NOTE

FORWARD-LOOKING IMPROVEMENTS TO LICENSING THE NEXT GENERATION OF NUCLEAR REACTORS

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Nuclear regulation has faced a variety of challenges since the Atomic Energy Commission first introduced the procedure of two-step licensing, in which construction and operational licenses are issued separately to nuclear reactor developers. Since 1974, and the establishment of the Nuclear Regulatory Commission, the process for licensing a nuclear power plant has changed dramatically. In addition to the two-step licensing process of old, developers now have the option of choosing a one-step combined license, which offers more flexibility in terms of developing technical specifications. The two-step and combined license options are codified under 10 C.F.R. §§ 50 and 52, respectively. Although intended to streamline the process and avoid expensive licensing periods that plagued plant development under the old regime, the newer combined license method is not being executed as planned and runs the risk of confronting developers with the same economic hurdles. This Note examines both licensing options and posits that a new strategy must be developed to efficiently license the next generation of nuclear power plants.

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INTRODUCTION

The success of the commercial nuclear industry has fluctuated significantly over the past several decades due to a wide variety of safety related, economic, and political developments.\(^1\) Recently, there has been a growing movement towards expanding nuclear power in the United States once again.\(^2\) Despite the renewed interest, support for nuclear power has

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2. See Licensing New Nuclear Power Plants, NUCLEAR ENERGY INST. (Oct. 2010), http://www.nei.org/resourcesandstats/documentlibrary/newplants/factsheet/licensingnewnuclearpowerplants/?page=4 [hereinafter NEI LICENSING FACTSHEET] (attributing policy makers’ increased support for nuclear power to factors, such as reliability, pollution concerns, and desires for a diversified energy portfolio); see also Economic Benefits of New Plants, NUCLEAR ENERGY INST., http://www.nei.org/keyissues/newnuclearplants/economicbenefitsofnewnuclearplants/ (last visited Mar. 16, 2012) (detailing the significant economic benefits plant construction presents to state and
also proven to be polarizing; concerns over improper nuclear waste disposal and plant safety are hotly debated issues. Public opposition to nuclear plants was propelled further following the accident at Three Mile Island in 1979, calling into question the desirability of large-scale nuclear power production. These concerns have been surfaced yet again following the recent developments at Japan’s Fukushima Daiichi plant in 2011.

Notwithstanding the myriad safety concerns, the economics of plant development remains perhaps the most significant barrier to nuclear production. The construction and operation of nuclear facilities is an expensive business, which must also factor in decommissioning and waste disposal costs, among others. Cost overruns and construction delays witnessed in the 1970s and 1980s remain a crucial issue today in the debate over the economics of nuclear power. Long construction periods tend to significantly increase financing costs and push overall project costs well beyond initial estimates. Furthermore, with abundant shale-gas deposits contributing to even lower electricity rates, the high cost of developing a plant due to extended construction and engineering time may easily “dampen enthusiasm for major nuclear expansion.”

3. See Johnson, supra note 1 (describing the obstacles and arguments against nuclear power).
5. See Johnson, supra note 1 (describing how the Fukushima disaster “has raised new questions” about nuclear power safety and whether it is a necessary component of the country’s energy future).
6. See id. (characterizing spiraling costs as the “biggest hurdle” for the nuclear industry); see also The Dream That Failed, ECONOMIST, Mar. 10, 2012, http://www.economist.com/node/21549098 (noting that forecast reductions in capital costs for plant construction have not materialized while construction periods have lengthened).
7. See The Economics of Nuclear Power, WORLD NUCLEAR ASS’N (July 2012), http://www.world-nuclear.org/info/inf02.html (discussing the impact of fuel procurement and management, capital costs, and financing on the cost competitiveness of nuclear generation, compared to other energy alternatives).
9. See The Economics of Nuclear Power, supra note 7 (illustrating the variability in financing costs with Georgia Power’s proposed AP1000 reactors as an example, which were estimated to cost between $9.6 million and $14 billion depending on whether the project could be financed progressively by ratepayers).
11. See SHARON SQUASSONI, NUCLEAR ENERGY: REBIRTH OR RESUSCITATION? 34 (2009), available at http://carnegieendowment.org/files/nuclear_energy_rebirth_resuscitation.pdf (arguing that the combination of federal subsidies and policies that disincentivize carbon-based electricity generation may overcome financial barriers to
At the nexus of these issues is nuclear regulation. The government oversees nuclear licensing and regulation in the United States and must balance the need for advancing economical electricity generation with public opinion and safety. This Note examines broadly the licensing options available to nuclear plant developers today and suggests that the regulations need to be adapted to avoid the economic pitfalls of costly design and engineering-related delays for the advanced nuclear systems known as Generation IV reactors. Part I describes the history of nuclear reactor licensing, provides background on the Generation IV initiative, and introduces the prototype being developed in the United States, known as the Next Generation Nuclear Power Plant (“NGNP”). Part II outlines the feasibility of licensing a Generation IV reactor under today’s available alternatives, while Part III provides broad suggestions for improving these alternatives.

