing so is in the consumer's best interest.[83]

It is important to note that the repeal of any constitutional restriction does not automatically authorize specific nuclear energy sites in the state; additional federal, state, and local approvals would be necessary. For certain agencies, rulemaking and new procedures would need to be developed.

Renewable Portfolio Standard

In 2015, Hawaiʻi made history as the first state to adopt a 100% renewable portfolio standard (RPS), setting a statutory target to achieve 100% renewable electricity generation by 2045 under

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[79] Fast Democracy. (2025). *Connecticut legislative bill search: CTB00029242*. https://fastdemocracy.com/bill-search/ct/2025/bills/CTB00029242/#billtexts

[80] American Nuclear Society. (2025). *Nuclear moratoriums crumble around the world*. https://www.ans.org/news/2025-05-20/article-7054/nuclear-moratoriums-crumble-around-the-world/#:~:text=Other%20developments:%20Looking%20below%20nation,massachusettsmoratoriumnova%20scotiataiwan

[81] Barclay Damon LLP. (2025). *Connecticut law advance act*: Offers opportunity to enhance carbon-free energy and improve reliability with advanced nuclear technologies. https://www.barclaydamon.com/news/connecticut-law-tribune-advance-act-offers-conn-opportunity-to-enhance-carbon-free-energy-and-improve-reliability-with-advanced-nuclear-technologies

[82] Connecticut House Democrats. (2025). *Connecticut becomes 40th U.S. NRC agreement state*. https://www.housedems.ct.gov/gresko/ct-becomes-40th-us-nrc-agreement-state

[83] 2025 Acts Affecting Energy and Utilities By: Jessica Schaeffer-Helmecki, Senior Legislative Attorney, July 28, 2025, Connecticut General Assembly Office of Legislative Research, Special Report.

Hawaiʻi Revised Statutes (HRS) 269-92.[84] Renewable energy is defined in HRS 269-91 as wind, sun, falling water, biogas, geothermal, ocean water, currents, waves, ocean thermal energy conversion, biomass, biofuels, and hydrogen.

The RPS law dictates the energy sources any regulated utility is allowed to count toward its renewable energy goals, and, by statute, it restricts the procurement of non-renewable resources beyond 2045. Advanced nuclear is not classified as a renewable resource and has an operational lifespan of 60 years or more.[85] Therefore, its deployment under the current RPS would conflict with the law. Legislative amendments would be necessary for the deployment of nuclear power to be considered renewable under the RPS.

Renewable and Clean Portfolio Standards – Other States

At the time of this report, 28 states plus the District of Columbia have enacted mandatory Renewable Portfolio Standards (RPS), which require utilities to procure a specified share of electricity from renewable resources such as wind, solar, and biomass. An additional 16 states have adopted broader Clean Energy Standards (CES) that define eligible technologies more expansively to include zero-carbon resources such as nuclear energy, hydropower, or fossil generation with carbon capture in addition to traditional renewables.[86] Most states outline their acceptable renewable energy sources in their RPS; all but one do not include nuclear. Some states, New Mexico, for example, explicitly characterize nuclear as a non-renewable energy source. On the other hand, Colorado's RPS policy evolution illustrates how definitions can change: Colorado initially adopted an RPS focused on renewable resources, but it has transitioned to a broader clean energy standard, based on operational emissions, under which **nu**clear is recognized as an eligible clean energy resource alongside renewables and other zero-carbon generation.[87]

Since nuclear is recognized for producing zero greenhouse gas emissions during operations, some states consider nuclear a "clean energy source" or "zero emission source." If nuclear were to become a viable option in the future, Hawaiʻi could replace the RPS or pair it with a carbon-based standard or a clean energy standard, as an alternative to including nuclear in the definition of renewable energy. Carbon-based or clean energy standards are based on emissions versus the statutorily defined renewable energy sources attributed to an RPS. Twelve states have passed clean energy standards.[88] Some states explicitly mention nuclear in their clean

[84] Hawaiʻi State Legislature. (2025). *HRS 0269-0092 Energy adequacy report*. https://puc.hawaii.gov/reports/energy-reports/adequacy-of-supply/
[85] World Nuclear Association. (2024). *Life cycle of nuclear plants: Decommissioning and long-term operation (LTO)*.
[86] Barbose, G. L. (2025). *U.S. State Electricity Resource Standards: 2025 Data Update*. Lawrence Berkeley National Laboratory. https://emp.lbl.gov/publications/us-state-electricity-resource
[87] Colorado General Assembly. (2025). *HB25-1040 nuclear energy bill text*. https://leg.colorado.gov/bills/hb25-1040
[88] Center for Climate and Energy Solutions. (2024). *Renewable and alternate energy portfolio standards*. https://www.c2es.org/document/renewable-and-alternate-energy-portfolio-standards/

energy standards. New York includes zero-emission credits for nuclear facilities to support nuclear generation in the state.[89]

New York and Colorado are two states that Hawai‘i could model an updated RPS or a clean energy standard after. New York has a hybrid clean energy standard, whereby 70% of generation shall be from renewables by 2030, and 100% shall be “zero emissions” by 2040.[90]

In addition to Colorado, Kentucky, and New Hampshire have declared nuclear a “clean energy source”.[91] Unlike Colorado, Kentucky does not have an RPS or clean energy standard. Kentucky currently has no nuclear energy.[92] HCR 22 was signed into law in March 2025 in Kentucky, stating that nuclear power generation is a clean and dispatchable means of providing baseload electricity.[93] To continue advancing nuclear in New Hampshire, the State passed, as of July 2025, a law stating that clean energy includes “new technology, small-scale nuclear energy.”[94] At the time of this report, conventional nuclear energy makes up over half of New Hampshire’s electricity generation.[95]

Other relevant Hawai‘i Legislation

During the 2011 Hawai‘i State Legislative Session, HB 57 was proposed, requesting Chapter 196 of the Hawai‘i Revised Statutes be amended to include requirements for Hawai‘i’s Department of Business, Economic Development, and Tourism (DBEDT) to develop proposed legislation and rules to establish the appropriate permitting process to enable the construction and operation of nuclear energy generation facilities in Hawai‘i.[96] HB 57 was never heard in committee.

Also in 2011, HB 62 was proposed to establish a nuclear commission within DBEDT for the purpose of studying the feasibility and advisability of developing nuclear energy generation in Hawai‘i. The language in SCR 136, from the 2025 legislative session, that prompted this working

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[89] Database of State Incentives for Renewables & Efficiency. (2025). *Energy efficiency programs*. https://programs.dsireusa.org/system/program/detail/5883

[90] New York State Energy Research and Development Authority. (n.d.). *Clean energy standard programs*. https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Standard

[91] Nuclear Energy Institute. (2025). *Where is nuclear energy policy in the states?* https://www.nei.org/news/2025/where-is-nuclear-energy-policy-in-the-states

[92] Nuclear Energy Institute. (2025). *State electricity generation fuel shares*. https://www.nei.org/resources/statistics/state-electricity-generation-fuel-shares

[93] Kentucky General Assembly. (2025). *Kentucky resolution on energy supply adequacy*. https://apps.legislature.ky.gov/record/25rs/hcr22.html#:~:text=A%20CONCURRENT%20RESOLUTION%20declaring%20that,and%20businesses%20of%20the%20Commonwealth.

[94] New Hampshire Legislature. (2025). *HB189 nuclear initiatives*. https://legiscan.com/NH/text/HB189/id/3041647

[95] Nuclear Energy Institute. (2025). *State electricity generation fuel shares*. https://www.nei.org/resources/statistics/state-electricity-generation-fuel-shares

[96] U.S. House of Representatives. (2025). *HB57 nuclear initiatives*, *Regular Session*, 2011.

group, is similar to the language proposed in the 2011 HB 62.[97] HB 62 was never heard in committee.

Federal Policies

Nuclear Regulatory Commission

The U.S. Nuclear Regulatory Commission (NRC) is an independent U.S. government agency. The NRC licenses and regulates the operation of U.S. commercial nuclear power plants, pursuant to 10 CFR Part 50 or Part 52.[98] [99] Entities must apply to the NRC to do any of the following: construct, operate, and decommission commercial reactors and fuel cycle facilities; possess, use, process, export, and import nuclear materials and waste, and handle certain aspects of their transportation; and to site, design, construct, operate, and close waste disposal sites.[100] In certain situations, the NRC will issue certificates instead of licenses.[101] Current operating nuclear power plants were licensed using a two-step process, which requires a construction permit and an operating license.[102] Since then, the NRC has created a combined licensing process that includes the operating license and construction permit. Applicants can also apply for an Early Site Permit, where they can obtain approval for a reactor site before specifying the design of the reactor. However, NRC design approval is necessary before a nuclear power plant can be built.[103]

The NRC maintains oversight throughout the construction and operation of all nuclear facilities in the country. The NRC will authorize operation after verifying that the licensee has completed the required inspections, tests, and analyses. The NRC will authorize operation only after verifying that the plant is constructed and will be operated in conformance with the license and NRC requirements. The NRC publishes notice of intended operation in the Federal Register 180 days before the initial loading of fuel. The NRC regulates both safety and environmental

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[97] U.S. House of Representatives. (2025). *HB62 nuclear energy bill, Regular Session, 2011*.

[98] U.S. Nuclear Regulatory Commission. (2020). *Backgrounder on nuclear power plant licensing process* (Fact Sheet). U.S. Nuclear Regulatory Commission. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-fs.html

[99] Walker, S. J., & Wellock, T. R. (2024, July). *A Short History of Nuclear Regulation, 1946-2024*. U.S. Nuclear Regulatory Commission.

