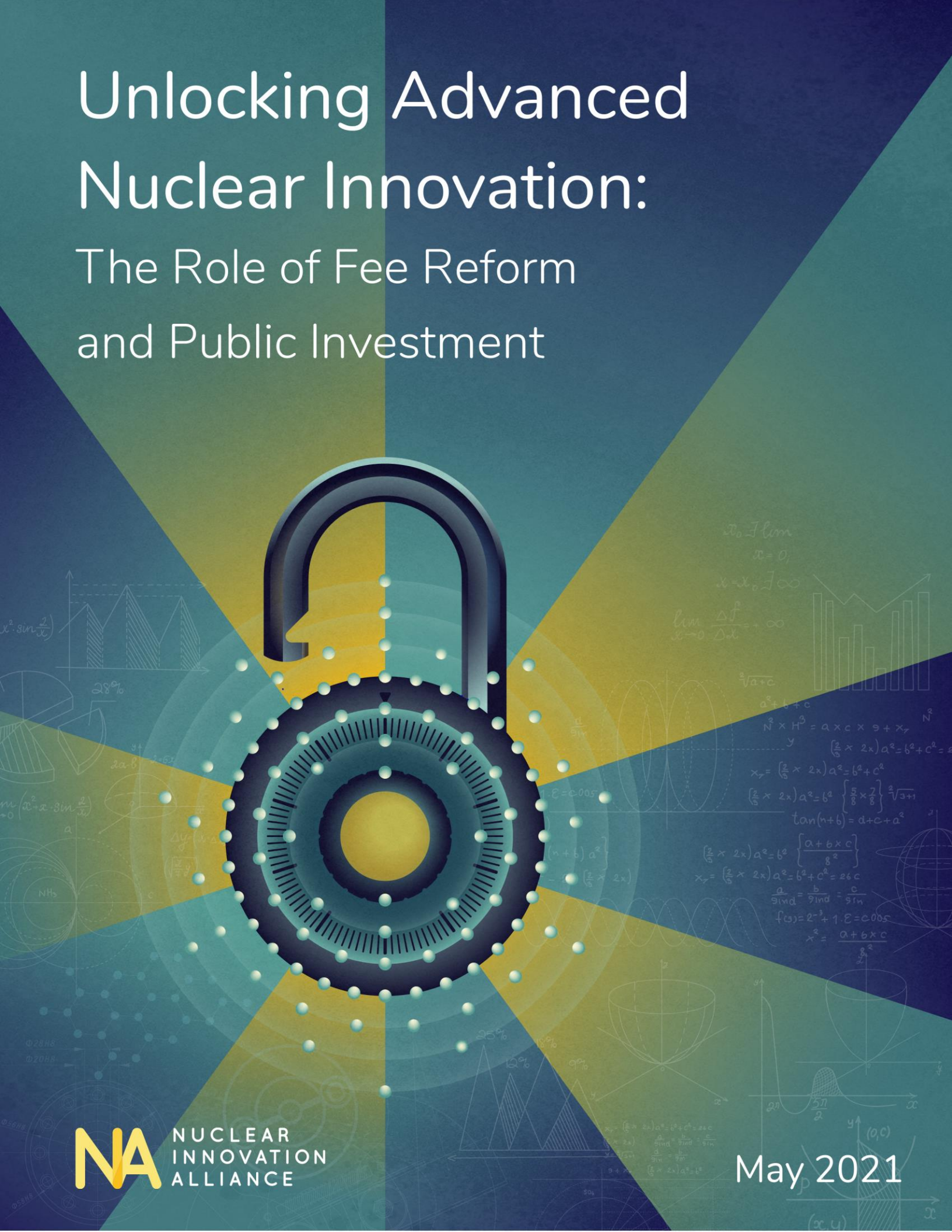
Unlocking Advanced Nuclear Innovation:

The Role of Fee Reform and Public Investment



NUCLEAR INNOVATION ALLIANCE

May 2021

Unlocking Advanced Nuclear Innovation: The Role of Fee Reform and Public Investment

Lead Author:
Alex Gilbert

NIA Contributors:
Judi Greenwald
Victor Ibarra, Jr.

Disclaimer:

The views expressed herein are those of the author(s) and the Nuclear Innovation Alliance.

May 2021

This report is available online at:

https://nuclearinnovationalliance.org/fee-reform-nuclear-innovation

Executive Summary

This report evaluates the history and effects of the licensing fee system at the Nuclear Regulatory Commission (NRC), compares it to other regulatory agencies, finds that the current fee system poses a barrier to carbon free advanced nuclear energy, and recommends options for reform. NRC recovers its costs by charging industry for regulatory activities, including licensing. The current fee model limits NRC's capabilities to review advanced reactors, slows innovation, and makes the U.S. a less attractive regulatory environment. There is no evidence that the current fee model enables innovation. Alternative models at other federal agencies provide examples for how fee models can support innovation, particularly with clear and efficient regulatory processes. Compared to NRC fees, which cover all an applicant's costs, the Federal Aviation Administration (FAA) does not charge fees for licensing. The Food and Drug Administration (FDA) successfully balances public and private funding to expeditiously review innovative activities. Fee reform for new license applicants is a timely next step in the ongoing regulatory modernization at NRC.

As currently structured, the fee model inhibits carbon-free advanced nuclear innovation in two primary ways:

First, the current model limits NRC's resources, flexibility, and efficiency. It constrains NRC's ability to conduct broad, important rulemakings, licensing reviews, and proactive research to support risk-informed, performance-based regulation. It also limits NRC's flexibility to assign and prepare staff ahead of application submittals. The NRC's budget has declined more than 30% since the mid-2010s due to plant retirements and reduced application activity, accompanied by a 25% reduction in NRC staff. As NRC looks to handle future applications for novel reactor applications, the fee model constrains the agency's ability to apply the right resources to the right projects at the right time.

Second, the open-ended costs associated with paying fees imposes barriers to new entrants. License applicants must pay NRC fees before they begin earning revenues. This is particularly burdensome for developers with limited capital and new customer types like small towns, rural communities, and industrial users. NRC is in the process of modernizing its existing regulatory framework, which was designed for light water reactors. At least until this modernization is complete, advanced reactor licensing requires significant extra regulatory work. Thus, the current fee model leads to inefficient and more costly reviews for advanced reactors, despite safety performance that is expected to be better than existing designs. This further discourages early applicants as they essentially subsidize NRC to develop procedures and train staff that can then assist later applications from other companies.

Given the importance of developing advanced reactors, Congress should reevaluate the licensing fee recovery system. User fees can be effective models to internalize regulatory costs of regulated industries, but they can also discourage innovation and limit agency capabilities and flexibility. Generally, fees should be levied based on benefits – those entities that benefit should pay the costs. Although advanced reactor designers and applicants benefit from reactor licensing, the public also receives substantial benefits through NRC's adequate protection

of public health and safety, as well as reductions in carbon and air pollution emissions from the use of nuclear energy. Encouraging research and development also serves a public benefit, over and above the direct benefit to the designer or applicant. To maximize the climate, economic, and security benefits of nuclear power, NRC fees must not pose an undue barrier on innovation.

Alternative fee approaches can support nuclear innovation activities while achieving greater public benefits. Fee reform is especially important in the short term as the inefficiency of current NRC regulations leads to higher fee expenses for near-term applications by first movers. NIA recommends that Congress:

1. **Significantly reform, modify, or replace the licensing fee cost recovery model to exclude or substantially reduce fees for new license applicants at NRC.** Multiple aspects of U.S. nuclear regulation bring benefits to the public and entities rather than just the applicant. Reduced fees, especially for new designs and innovative technologies, can reflect these broad benefits. Increasing the fraction of the NRC's budget that is funded from general revenues can incentivize more innovation, improve regulatory efficiency, and ensure the American regulatory environment remains competitive. If licensing fees are not completely replaced, then excluding fees for other items such as pre-application, topical reports, and environmental reviews from fees can still bring substantial benefits. Alternative fee designs, such as fixed fees or deferred fees, could also offer flexibility compared to the current model.
2. **Alternatively, expand options for Department of Energy (DOE) funding of advanced reactor licensing.** Although the Nuclear Energy Innovation Capabilities Act authorized a program for DOE funding for advanced reactor licensing, it does not appear the program has been implemented. While this would not fully address the challenges of the current NRC structure, Congress could consider appropriating funds for this authorization, as well other measures such as licensing prizes, fee caps, and fee deferrals.
3. **Expand funding for advanced reactor regulatory infrastructure.** Recent increases in "off-fee" NRC funding have helped NRC prepare to review advanced reactor designs, but individual license applications are also innovation activities. Large increases in off-fee funding are needed to develop the regulatory infrastructure to maintain NRC as a world-leading nuclear regulator. Just as Congress is considering infrastructure funding for roads and bridges, so too does the nuclear regulatory infrastructure deserve support.

Additionally, NIA recommends that NRC take several actions to reduce the negative impacts of the fee model on nuclear innovation. First, NRC should expand the definition of activities that are can be funded as advanced reactor regulatory infrastructure and seek additional funding for these activities. Second, NRC should evaluate what it can do with existing authorities to defer fee collection or otherwise reduce the impacts of fees on new reactor license applicants.

More broadly, the NRC funding model should be reevaluated to ensure that it is consistent with U.S. climate goals. While NIA did not look at the impact of current annual fees for operating nuclear power plants, the time is ripe to review how the fee model impacts the industry's overall competitiveness domestically and internationally.