I. A BACKGROUND ON NUCLEAR POWER REGULATION AND GENERATION IV TECHNOLOGY

A. Historical Underpinnings of Nuclear Power Regulation

The Atomic Energy Act of 1954 (“1954 Act”) governs the operation and regulation of nuclear energy and gave licensing and enforcement power to the Atomic Energy Commission (“AEC”), which previously maintained jurisdiction over both military and civilian applications of nuclear technology. Eventually, Congress decided to abandon the AEC entirely due to its controversial policies and split the organization’s regulatory and promotional duties under the Energy Reorganization Act of 1974. As part of the split, Congress granted authority over civilian nuclear regulation, enforcement, and licensing to the newly created Nuclear Regulatory Commission (“NRC”). The NRC formally began its regulatory oversight

duties in 1975.17

B. Two-Step Licensing Under 10 C.F.R. § 50

The NRC continued to use the licensing process developed by the AEC under the 1954 Act, codified in 10 C.F.R. § 50 (“Part 50”) of the AEC’s regulations.18 The primary components of the two-step licensing process are the construction permit and the operating license.19 Applicants must first apply for a construction permit, which requires extensive review by the NRC of the preliminary reactor design specifications.20 Following a successful public hearing and an environmental review conducted in accordance with the National Environmental Policy Act, the NRC may approve a construction permit or authorize the licensee to complete a minimal amount of construction on the plant before the permit is issued.21

Developers must next obtain operating licenses to bring a constructed plant into full operation.22 Operating license applications are only permitted once the plant’s construction is substantially complete.23 The applications, furthermore, contain a final safety analysis, an environmental report on the plant’s design, as well as emergency plans in case of a malfunction.24

C. Combined Licensing Under 10 C.F.R. § 52

In 1989, the NRC developed new regulations, codified in 10 C.F.R § 52 (“Part 52”), as an alternative to licensing a nuclear power plant. The regulation25 attempts to mitigate the economic burden and cost overruns of nuclear plant development by enabling developers to resolve design and

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19. Id. at 2.
20. The review requires that applicants provide safety analysis information, environmental reviews, and financial statements. See id. at 2–3.
21. See NUCLEAR POWER PLANT LICENSING PROCESS, supra note 18, at 2–3 (explaining that applicants are allowed to commence plant construction only after the NRC is satisfied with the proposed site and preliminary plant design); see also 10 C.F.R. § 50.10(c), (d)(1)–(3) (2012) (clarifying both the scope and the conditions under which an applicant will be granted a limited work authorization, which allows for preliminary construction, such as driving of piles, subsurface preparation, or foundation installation).
22. NUCLEAR POWER PLANT LICENSING PROCESS, supra note 18, at 4.
25. See 10 C.F.R. § 52.0(a) (2012).
environmental licensing requirements before the start of construction by giving applicants more options.\textsuperscript{26}

Long Island’s Shoreham facility serves as a stark reminder of the licensing issues the NRC intends to avoid with Part 52; it was the first full-sized nuclear power plant to be decommissioned and closed before being fully powered.\textsuperscript{27} The Shoreham plant collapsed under intense scrutiny following disagreements over a proposed emergency evacuation plan.\textsuperscript{28} In the end, Shoreham’s cost was approximately eighty times higher\textsuperscript{29} than original estimates and saddled Long Island ratepayers with some of the highest electric rates in the nation.\textsuperscript{30}