[100] U.S. Nuclear Regulatory Commission. (2024). *Licensing* (Regulatory overview). U.S. Nuclear Regulatory Commission. https://www.nrc.gov/about-nrc/regulatory/licensing.html

[101] U.S. Nuclear Regulatory Commission. (2020). *Certification* (Regulatory overview). U.S. Nuclear Regulatory Commission. https://www.nrc.gov/about-nrc/regulatory/certification.html

[102] U.S. Nuclear Regulatory Commission. (2020). *Backgrounder on nuclear power plant licensing process* (Fact Sheet). U.S. Nuclear Regulatory Commission. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-fs.html

[103] U.S. Nuclear Regulatory Commission. (2020). *Backgrounder on nuclear power plant licensing process* (Fact Sheet). U.S. Nuclear Regulatory Commission. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-fs.html

impacts (under NEPA). The NRC provides opportunities for public engagement, including a hearing for petitions.[104]

Under Part 52, the step-by-step NRC approval process for SMRs includes the following. First, the reactor design is submitted, including detailed plans, data, calculations, and reports that show known risks and safety systems. If the design is approved, the next step is to apply for the Combined Operating License, which includes specific plans for construction, operation protocols, and safety and security measures, as well as an environmental review and public input. If approved, construction may begin. During this phase, the NRC inspects construction activities to ensure compliance with approved plans. NuScale was the first SMR to be certified by the NRC, taking 41 months – the fastest NRC design review – to gain approval for the 50 MW SMR design. Recently, NuScale has improved its SMR to a 250 MWth /77-MWe module, which was approved in 22 months.[105]

Under the Atomic Energy Act of 1954, Section 274, the NRC relinquishes some of its regulatory authority to states that are Agreement States; agreement states can regulate certain radioactive materials within their borders. The NRC does not relinquish licensing of commercial power reactors. Hawaiʻi is not an Agreement State.[106]

U.S. Department of Transportation

Alongside the NRC, the U.S. Department of Transportation (USDOT) regulates the safety of shipping radioactive materials. DOT regulates shipments while they are in transit. USDOT sets standards for labeling and smaller quantity packages.[107] States bear the primary responsibility for responding to accidents and incidents within their jurisdictions. Many states have enacted additional requirements. USDOT's role in the transportation of spent nuclear fuel includes the following: a program to protect life, property, and environment from risks in intrastate and interstate commerce; USDOT's agencies Pipeline and Hazardous Materials Safety Administration, the Federal Railroad Administration, the Federal Motor Carrier Safety Administration, and the Federal Aviation Administration share the responsibility with state law

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[104] U.S. Nuclear Regulatory Commission. (2020). *Backgrounder on nuclear power plant licensing process*. U.S. Nuclear Regulatory Commission. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-fs

[105] NuScale Power. (n.d.). *How SMRs gain design approval in the U.S.* NuScale Power. https://www.nuscalepower.com/exploring-smrs/smr-101/how-smrs-gain-design-approval-in-the-u.s

[106] Nuclear Regulatory Commission. (2024). *Agreement State program*. U.S. Nuclear Regulatory Commission. https://www.nrc.gov/about-nrc/state-tribal/agreement-states

[107] U.S. Nuclear Regulatory Commission. (2023). *Materials transportation*. U.S. Nuclear Regulatory Commission. https://www.nrc.gov/materials/transportation

enforcement officials and the State Coast Guard to enforce the Hazardous Materials Regulations.[108]

Both USDOT and the NRC are involved in aspects of radioactive waste management oversight, although the NRC is the primary regulatory agency. The NRC oversees the treatment and disposal of radioactive waste from nuclear weapons as well as the siting, building, and operation of the repositories for disposing of this waste.[109] The U.S. has one deep geologic repository for defense-related transuranic waste, the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico.[110]

U.S. Department of Energy

Under the Nuclear Waste Policy Act of 1982, the DOE has the primary responsibility to plan for and arrange the transportation of spent nuclear fuel to an NRC-licensed geological repository.[111] DOE suspended work on a permanent geologic repository for spent nuclear fuel in 2011, and therefore, the amount of spent nuclear fuel stored at nuclear power plants continues to grow by about 2,000 metric tons per year.[112] About one quarter of the over 70 nuclear power reactor sites storing spent fuel are no longer operational reactors.[113] At these sites, the spent fuel is stored in dry cask storage systems. At operating reactors, the fuel is stored in pools until they have reached their pool capacity limit, or are a decommissioned reactor site, or are pending storage at a permanent disposal facility.

The NRC regulates the storage of spent nuclear fuel in fuel pools and dry cask storage through licensing, safety and security oversight, enforcement, operational experience evaluation, and regulatory support activities.[114] The federal government pays utilities billions in damages for

[108] U.S. Department of Transportation. (2025). *The Department of Transportation's role in the safe and secure transportation of spent nuclear fuel (SNF) and high-level radioactive waste*. https://www.transportation.gov/testimony/dot%E2%80%99s-role-safe-and-secure-transportation-spent-nuclear-fuel-snf-and-high-level

[109] U.S. Department of Transportation. (2025). *The Department of Transportation's role in the safe and secure transportation of spent nuclear fuel (SNF) and high-level radioactive waste*. https://www.transportation.gov/testimony/dot%E2%80%99s-role-safe-and-secure-transportation-spent-nuclear-fuel-snf-and-high-level

[110] US Government Accountability Office (2021) Nuclear Waste Disposal. https://www.gao.gov/nuclear-waste-disposal

[111] Id.

[112] Id.

[113] U.S. Department of Energy. (2025). *5 fast facts about spent nuclear fuel*. https://www.energy.gov/ne/articles/5-fast-facts-about-spent-nuclear-fuel

[114] U.S. Nuclear Regulatory Commission. (2025). *Spent fuel storage*. https://www.nrc.gov/waste/spent-fuel-storage

failing to dispose of the spent nuclear fuel.[115] The U.S. currently does not recycle spent nuclear fuel like some other countries, such as France, do.[116]

The Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) has oversight into nuclear energy worker safety. OSHA is obligated to protect employees from workplace hazards under the Occupational Safety and Health (OSH) Act of 1970. OSHA protects workers from traumatic injuries. Additionally, OSHA protects workers from the potential overexposure to toxic substances that can cause harm or illness. This includes all radiation sources that are not regulated by the NRC, such as X-ray equipment, accelerators, electron microscopes and betatrons, and naturally occurring radioactive materials. In many cases, the NRC and OSHA work together or conduct joint evaluations, such as at workplaces that conduct the chemical processing of nuclear materials. OSHA, in some circumstances, works with the NRC at nuclear power plant sites in responding to reports of injury or other worker safety complaints. The NRC conducts inspections of nuclear power reactor sites but OSHA conduct chemical and industrial safety training to workers, which is consistent with NRC radiation training programs.[117]

Liability

First enacted by the U.S. Congress in 1957, the Price-Anderson Act limits the liability of nuclear power operators in the event of a nuclear-related accident. The Act ensures compensation, up to a defined limit, to those injured by nuclear or radiological incidents, no matter who may be liable. If damages were to exceed the limit, Congress could take further action and appropriate funds. The Act obligates compensation for damages and requires the nuclear power industry to pay into this fund over time. The scope of compensation includes nuclear incidents, test and research reactors, DOE nuclear and radiological facilities, and transportation of nuclear fuel to and from a covered facility. The liability limit for DOE facilities is $10 billion, subject to inflation adjustments. In the event of a nuclear accident that causes over $500 million in damages, each licensee would be assessed up to about $158 million per reactor. For the secondary tier of funds, the pool contains around $15 billion, based on the 94 operating reactors and the Unit 1 still participating in the insurance pool. If the court determines public liability may exceed the maximum amount of financial protection available from the primary and secondary tiers, each licensee would be assessed a pro rata share of this excess, not to exceed 5% of the maximum deferred premium ($159 M, which is about $7.9 million per reactor). If the second tier is

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[115] U.S. Government Accountability Office. (2021). *Nuclear waste disposal*. https://www.gao.gov/nuclear-waste-disposal

[116] U.S. Department of Energy. (2025). *5 fast facts about spent nuclear fuel*. https://www.energy.gov/ne/articles/5-fast-facts-about-spent-nuclear-fuel

[117] Occupational Safety and Health Administration. (1988). *Memorandum of understanding between the Department of Energy and OSHA*. https://www.osha.gov/laws-regs/mou/1988-10-21

depleted, Congress will determine if additional disaster relief is required.[118] Ultimately, because the Price-Anderson Act does not limit the payment to those harmed but only limits what the owners are responsible for, there could be a gap that could leave the State exposed. In the absence of federal compensation, Article I, Section 21 of the State Constitution, may create an obligation for the State to pay liabilities exceeding those set by the Price-Andersen Act.[119]

Amendments to the Price-Andersen Act ensure that power plants comprised of Small Modular Reactors are covered by this obligatory compensation scheme and associated liability limits. Current NRC regulations would limit the liability of a plant comprised of SMRs to a maximum of $74 million for the plant owner, and a maximum of $560 million from the federal government; additional compensation would need to come from Congress.[120]

Integrating Nuclear Power on Hawaiʻi's Grids

Oʻahu has a daily peak of about 1,200 MW.[121] The system peak load is also expected to grow to approximately 1,800MW or more by 2050.[122] Total firm generation capacity on Oʻahu is 1,516.5 MW. During normal operations, baseload units run 24 hours a day, seven days a week, except during planned outages, most common for maintenance. Maintenance schedules are adjusted to ensure adequacy of supply. Firm generation sources on Oʻahu are currently almost entirely low-sulfur fuel oil (LSFO) with a bit of diesel/biodiesel and refuse. Baseload units run almost entirely off LSFO, while biodiesel plants are limited to peaking units.