Table of Contents

Executive Summary i
1. Introduction to Fee Reform, Public Investment, and Nuclear Innovation 1
2. History of Licensing and Annual Fees at NRC 6
   a. Emergence of Regulatory Fees 6
   b. NEIMA and Initial Fee Reform 9
   c. Post-NEIMA Fees 11
3. User Fee Funding of Regulatory Agencies 14
   a. Emergence and rationale of user fees 14
   b. Limitations of User Fees 16
4. Fees as a Regulatory Barrier to Nuclear Innovation 17
   a. License fees as barrier to new projects 17
   b. Advanced Reactor Reviews and Fees 19
   c. Applying a Benefits Test for Nuclear Innovation Activities 20
5. Comparison to other fee-funded regulatory agencies 23
   a. User Fees at Similar Regulatory Agencies 23
   b. Case study: FAA's User Fees Exclude Design Reviews 24
   c. Case study: FDA's Predictable Processes and User Fees 26
6. Fee models at nuclear regulators in other countries 28
7. Recommendations for Legislative and Regulatory Action 30
   a. Legislative Options to Reduce Fees as a Barrier 30
   b. Regulatory Options to Reduce Fees as a Barrier 31
8. Conclusion 32

1. Introduction to Fee Reform, Public Investment, and Nuclear Innovation

Summary

1. User fees for license applications are quickly emerging as a barrier to advanced reactor development and can inhibit regulatory modernization.
2. It is not clear that the Nuclear Regulatory Commission's current fee model enables innovation; since its implementation in 1990, no new reactor builds have yet begun operation (as of April 2021).
3. The fee model was not designed for small, entrepreneurial companies that do not yet have revenue streams.
4. More public investment is needed to provide sufficient resources for NRC to develop a globally competitive regulatory framework for advanced reactors.

Reevaluating Fee Models to Promote Nuclear Innovation

The Nuclear Regulatory Commission (NRC) plays an essential role in regulating nuclear energy in the United States. As a technical regulator, NRC brings extensive expertise to evaluations of reactor design and safety. The independent agency is also an international model for nuclear regulation and assures the public that nuclear energy is operated safely. Without strong regulations, the public would not benefit from the many advantages of nuclear energy, including clean air, carbon-free power, reliability, energy security, and global leadership in nuclear non-proliferation.

To provide these public benefits, NRC is almost entirely funded by two types of industry user fees. Under Title 10 CFR, Part 170 applicants for new reactor licenses are charged an hourly rate (generally) for the full costs incurred in conducting licensing reviews and activities, such as reviews or pre-application.[1] Under 10 CFR Part 171, existing license holders, including operating nuclear power plants and materials license holders, are charged for most of the remainder of NRC's total operating costs.

Although NRC charges user fees, they are not directly available to the agency. Rather, they are routed to the general Treasury to offset Congressional appropriations for NRC's budget. Therefore, Congress still has substantial control over resource allocation and budgets at NRC. Every year, Congress sets NRC's budget based on an agency request. NRC then conducts an annual rulemaking to determine annual fees (Part 171) for existing license holders, and hourly rates under Part 170. Subtracting expected cost recovery from total appropriations, Congress provides a "net appropriation" from the general Treasury to cover activities not subject to fee

[1] "The NRC's professional hourly rate is derived by adding budgeted resources for (1) mission-direct program salaries and benefits; (2) mission indirect-program support; and (3) agency support (corporate support and the Inspector General (IG)), then subtracting certain offsetting receipts and then dividing this total by mission direct full-time equivalents (FTE) converted to hours. The only budgeted resources excluded from the professional hourly rate are those for mission-direct contract activities."
"FY 2021 Proposed Fee Rule Work Papers." *U.S. Nuclear Regulatory Commission*, p. 11, https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20346A173.

recovery. Accordingly, while Congress controls overall resources at NRC, the internal need at NRC to tie activities to certain fee categories can prevent efficient internal allocation of resources. Even if there are sufficient overall resources provided from user fees and net appropriations, the fee structure does not necessarily enable the right allocation of the right resources and staff to the right project at the right time.

Since the system of substantial fee recovery was implemented in Fiscal Year (FY)1990, no new reactor has received a construction permit or combined license and subsequently begun operation. When completed, the two reactors at Vogtle in Georgia will be the first such facilities. Although broader economic concerns have caused a lack of new builds, this fact indicates there is no evidence that the current NRC fee model can support a rapid and timely buildout of novel reactor technologies. With dozens of smaller companies aiming to reinvigorate a stagnant U.S. nuclear industry and needing a license before they can begin to earn revenues, NRC regulatory fees are looming as a major financial barrier to advanced reactor innovation.

While this report does not analyze annual fees for existing license holders in depth, previous analyses have identified 10 CFR Part 171 annual fees as an economic barrier to new reactors:

- Vegel and Quinn (2017) found that the annual fees that are comparable in size to those paid by existing large light water reactors posed a potential economic barrier to small modular reactors.[2]
- Similarly, the Nuclear Energy Institute (NEI) has recommended a technology-inclusive variable fee structure for non-light water reactors and found that current fee structures would have disproportionate impacts on microreactors, making up as much as quarter of their total costs. [3]
- A consultant report prepared for the Department of Defense found that licensing fees could adversely impact the economics of commercial small modular reactors (SMRs) for defense applications.[4]
- The American Action Forum noted that annual fees paid by the nuclear industry impose substantial regulatory costs, particularly compared to coal and natural gas plants that do not have to fund their primary public and environmental health regulator, the Environmental Protection Agency (EPA).[5]

[2] Vegel, Benjamin, and Jason C. Quinn. “Economic evaluation of small modular nuclear reactors and the complications of regulatory fee structures.” Volume 104, *Energy Policy*, May 2017, pp. 395-403, https://www.sciencedirect.com/science/article/abs/pii/S0301421517300538.
[3] "NRC Annual Fee Assessment for Non-Light Water Reactors." *Nuclear Energy Institute*, November 2020, https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20328A173.
[4] King, Marcus, et al. "Feasibility of Nuclear Power on U.S. Military Installations." *CNA Analysis & Solutions*, March 2011, https://www.cna.org/CNA_files/PDF/D0023932.A5.pdf.
[5] Batkins, Sam. "The Costs and Benefits of Nuclear Regulation." *American Action Forum*, 8 September 2016, https://www.americanactionforum.org/research/costs-benefits-nuclear-regulation/.

- In a subsequent analysis, American Action Forum found that the fees and associated regulatory costs can hurt the profitability of existing nuclear plants (and hence make premature retirements more likely).[6]

Other analyses have raised concerns about how 10 CFR Part 170 fees (i.e., hourly fees that NRC charges to perform licensing reviews and other activities) could discourage new license applications or make NRC review difficult:

- In 2016, NIA highlighted how the dependence on the fee model had limited NRC preparations for licensing advanced reactors.[7]
- After reviewing the high pre-licensing fees for the Next Generation Nuclear Plant project, Third Way recommended that NRC's fee model be reconsidered for advanced reactor demonstration projects, identifying more innovation-friendly fee models at FDA and FAA.[8]
- Due to constraints from its fee system, previous NRC Commissioners and several reports have highlighted the need for off-fee based funding for NRC to have the budget and flexibility to develop the regulatory infrastructure for advanced reactors (see Section 1.b.).[9,10]
- In a Master's thesis at MIT, White (2017) noted that the fee recovery model made it "difficult for the NRC to hire and train staff in anticipation of advanced reactor license applications," even when developers express interest through pre-application.[11]

Due to the limited resources and flexibility, NRC was unable to proactively develop rules and perform technical activities for advanced reactors. Many of these are now being done on an ad-hoc basis for individual applications. The current fee model creates uncertainty for developers, customers, and investors as NRC reviews of advanced reactors can be lengthy and thus involve unexpected and open-ended licensing review costs. While the NRC regulations require fees to recover "full cost" of NRC's review, there is no way to predict what that "full cost" will be and therefore what the fees will be. In some cases, at the time that NRC accepts an application for review, it has provided an estimate of how much the fees will be. But that estimate is only an estimate. The applicant is still responsible for the full cost, regardless of the estimate.

---

[6] Batkins, Sam, et al. "Putting Nuclear Regulatory Costs in Context." *American Action Forum*, 12 July 2017, https://www.americanactionforum.org/research/putting-nuclear-regulatory-costs-context/.
[7] Finan, Ashley E., et al. "Enabling Nuclear Innovation: Strategies for Advanced Reactor Licensing." *Nuclear Innovation Alliance*, April 2016, https://nuclearinnovationalliance.org/strategies-advanced-reactor-licensing-0.
[8] Goldberg, Matt. "Unleashing Innovation: A Comparison of Regulatory Approval Processes." *Third Way*, 13 April 2016, https://www.thirdway.org/report/unleashing-innovation-a-comparison-of-regulatory-approval-processes.
[9] "Interim Report of the American Nuclear Society President's Special Committee on Small and Medium Sized Reactor (SMR) Generic Licensing Issues." *American Nuclear Society*, July 2010, http://www2.ans.org/pi/smr/ans-smr-report.pdf.
[10] "The U.S. Nuclear R&D Imperative." *American Nuclear Society*, February 2021, https://www.ans.org/file/3177/2/ANS%20RnD%20Task%20Force%20Report.pdf.
[11] White, Robert Patrick. *Pathways and Frameworks for the Licensing and Regulation of Advanced Nuclear Reactors in the United States*. MS Thesis. Massachusetts Institute of Technology, February 2019, https://dspace.mit.edu/bitstream/handle/1721.1/121714/1104135127-MIT.pdf?sequence=1&isAllowed=y.