Part 52 employs a more modular approach to licensing and was enacted, among other reasons, to prevent another Shoreham-like saga from burdening ratepayers. The major components of the licensing scheme under Part 52 are the Early Site Permit (“ESP”), Standard Design Certification (“SDC”), and the Combined License (“COL”).\textsuperscript{31}

The ESPs grant NRC approval of a proposed site with a permit that lasts roughly ten to twenty years from the date it is issued.\textsuperscript{32} The permits address site safety, environmental, and emergency issues, which are investigated independent of a nuclear plant’s design and in conjunction with the Federal Emergency Management Agency.\textsuperscript{33}

SDCs signify NRC approval of the design of a nuclear plant and are

\textsuperscript{26} Blanton et al., \textit{supra} note 23, at 8. Public hearings were also streamlined under Part 52 to be less formalized and more affordable, thereby encouraging public participation. See Repka & Sutton, \textit{supra} note 4, at 44.

\textsuperscript{27} See Blanton et al., \textit{supra} note 23, at 8 (describing the issues, mostly related to public safety and emergency procedures, that caused the Shoreham facility to be denied an operating license); see also Shoreham Advisory Committee, \textsc{Long Island Power Auth.}, http://www.lipower.org/shoreham/history.html (last visited Oct. 15, 2012) (chronicling the decommissioning process, which began in 1991 and cost $186 million).


\textsuperscript{29} Shoreham Advisory Committee, \textit{supra} note 27.


\textsuperscript{31} 10 C.F.R. § 52.0(a) (2012).

\textsuperscript{32} See Early Site Permit Applications for New Reactors, \textsc{U.S. Nuclear Reg’Y Comm’N}, http://www.nrc.gov/reactors/new-reactors/esp.html (last updated Mar. 29, 2012) (stating that the public may participate in application reviews or request hearings on ESP issuances).

\textsuperscript{33} See \textit{Nuclear Power Plant Licensing Process}, \textit{supra} note 18, at 6–7 (listing information required for a complete application, such as seismic data and emergency evacuation plans).
reviewed independently of applications to bring the plant into operation. SDCs also verify the design of a reactor for roughly fifteen years and include “proposed tests, inspections, analyses, and acceptance criteria for the standard design” (“ITAAC”). This SDC stage is particularly important under the new licensing scheme and allows the developer to submit a design control document (“DCD”), which describes all the “essential features and functions of the nuclear plant” for approval before the NRC begins reviewing the combined operating and construction license.

The COL is the most important addition to Part 52. It allows developers to apply for a construction and operational license in one phase while referencing a previously approved ESP and DCD. A COL is issued based on a certified set of design specifications and requires the licensee to demonstrate that the ITAAC referenced in the DCD are satisfied. Once approved, a COL is valid for forty years.

D. Generation IV Technology and the Next Generation Nuclear Plant Project

Reactors in operation today are most commonly based on light water technology and use ordinary water as a coolant. These reactors were primarily constructed in the 1960s and 1970s and are classified as “Generation II” designs. Reactor designs currently planned for construction and licensing are known as “Generation III” or “III+” reactors, which offer simpler designs and more advanced safety features. The even more advanced “Generation IV” energy systems, which may not be

34. During the design certification review, the NRC also informs stakeholders and the public how they can participate in the regulatory process. See Design Certification Applications for New Reactors, U.S. NUCLEAR REG’Y COMM’N, http://www.nrc.gov/reactors/new-reactors/design-cert.html (last updated July 3, 2012).

35. See NUCLEAR POWER PLANT LICENSING PROCESS, supra note 18, at 8 (describing limitations on changes to NRC certified designs).

36. See id., supra note 23, at 8.

37. See id. (noting that the NRC intended for licensees to “finalize design and site issues before applying for a combined license”).

38. 10 C.F.R. § 52.103(g) (2012); see NUCLEAR POWER PLANT LICENSING PROCESS, supra note 18, at 9 (describing the requirements a licensee must demonstrate to ensure the plant has been constructed safely).