As Hawaiʻi increases penetration of intermittent renewables such as solar and wind, the importance of the presence of energy sources with load-following capabilities increases; in other words, firm units need to be able to adjust to the variable nature of solar and wind resources. Current baseload units in the current Oʻahu fleet do not fully possess these characteristics and will need replacement with modern units that do.[123]

Advanced nuclear power could help serve as a firm, clean energy source to support more renewable energy. New assets need to have operational flexibility: the ability to start quickly,

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[118] U.S. Nuclear Regulatory Commission. (2025). *Nuclear insurance*. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/nuclear-insurance

[119] Article I Section 21 states, "The power of the State to act in the general welfare shall never be impaired by the making of any irrevocable grant of special privileges or immunities." This provision could be read to give the State the responsibility to act in the general welfare in order to address gaps in compensation created by federal law. https://www.law.cornell.edu/constitution/articlei#section21

[120] 10 C.F.R. §140.12. https://www.congress.gov/crs-product/IF10821

[121] Hawaiʻi Public Utilities Commission. (2025). *Energy adequacy report: Hawaii's energy supply*. https://puc.hawaii.gov/reports/energy-reports/adequacy-of-supply/

[122] Hawaiian Electric. (2023). *Hawaii Powered Integrated Grid Plan: A pathway to a clean energy future.* https://hawaiipowered.com/igpreport/IGP-Report_Final.pdf

[123] Id.

ramp up and down at high rates, and must be designed to regularly start and stop multiple times daily even after long periods of being offline. Smaller nuclear plants could also be sized smaller to serve baseload. Nuclear reactors can be used to integrate with renewables, and today's reactors have been used to load follow. In France, where there is a high percentage of nuclear generation, conventional nuclear reactors have been used for load following since the 1980s.[124] France has used load following from nuclear reactors to achieve system stability and to adjust power in response to demand and changes in renewables inputs to the grid. New designs offer the ability to achieve higher load following performance, since these features can be incorporated at the beginning of the design. The Electric Power Research Institute issued the Owner-Operator Requirements Guide for Advanced Reactors that includes requirements for load following.[125] Ramping up and down the power level of the nuclear reactor to match load demand or renewable inputs is technically feasible, but it may not be the most economical solution. Some economic modeling has shown that micro-reactor electricity costs would be relatively stable if they have a capacity factor of 75% or greater (the capacity factor is the measure of actual energy output as compared to total possible energy output over a given time period, e.g., one year); however, if the utilization of the micro-reactor fell below 75%, then the costs would begin to increase significantly.[126] A more popular approach is to maintain a constant 100% power level of the reactor, but to change the amount of electricity output. In this approach, the grid would experience the nuclear reactor as a load following to match the changes in the needed amounts of electricity. As the nuclear reactor to continues producing 100% of its thermal output, but reduces its electrical output, the reactor could divert the excess heat to an energy storage system or another energy product. Future SMR deployments may demonstrate the commercial feasibility of this approach.

Landscape Analysis

Current Status and Key Players

Public and private institutions are working on SMR technology. There are over 80 commercial SMR designs being developed across 18 countries.[127] [128] These companies are racing to deploy

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[124] World Nuclear Association. (2025). *France nuclear energy profile*. https://world-nuclear.org/information-library/country-profiles/countries-a-f/france

[125] Electric Power Research Institute. (2025). *Nuclear energy reports and resources*. https://www.epri.com/research/products/000000003002015751

[126] Nichol, M. (2019, April 19). *Cost Competitiveness of Micro-Reactors for Remote Markets* (H. Desai, Ed.). Nuclear Energy Institute.

[127] International Atomic Energy Agency. (2025). *What are small modular reactors (SMRs)?* https://www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs

[128] European Commission. (2025). *Small modular reactors explained*. https://energy.ec.europa.eu/topics/nuclear-energy/small-modular-reactors/small-modular-reactors-explained_en

advanced reactors. Some of the leading companies include: TerraPower, X-Energy, Kairos Power, NuScale Power Corporation, GE Hitachi Nuclear Energy (GEH), Westinghouse Electric Company, Oklo Inc., Aalo, Radiant, and NANO Nuclear Energy. [129] [130] [131] [132]

Despite substantial investment from both the private and public sectors there are currently no operational advanced nuclear plants in the United States. A few SMRs are undergoing licensing review by the Nuclear Regulatory Commission (NRC), and most planned SMRs in the U.S. are in the pre-licensing phase and may initially be deployed around 2030.[133] Until these first-of-a-kind plants complete construction and begin operations, the costs will not be fully known.

On May 29, 2025, the NRC approved NuScale Power, LLC's US460 SMR 77MW module design, which was accepted by NRC for standard design approval in July 2023. The NuScale SMR is the only design to have received NRC regulatory design approval. NuScale Power Corporation is a leading company in developing SMRs for safe, efficient, and affordable power, headquartered in the U.S. NuScale's design has been approved by the NRC, which moves its development closer to commercial deployment.[134] [135] NuScale, publicly traded since 2022, is advancing VOYGR-12 SMR projects in Poland (targeting operation by 2029) and in Ghana (now in early planning). It also signed an agreement with the Tennessee Valley Authority to deploy up to 6 GW of SMR capacity. NuScale's modular technology can be configured in four-, six-, or 12-module units, providing up to 924 MWe.[136] [137]

In the US, any company or independent power producer that seeks to use the NuScale US460 SMR design would need to file a subsequent licensing application with the NRC to build and

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[129] CNBC. (2025). *These nuclear companies lead the race to build small reactors in the U.S.* https://www.cnbc.com/2025/03/29/these-nuclear-companies-lead-the-race-to-build-small-reactors-in-us.html

[130] Nuclear Business Platform. (2025). *Top 5 SMR technologies shaping the nuclear future*. https://www.nuclearbusiness-platform.com/media/insights/top-5-smr-tech

[131] VanEck. (2025). *Top nuclear energy companies shaping the future of clean power*. https://www.vaneck.com/us/en/blogs/natural-resources/top-nuclear-energy-companies-shaping-the-future-of-clean-power/

[132] Theme ETFs. (2025). *5 nuclear stocks to watch as SMRs and microreactors advance*. https://themesetfs.com/insights/5-nuclear-stocks-to-watch-as-smrs-and-microreactors-advance

[133] NEA (2024), The NEA Small Modular Reactor Dashboard: Second Edition, OECD Publishing, Paris. Available from: https://www.oecd-nea.org/jcms/pl_90816/the-nea-small-modular-reactor-dashboard-second-edition

[134] VanEck. (2025). *Top nuclear energy companies shaping the future of clean power*. https://www.vaneck.com/us/en/blogs/natural-resources/top-nuclear-energy-companies-shaping-the-future-of-clean-power/

[135] Nuclear Business Platform. (2025). *Top 5 SMR technologies shaping the nuclear future*. https://www.nuclearbusiness-platform.com/media/insights/top-5-smr-tech

[136] Nuclear Business Platform. (2025). *Top 5 SMR technologies shaping the nuclear future*. https://www.nuclearbusiness-platform.com/media/insights/top-5-smr-tech

[137] Theme ETFs. (2025). *5 nuclear stocks to watch as SMRs and microreactors advance*. https://themesetfs.com/insights/5-nuclear-stocks-to-watch-as-smrs-and-microreactors-advance

operate the nuclear reactor. See *Policy and Governance* for more information on the NRC regulatory approval process.

TerraPower, founded in 2008 by Bill Gates, filed an NRC construction permit in 2024 for its Natrium demonstration reactor on a former coal site in Kemmerer, Wyoming, targeting operation by 2030 with power sold to PacifiCorp. The 345-MW Natrium design can ramp up to 500 MW for several hours using molten-salt thermal storage. Its sodium coolant and atmospheric-pressure operation reduce steel, concrete, labor, and system needs. The NRC's permit decision is anticipated in 2026.[138]

X-Energy, founded in 2009, developed an 80-MWe (200-MWth) high-temperature gas reactor scalable to 320 MWe in four units or 960 MWe in 12. Its reactors use TRISO-X fuel, originating from an Oak Ridge pilot, and helium coolant with melt-proof graphite-pebble fuel. X-Energy is building a TX-1 plant to produce TRISO-X fuel and secured a tax credit in 2024. The company's Washington project with Energy Northwest is backed by Amazon and will deploy four Xe-100 demonstration units in the early 2030s, with another Texas demonstration targeted for 2030. X-Energy Canada is pursuing licensing, and the NRC expects a construction permit decision in 2026. [139] [140]

Kairos Power signed a contract with Google to deploy advanced reactors for 500 MWs, with a planned operation date of 2030 and additional deployment through 2035. Kairos Power's reactor is a 75-MW reactor deployed in pairs. It operates at near atmospheric pressure and uses molten fluoride salt instead of water as a coolant. Kairos Power uses fuel that encases uranium kernels in ceramic and graphite pebbles that cannot melt in high-temperature reactors.[141] Kairos has received a construction permit from the NRC to construct a low-power demonstration reactor in Oak Ridge, Tennessee.[142]

GE Hitachi Nuclear Energy (GEH) is another U.S.-based company. GE Hitachi Nuclear Energy has had boiling water reactors since the 1950s. Its focus is on coal plant replacements. GEH is working with the UK on its Net Zero Future. As of March 2025, GE's BWRX-300 was passing through Step 2 of the UK's Generic Design Assessment and is a contender for Great Britain's