Congress addressed some of these concerns when it passed NEIMA (See Section 2.c.). Off-fee funding in NEIMA and subsequent legislation are providing initial resources for NRC activities to build advanced reactor regulatory infrastructure. While NIA applauds these activities, expanded and more durable public resources are needed to ensure NRC remains a global leader in nuclear regulation. In addition, a more holistic review and revision to NRC's fee structure can address the underlying issues that NEIMA attempted to address.

Fees are an important consideration for commercializing advanced reactors, and near-term licensing activities make reconsideration of licensing fees an urgent imperative. In the case of fees collected for NuScale's recent design certification, estimated upfront licensing fees were equivalent to at least 10-15 years of annual fees for operating facilities.[12] These costs could be even more significant for combined or operating license applicants who must recoup fees through revenues from a specific and limited customer base. As licensing fees occur at the beginning of the project, they require equity or debt servicing until operation commences, and can have large impacts on a project's net present value. Therefore, even though fees are only a small part of a project's lifecycle cost, they can have disproportionate impacts on early-stage projects and even discourage consideration of nuclear energy in the first place.

Today, NRC's regulatory framework for licensing reviews is largely predicated on review of large light-water reactors. To apply this framework to advanced reactors requires extensive company and staff work to identify non-applicability of regulations, exemptions, and other adaptations. This can cause initial advanced reactor reviews to take longer and cost more than historical reviews. This conflicts with the general principle of risk-informed, performance-based regulation. Advanced reactors are expected to be significantly safer than past designs, and the fees incurred should be reflective of the enhanced safety, rather than a result of inefficient requirements. Until regulations are modernized, fees pose additional undue burdens on innovators and may be costlier compared to licensing with performance-based regulatory frameworks in other countries.

Additionally, the advanced reactor rulemaking funding for NRC under NEIMA presumes regulatory infrastructure is separate from individual license applications. The reality is the Commission and future applicants are constantly learning from ongoing licensing and the benefits of some of levied applicant fees accrue to future license seekers. Effectively, first movers are cross-subsidizing efficient reviews for subsequent applicants. Any changes to the fee structure should allow the Commission to make improvements constantly and proactively to its processes as experience is gained. *Further, to the degree that performance-based regulation has different costs from a prescriptive review, Congress should use regulatory modernization as a chance to reconsider the licensing fee model. As we are changing from a prescriptive system to a performance-based one, we should also reconsider how we fund that regulation.*

This report focuses on how the fee model of NRC impacts new license applications. First, it provides the history of fee funding at NRC and recent changes with NEIMA (Section 2). The

[12] Estimating NuScale's fees at $70 million total, with an annual fee estimate of $4-5 million, leads to 14 to 17 years.

report then describes the theory and basis for user fee funding of regulatory agencies, with a particular focus on the concept of public and private benefits (Section 3). Looking at recent regulatory experiences, it next identifies issues with the current license fee model for advanced reactor innovation and deployment (Section 4). Then it compares NRC to other fee-funded regulatory agencies (Section 5). Next, by looking globally, this report underscores the importance of NRC fee reform for maintaining American competitiveness in a global advanced nuclear innovation market (Section 6). Finally, it provides options and recommendations for fee reform and increased public investment to unlock advanced nuclear innovation (Section 7).

2. History of Licensing and Annual Fees at NRC

Summary

- Although small license fees for new reactors were first implemented by the Atomic Energy Commission (AEC) in 1968, these fees grew over time to cover all direct and indirect costs associated with new reactor licensing reviews.
- In response to federal budgetary pressures in the 1980s, Congress quickly increased fees for existing commercial licensees, starting at 33% of NRC's total budget in FY1985 and rising to 100% by FY1990 and falling to 90% beginning in FY2005.
- Fee reforms implemented in NEIMA in 2019 began to provide NRC with off-fee resources for reforming regulations for advanced reactors, but shrinking NRC budgets may constrain the ability of NRC to modernize regulations at the pace needed for advanced reactors as well as increasing financial pressures on existing facilities and new applicants as both annual fees and hourly fees have continued to increase.

a. Emergence of Regulatory Fees

Nuclear regulation in the United States began in the 1950s when the AEC began to promote the use of commercial nuclear power. In the 1950s and 1960s, the AEC began regulatory activities to oversee the development of the domestic nuclear energy industry. The Independent Offices Appropriation Act of 1952 (IOAA) authorized agencies like AEC to charge fees to recoup "the cost to the agency of a specific benefit rendered to a particular entity," such as licensing applications or inspections.[13] The AEC adopted its first fee schedule for applications in 1968 with a flat license application fee based on plant capacity.[14] For a power reactor, AEC charged a $2,500 application fee (1968$) for the construction permit, $5,000 plus $10/Megawatt-thermal (MWt) for issuance of the construction permit , and a $2/MWt operating license fee. For a 1,000 megawatt-electric reactor built in 1968, this equates to a total fee of $313,514 in inflation-adjusted 2020 dollars, approximately 0.5% of the cost of NuScale's design certification, for a reactor with about twice the thermal output.[15] Fees covered only a fraction of the regulatory costs at the AEC, and at the time, license applicants were primarily large investor-owned utilities, with rate-of-return regulation, captive rate bases, and stable, existing revenues.

Eventually, the dual mandates of the AEC to both promote and regulate nuclear energy led to Congress splitting it in 1974 into NRC and the Energy Research and Development Authority (the precursor to the DOE). During its early years, NRC budgets were primarily funded by the taxpayer. The Commission adopted a fee schedule in 1978 that charged fees based on services that provided "special benefits to identifiable recipients," leading to approximately

[13] U.S. Court of Appeals for the District of Columbia Circuit. *Florida Power & Light Company, et al., Petitioners, v. United States of America and Nuclear Regulatory Commission*. 846 F.2d 765, 1988.
[14] United States, Nuclear Regulatory Commission. "Revision of Fee Schedules; Fee Recovery for Fiscal Year 2012." 77 Fed. Reg. 15,530 – 15,554 (15 March 2012). https://www.govinfo.gov/content/pkg/FR-2012-03-15/html/2012-6153.htm.
[15] The AEC fees cover both a construction permit and operating license, which allows a facility to operate. The NuScale Design Certification does not allow a facility to operate.

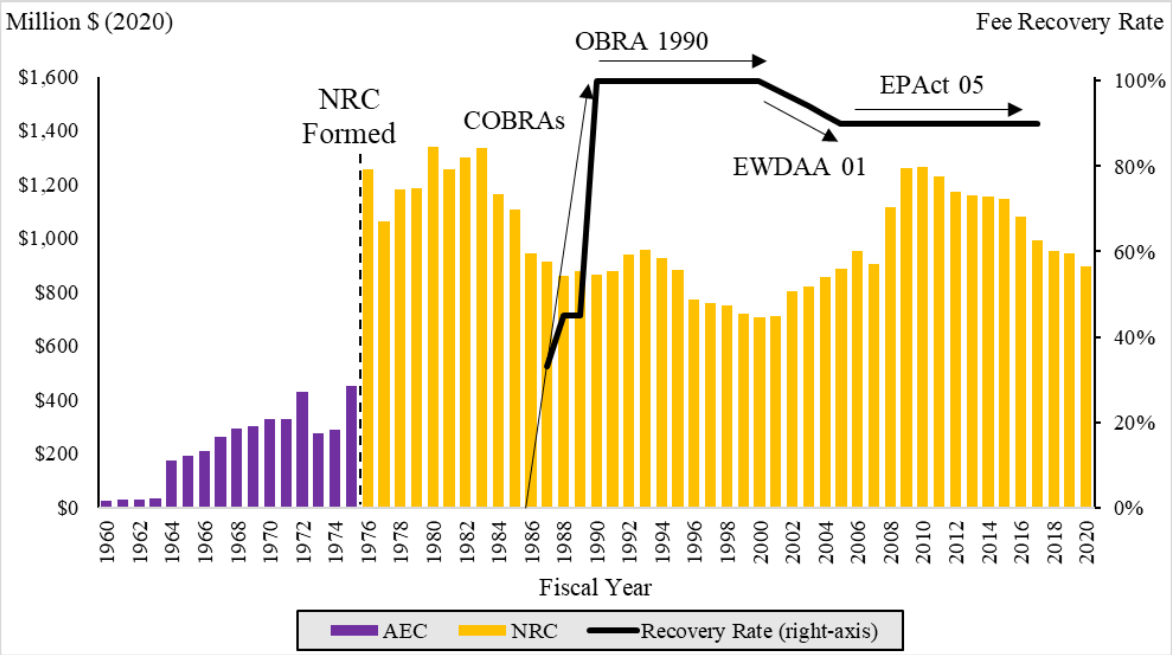
20% of the actual licensing costs being reimbursed by licensing fees.[16] At the time, NRC was reviewing dozens of reactor license applications. In *Mississippi Power & Light Co. v. U.S. Nuclear Regulatory Commission*, the US Court of Appeals for the 5th Circuit ruled that the amount of these fees charged to private entities did not have to account for public benefits from such activities if there was an identifiable private beneficiary.[17] Notably, the Court also ruled NRC could charge for costs for environmental reviews under the National Environmental Policy Act (NEPA).