41. Gundlach, supra note 8, at 623.

42. See id. at 622–23 (noting that newer designs have more generating capacity and feature “passive” safety systems, which can operate autonomously).
commissioned for commercial use until 2030, depart from the water-cooled design model and are currently being researched.43

The Generation IV International Forum is coordinating the multinational research effort to develop these advanced systems.44 Ten countries agreed to cooperate on Generation IV research and develop six prototype technologies to be deployed internationally by 2030.45 The Generation IV Initiative strives to develop advanced nuclear technology that will make waste more manageable, increase safety performance, and improve the long-term economic viability of new plants.46 In terms of performance, Generation IV reactor designs mark an improvement over existing reactors by offering greater safety, reliability, and efficiency.47 The new systems will also reduce toxicity and heat generated by nuclear waste and instead provide “process heat” for a wide variety of secondary applications, such as large-scale hydrogen production.48

The Energy Policy Act of 2005 (“2005 Act”) played a significant role in furthering the development of advanced nuclear plants by funding research and providing significant financial incentives to developers.49 The 2005 Act also formally authorized the NGNP Project as the official pilot program for next generation nuclear reactors in the United States.50 Among the candidates considered by the Initiative is the Very-High Temperature Reactor (“VHTR”), a helium-cooled reactor concept that operates at much


45. Argentina, Brazil, Canada, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom, and the United States were initial members of the multi-national research initiative. See id. at 5–9.

46. See id. at 5–6 (emphasizing seven goals of the international effort and the need to collaborate on research and development).


48. See id.


higher temperatures than existing light water reactors ("LWR").\textsuperscript{51} In addition to its increased generation capacity, the VHTR can recycle spent fuel from LWR and VHTR reactors to reduce the amount of resulting waste.\textsuperscript{52} This gas-cooled design was selected as the prototype reactor for the NGNP\textsuperscript{53} and is to be constructed at Idaho National Laboratory, where the efficiency of the new reactor as well as its applicability to the industrial and transportation sectors will be studied.\textsuperscript{54} The higher temperature of the reactor will enable the plant to produce electricity for industrial processes, such as coal or synthetic oil refinement, as well as other uses.\textsuperscript{55}

The NGNP Project executes in two phases.\textsuperscript{56} Phase 1 covers conceptual design work and technical work, while Phase 2 covers the final design leading to the construction and licensing of the prototype reactor.\textsuperscript{57} Phase 2 aims to establish a full licensing implementation plan for the advanced reactor design.\textsuperscript{58} Among other considerations, the unique design of the plant and its fuel procedures will likely require some changes to the current regulatory structure.\textsuperscript{59}

\section*{II. 10 C.F.R. § 52 IS AN IMPROVEMENT OVER THE PREVIOUS LICENSING SCHEME, BUT MUST BE FURTHER OPTIMIZED FOR INCOMING GENERATION IV REACTORS}

Existing regulations have been developed primarily based on technical experience with Generation II LWR technology.\textsuperscript{60} Due to several

\begin{itemize}
\item \textsuperscript{51} \textit{See Gen IV Roadmap, supra} note 44, at 48.
\item \textsuperscript{52} \textit{See id.} at 51 (noting the VHTR’s symbiotic fuel cycle, which can “achieve significant reductions in waste quantities”).
\item \textsuperscript{53} \textit{See 2010 NGNP Report, supra} note 50, at 3 (explaining that the VHTR was identified as the economical choice for development). Specifically, the High Temperature Gas Reactor, a helium-cooled VHTR, was selected as the NGNP prototype. \textit{The High Temperature Gas Cooled Reactor (HTGR), NGNP Industry Alliance Ltd., http://www.ngnpalliance.org/index.php/htgr} (last visited Dec. 15, 2012).
\item \textsuperscript{54} \textit{U.S. Nuclear Power Policy, supra} note 49.
\item \textsuperscript{55} Id.
\item \textsuperscript{57} \textit{See Energy Policy Act of 2005} § 643, 119 Stat. at 794 (outlining the research, development, and demonstration efforts to occur in Phase I).
\item \textsuperscript{58} \textit{See id.}
\item \textsuperscript{59} Anticipating this need, the NRC planned for the project to take five years, with an anticipated COL application filed within the next few years. \textit{See U.S. Nuclear Power Policy, supra} note 49.
\end{itemize}
technology-neutral provisions, the existing regulatory framework can be used to structure licensing for non-LWR systems. 61 Still, the operational systems of Generation IV reactors are substantially different from LWRs. 62 Considering the technical complexity of advanced reactors and historical shortcomings of the licensing process, the existing licensing options may be insufficient for Generation IV systems.