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[138] CNBC. (2025). *These nuclear companies lead the race to build small reactors in the U.S.* https://www.cnbc.com/2025/03/29/these-nuclear-companies-lead-the-race-to-build-small-reactors-in-us.html

[139] Nuclear Business Platform. (2025). *Top 5 SMR technologies shaping the nuclear future*. https://www.nuclearbusiness-platform.com/media/insights/top-5-smr-tech

[140] CNBC. (2025). *These nuclear companies lead the race to build small reactors in the U.S.* https://www.cnbc.com/2025/03/29/these-nuclear-companies-lead-the-race-to-build-small-reactors-in-us.html

[141] Nuclear Business Platform. (2025). *Top 5 SMR technologies shaping the nuclear future*. https://www.nuclearbusiness-platform.com/media/insights/top-5-smr-tech

[142] Id.

nuclear SMR competition. GEH is also working with Canada, Poland, and the U.S. for future deployment.[143]

Westinghouse Electric Company is working on its eVinci™ microreactor. This technology is a transportable nuclear battery producing up to 5 MWe and up to 13 MWth total. It is assembled at its facility in Pennsylvania. In addition, Westinghouse worked with the UK-based CORE POWER and designed a floating nuclear power plant that uses eVinci. In 2024, it became the first microreactor system to earn NRC approval. It improves safety and autonomy with its FPGA-driven, software-free design. It is planned to be tested at Idaho National Lab in 2026, with commercial deployment planned for 2029.[144] Additionally, as of October 28, 2025, Westinghouse has signed a deal with the U.S. Government to supply the U.S. with $80 billion worth of their AP 1000 technology.[145]

Oklo Inc.'s work is focused on ultra-compact micro-reactors for remote locations, industrial sites, and data centers. Their design focuses on the use of recycled nuclear fuel.[146] They are aiming for a deployment date in 2027. Oklo plans to adopt a vertical, power-as-a-service model. They have received a site use permit from the DOE and have been awarded their first fuel from the Idaho National Lab.[147]

NANO Nuclear Energy is focused on microreactor technology. They have several designs in development. Their design, KRONOS MMR Energy System, is currently awaiting NRC approval. This design has a generation capacity of up to 45 MWth in a single-unit configuration and gigawatt-level power in a multi-unit configuration. Their ZEUS Microreactor is a portable, solid-core battery reactor that can fit in a standard shipping container. Their LOKI MMR is portable and configurable for earth and space with a generation capacity between 1.5 MWth and 5 MWth. NANO Nuclear Energy is also developing High-Assay Low-Enriched Uranium nuclear fuel, nuclear fuel transportation, and electromagnetic pumps.[148]

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143 Id.
144 Id.
145 Brookfield Asset Management. (2025). *United States government, Brookfield, and Cameco announce transformational partnership*. https://bam.brookfield.com/press-releases/united-states-government-brookfield-and-cameco-announce-transformational-partnership
146 VanEck. (2025). *Top nuclear energy companies shaping the future of clean power*. https://www.vaneck.com/us/en/blogs/natural-resources/top-nuclear-energy-companies-shaping-the-future-of-clean-power/
147 Theme ETFs. (2025). *5 nuclear stocks to watch as SMRs and microreactors advance*. https://themesetfs.com/insights/5-nuclear-stocks-to-watch-as-smrs-and-microreactors-advance
148 Theme ETFs. (2025). *5 nuclear stocks to watch as SMRs and microreactors advance*. https://themesetfs.com/insights/5-nuclear-stocks-to-watch-as-smrs-and-microreactors-advance

Community Considerations

Community Perception

Perception of Nuclear in Hawaiʻi

Community engagement is critical for any key infrastructure decision, particularly with respect to nuclear energy. To conduct an informed and constructive dialogue with the public, the State must first have answers to key technical, cost, and safety questions. Any community engagement must be informed by established facts regarding safety, waste, and costs. Without sufficient information about the technology's feasibility in Hawaiʻi, early community engagement risks generating unnecessary fear or concern, potentially heightening mistrust, or, conversely, creating unrealistic expectations and unwarranted optimism about advancements in a technology that have not yet been proven commercially viable.

Meaningful engagement requires a foundation of clear, accurate, and accessible information, including details on safety protocols, waste management, regulatory oversight, costs, and timelines. Only with these facts can community members, and potential host communities, participate in a balanced discussion, weigh potential risks and benefits, and contribute to decision-making in a way that reflects the community's values and priorities. Establishing an informed dialogue early in the process is essential to building public confidence and ensuring that any consideration of nuclear energy aligns with both technical realities and the public interest.

Historical Context in the Pacific

The history of nuclear testing and nuclear energy incidents in the Pacific, in particular, has a pertinent impact on the perception and social acceptance of nuclear energy in Hawaiʻi. Hawaiʻi's community connections with many of the islands and countries impacted by nuclear activities influence community perception. Understanding this history is important to acknowledge and recognize if nuclear energy is ever to be seriously considered in Hawaiʻi. While this history is largely tied to weapons activities and military actions, and not the peaceful production of energy, the legacy and associated impacts of nuclear activities throughout the Pacific cannot be ignored, as they strongly and understandably influence public perception. The impacts of nuclear and associated radiation in Pacific countries and indigenous communities in these regions should not be downplayed, particularly when evaluating and considering community, cultural, and social impacts.

Historical Nuclear Destruction and Waste in the Pacific

The Pacific Islands have had a history of nuclear testing and nuclear waste dumping since the end of World War II. Collectively, the United States, the United Kingdom, France, and other

Western nations used the Pacific islands to further international nuclear power, at the cost of the health and environment of people indigenous to the islands, the immediate and long-term impacts of radiation exposure have caused physical health issues, cancers, birth defects, and chronic illness.

The Marshall Islands

To this day, the Republic of the Marshall Islands still experiences radiation impacts from the 67 detonations of atmospheric and ground weapons by the U.S. from 1946 to 1958.[149] Many Marshallese people reside in Hawaiʻi today under the 1986 Compact of Free Association to "escape from the permanent and devastating damage that the United States did to our [the Marshall] islands" during this time period.[150] In 1968, the U.S. Atomic Energy Commission declared portions of the Marshall Islands safe for resettlement, but the International Atomic Energy Agency later challenged those conclusions in 1994, leading to the re-evacuation of families who had already returned. This repeated cycle of assurances and reversals has deepened mistrust in federal assessments of radiological safety, even in the context of otherwise safe nuclear power operations internationally.[151]

Fukushima

In March 2011, a magnitude 9.0 earthquake off the coast of Japan triggered a tsunami exceeding 15 meters (approximately 50 feet), which overwhelmed coastal defenses and disabled off-site power and on-site backup generators at Fukushima Daiichi Nuclear Power Plant. The loss of power led to the failure of cooling systems in three operating reactors, resulting in core damage and partial meltdowns within the first several days following the event. A fourth reactor, which was shut down for maintenance, experienced hydrogen explosions that damaged its reactor building.[152]

Substantial releases of radioactive material occurred primarily during the first week of the accident, particularly between March 12 and March 16, 2011. Emergency response actions—including evacuations, sheltering, and restrictions on food and water—were implemented to reduce public exposure. Within approximately two weeks, the reactors were stabilized through

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[149] Forum for Nuclear Cooperation in the Pacific. (2025). *Nuclear issues in the Pacific*. https://forumsec.org/nuclear-issues
[150] Civil Beat. (2013). *For Marshallese, Hawaii is the only home we have left*. https://www.civilbeat.org/2013/05/18955-for-marshallese-hawaii-is-the-only-home-we-have-left/
[151] Forum for Nuclear Cooperation in the Pacific. (2025). *Nuclear issues in the Pacific*. https://forumsec.org/nuclear-issues
[152] International Atomic Energy Agency. (2015). *The Fukushima Daiichi accident (Technical Volume 1–5)*. IAEA. https://www.iaea.org/publications/10962/the-fukushima-daiichi-accident

water injection, and by December 2011, the plant was declared to be in a condition of cold shutdown, with reactor temperatures and releases under control.[153, 154]

The accident had significant social, economic, and environmental consequences, including large-scale displacement of communities and long-term land use restrictions. However, comprehensive assessments by international health authorities have found no deaths or cases of acute radiation sickness among workers or the public attributable to radiation exposure from the accident. Estimated radiation doses to the general population were generally low, and long-term health impacts are small and difficult to detect epidemiologically.[155, 156]

The Fukushima accident highlighted vulnerabilities in older reactor designs, particularly reliance on active cooling systems and external power. Many advanced nuclear reactor concepts, including some small modular reactors (SMRs), incorporate passive safety features designed to maintain cooling without external power or operator intervention, features that are widely cited as lessons learned from Fukushima.[157]

In 2023, Japan began the controlled release of treated water from the Fukushima site using the Advanced Liquid Processing System (ALPS), which removes most radionuclides except tritium. The release was reviewed by the International Atomic Energy Agency and found to be consistent with international safety standards, with projected radiation doses to the public well below regulatory limits. Nevertheless, the decision prompted concern among some Pacific Island nations, reflecting broader regional sensitivities related to nuclear contamination and trust in long-term environmental stewardship.[158] [159] [160]

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[153] International Atomic Energy Agency. (2016). *Safety of nuclear power plants: Design (SSR-2/1, Rev. 1)*. https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1715web-46541668.pdf

[154] Tokyo Electric Power Company. (2012). *Fukushima Nuclear Accident Analysis Report*.