In the 1980s, budgetary pressures and regulatory reform led to Congress expanding the use of user fees for regulatory agencies across the federal government. As described in Sections 3 and 5 of this report, these fees varied greatly across different agencies and had different impacts on regulated entities. Over the course of the decade, Congress instituted a fee recovery requirement for NRC budget that eventually required all Commission expenditures to be recovered by fees on license applications and existing licensees. The Consolidated Omnibus Budget Reconciliation Act of 1986 ("COBRA") required NRC to recover up to 33% of its total budget through fees.[18] In *Florida Power & Light Company vs. Nuclear Regulatory Commission*, the D.C. Circuit ruled that this legislation did not require identification of a specific benefit and hence was not governed by the same justifications as IOAA.[19] For the first time, NRC was able to levy annual fees on licensees.[20] Subsequent legislation increased the recovery requirement to 45% of the agency's budget for FY1988 and FY1989.[21] An NRC survey of nuclear operators in 1990 found concerns that the rising costs of fees could impact the financial viability of nuclear power, especially for smaller plants.[22] *One respondent noted the charging of fees disincentivized the submissions of topical reports that could otherwise improve efficiency or safety as NRC would charge fees to review the topical report*.[23] The Omnibus Budget Reconciliation Act of 1990 further increased the fee recovery requirement to 100% of NRC's budget.

---

[16] "Nuclear Power Costs and Subsidies." Comptroller General of the United States, EMD-79-52, *Government Accountability Office*, 13 June 1979, https://www.gao.gov/assets/emd-79-52.pdf.
[17] United States Court of Appeals, Fifth Circuit. *Mississippi Power Light Co. v. Nuclear Regulatory Commission*. 601 F.2d 223, 1979.
[18] United States, Nuclear Regulatory Commission. "Revision of Fee Schedules; Fee Recovery for Fiscal Year 2012." 77 Fed. Reg. 15,531 (15 March 2012). https://www.govinfo.gov/content/pkg/FR-2012-03-15/html/2012-6153.htm.
[19] U.S. Court of Appeals for the District of Columbia Circuit. *Florida Power & Light Company, et al., Petitioners, v. United States of America and Nuclear Regulatory Commission*. 846 F.2d 765, 1988.
[20] A previous attempt by the AEC to charge existing licensees was rebuffed as exceeding the specific benefits requirement of the IOAA, with charged fees refunded.
[21] United States, Congress. Public Law 100-203. Internal Revenue Cumulative Bulletin, vol. 3, 1987. *U.S. Government Publishing Office*, https://www.govinfo.gov/content/pkg/GOVPUB-T22-aea199473486be343141837068bc0f08/pdf/GOVPUB-T22-aea199473486be343141837068bc0f08-3.pdf.
[22] Davis, A. Bert, and Cynthia D. Pederson. "Industry Perceptions of the Impact of the U.S. Nuclear Regulatory Commission on Nuclear Power Plant Activities." *U.S. Nuclear Regulatory Commission*, March 1990, https://inis.iaea.org/collection/NCLCollectionStore/_Public/35/053/35053338.pdf?r=1.
[23] Topical reports are industry-drafted reports about safety-related topics that are submitted for NRC staff review and can be referenced in future licensing activities. *U.S. Nuclear Regulatory Commission*, https://www.nrc.gov/about-nrc/regulatory/licensing/topical-reports/overview.html.

Figure 1. AEC and NRC Budgets versus Fee Recovery Rates, 1960-2020, 2020$



Source: NIA, based on data from NRC and GAO[24,25]

The rapid shift to full fee recovery of NRC's budget was not without political controversy. During budget negotiations on OBRA 1990, the Chair and Ranking Member of the Senate Committee on Environment and Public Works sent a letter critical of the approach:

> "We are opposed to the proposal in the President's budget to recover 100% of the Nuclear Regulatory Commission's expenses through user fees. The issue of increased NRC fees has been addressed in the context of reconciliation legislation in 1985, 1987 and 1989. The Committee has consistently maintained during deliberations on these reconciliation bills that increases on the order of the Administration proposal are both impractical and inequitable. It would be impossible to reasonably relate the fees assessed to the services rendered and would be unfair to require those subject to regulation by the NRC to bear a burden that those regulated by other agencies are not required to meet. We are opposed to elevating NRC fees above the current level."[26]

The Committee's concerns about the practicality and equity of the 100% fee recovery requirements were realized quickly after OBRA 1990 passed. NRC issued implementing regulations, leading to questions about whether fees could be charged to other government

[24] "Nuclear Power Costs and Subsidies." Comptroller General of the United States, EMD-79-52, *Government Accountability Office*, 13 June 1979, https://www.gao.gov/assets/emd-79-52.pdf.
[25] Note that the data for AEC includes direct regulatory costs only. Indirect regulatory costs, particularly regulatory research was funded across the AEC and these functions were folded into NRC, leading to the large apparent increase from the AEC to NRC.
[26] U.S. Senate Committee on Environment and Public Works, Letter to Senate Budget Committee, March 26, 1990. Available in: "Budget requests from agencies under the jurisdiction of the Committee on Environment and Public Works, U.S. Senate," April 1990.

agencies, questions about relating private benefits to licensees to specific costs, and concerns about the impact on small and educational users.[27]

In the 2000s, Congress enacted multiple updates to the fee recovery requirements.[28] The FY2001 Energy and Water Development Appropriation Act modified OBRA 1990 to steadily decrease fee recovery from 100% in FY2000 to 90% in FY2005. The Energy Policy Act of 2005 made the 90% fee recovery level permanent starting in FY2007.[29] The rationale for these changes was that around 10% of NRC activities (e.g., NRC's international programs) were not directly tied to industry regulation, and thus had public benefit that should be funded publicly.

In reviewing the congressional and administrative history of the NRC fee model before NEIMA, NIA found relatively little consideration of the impacts of regulatory user fees on nuclear innovation. Despite some targeted actions, such as small business annual fee relief and annual fee exemptions, there appears to have been limited debate over whether licensing fees would pose a barrier to future nuclear power development. Nor has there been substantial Congressional debate about whether NRC regulatory fees burden nuclear power compared to other sources of energy, which generally are subject to government regulation without fees (see Section 5).

b. NEIMA and Initial Fee Reform

As early as 2008, concerns emerged that the structure of the NRC fee model design would not support NRC's development of capabilities for advanced reactor reviews.[30] At the time, NRC was in the middle of managing workforce expansion to meet the expected review needs for the then-expected light-water reactor nuclear renaissance. At an oversight hearing, then-Commissioner Peter Lyons highlighted how resource limitations constrained NRC's preparations for regulating advanced reactors: "… the NRC is receiving an increasing number of requests for pre-application meetings by potential applicants for small, so-called grid-appropriate advanced reactor concepts, for potential sales to developing nations and into markets with very small grids. There are currently no U.S. licensees expressing serious interest in building such plants. That has limited our associated resource allocations."[31] During that hearing, multiple Commissioners highlighted the need for Congressional funding for research to support advanced

[27] McGinnis, John O. Memorandum Opinion for the General Counsel of the Nuclear Regulatory Commission, *U.S. Department of Justice*, Washington, DC. 30 July 1991, https://www.justice.gov/file/23316/download.

[28] United States, Nuclear Regulatory Commission. "Revision of Fee Schedules; Fee Recovery for Fiscal Year 2012." 77 Fed. Reg. 15,530 – 15,554 (15 March 2012). https://www.govinfo.gov/content/pkg/FR-2012-03-15/html/2012-6153.htm.

[29] Holt, Mark, and Carol Glover. "Energy Policy Act of 2005: Summary and Analysis of Enacted Provisions." *CRS Report to Congress*, 8 March 2006, https://www.circleofblue.org/wp-content/uploads/2010/08/CRS-Summary-of-Energy-Policy-Act-of-2005.pdf.

[30] United States, Congress, Senate, Committee on Environment and Public Works. *Nuclear Regulatory Commission's Licensing and Relicensing Process for Nuclear Plants*. Senate Hearing 16 July 2008, *U.S. Government Publishing Office*. 110th Congress, 2nd session. https://www.govinfo.gov/content/pkg/CHRG-110shrg85537/html/CHRG-110shrg85537.htm.

[31] United States, Congress, Senate, Committee on Environment and Public Works. *Nuclear Regulatory Commission's Licensing and Relicensing Process for Nuclear Plants*. Senate Hearing 16 July 2008, *U.S. Government Publishing Office*. 110th Congress, 2nd session. https://www.govinfo.gov/content/pkg/CHRG-110shrg85537/html/CHRG-110shrg85537.htm.

reactor reviews. Subsequently, NRC prepared a report for Congress regarding NRC activities to prepare for review of advanced reactors.[32] In 2017, former Commissioner Stephen Burns described the challenge:

> "The NRC has engaged in a steady, albeit modest, examination of its preparedness for advanced designs over the past few years… But the NRC is constrained in some respects from devoting substantial resources to the development of new or revised regulatory approaches due to statutory requirements that the NRC recover most of its appropriated funds through user fees imposed on the industry. Unless designers are prepared to put up the funds necessary to cover the fees for review of the new designs, the NRC is not able to review them, and licensees of operating facilities paying annual fees may not all be supportive of the NRC expending resources to develop infrastructure for the review of advanced reactor designs."[33]

Reflecting these concerns, NIA's previous 2016 report "*Strategies for Advanced Reactor Licensing*" [34] made several recommendations for Congress related to the fee model and NRC resources for advanced reactor reviews:

1. Revise NRC's budget structure with public funding of agency-related activities such as advanced reactor regulations and other initiatives not related to a specific licensee.
2. Appropriate funding to prepare for advanced reactor licensing, including a new regulatory framework, staff training, and preparations for licensing reviews.
3. Expand financial resources for advanced reactor companies through competitive DOE grants for licensing activities.