A. 10 C.F.R. § 50 Is Not Well-Suited to Efficiently License Generation IV Nuclear Reactors

Supporters of licensing under Part 50 suggest a plant could be deployed and available for commercial use more quickly than under other alternatives, providing more certainty for investors. 63 Although an earlier construction start is more feasible with Part 50, construction rework and severe delays are more probable, as the industry has little experience with the more technically complex Generation IV reactors. 64 If initial capital costs are deemed by investors to be unrecoverable within a reasonable time after the plant is operational, construction may be suspended or even cancelled. 65

Perhaps most indicative of the drawbacks of licensing under Part 50 is the NRC’s overhaul in 1989 of the licensing process to create a more “attractive environment for new utility investments in nuclear power.” 66 In the end, the gains observed by accelerated initial construction are likely offset by extensive delays and expensive retrofits, thereby jeopardizing the development and future commercial operation of the entire plant. 67

61. See id.
63. The perception is that private-sector financing would be more attracted to the quicker initial timeline, and thus, readily available under this licensing alternative. See U.S. DEPT. OF ENERGY & U.S. NUCLEAR REG’Y COMM’N, NEXT GENERATION NUCLEAR PLANT LICENSING STRATEGY: A REPORT TO CONGRESS 15 (Aug. 2008), available at http://www.ne.doe.gov/pdfFiles/NGNP_reporttoCongress.pdf [hereinafter 2008 NGNP REPORT]. Yet, the DOE and NRC disagree with this viewpoint, asserting that licensing under Part 50 presents the “greatest risk.” See id. at 16.
64. See id. at 16 (predicting that, should issues remain unresolved, “significant design changes will likely be required during the [operational license] stage of review”).
66. Id.
67. Post-investment delays are an investor’s “greatest fear.” Gundlach, supra note 8, at 642 (citing Roland M. Frye, Jr., The Current ‘Nuclear Renaissance’ in the United
B. 10 C.F.R. § 52 Is an Improvement That Can Be Further Optimized to Better Facilitate Generation IV Reactors

1. Part 52 Is Not Functioning as Intended

In 1989, the NRC introduced licensing under Part 52 to provide developers with a more predictable and efficient licensing process suited for new reactors (namely Generation III+) with more advanced features. In this regard, Part 52 would be useful for certifying Generation IV reactors, as its objective is to resolve design issues up front, regardless of how advanced or unfamiliar the technology may be.

Despite the improvements under Part 52, the regulatory process is still vulnerable to significant delays and cost overruns given the complexity and uncertainty of examining a nuclear reactor. Furthermore, the “order of operations” laid out by the NRC in Part 52 is not being executed as planned due to the Commission’s flexibility. All four standard designs approved by the NRC since Part 52 took effect incorporated amendments and changes to their initial design specifications; for example, the Vogtle plant AP1000 reactor incorporated an amendment to a previously certified design. In other words, the four designs approved by the NRC since Part 52 took effect were not finalized by the time of the COL application, as all four designs were eventually amended.

Despite the NRC’s original vision when authoring Part 52, licensees pursued a COL in parallel with uncertified designs. There are several factors that contribute to deviations from the Part 52 framework. For example, responding to economic pressures, some licensees attempt to...
condense the schedule by filing COL applications in parallel with design certification reviews. Additionally, the agency often must make a cost-benefit analysis and focus on the most complete designs submitted, delaying the progress for licensees with more incomplete designs and prompting them to submit further changes or suspend the application altogether. Lastly, design issues continue to present challenges to the licensing framework, as advancements in technology and engineering experience can induce post-certification changes that are inconsistent with the design control document approved by the NRC.