[155] United Nations Scientific Committee on the Effects of Atomic Radiation. (2014). *Sources, effects and risks of ionizing radiation: UNSCEAR 2013 report*. United Nations

[156] World Health Organization. (2013). *Health risk assessment from the nuclear accident after the 2011 Great East Japan Earthquake and Tsunami*. WHO https://www.who.int/publications/i/item/9789241505130

[157] International Atomic Energy Agency. (2016). *Safety of nuclear power plants: Design (SSR-2/1, Rev. 1)*

[158] Japan Forward. (2025). *The Pacific Island nations and nuclear energy*. https://japan-forward.com/the-palm-countries-and-nuclear-energy/

[159] International Atomic Energy Agency. (2025). *Fukushima Daiichi treated water discharge: FAQs*. https://www.iaea.org/topics/response/fukushima-daiichi-nuclear-accident/fukushima-daiichi-alps-treated-water-discharge/faq

[160] Forum for Nuclear Cooperation in the Pacific. (2025). *Nuclear issues in the Pacific*. https://forumsec.org/nuclear-issues

Perception in the Pacific

Nuclear has been and still is an issue that impacts the lives, health, and safety of all Pacific Island countries and Japan. Nuclear is still an important standing agenda item at Pacific Island Forums as Pacific Island countries continue to advocate for a nuclear-free Pacific.[161]

At the time of this report, no Pacific Island country uses advanced nuclear power as a source of energy generation (China, Japan, and South Korea operate *conventional* reactors); however, some are contemplating adding it.[162] Indonesia is planning a 10GW nuclear generation capacity by 2040 and plans to construct its first reactor in Borneo by 2032, using SMR technology. The Philippines is also planning to introduce nuclear energy generation through small modular reactors with a target of 1,200 MW by 2032 and 4,800 MW by 2050. Singapore is also seriously considering nuclear energy, and recognizing the importance of early public engagement, has released a backgrounder to further the public's consideration.[163] Australia has no nuclear power currently and plans to continue to prioritize other clean energy sources.[164]

Recommendations and Conclusion

HSEO asserts that existing State laws are adequate to address current concerns associated with nuclear energy. Conventional nuclear reactor design leads to power plants being too large for the State, often in the 1,000MW range, and very few advanced nuclear reactor designs, such as Small Modular Reactors, have been built around the world. Consequently, this solution is not currently a match for the State in terms of cost or technical readiness. As such, specific impacts on health, the environment, and electricity bills remain hard to articulate and discuss in an actionable way.

Modifications to two key state laws that currently restrict nuclear development—1) Article XI, Section 8 of the Hawaiʻi Constitution, and 2) Hawaiʻi Revised Statutes §269-91, the State's Renewable Portfolio Standard, would be required and would be subject to approval by the State Legislature. HSEO does not recommend any amendments to the State Constitution or the Renewable Portfolio Standard to accommodate nuclear energy at this time. No proposed legislation is included in this report.

[161] Forum for Nuclear Cooperation in the Pacific. (2025). *Nuclear issues in the Pacific*. https://forumsec.org/nuclear-issues

[162] International Atomic Energy Agency. (2025). *Public nuclear power plant information*. https://cnpp.iaea.org/public/

[163] Singapore Government. (2025). *Building Singapore's Capabilities to Assess Nuclear Energy*.

[164] Pinsent Masons. (2025). *Nuclear update in the Asia-Pacific region*. https://www.pinsentmasons.com/out-law/analysis/nuclear-update-apac

While the Working Group recognizes the potential long-term benefits associated with nuclear energy, the discussion identified significant risks as well; until a more viable nuclear power solution emerges as a fit for Hawaiʻi, the conversation around risks and benefits remains abstract and conceptual. Accordingly, HSEO recommends the State continue to monitor advancements and consider an update to this report every five years to reflect emerging developments. If desirable advances are made, including answers to the questions and challenges identified herein, long-term goals for implementation can then be considered.

While the technology is not mature enough to pursue in terms of cost, technical readiness, and health and environmental impact mitigation, many working group members recognize the potential long-term benefits associated with nuclear energy. Community engagement is critical for any key infrastructure decision, particularly with respect to nuclear energy. However, to conduct an informed and constructive dialogue with the public, the State must first have answers to key technical, regulatory, and safety questions, which at this time do not currently exist for SMRs.

However, HSEO asserts that, without sufficient information about advanced nuclear reactor technology, early community engagement risks generating unnecessary fear or concern, potentially heightening mistrust, or, conversely, creating unrealistic expectations and unwarranted optimism about advanced nuclear reactor technology that has not yet been proven commercially viable.

In conclusion, while nuclear energy continues to evolve globally and may offer future opportunities for firm, carbon-free generation during operations, the current state of technology, cost, and deployment readiness does not align with Hawaiʻi's near- or medium-term needs. The Working Group underscores that key questions regarding safety, regulation, siting, waste management, financing, and health and environmental impacts remain unresolved for the advanced reactor designs being discussed today. Without sufficiently detailed and reliable information, early community engagement would be premature and may foster confusion, concerns, mistrust, or expectations that cannot be met.

Given these uncertainties—and considering Hawaiʻi's existing legal framework, scale, and other higher-priority energy initiatives—HSEO and most members of the working group do not recommend pursuing nuclear energy at this time. Instead, the State should continue to monitor global advancements and revisit this assessment periodically, particularly if commercially proven, right-sized technologies emerge that address the concerns outlined in this report. By taking a measured, evidence-based approach, Hawaiʻi can ensure that future decisions about its energy system remain grounded in transparency, community trust, and the best available information.

Appendix A - Working Group Perspectives

Prompt 1: In your view, how feasible is it for Hawai‘i to consider advanced nuclear power as part of its energy mix?

Responses:

Working Group Member 1: Adequate and accurate information and data on SMRs are presently unavailable, and hence, it is impossible to make responsibly informed decisions. The technology does not presently exist, nor does information on the fuel to be used, the amount, the cooling technology and hence, the expected wastes that need to be dealt with. Full and candid cost-benefit and human/environmental health risk analyses should be performed prior to any consideration.

Working Group Member 2: Hawaii is significantly challenged by the constitutional restrictions and potential community concerns. Community support is essential for project success.

Working Group Member 3: I think it is technically feasible, but the SMR/micro reactor technology has not been commercially proven. Nonetheless, I think it is technically viable future option, but actual operational characteristics need to be first understood. With that said, the permitting, legislative, and community concerns will be tremendous hurdles. Development timelines will likely exceed a decade.

Working Group Member 4: It is very feasible for Hawai'i to consider advanced nuclear power and part of its energy mix. The new technology and business models are compatible with the energy system and needs of the State, and it is the right time to understand and enable potential options to meet the energy goals.

Working Group Member 5: Based on cost and the current lack of commercial readiness of modular and micro-reactors, not very feasible at this time. A large reactor would not make sense for Hawaii's grids for a number of reasons. However, we shouldn't take any options off the table for the future.

Working Group Member 6: I believe nuclear power in any form holds the lowest feasibility for adoption in Hawaii amongst the energy production means considered. Even if we were to assume that the constitutional issues are taken care of, which is a heavy lift in and of itself, obtaining social license will be extremely difficult.

Working Group Member 7: I consider it to be very feasible, even essential, for Hawaii to consider advanced nuclear power as an option for our energy mix.

Working Group Member 8: Currently, it is not feasible for Hawaiʻi to consider advanced nuclear power as part of its energy mix. Advanced nuclear power is likely to take 10-15 years to become available. Thus, even, it materializes, it would not be available in time to have a meaningful impact on Hawaiʻi's climate goals for 2030 and 2045. It is also projected to be extremely expensive and raises serious safety and public health concerns, especially for our isolated island state. Under Hawaiʻi's public trust doctrine, Haw. Const. art. XI, sec. 1, the State must apply a precautionary approach to advanced nuclear power by waiting to see whether this technology materializes and what the costs and risks are before considering changing laws and creating policies to encourage and enable it in Hawaiʻi. Making policy based on a void of information when the potential risks to Hawaiʻi are so high and consequential is categorically bad policy.

Working Group Member 9: Because the exact modalities to implement nuclear technology here in Hawaii are not clearly defined, it is unknown how feasible implementing it here is.

Working Group Member 10: Advanced nuclear power is not feasible in Hawaiʻi because it is not feasible anywhere. There are no commercially operating "advanced" reactors producing electricity for the grid—only experimental units plagued by cost overruns, cancellations, and safety uncertainties. Globally, every attempt to commercialize new reactor designs has failed to meet projected timelines or costs. The technologies marketed as "advanced" remain in demonstration phases and are decades away, if ever, from proven commercial use.

Even if these technologies were viable, Hawaiʻi's legal and physical conditions make nuclear development impossible. The Hawaiʻi State Constitution requires a two-thirds supermajority vote in both houses for any nuclear fission plant or radioactive waste site (Article XI, Section 8). Hawaiʻi's Renewable Portfolio Standard mandates 100 percent renewable energy by 2045 (HRS §269-92), and "clean energy technology" as defined in state law expressly excludes nuclear power (HRS §269-121). At the county level, Hawaiʻi County Ordinance 24-97 designates the island a nuclear-free zone. These measures ensure that nuclear fission cannot be introduced without extraordinary public consent.

Beyond law, Hawaiʻi's isolation, geology, and limited grid scale render nuclear power technically and economically unworkable. The islands lack evacuation routes, radioactive-waste facilities, and emergency-response capacity. Transporting or exporting spent fuel would require Nuclear Regulatory Commission, Department of Transportation, and Coast Guard approvals, specialized Type B shipping casks, and expenditures in the hundreds of millions.

After seven decades of promises, nuclear technology has yet to deliver a safe, timely, or affordable solution anywhere. For Hawaiʻi—an isolated archipelago committed by statute to a 100 percent renewable portfolio—the conclusion is unequivocal: advanced nuclear power is neither technically nor legally feasible.