These concerns were echoed in MIT's major 2018 report on nuclear energy "*The Future of Nuclear Energy in a Carbon-Constrained World*."[35]

Beyond resource issues for advanced reactor reviews, several other issues with NRC fee model emerged. Economic issues were leading to multiple nuclear reactor retirements, raising questions about how annual and hourly fees charged to existing reactors would impact a shrinking industry. Further, questions arose about the transparency and design of NRC's administration of annual fees and collection practices, as noted in a GAO report.[36]

---

[32] "Report to Congress: Advanced Reactor Licensing." *U.S. Nuclear Regulatory Commission*, August 2012, https://www.nrc.gov/reading-rm/doc-collections/congress-docs/correspondence/2012/frelinghuysen-08-22-2012.pdf.
[33] Burns, Stephen G. "Reformed and reforming: Adapting the licensing process to meet new challenges." Nuclear Law Bulletin No. 99, p.9, https://www.oecd-nea.org/upload/docs/application/pdf/2020-11/nlb99.pdf#page=9.
[34] Finan, Ashley E., et al. "Enabling Nuclear Innovation: Strategies for Advanced Reactor Licensing." *Nuclear Innovation Alliance*, April 2016, https://nuclearinnovationalliance.org/strategies-advanced-reactor-licensing-0.
[35] Buongiorno, Jacopo, et al. "The Future of Nuclear Energy in a Carbon-Constrained World." *Massachusetts Institute of Technology*, 2018, https://energy.mit.edu/wp-content/uploads/2018/09/The-Future-of-Nuclear-Energy-in-a-Carbon-Constrained-World.pdf.
[36] "Nuclear Regulatory Commission: Regulatory Fee-Setting Calculations Need Greater Transparency." GAO-17-232, *Government Accountability Office*, February 2017, https://www.gao.gov/assets/690/682455.pdf.

In 2018, Congress responded to these concerns by enacting initial reforms of the fee model in NEIMA. A Senate report on license application fees described the issues with the preceding model:

> "Another problem that results from the current budget and fee structure is the NRC's limited ability to develop expertise in advance[d] reactor technologies. To date, any work in this area … has been general and exploratory. The NRC dedicates few resources to the subject since it would be unfair to collect fees from current licensees, and consequently their ratepayers, to fund exploratory work. In addition, if appropriators provided funds directly to the NRC by increasing the amount of the 10 percent paid by the taxpayers, it would trigger an increase in the fee recovery under the 90 percent fee recovery mandate. For every $1 million appropriators might fund for advanced reactors, licensees would need to be billed an additional $9 million to pay the amount necessary to reach 90 percent of the NRC's budget authority."[37]

Instead of an approximate 90% fee recovery rate, NEIMA excluded specific activities from the fee base and required that NRC recover 100% of the remainder from industry fees. Innovation activities related to regulation of advanced reactors were included in this off-fee base funding, initially at a level of ~$5 million in FY18. NEIMA also imposed caps on annual fees for existing reactors and made changes to the fee structure to increase predictability, transparency, and efficiency. Overall, NEIMA did not substantially change the overall budget and level of industry annual and hourly fees as the amount of off fee based activities was already approximately 10% of the NRC's total budget.

Additionally, the Nuclear Energy Innovation Capabilities Act (NEICA) authorized the creation of a DOE-administered cost share program to help fund certain aspects of advanced reactor development engagements with the NRC.[38] Under the program, DOE is authorized to cover as much as 80% of the NRC fees associated with developing a licensing project plan, obtaining a statement of licensing feasibility, reviewing topical reports, pre-application reviews, application reviews, and interactions with the Commission. However, as far as NIA could tell, no public information indicates that this program has been established nor funds appropriated. Beyond a lack of funding, industry concerns about the cost-share program include cost-share requirements and other program transaction costs, such as application and reporting requirements. Since 2018, a separate program has awarded less than $5 million for Regulatory Assistance Grants from DOE.

c. Post-NEIMA Fees

Following the passage of NEIMA, NRC's enacted budget has continued to fall, hitting a seventeen-year inflation-adjusted low of $855.6 million in 2020. For the last five years, NRC's enacted budget has consistently been $32-69 million below the Administration's budget requests.

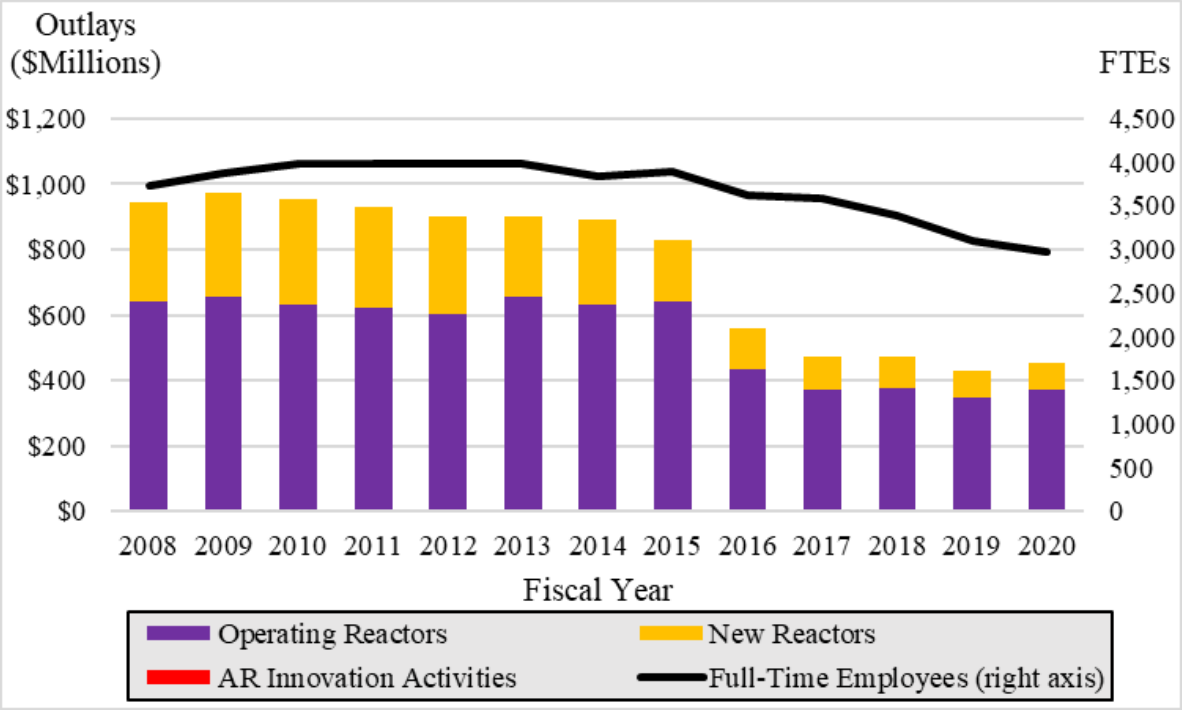
---

[37] United States, Congress, Senate, Committee on Environment and Public Works. *Nuclear Energy Innovation and Modernization Act*. Senate Report 528. *U.S. Government Publishing Office*, 23 June 2016. 114th Congress, 2nd session, https://www.govinfo.gov/content/pkg/CRPT-114srpt285/html/CRPT-114srpt285.htm.

[38] 42 U.S. Code § 16280 - Advanced Nuclear Energy Licensing Cost-Share Grant Program. *Legal Information Institute*, Cornell Law School, https://www.law.cornell.edu/uscode/text/42/16280.

As seen in Figure 2, the NRC has recently downsized significantly, which could limit its capability to rapidly modernize to regulate the next generation of reactors. From 2015 to 2020, NRC's full-time equivalent employee count has dropped 25%, from about 3,900 to less than 3,000. *This reflects an almost 30% decline in NRC's budget between 2010 and 2020*. Cost pressures, particularly from decreasing receipts from hourly fees from new license applicants, were a factor of merging the Office of Nuclear Reactor Regulation and the Office of New Reactors.[39]

Figure 2. NRC Spending for Operating and New Reactors (2020$) and Full-Time Employees (FTEs)



Source: NIA, based on data from NRC

Importantly, by excluding international activities from the fee basis in FY2020, the Further Consolidated Appropriations Act of 2020 led to there being no fees for import and export licensing actions at the NRC.[40] This exclusion helps the competitiveness of U.S. advanced reactor vendors in global markets, especially against state-owned enterprises.

At the same time that NRC needs to redesign its regulatory framework for advanced non-light water reactors and handle multiple first-of-a-kind applications, the Commission is resource constrained. This constraint is in large part due to the fee recovery model, which limits the NRC's ability to plan for, hire, and train staff for reviews and to conduct other activities. Congress has increased the amount of funding for advanced reactor regulatory development,

[39] SECY-16-0075: Proposed Merger of the Offices of New Reactors and Nuclear Reactor Regulation. U.S. Nuclear Regulatory Commission, 8 June 2016, https://www.nrc.gov/docs/ML1608/ML16083A485.pdf.
[40] 10 CFR 170, 1 January 2015, *U.S. Nuclear Regulatory Commission*, https://www.nrc.gov/reading-rm/doc-collections/cfr/part170/full-text.html#ftn6-6_170021.

from $4.6 million in FY2018 to $15.5 million in FY2020. For FY2021, NRC requested an increase to more than $17 million.[41] While this line item funds activities like the development of Part 53, it remains a small portion of NRC's overall budget (see Figure 2) and limits the overall ability of the NRC to pursue broad regulatory reforms. Further, this amount is not intended for specific applications, meaning there are still funding shortfalls and limitations related to cross-subsidies and staffing for first-of-a-kind reviews. *A strong, independent, and technically competent NRC is in the public interest of the United States. Without a substantive change in how NRC is resourced and how new license application fees are levied, a lack of resources for regulatory modernization jeopardizes U.S. leadership potential in advanced nuclear energy.*

[41] United States, U.S. Nuclear Regulatory Commission. *Congressional Budget Justification Fiscal Year 2021*. NUREG-1100, vol. 36, https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1100/v36/index.html.