Referencing pending designs may not be consistent with the vision of the new licensing scheme; however, it is expressly authorized under Part 52. The NRC anticipated these challenges during the first wave of COL applications, and the agency works to manage the licensing proceedings to give effect to the intent of Part 52 while allowing parallel proceedings to continue. It therefore appears that the NRC is stretching to accommodate the needs of its applicants while also trying to satisfy the original intentions of Part 52.

2. Licensing the Next Generation Nuclear Plant Prototype

As per the 2005 Act, the NGNP Project Team intends to establish a regulatory framework and licensing scheme that enables the successful licensing, construction, and operation of the reactor prototype. Since the NGNP will use a new technology, the NRC recognizes the need for an alternative licensing strategy and submitted a report detailing the

74. See Blanton et al., supra note 23, at 8–9 (explaining that some applicants were hopeful for completion dates before 2020 and emphasizing the impact of design amendments on the construction and regulatory timeline).

75. See id. at 9 (suggesting that the NRC is forced to selectively review applications due to limited resources).

76. See id. at 10 (citing the example of General Electric’s advanced boiling water reactor (“ABWR”), which incorporated an ITAAC incompatible with the design already approved by the NRC and referenced a design element which was unable to be engineered as planned; see also Design Certification Application Review—ABWR Amendment, U.S. NUCLEAR REG’Y COMM’N, http://www.nrc.gov/reactors/new-reactors/design-cert/amended-abwr.html (last modified Mar. 12, 2012) (detailing the chronology of the ABWR amendment and NRC’s response).

77. See 10 C.F.R. § 52.55(c) (2012) (stating that applicants are permitted to reference “a design for which a certification application has been docketed but not granted,” doing so at their own “risk”).

78. The NRC has allowed parallel design and combined licensed proceedings when the approach efficiently conserved NRC resources and maintained the “consistency” of licensing regulations. See Blanton et al., supra note 23, at 11 (citing Progress Energy Carolinas, Inc., CLI-08-15, 68 NRC 1, 4 (2008)).

79. See id. (concluding that, no matter how the process evolves, NRC must remain flexible with applicants).

recommended licensing approach. Of the licensing alternatives considered, the NRC concluded that the NGNP prototype will be licensed under Subpart C of Part 52. In terms of the licensing timeline, the selected licensing approaches will benefit the NGNP by providing an expedited timeframe for construction and final licensing. By requiring only critical safety design elements to be passed on to the COL phase, the NGNP team can obtain NRC approval before significant construction begins and can thus identify “first-of-a-kind non-LWR” technical issues in parallel to the COL review.

III. THE NRC CAN PREVENT GENERATION IV DESIGN-RELATED DELAYS BY REFORMING REGULATIONS AND FURTHERING STANDARDIZATION EFFORTS

The technical complexity of Generation IV systems will make it more difficult for developers to expeditiously adapt design specifications in the initial years after the technology is deployed. Given the flexibility the NRC allows in the licensing process currently, the next generation of nuclear plants could continue to see delays and present economic barriers to developers. As an alternative to the existing dual framework, the NRC could make Part 52 licensing mandatory for untested or new reactor technology and include more stringent rulemaking provisions for these advanced systems to avoid the licensing delays of the past.

In addition, the NRC should embrace a more aggressive standardization policy to preempt licensing delays caused by the variety of available designs. From an engineering standpoint, standardization offers greater efficiency in the operation of a plant and will lower maintenance, training,

81. See 2008 NGNP REPORT, supra note 63, at 1 (acknowledging the challenge in adapting current regulations to an unproven reactor design); see also GEN IV INT’L FORUM, GIF R&D OUTLOOK FOR GENERATION IV NUCLEAR ENERGY SYSTEMS 11 (Aug. 21, 2009), available at http://www.gen-4.org/PDFs/GIF_RD_Outlook_for_Generation_IV_Nuclear_Energy_Systems.pdf [hereinafter GIF R&D OUTLOOK] (describing the unique components and materials needed for the VHTR, such as thicker reactor pressure vessels).

82. See 2008 NGNP REPORT, supra note 63, at 8–9 (acknowledging that the applicant would not be required to submit a complete design).

83. See id. at 3 (characterizing the licensing, design, and construction strategy as “aggressive”).

84. See id. at 10 (suggesting that the NRC’s recommended approach will provide lessons for developing risk-informed criteria for future NGNP designs).