Prompt 2: On a scale of 1-10 (1 being not important and 10 being vital) in your opinion, how important do you believe nuclear energy could be for helping Hawaiʻi achieve its clean energy goals and explain your ranking.

Responses:

Working Group Member 1: 3

Far safer, cheaper, and proven technologies exist at this time.

Working Group Member 2: 9

Nuclear power could be a significant, reliable, base load clean energy source. While other options of solar, wind and battery storage are available, those technologies present challenges of land use, can be intermittent and present cost challenges too.

Working Group Member 3: 6

I believe nuclear power is a viable and effective clean energy solution. However, the hurdles of development are very significant and therefore other non-nuclear options need to have just as high of a priority.

Working Group Member 4: 9

Historical data and planning studies show that the most affordable, reliable and clean energy systems include some amount of nuclear energy in the generation portfolio mix. Nuclear is the only currently available commercial scale clean firm (baseload) source of energy. It uses the least amount of land to generate energy, has zero carbon emissions, one of the lowest total lifecycle carbon emissions, is one of the safest forms of energy, and provides significant economic and other benefits to the local community and the State.

Working Group Member 5: 1

Based on my understanding of it not being very feasible, we should look to other solutions.

Working Group Member 6: 7

Despite my low opinion on the feasibility of adoption, I believe that nuclear power holds the potential to provide consistent energy to our grids while forwarding decarbonization efforts.

Working Group Member 7: 9

I have been in the Hawaii energy market for over a decade, as a utility employee, a developer, and in the engineering field, and I have been a nuclear engineer and power plant operator (in the Navy) for over two decades. I have kept abreast of the energy demand forecasts, the plans to meet those forecasts, the grid operational needs, the land use issues, and the costs. Based on the sum of my experience in these fields I am 100% convinced that the only technology that can close the final gap between what is achievable with locally available and viable renewable resources (wind, solar, and geothermal) and our goals, with any hope of reliable power and reasonable cost, is nuclear power.

In addition, aside from electrical generation, the integration of nuclear power into our energy economy will provide excess heat and electrical power that can be used to supplement or offset our transportation energy needs.

The only reason that I didn't rank a 10 is that it may be technically feasible to achieve our clean energy goals without nuclear power, however the resultant energy resource mix will either be unreliable, or astronomically costly, or both.

Working Group Member 8: 0

Advanced nuclear power will not become available in time to meaningfully contribute to achieving Hawai‘i’s climate goals and advanced nuclear power is not a clean or renewable energy source.

Working Group Member 9: 5

It is unclear what help nuclear energy may provide to help Hawai‘i achieve its clean energy goals.

Working Group Member 10: 0

Nuclear power has no role in achieving Hawai‘i’s clean energy goals. It is excluded from the Renewable Portfolio Standard (HRS §269-92) and “clean energy technology” definitions (HRS §269-121) and would directly undermine the state’s 100 percent renewable mandate. Proven renewables and storage can meet Hawai‘i’s needs faster, cheaper, and without introducing radioactive risk.

Prompt 3: There are several advanced nuclear power technology options available, in your opinion, which options are the most viable for Hawai‘i? Which options should be tracked most closely?

Responses

Working Group Member 1: I have not seen any compelling and realistic information that indicates nuclear energy is a viable option in the foreseeable future.

Working Group Member 2: All of the leading technologies should be monitored for their technology progress and cost competitiveness. The leading Advanced Reactor Designs to monitor include X-energy and TerraPower. These have improved fuels and nuclear safety The leading Light Water Reactor Designs to monitor include NuScale and GE-Hitachi. While less advanced, still present significant safety improvements.

Working Group Member 3: There are various SMR technologies in the 70-100 MW range that seem viable for Oʻahu while microreactor technology may be viable for specific applications.

Working Group Member 4: Micro-reactors in the range of a few megawatts in capacity up to 50 to 100 MWe. They are the best fit for the size of the electric system demand, and have flexibility to generate heat for industrial applications. They also have the smallest land footprint and the lowest siting criteria of the nuclear technologies.

Working Group Member 5: The smaller generators are the most relevant for Hawaiʻi.

Working Group Member 6: Microreactors and SMRs are the most viable because of the smaller load size.

Working Group Member 7: The nuclear power technologies under development are undergoing rapid improvements and changes. It is too early to select any technology. By the time that we have worked out the regulatory, legal, and social issues, the winning technologies will be more clear.

Working Group Member 8: There are not any advanced nuclear power technology options currently commercially available.

Working Group Member 9: Due to the uncertainty of outcome with these largely experimental technologies, it is unclear which options are most viable in our state.

Working Group Member 10: None of the so-called "advanced" reactor designs are viable for Hawaiʻi. Every option—small modular, micro, molten-salt, sodium-cooled, or gas-cooled—still relies on nuclear fission, which under Hawaiʻi law requires a two-thirds supermajority vote of the Legislature (Article XI, Section 8) and is excluded from the State's renewable and clean-energy statutes (HRS §269-92, §269-121**). Each design still produces long-lived radioactive waste and requires periodic refueling, security, and federal oversight.

The "plug-in, chug-out" narrative is scientifically inaccurate. There is no reactor that can be delivered, operated, and removed like a battery. All would require specialized fuel shipments, on-site maintenance, and waste handling beyond Hawaiʻi's capacity. For these reasons, no "advanced" reactor type is viable or appropriate for the islands.

Prompt 4: Please rank your top five concerns from the list below regarding the potential deployment of nuclear energy in Hawai‘i. (1 being the highest, 5 lowest). Please explain your ranking.

List: Nuclear waste storage/disposal, safety and disaster resilience, environmental impacts (land, water, air), economic risk/capital investment, community acceptance/support, regulatory and legal barriers, grid integration, technology readiness.

Responses

Working Group Member 1: Having been involved in reviewing studies of the Fukushima-Daiichii, Pilgrim and San Onofre Nuclear Power Plants, as well as those documenting the effects of radiation from nuclear testing on human populations and the environment, I have serious concerns about how the people of Hawaii and the region could be negatively affected if and when something goes wrong.

1 (highest concern): nuclear waste storage/disposal, safety and disaster resilience, environmental impacts (land, water, air), economic risk/capital investment, community acceptance and support, and technology readiness.

2:

3 (mid-level concern): regulatory and legal barriers

4: grid integration

5 (least concern):

Working Group Member 2 : Community acceptance and the legal (constitutional) issues of nuclear power are paramount. If the communities would rather use fossil fuels or relay on potentially intermittent renewables plus storage and their high cost, nuclear power would not be a good option. Practically all other technological issues can be addressed.

1 (highest concern): Community acceptance/support

2: regulatory and legal barriers

3 (mid-level concern): grid integration, technology readiness, economic risk/capital investment

4: safety and disaster resilience, environmental impacts (land, water, air)

5 (least concern): nuclear waste storage/disposal

Working Group Member 3: I believe regulatory, legal, and community acceptance to be the most critical issue regarding the success of nuclear power in Hawaiʻi, assuming the decision was to proceed. I believe that SMR and/or micro-reactor technology is potentially viable for Hawaiʻi, but such technology has not been proven. Actual upfront capital, reliability, and resiliency of the technology has not been commercially proven. With that said, nuclear requires significant upfront capital coupled with long development periods adds additional risk. Actual ability of these new technologies to operate in a manner beneficial to our island grid remains a question.

1 (highest concern): Regulatory and legal barriers

2: Community acceptance/support

3 (mid-level concern): Technology readiness

4: Economic risk/capital investment

5 (least concern): Grid integration

Working Group Member 4: The Hawai'i Constitution and State Renewable mandate preclude nuclear from being an option and discourage any serious consideration of the technology to meet state energy needs. Community acceptance is essential, but the public is likely to not be very knowledgeable about nuclear energy in order to make informed decisions. Capital investments are challenged with uncertainty about the political and legal viability and public acceptance. With smaller grids and high renewable penetrations, grid integration will be a key consideration. Used fuel is safely managed, stored and transported, and while uncertainty about the timing of final disposal is not a challenge in most other areas, it could have unique considerations for siting on islands and more dependent on business models that would remove it from site to avoid long term storage at site.

1 (highest concern): Regulatory and legal barriers

2: Community acceptance/support

3 (mid-level concern): Economic risk/capital investment

4: Grid integration

5 (least concern): Nuclear waste storage/disposal

Working Group Member 5:

1 (highest concern):

2: Grid integration

3 (mid-level concern): Environmental impacts (land, water, air), economic risk/capital investment, technology readiness

4: Regulatory and legal barriers, safety and disaster resilience

5 (least concern): Grid integration, community acceptance/support

Working Group Member 6: Regarding nuclear waste storage/disposal - A permanent repository for waste is still an unknown. For Hawaiʻi, that implies either long duration on-island storage or transport to the continent. Regarding safety/disaster resilience – Hawaiʻi faces tsunami, hurricane, earthquake, wildfire, and other hazards - evacuation routes are limited. Regarding environmental impacts - HEPA would be triggered and I expect strong public participation. Regarding community acceptance/support - social license is hard to obtain; HEPA will guarantee public participation that will give communities sizeable leverage; without support, timelines and costs are prohibitive. Regarding regulatory/legal barriers - the constitutional requirement for 2/3rds vote in each house for a nuclear fission plant to be built is a huge hurdle; and that is before other permitting layers are dealt with. Regarding grid integration - non-interconnected island grids make size a critical element; Oʻahu is probably best suited due to energy draw demand. Regarding technology readiness - options are advancing; and given the need for a long timeline for public education and gaining social license- I'm fairly confident strides will be made in technology development. Regarding economic risk/capital investment - with increasing federal support for financing these types of projects, I'm not worried about economic risks.