3. User Fee Funding of Regulatory Agencies

Summary

- User fees can be a fair and equitable way to provide government services where there is a clear, specific beneficiary.
- Generally, best practice guidelines recommend user fees be levied based on benefits to private entities.
- The core benefit of NRC is it ensures public health and safety, just like the core benefit of the Environmental Protection Agency (EPA) is it protects public health and the environment. While it is beneficial to industry to be regulated so they can operate commercially, the primary benefit is a public one.

a. Emergence and rationale of user fees

At the federal level, user fees for federal services have been employed since the 19th century and began to expand considerably in 1952 with the IOAA. Under that law, user fees could be levied based on private benefits going to a specific beneficiary. The use of user fees or user charges increased rapidly during the 1980s and 1990s, particularly following the 1984 recommendations from the Grace Commission. Responding to the Reagan administration's concerns about government inefficiency and rising deficits, the Grace Commission comprehensively examined potential cost savings across the federal government.[42] Although relatively minor compared to other recommendations, the Grace Commission identified user charges as a potential way to increase revenues by several billion dollars cumulatively between 1985 and 1987. Notably, while these recommendations did not specifically suggest increasing charges at NRC, they noted NRC already had limited user fees and recommended similar entities like FCC and FERC impose user fees.[43] Throughout the 1980s and 1990s, Congress increasingly expanded user fees to finance government regulatory entities (see Section 4). The role of fees has continued to increase, demonstrated by an almost $100 billion (69%) rise in annual federal fee revenues across the federal government between 1999 and 2007.[44]

At a basic level, user fees ensure that the costs of government services, like regulation or information, are levied upon those entities receiving the benefits. A 1987 report for the Administrative Conference of the United States describes the purposes of user fees:

> "We suggest that user fees are best understood as a mechanism for matching the burdens of governmental services with their benefits, structured so as to enhance the efficient provision of governmental services. Where consumption of services confers substantial benefits on nonpayers, it may be desirable to charge fees that recover less than full costs

[42] Harriss, C. Lowell. "Blueprints for Cost Control: Recommendations of the Grace Commission." *Proceedings of the Academy of Political Science*, vol. 35, no. 4, 1985, pp. 1–26. *JSTOR*, www.jstor.org/stable/1173930.
[43] President's Private Sector Survey on Cost Control (U.S.). Task Force Report on User Charges. U.S. Government Printing Office, 1983.
[44] "Federal User Fees: A Design Guide." GAO-08-386SP, Government Accountability Office, May 2008, https://www.gao.gov/assets/gao-08-386sp.pdf.

in order to avoid disincentives for individuals or firms to engage in socially useful conduct."[45]

To a degree, fees as currently implemented can be envisioned as a type of Pigouvian tax: without a fee, the government service provided resembles an externality where private sector activities do not reflect their true social costs.[46] Accordingly, when levying user fees, it would be expected that entities subject to fees, "will presumably demand fewer services."[47] *In the case of activities like nuclear regulation, user fees can thus discourage development of nuclear power in the first place.* However, a better framework is to consider regulation for public health and safety as a public good, not an externality, and fund it accordingly.

Considering the potential costly and activity-reducing effects of fees, best practice public administration and design are needed to ensure effective fee models. The Government Accountability Office has identified four key elements of regulatory fees:[48]

- **Setting regulatory user fees.** Policymakers in Congress determine in statute how agencies levy user fees.
- **Collecting regulatory user fees.** The point of collection, whether at point of service, annually, or otherwise, shapes how fees impact private sector decision making.
- **Using regulatory fees.** Generally, agencies should have relative flexibility in using fees for budgets or they may face revenue instability.
- **Reviewing regulatory user fees.** Agency and Congressional review of fees can provide feedback on their effectiveness and ability to bring public benefits.

Of these, Congressional decisions to set regulatory user fees and the associated mechanisms they authorize are the most important in determining the scope and incentive impacts of user fees.

In setting fees, the benefit principle, derived from economics, is a best practice to ensure fairness and maximum societal outcomes. As described by the Congressional Research Service, the benefit principle links "the fiscal burden of publicly provided benefits to those who enjoy those benefits."[49] Although licensee user fees dominate the NRC's funding, there are many public benefits that accrue from an independent nuclear safety regulator to entities other than licensees. Nuclear power provides public economic and environmental benefits. Section 3 discusses how to apply the public benefits principle to advanced reactors to better allocate private and public costs and benefits.

---

[45] United States, Administrative Conference of the United States, Office of the Chairman, Recommendations and Reports, vol.1, 1987, https://archive.org/stream/gov.acus.1987.rec.1/adminconf198701unse_djvu.txt

[46] A Pigouvian tax is a tax levied on a negative externality, like carbon emissions, to internalize the complete cost of an activity within a market price.

[47] Gillette, Clayton P., and Thoomas D. Hopkins. "Federal User Fees: A Legal and Economic Analysis." vol. 67, rev. 795, Boston University Law Review, 1987, p. 798, https://www.acus.gov/sites/default/files/documents/1987-04%20User%20Fees.pdf.

[48] "Federal User Fees: Key Considerations for Designing and Implementing Regulatory Fees." GAO-15-718. Government Accountability Office, September 2015, https://www.gao.gov/assets/gao-15-718.pdf.

[49] United States, Congressional Research Service. "Economics of Federal User Fees." 22 January 2019, https://crsreports.congress.gov/product/pdf/R/R45463.

Beyond U.S. user fee design, there is also an important principle in nuclear regulatory agency design internationally: budgetary independence. *Particularly with new nuclear regulators, the budgetary independence of the nuclear regulator is important to ensure that the regulator has sufficient resources to conduct reviews of nuclear safety*. By ensuring that the funding of a nuclear regulator is independent from the results of its safety reviews, countries can ensure a high level of safety performance and public confidence. This is especially important internationally, as many governments develop nuclear projects that are regulated by separate agencies.

b. Limitations of User Fees

User fees that fund agencies may have limitations in their ability to facilitate effective administration. This is especially true for regulatory agencies, which often exist to deliver certain public benefits, like safety or economic oversight. Limitations from user fees generally fall into three categories: insufficient funding for regulatory programs, the potential to discourage regulated activities, and concerns about impartiality.

Tying a regulator's budget in part or in whole to a regulated industry's activities can create inefficiencies in regulatory reviews and reduce the capability of the regulator. While not applicable to the NRC, this is a concern for new regulators in emerging economies using nuclear power whose budget and capabilities would depend on the maturity of the industry they regulate. Further, fee collection can introduce inefficiency to a regulator.

Just as user fees internalize regulatory costs like a Pigouvian tax, they also discourage more of a specific regulated activity. *In the case of nuclear regulation, this means that fees discourage some level of nuclear energy production*. More broadly, user fees can have negative impacts on innovation. In the case of the U.S. Patent Office, funding reviews of new applications based on fees from existing patents has proved problematic in (much like the issues the NRC faces).[50] Insufficient capacity due to fee timing can create cross-subsidization between existing and new licenses, as well as among first movers.

Finally, user fees can potentially create a perception of a conflict of interest. In South Africa, Greenpeace has argued that a licensing fee system gives the regulator a stake in the expansion of nuclear power, potentially jeopardizing the independence of their decision making.[51] However, internationally, the U.S. NRC is considered the prime example of an independent safety regulator, even with its user fee system.

---

[50] Frakes, Michael D., and Melissa F. Wasserman. "The Failed Promise of User Fees: Empirical Evidence from the U.S. Patent and Trademark Office." *Journal of Empirical Legal Studies*, vol. 11, no.4, *Wiley Online Library*, https://onlinelibrary.wiley.com/doi/abs/10.1111/jels.12051.

[51] Adam, Ferrial, et al. "The True Cost of Nuclear Power in South Africa." *Greenpeace*, August 2011, https://www.greenpeace.org/static/planet4-africa-stateless/2018/10/66fc5759-66fc5759-the-true-cost-of-nuclear-power-in-sa-screen.pdf.

4. Fees as a Regulatory Barrier to Nuclear Innovation

Summary

- Recent conventional and advanced reactor licensing activities indicate large and growing fee expenses.
- As NRC's current regulations are intended for conventional light-water reactors, many advanced reactor applicants incur increased regulatory costs. Innovators are thus forced to pay more for the inefficient structure of the regulatory system.
- Due to inefficient regulations, reactors with expected substantial improvements to safety and operational performance will cost more to regulate than their conventional counterparts.
- Ultimately, the public and nation receive substantial benefits from safe, reliable, and cost-competitive advanced nuclear energy, including climate protection. Accordingly, they should share in a portion of the regulatory costs as they do at other regulatory agencies like EPA, FDA, and FAA.