85. Blanton et al., supra note 23, at 8–11.

86. See T.L. Fahringer, Nuclear Uncertainty: A Look at the Uncertainties of a U.S. Nuclear Renaissance, 41 TEX. ENV’T’L L.J. 279, 304 (2011) (arguing that, if it is indeed more efficient and less costly, there is no downside to the new streamlined licensing process).

87. Standardization involves confining reactors to one family of designs with few engineering differences. NEI LICENSING FACTSHEET, supra note 2 (noting that international experience demonstrates the advantages of reactor fleet standardization).
and parts-procurement. \footnote{Id.} Moreover, standardization would facilitate shared learning among vendors and operators, leading to more predictability and safety.\footnote{See World Nuclear Ass’n, WNA Report: International Standardization of Nuclear Reactor Designs 2 (2010), available at http://world-nuclear.org/uploadedFiles/org/reference/pdf/CORDELreport2010.pdf [hereinafter WNA Standardization Report] (discussing the possibility of developing best practices from shared feedback throughout “the full plant lifecycles of a worldwide nuclear fleet”).}

While there are substantial benefits to this suggested approach, standardization also presents a variety of technological and economic challenges.\footnote{See Leonard M. Trosten & David M. Moore, Nuclear Power Plant Standardization: Promises and Pitfalls, 15 WM. & MARY L. REV. 527, 528 (1974) (discussing the gains to administrative efficiency when generic plant designs receive prior approval).} Among the engineering challenges, there are difficult questions about what degree of standardization is desirable and how to develop uniformity for components.\footnote{See id. at 531.} There are also safety concerns that emerge with standardization, such as the inability to incorporate newly developed safety features due to complacency among industry-side developers who are “deterred” from altering previously approved plants.\footnote{Fahring, supra note 86, at 296 n.192.} Additionally, a design defect may be undetected and replicated in each standardized reactor.\footnote{See id. (describing tradeoffs when determining the scope of standardization; for example, deciding “the extent to which components rather than criteria should be standardized”).}

Standardization of reactor designs is not a novel solution, as the NRC has stated before that it is a policy objective for the agency’s future.\footnote{See Backgrounder on New Nuclear Plant Designs, U.S. Nuclear Reg’v Comm’n. http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/new-nuc-plant-des-bg.html (last updated Feb. 4, 2011) (“The NRC has long sought standardization of nuclear power plant designs.”).} So far, this policy has not yet fully materialized.\footnote{John F. Ahearne et al., The Future of Nuclear Power in the United States 19, 32 (2012), available at http://www.fas.org/pubs/_docs/Nuclear_Energy_Report-lowres.pdf.} The reactors in the United States are distinct from one another and are virtually “one-of-a-kind.”\footnote{See id.; see also Tinu Mario Mathew, Nuclear Energy in France: Lessons to Learn for India, INST. OF ENERGY MGMT. & RESEARCH 4 (Jan. 14, 2011), available at}
a scale similar to France, the NRC must address the aforementioned safety risks to ensure that standardization will succeed, as safety is obviously a critical component for long term nuclear energy growth.\footnote{A HEARNE ET AL., supra note 95, at 31.}

CONCLUSION

The current strategy for licensing the prototype NGNP, if extended to other advanced reactors, may prove problematic. While Part 52 is a marked improvement over two-step licensing, the same risks are present today when design specifications are finalized in parallel to the COL phase of licensing. Improvements to this process may help nuclear developers avoid the same fate of the 1970s and 1980s and potentially save billions of dollars in the process.\footnote{See Jonathan Kahn, Keep Hope Alive: Updating the Prudent Investment Standard for Allocating Nuclear Plant Cancellations, 22 FORDHAM ENVTL. L. REV. 43, 47 (2011) (noting that plant cancellations in the 1980s “prompted Forbes magazine to call the nuclear power industry ‘the largest managerial disaster in business history’”).}

http://greatlakes.edu.in/gurgaon/pdf/Nuclear_Energy_in_France.pdf (lauding France’s standardized fleet, which facilitated cheaper generation due to economies of scale in the component manufacturing process).