1 (highest concern): Nuclear waste storage/disposal, safety and disaster resilience, environmental impacts (land, water, air), community acceptance/support

2: Regulatory and legal barriers

3 (mid-level concern): Grid integration, technology readiness

4: Economic risk/capital investment

5 (least concern):

Working Group Member 7: If community acceptance and support is achieved, then the regulatory and legal barriers can be resolved. If these two items are achieved, then the economic risk will be significantly reduced. I don't have any concerns about grid integration and technology readiness (it isn't ready now, but it will be by the time the other items are resolved).

Nuclear waste storage is the very best thing about nuclear power. Unlike all other energy generation technologies, the waste is completely contained and has decades of history of being safely stored and transported. There is no other technology that can say that the disposal of waste is as well managed and regulated as the nuclear industry.

1 (highest concern): Community acceptance/support

2: Regulatory and legal barriers

3 (mid-level concern): Economic risk/capital investment

4: Safety and disaster resilience

5 (least concern): Nuclear waste storage/disposal, grid integration, technology readiness

Working Group Member 8: Nuclear power is unlikely to materialize in time to help Hawaiʻi achieve its climate goals. Even if it does become available, it will be too costly for a small, remote place like Hawaiʻi.

Hawaiʻi already faces significant problems siting landfills for normal waste. For example, Oʻahu and Kauaʻi have been struggling to site new landfills for years because any location not located above the drinking water supply is usually located on the coastline and vulnerable to coastal hazards, including sea-level rise, coastal flooding, and tsunamis. Thus, Hawaiʻi would likely need to ship nuclear waste off island, which would be environmentally risky and cost-prohibitive (not to mention the fact that there currently are no nuclear waste disposal facilities available where Hawaiʻi could send its nuclear waste). Even if shipping nuclear waste off island were a viable option, Hawaiʻi would nonetheless need to find a safe place to store the nuclear waste while waiting for shipment.

In Hawaiʻi, there is limited capacity to evacuate to escape a nuclear meltdown and associated hazards. We don't know enough about this undeveloped technology to understand the myriad of other safety, environmental, and cultural risks that advanced nuclear technology presents.

1 (highest concern): Technology readiness

2: Economic risk/capital investment

3 (mid-level concern): Nuclear waste storage/disposal

4: Safety and disaster resilience

5 (least concern): Environmental impacts (land, water, air)

Working Group Member 9: Because the Department of Health's primary concern with regard to ionizing radiation is to ensure ongoing public health and safety when proximity to these phenomena can't be avoided and because the Department of Health works together with state and federal partners to develop living mitigation and emergency response strategies to address radiologic threats, according to their likelihood of occurring in Hawaiʻi, the Department's priorities are first and foremost concerned with environmental impacts, safety and disaster resilience, and nuclear waste storage and disposal. All of these concerns directly affect the public health and safety of Hawaiʻi's residents and visitors.

Additionally, the Department of Health has priority to understand the regulatory and legal barriers associated with the potential deployment of nuclear energy and our community's level of support and acceptance for the technology being used here in Hawaiʻi.

1 (highest concern): Environmental impacts (land, water, air)

2: Safety and disaster resilience

3 (mid-level concern): Nuclear waste storage/disposal

4: Regulatory and legal barriers

5 (least concern): Community acceptance/support

Working Group Member 10: All categories are equally concerning because they are inseparable. Safety, radioactive waste, cost, and social acceptance are all critical and mutually reinforcing. Hawaiʻi has no emergency infrastructure, evacuation routes, or facilities to handle radioactive materials or nuclear waste. Every so-called "advanced" design still uses nuclear fission, produces radioactive waste, requires imported nuclear fuel, and depends on complex cooling, transport, and security systems. The grid is also unprepared for any nuclear integration; Hawaiʻi's isolated system cannot simply "plug in" a reactor module. The combined technical, environmental, and social risks make every category of concern equally unacceptable.

1 (highest concern): ranked all of them at highest concern

Prompt 5: Do you have any additional concerns regarding advanced nuclear energy in Hawaiʻi.

Responses

Working Group Member 1: Costs

Working Group Member 2: No additional concerns

Working Group Member 3: Issues regarding safety in time of war.

Working Group Member 4: No additional concerns.

Working Group Member 5: N/A

Working Group Member 6: Siting on State lands or coastal/conservation areas – increased permitting and increased concerns from public.

Working Group Member 7: Concerned about the lack of awareness of public perception of nuclear energy in Hawaiʻi.

Working Group Member 8: No additional concerns.

Working Group Member 9: Additional concerns may become more apparent as more information is gathered for review on this technology.

Working Group Member 10: Additional concerns include the global and ethical dimensions of the nuclear fuel cycle and the financial instability of reactor developers. Nearly every "advanced" nuclear project has suffered massive cost overruns and bankruptcies, leaving taxpayers and communities to absorb stranded costs. If a company operating in Hawaiʻi failed, the state would be left with radioactive waste and no legal or physical means to remove or store it. Uranium extraction and fuel processing continue to devastate Indigenous lands worldwide—from the Southwest deserts to Australia and Kazakhstan—causing cancer, contamination, and cultural loss. Pursuing nuclear power in Hawaiʻi would contradict the ethic of Aloha ʻĀina, which requires that we protect both our own lands and those of other Indigenous peoples from harm.

Prompt 5: On a scale of 0-10 (0 being the lowest and 10 being the highest) how concerned are you about the risks of advanced nuclear energy in Hawaiʻi?

Responses

Working Group Member 1: 8

Working Group Member 2: 0

Working Group Member 3: 9

Working Group Member 4: 1

Working Group Member 5: 6

Working Group Member 6: 8

Working Group Member 7: 1

Working Group Member 8: 10

Working Group Member 9: 5

Working Group Member 10: 10

Prompt 6: In your view, what are the potential benefits of advanced nuclear power?

Responses

Working Group Member 1: Reduced greenhouse gas emissions.

Working Group Member 2: Nuclear power is safe, clean, and can be affordable compared to renewables plus storage. It is a highly reliable, baseload energy source that lasts decades or longer.

Working Group Member 3: Clean, firm, resilient, safe, zero carbon emissions.

Working Group Member 4: Better able to meet clean energy goals and to achieve them sooner. Less land use allows land to be used for other things such as housing, nature perseveration, agriculture, recreation, and industry. Economic benefits include jobs, local and state taxes, and lower cost of power. Decarbonization of applications that use heat energy.

Working Group Member 5: Provides a firm power source, if it can be flexible and complement renewables. Does not take up a large amount of land area. Reduced emissions.

Working Group Member 6: Unlike solar and wind, nuclear power provides firm, low or no-carbon power. The same can be said for geothermal, which is much more feasible.

Working Group Member 7: Statistically, it is the most reliable, safest, and cleanest energy technology on the planet. All nuclear waste is contained and stored safely, unlike all other energy sources. The LCOE for nuclear is not known, but based on historical trends it will be lower over the life of the plant than any other form of firm generation. Certainly, a 100% clean generation mix that includes some amount of nuclear will be a lower overall cost to customers than a generation portfolio that does not include nuclear. It will result in good, high technology jobs here in Hawaiʻi that will retain workforce talent. It will keep Hawaiʻi relevant in the world of technology, and will allow for larger than forecast energy demands from things like new data centers. It will significantly enhance the energy and social resilience of our islands in the face of natural threats to our isolated islands, and allow us to maintain our lifestyle regardless of global energy trends.

Working Group Member 8: Cannot think of any benefits.

Working Group Member 9: It is unclear what benefits implementation of nuclear power here would provide to the State of Hawaiʻi.

Working Group Member 10: There are no potential benefits of advanced nuclear power for Hawaiʻi. The technology is unproven, economically unstable, and dependent on imported uranium or other nuclear fuels that generate radioactive waste and security risks. Every stage of the nuclear cycle—from mining to fuel fabrication to waste disposal—creates contamination and long-term hazards. Nuclear plants require vast cooling water, complex safety systems, and long construction timelines that are incompatible with Hawaiʻi's grid, geography, and clean-energy goals. Any claimed benefit is theoretical and outweighed by irreversible social, financial, and environmental harm.

Prompt 7: What are the potential next steps the state should consider regarding nuclear technology development/deployment?

Responses

Working Group Member 1: Develop a set of key, foundational questions that need to be answered before further consideration.

Working Group Member 2: The community, constitutional, and legal issues must be addressed initially and in parallel with all other reviews. As those issues move forward positively, location is a key next step. Community acceptance combined with location suitability should be initial hurdles to overcome, as the state monitors continued vendor technology maturity and cost.

Working Group Member 3: Monitor technology development of advanced technologies. When commercially viable, review for safety, applicability, etc.

Working Group Member 4: The first step is to change the Renewable Portfolio Goal to include nuclear energy. The next step (could be pursued in parallel) is to repeal the Constitutional Article that requires legislative approval for nuclear. The third step should be to a) provide educational resources to the public so that they can better understand the facts about nuclear energy and communities can make decisions on whether they would consider hosting sites, and b) establishing the state framework for nuclear energy, e.g., changes to or new, if necessary, requirements for environmental, economic, and emergency preparedness approvals by State agencies. This would enable the private sector to work with stakeholders to determine if and where nuclear sites would be viable and welcomed by communities.

Working Group Member 5: Move forward with other solutions and keep an eye on developing technology.