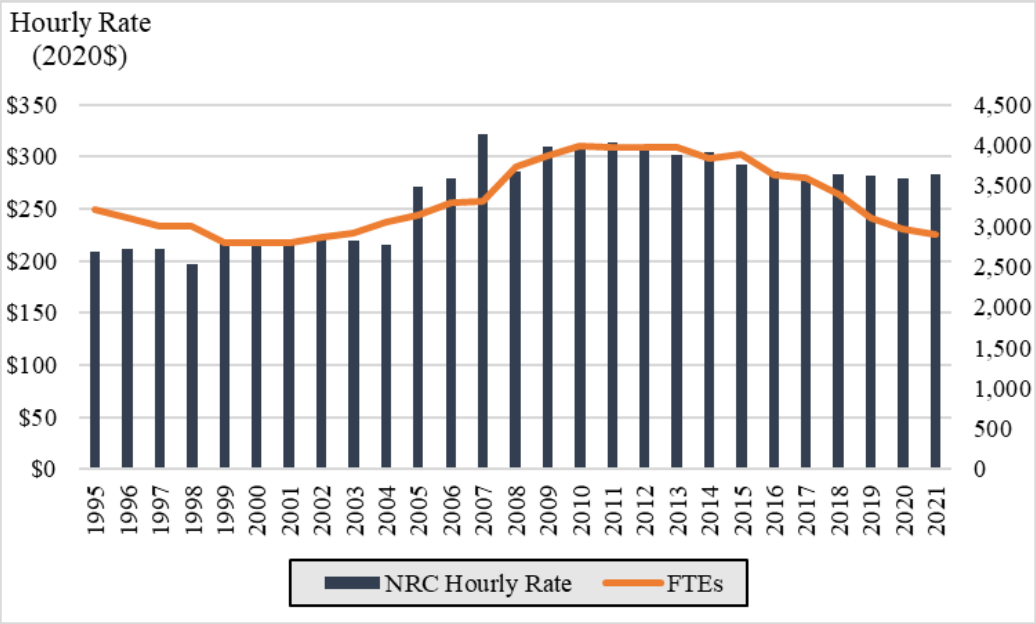
a. License fees as barrier to new projects

NRC is responsible for licensing nuclear reactors for radiological safety. There are two current licensing frameworks in place. The original framework, 10 CFR Part 50, was originally developed under the AEC and is the framework used for all currently operating reactors. Under the two steps in Part 50, a project developer, historically a utility, would apply for a construction permit to build a facility and subsequently apply for an operating license to operate the facility. In the late 1980s NRC developed 10 CFR Part 52, which provided for a one-step combined construction and operating license process. Part 52 also provided optional regulatory pathways for licensing efficiency and flexibility, including design certifications, standard design approvals, and early site permits.

Both Parts 50 and 52 allow reactor applicants to engage in pre-application activities to share technical information with NRC and address potentially novel issues. In addition, licensing of a nuclear power reactor is considered a "major federal action significantly affecting the quality of the human environment" under the National Environmental Policy Act (NEPA) and requires an environmental impact statement (EIS).

Under 10 CFR Part 170, a license applicant is charged fees to reimburse NRC for staff time used in all aspects of a license application, including pre-application engagement and environmental reviews. This hourly fee is set annually. Figure 3 provides the inflation-adjusted hourly rates since 1995. Between 1995 and 2004, fees averaged $214/hour. They rapidly rose to more than $300/hour in 2007, to meet rising personnel costs from new full-time employee equivalents conducting reviews for the then-expected "nuclear renaissance." Despite FTEs decreasing to pre-2005 levels by 2021, NRC hourly fees remain high and have averaged around $280/hour the last several years.

Figure 3. NRC Hourly Rate, 2020$



Source: NIA, based on data from NRC

In February 2021, NuScale submitted a lessons learned document highlighting issues it encountered during its path to receiving the first design certification under Part 52 for an advanced reactor.[52] Although the duration of the formal license application was about 3.5 years, the overall process including pre-application, early engagement with NRC to identify licensing pathways, took more than ten years. Due to regulatory fees, development costs, and associated engineering, NuScale noted that it cost the company more than a half a billion dollars in total to get their design certification. Although this process occurred during the beginning of regulatory modernization at NRC, the lessons learned are instructive to the costs imposed by the hurdles in the current regulatory framework in adapting to new technologies. Improving the regulatory framework, with actions like Part 53 and other regulatory modernization, are intended to make the regulatory process more efficient, thereby reducing the barriers that fees pose. However, the previous efforts to improve regulatory efficiency and predictability through Part 52 have not led to successfully licensing an operating nuclear reactor. Short-term actions to mitigate fee impacts on innovation can reduce the cost to licensees of current licensing inefficiencies. Nevertheless, a future performance-based system does not inherently guarantee there would be no unnecessary licensing costs from process inefficiencies under the fee model.

[52] Bergman, Thomas A. "Lessons-Learned from the Design Certification Review of the NuScale Power, LLC Small Modular Reactor." ML21050A431, U.S. Nuclear Regulatory Commission, 19 February 2021, https://www.nrc.gov/docs/ML2105/ML21050A431.pdf.

b. Advanced Reactor Reviews and Fees

Licensing fees can discourage investment in first-of-a-kind advanced nuclear demonstration projects, as well as widespread use of microreactors. One of the attractive aspects of smaller advanced reactor designs is that they can serve new customer classes, such as small cities, industrial users, and remote communities for the first time. Potential barriers that may deter customers include the timing of fees (required several years before operation), uncertainty on the total cost of licensing fees, and existing uncertainty in advanced reactor licensing.

These barriers can be especially discouraging for microreactors as current fee costs for licenses would compose a significant fraction of the overall project costs and determine profitability. A case study of a microreactor in Alaska illustrated these concerns, with costs that would be prohibitively expensive, especially for the first units.[53] Until regulatory modernization is complete, the current regulatory framework needs to be adapted for each advanced reactor design, which can create significant uncertainty in the timing and total amount of fees levied for a project. Although NEIMA has improved NRC billing practices, the need for design-specific regulatory work to adapt the existing licensing framework to novel designs makes it difficult for NRC to predict total fees for a license applicant at the beginning of the process. Together, fees and associated uncertainty limits investment and discourages customers for advanced reactors.

Closely tying agency resources to fee revenues reduces the overall efficiency and adaptability of NRC staffing. *Generally, NRC does not have the resources to do activities until they charge fees.* Even if NRC expects many future license applicants, it does not have the budget to hire and train a staff in preparation for those applications. Thus, NRC must wait to shift staff around and have those staff costs reimbursed until a new applicant submits a license application. Furthermore, multiple applicants can strain these resources as the lack of preparation can limit training and development of staff. This lack of preparation is even more acute due to the variety of advanced reactor designs that require specialty skills in topics like fuel and materials.

The broad nature of required regulatory reform to adopt performance-based regulation at the same time as dealing with novel advanced reactor applications may require additional growth in NRC staff focused on advanced reactors and specialized training for new designs.[54] Conversely, since reaching highs of about 3,900 full-time employees between 2009 and 2016, NRC's full-time employees have declined rapidly to 2,900 today and the overall size of advanced reactor staff remains limited. Hence, in the broader context of an overall decline in NRC staff, resources for advanced reactor reviews may be a growth area that requires careful attention at the project level. Staff issues have been noted by early movers developing advanced reactors. Delaying reviews due to a lack of existing staff lengthens reviews and further increases applicant costs. The docket of current and upcoming NRC advanced reactor applications is

[53] Holdmann, Gwen, et. al. "Small Scale Modular Nuclear Power: *an option for Alaska,"* March 2011. https://acep.uaf.edu/media/147559/Small-Scale-Modular-Nuclear-Power-an-option-for-Alaska-2011-ACEP-and-ISER.pdf

[54] Recent reforms to provide non-fee base funding for NRC regulatory activities in NEIMA and subsequent appropriations helps but remains insufficient.

daunting – by 2027, NRC staff now expect to have issued at least six operating licenses for advanced reactors while conducting reviews for at least seven more.[55] Near term project include:

- Standard Design Approval for NuScale and subsequent COL from UAMPS
- The first of several expected combined license applications from Oklo
- License applications for ARDP projects from TerraPower, X-energy, and Kairos Power
- Pre-application interactions or other licensing activities from other winners of ARDP Risk Reduction or ARC awards

Beyond these applications, NRC also has multiple vendors engaged in pre-application activities, and is pursuing ambitious regulatory reform including the new, complex, and challenging Part 53 licensing rulemaking for advanced reactors.[56] As NRC looks to prepare its staff for these and other activities, dependence on license application fees for resource allocation limits the ability of the Commission to assign resources proactively and flexibly for expeditious reviews. Similar staffing concerns occurred during the nuclear renaissance in the mid-2000s, as the resource constraints imposed by fee dependence limited the ability of NRC to prepare for planned license applications. It also led to relatively rapid increases in hourly fees for NRC review, which could hamper advanced reactor developer budgets if it occurs again. If the nation is to substantially deploy advanced reactors for climate mitigation in the 2020s and 2030s, separating NRC resources from short-term fee revenues is essential to minimizing regulatory delays.

Regulatory fee requirements also reduce the cost effectiveness of Department of Energy demonstration programs. *A significant portion of DOE funding for NuScale went to paying for regulatory fees or associated engineering costs from NRC interactions.* Similarly, the ARDP award winners face tens of millions of dollars in NRC fees for their license applications. Ultimately, DOE funds for these license applications come from the taxpayer, a tacit acknowledgement by Congress that licensing these innovations yields public benefits, but this funding is only for the awardees instead of a change to the NRC's fee structure that would be available to all companies. Such a system only heightens concerns about the government picking winners and losers as opposed to a fairer system that would cover fees for all applicants. Increasing public funding to cover licensing costs would provide the resources and flexibility NRC needs to meet current licensing needs and complete regulatory reform efficiently, effectively, and fairly.

c. Applying a Benefits Test for Nuclear Innovation Activities

Considering the potential negative impacts of the current fee model on nuclear innovation, it is worth reevaluating user fees for new license applications. During the initial development of license and annual fees, there was little or no Congressional consideration of how it could limit innovation or new deployment. Congress should evaluate the public benefits that accrue from regulation of advanced reactors. License applicants do benefit from the granting

[55] "Briefing on Advanced Reactor Preparedness." U.S. Nuclear Regulatory Commission. https://www.nrc.gov/docs/ML2109/ML21097A045.pdf

[56] "Pre-Application Activities." *Advanced Reactor Details*, U.S. Nuclear Regulatory Commission, https://www.nrc.gov/reactors/new-reactors/advanced/details.html#preAppAct.

of licenses to build and operate facilities as they can then make money. However, the benefits of licensing of advanced reactors go well beyond the applicants themselves.