Working Group Member 6: Robust, early, sustained community engagement. Start with education, plain-language explanations on what nuclear is and is not, safety and waste management, and environmental impacts. Focus on community listening sessions statewide, create a facilitated dialogue, especially in communities where sites would be planned. Build trust. Be clear on benefits and risks.

Working Group Member 7: Poll the public about their understanding of nuclear power and how it compares to other energy options, especially our youth. Identify gaps in understanding and develop an education program to address those gaps. Without an informed public, it will not be realistic to consider this important technology in our state.

Conduct a strategic analysis of the geological viability of siting nuclear power plants in Hawaiʻi. If we do not have any sites that can meet NRC requirements, then floating nuclear would be the next option.

Working Group Member 8: Adopt a wait and see approach to finding out whether advanced nuclear power materializes, how much it costs, and what the risks are.

Working Group Member 9: The lack of specific details related to this technology makes it difficult to forecast next steps.

Working Group Member 10: The only appropriate next steps are to strengthen Hawaiʻi's nuclear prohibitions and reaffirm its commitment to a 100 percent renewable future. The Legislature should preserve and reinforce the constitutional two-thirds supermajority requirement (Article XI, Section 8), maintain the exclusion of nuclear power from the Renewable Portfolio Standard (HRS §269-92) and clean-energy definitions (HRS §269-121), and extend Hawaiʻi County's nuclear-free protections statewide. At the same time, the state should accelerate investment in distributed solar, wind, geothermal, ocean energy, and community-owned storage that advance true energy democracy and resilience. Hawaiʻi's path forward is renewable, local, and nuclear-free.

Prompt 8: What environmental or safety safeguards should be prioritized for nuclear energy if ever pursued?

Responses

Working Group Member 1: Siting, security, disaster response, liability.

Working Group Member 2: Nuclear power has strong safety and environmental requirements, standards and history of performance. Ensuring that State and local requirements are not more restrictive than those already established by the NRC or other states should be reviewed.

Working Group Member 3: Nuclear power operations requires total commitment to safe operations. Understanding the licensing and performance standards required is necessary for proper development of nuclear power in Hawaiʻi.

Working Group Member 4: Federal environmental and safety safeguards are already in place. The State may consider its own additional requirements. Most of the environmental and safety safeguards for other technologies would be similarly applicable to nuclear, so there should not be a need for many nuclear unique safeguards at the State level.

Working Group Member 5: All of them.

Working Group Member 6: Top priority would be siting and design safeguards to account for natural disaster/threats like tsunami, sea-level rise, hurricanes, and earthquakes.

Working Group Member 7: Compliance with NRC requirements should be all that is needed. Nuclear power is the most highly regulated industry in the country for environmental and safety requirements.

Working Group Member 8: Emergency preparedness and evacuation, safe waste storage, disposal, and shipping.

Working Group Member 9: There is currently too little information regarding the details of this energy technology to propose environmental or safety safeguards that should be prioritized as, among other things it is unknown what radionuclides will be used to power such a facility here in Hawaiʻi.

Working Group Member 10: If Hawaiʻi were ever to consider nuclear power, the minimum safeguards would have to include full Environmental Impact Statements under NEPA and state law, free, prior, and informed consent of affected communities, permanent waste management capacity, emergency evacuation infrastructure, and binding financial guarantees to protect ratepayers if a developer fails. None of these safeguards exist or can realistically be achieved in the islands. For that reason, the only genuine safety measure is to maintain Hawaiʻi's constitutional, statutory, and county prohibitions and keep the state entirely nuclear-free.

Prompt 9: How significant a barrier do you think Hawaiʻi's constitutional requirement for a two-thirds legislative vote is to developing nuclear energy projects?

Responses

Working Group Member 1: Moderately significant

Working Group Member 2: Very significant

Working Group Member 3: Extremely significant

Working Group Member 4: Extremely significant

Working Group Member 5: Moderately significant

Working Group Member 6: Extremely significant

Working Group Member 7: Very significant

Working Group Member 8: Extremely significant

Working Group Member 9: Moderately significant

Working Group Member 10: Extremely significant

Prompt 10: What other legislative or regulatory reforms would be necessary to responsibly consider nuclear energy development in Hawai‘i?

Responses

Working Group Member 1: Ensure a proper and enforceable regulatory framework is established, identify effective and necessary monitoring protocols and procedures be clearly established and put the liability on the nuclear power plant operators, not the consumers/rate payers.

Working Group Member 2: A review of all local requirements and community acceptance is necessary.

Working Group Member 3: A formal process to go from conception to design to permitting to PUC review and legislative approval needs to be developed.

Building and operating a nuclear plant is at least a 40-year commitment. If nuclear power development were to proceed, modifying the definition of renewable energy or modifying the State’s RPS law would be necessary.

Working Group Member 4: The Renewable Portfolio Standard that requires 100% renewable energy by 2045 and does not include nuclear is the most significant barrier. Since nuclear would not qualify as a renewable source and is a long-term, high capital cost asset, 40 to 80 years, it is not economically viable to build nuclear that could not operate past 2045. Even if the

Constitutional Article were repealed, the RPS would prevent nuclear. Therefore, the first priority should be to change the RPS to include nuclear energy. Since the RPS goal is focused on carbon emissions, it should include all zero carbon emitting sources of energy, including nuclear.

Working Group Member 5: N/A

Working Group Member 6: Need to revisit the Hawai'i Constitution to clarify how the legislative vote requirement is triggered. Need to revisit HRS Ch. 343 on whether there needs to be nuclear specific updates.

Working Group Member 7: Like other long-lead generation technologies, a separate procurement process for nuclear would need to be developed. Using the existing method, where the utility proposes an RFP for PUC approval, and then issues it openly to all bidders with a wide set of requirements, will fail, and potential bidders will not be able to provide viable, financeable bids due to the high risk and long timelines.

I suggest that if the State wants nuclear power, then the State should engage in a special procurement process. No other entity would have the authority to make the representations needed to attract investors.

Alternatively, the State could work in concert with the DoD to site nuclear facilities on federal lands, as part of the DoD's drive to enhance energy security for their facilities around the world using nuclear power.

Working Group Member 8: Nuclear power could never qualify as a "clean" or "renewable" resource because it relies on finite resources.

Working Group Member 9: It is unclear what additional regulatory reforms would be necessary to consider nuclear energy in Hawai'i.

Working Group Member 10: The premise of this question is flawed. It is not possible to "responsibly consider" nuclear energy in Hawaiʻi under any circumstance. Doing so would require amending the Hawaiʻi State Constitution (Article XI, Section 8) to weaken the two-thirds supermajority safeguard and rewriting Hawaiʻi's energy statutes (HRS §269-92, §269-121) to falsely redefine nuclear fission as renewable. Beyond the law, Hawaiʻi's isolation makes nuclear energy fundamentally irresponsible: there is no safe way to store or export radioactive waste from islands in the middle of the Pacific Ocean. No legal reform can change geography, physics, or risk. The only responsible action is to strengthen existing prohibitions and keep Hawaiʻi nuclear-free.

Prompt 11: Are there any specific lessons or best practices from other jurisdictions that you think could guide Hawai'i's nuclear energy planning?

Responses

Working Group Member 1: Fukushima, Three-mile Island, Pilgrim, and San Onofre provide good examples of concerns.

Working Group Member 2: As previously stated, early community engagement and early reviews of all permitting and legal issues that could restrict nuclear power should be performed.

Working Group Member 3: N/A

Working Group Member 4: The following states have changed from renewable portfolio standards (that exclude nuclear) to clean energy standards that include nuclear and all other forms of clean energy: Idaho, Michigan, Minnesota, North Carolina, Ohio, Tennessee, Utah, Virginia and Washington. The following states have repealed moratoriums on nuclear: Connecticut, Illinois, Kentucky, Montana, West Virginia, and Wisconsin.

Working Group Member 5: N/A

Working Group Member 6: N/A

Working Group Member 7: I think that a viable argument could be made that nuclear power is as renewable as any other form of energy we use. I would like to see this investigated as to how other jurisdictions have approached this.

Working Group Member 8: N/A

Working Group Member 9: I am unaware of any specific lessons or best practices that could guide Hawai'i's nuclear energy planning.

Working Group Member 10: The clearest lesson from other jurisdictions is don't start. Large and "advanced" nuclear projects worldwide show the same pattern: massive cost overruns, schedule delays, and cancellations—Vogtle in Georgia, NuScale in Idaho, and Hinkley Point C in the U.K. Where such projects proceed, ratepayers and taxpayers bear the losses while developers walk away. The real best practice for Hawaiʻi is to remain nuclear-free and accelerate distributed renewables, storage, and grid modernization.

Hawaiʻi already sets the model. Hawaiʻi County established a nuclear-free zone through Ordinance 97-24 (1997), prohibiting nuclear materials, testing, and power generation. That local precedent should guide statewide policy: protect the ʻāina, prevent radioactive risk, and align all energy planning with Aloha ʻĀina and the public trust.

Any legitimate energy planning process in Hawaiʻi must include Kanaka ʻŌiwi organizations and Indigenous leadership at every stage. Decisions that affect the ʻāina and wai require free, prior, and informed consent consistent with the U.N. Declaration on the Rights of Indigenous Peoples (2007). Kanaka ʻŌiwi voices are not stakeholders—they are the original stewards of these lands and must lead in defining what energy sovereignty means for Hawaiʻi.

If nuclear were ever considered despite these lessons, minimum safeguards would require: no public subsidies, full Environmental Impact Statements, free, prior, and informed consent of affected communities, proof of lawful off-island waste disposal, developer-funded decommissioning, and demonstrated emergency-response capacity. These conditions themselves prove that nuclear development is unworkable in Hawaiʻi.