Most importantly, NRC regulates nuclear industry activities to minimize safety risks to the public. NRC reviews of applicant designs protect public health and safety. Beyond the specific safety reviews, the societal use of nuclear energy enabled by NRC's regulatory oversight brings substantial public benefit. Nuclear power reduces air pollution, which saves lives as well as mitigates climate change. Internationally, nuclear energy can increase U.S. economic competitiveness and provide entree to non-proliferation policy conversations. Thus, public funding of new applicant reviews can yield substantial public benefits.

During the review of each advanced reactor application, NRC improves its technical capabilities, adapts current regulations to advanced reactors, and learns lessons to inform future advanced reactor licensing. Each individual application can take a significant amount of additional time to review to determine whether the existing prescriptive licensing requirements should actually apply to novel reactor designs to ensure safety. With unclear regulatory requirements and limited advanced reactor specific guidance, applicants must go through additional expense to determine which requirements are relevant for safety.[57] Applicants are paying greater regulatory fees because NRC's regulations are not yet designed for risk-informed, performance-based evaluations of safety of newer technologies. This heavily disincentivizes innovators from being the first to move through the regulatory process because they are paying for NRC learning, which can benefit their later competitors. This issue is emergent in pre-application activities, topical reports, and other novel activities.

Beyond the safety evaluation, applicants are also responsible for paying for the environmental reviews for their license applications. NEPA requires that federal agencies conduct an environmental impact statement process for "major federal actions that significantly affect the quality of the human environment." Following the D.C. Circuit Court's decision in *Calvert Cliffs*, NRC is required to do a NEPA analysis for federal activities such as granting licenses to private parties.[58] License applicants have had to pay for NEPA reviews since at least the 1978 NRC fee schedule revision. However, many aspects of reviews do not provide specific benefits for the applicant. For example, NEPA requires consideration of alternatives (like building a solar or natural gas facility) that are not realistic alternatives for advanced nuclear project developers to pursue.[5960] Rather, NEPA benefits the general public and the federal

[57] Renner, Alexandra. "Oklo Inc. Response Letter to the NRC Letter, Oklo Step 1 Technical Review of Key Safety and Design Aspect Activities Related to the Applicability of Regulations" *U.S. Nuclear Regulatory Commission*, 21 December 2020, https://www.nrc.gov/docs/ML2035/ML20357A002.pdf.
[58] U.S. Court of Appeals for the District of Columbia Circuit. Calvert Cliffs' Coordinating Committee, Inc., et al., Petitioners, v. United States Atomic Energy Commission and United States of America. 449 F.2d 1109, 1971.
[59] Roma, Amy, et al. "Nuclear Innovation and NEPA: Streamlining NRC NEPA Reviews for Advanced Reactor Demonstration Projects While Safeguarding Environmental Protection." *Nuclear Innovation Alliance*, September 2019, https://nuclearinnovationalliance.org/streamlining-nrc-nepa-reviews-advanced-reactor-demonstration-projects.
[60] Merrifield, Jeffrey S., and Reza Zarghamee. "White Paper: Advocating the Use of Generic Environmental Impact Statements in Support of the Construction and Operation of Advanced Nuclear Reactors." *ClearPath*, 19 February 2019, https://static.clearpath.org/2019/03/clearpath-geis-whitepaper.pdf.

government by disclosing the potential environmental impacts of federal activities such as licensing a nuclear facility.

5. Comparison to other fee-funded regulatory agencies

Summary

- Although user fees are used throughout the federal government, agencies most directly analogous to NRC do not require fee recovery to the degree or in the manner NRC does.
- Among energy technologies, nuclear energy technologies are uniquely charged for the full cost of their public health and safety regulation, which creates an uneven playing field.
- Funding models at two similar regulatory agencies, the Federal Aviation Administration and Federal Drug Administration, demonstrate better ways to minimize regulatory barriers to innovation, especially under efficient licensing frameworks.
- NRC's user fee model is burdensome and does not recognize the public benefits of effective nuclear regulation. Congress should consider modifications.

a. User Fees at Similar Regulatory Agencies

As described in Section 2, Congress transitioned the funding of many agencies to incorporate user fees, especially in the 1980s and 1990s. Although some agencies require full recovery of appropriations through fees like the NRC, others do not.

NRC is unique among regulatory agencies focused on public health and safety in requiring that almost all its costs be recovered from technology licensees. The EPA, which regulates many of the energy market competitors for nuclear energy, only requires a small portion of its cost to come from fees. Although the FAA requires almost all its costs to be recovered through fees, it employs a trust fund to ensure sufficiency and predictability of regulatory resources, imposing fees on economic activity instead of innovation. The FDA now recovers more than 40% of its total spending through fees, with 60 percent of its budget covered by public funding. Unlike NRC, where the imposition of fees coincided with declining budgets, FDA fees have allowed it to more than double its funding since the mid-2000s.[61] In comparison to NRC, both FAA and FDA have better specified and more efficient processes for approving new technologies. As FAA and FDA are the most like the NRC in terms of regulating innovative technologies, we conduct case studies of each in Sections 5.b. and 5.c.

Most agencies that recover 100% of their costs through fees are financial or economic regulators. Notably, FERC is required to recover 100% of its fees from the electric and natural gas industries it regulates, including existing nuclear power plants. However, FERC's total budget for regulating both sectors is less than the NRC's budget for just the nuclear industry. *Generally, agencies that recover as much as 100% of their budget from user fees are regulating industries with existing revenue.* The user fees are tied closely in time to *economic activities*, providing sufficient revenue for regulated entities to pay fees. The effects on innovation in such contexts are indirect and costs are lower as they require limited financing.

[61] United States, Congressional Research Service. "The Food and Drug Administration (FDA) Budget: Fact Sheet." 2 April 2020, https://crsreports.congress.gov/product/pdf/R/R44576.

b. Case study: FAA's User Fees Exclude Design Reviews

Summary

- FAA does not charge license fees for "type certifications", which are approximately equivalent to NRC's design certification.
- Rather, 80-95% of FAA's budget is covered by a multi-year trust fund raised through broad-based fees on users of national airspace and infrastructure – i.e., travelers, not airplane developers.
- Compared to NRC, the FAA model supports innovation by minimizing upfront costs to innovators and ensuring FAA is not resource constrained by annual fees.

FAA User Fees Levied on Economic Activity, Not Innovation

The Federal Aviation Administration is responsible for regulating the safety of civilian aircraft in the United States. Through its certification process, FAA issues type certifications certifying the safety of aircraft designs, issues production certificates for manufacturer processes, and approves individual aircraft through inspection or delegation.[62] To a degree, this model resembles the framework for NRC's Part 52 regulations, with a design certification approximating a FAA type certification and a combined license as a more stringent individual approval. Among other groups, NIA has previously identified FAA's model as well-suited for regulation of innovative activities.[63,64] FAA's type certification process involves substantial engagement between applicant and regulator, has clear regulatory phases and standards, and implements risk-informed processes. This has led to timely and efficient reviews, as well as relatively rapid consideration of innovative activities like unmanned aerial vehicles (drones).

FAA does not currently charge fees to airplane designers and manufacturers for certification and approval activities. Rather, the vast majority of FAA funding is provided by the Airport and Airway Trust Fund (AATF), which primarily comes from airline ticket sales. Between FY2014 and FY2018, the AATF provided ~80-95% of the overall FAA budget, with the remainder coming from public funding.[65] The AATF is funded by a passenger ticket tax, flight segment tax, fuel taxes, and other taxes on users of U.S. aviation services.

The use of a trust fund, as opposed to annual fees, enables budgetary flexibility for FAA and allows it to weather variations in trust fund receipts and make needed investments. For example, FAA's efforts to quickly integrate unmanned aircraft systems, also known as drones, have been effective, in part, because the FAA is not dependent on license application fees and is

[62] Richardet, Brian, et al. "The FAA and Industry Guide to Product Certification." edition 3, Aerospace Industries Association, et al., May 2017, https://www.faa.gov/aircraft/air_cert/design_approvals/media/cpi_guide.pdf.
[63] Finan, Ashley E., et al. "Enabling Nuclear Innovation: Strategies for Advanced Reactor Licensing." *Nuclear Innovation Alliance*, April 2016, https://nuclearinnovationalliance.org/strategies-advanced-reactor-licensing-0.
[64] Goldberg, Matt. "Unleashing Innovation: A Comparison of Regulatory Approval Processes." *Third Way*, 13 April 2016, https://www.thirdway.org/report/unleashing-innovation-a-comparison-of-regulatory-approval-processes; Lovering, Jessica, et. al. "How to Make Nuclear Innovative: Lessons from Other Advanced Industries." *The Breakthrough Institute*, March 2017, https://s3.us-east-2.amazonaws.com/uploads.thebreakthrough.org/legacy/images/pdfs/How_to_Make_Nuclear_Innovative.pdf
[65] United States, Congressional Research Service. "Federal Aviation Administration (FAA) Reauthorization Issues and Debate in the 115th Congress." 29 May 2018, https://crsreports.congress.gov/product/pdf/R/R45207.

able to flexibly employ staff.[66] The application of user fees to commercial regulated entities has been a continuing debate, with concerns echoing those raised with respect to nuclear regulation.[67]

Compared to nuclear regulation, the public benefits of safe air travel are largely compensated through payments from users of air services, as opposed to manufacturers of safe products. **Three important lessons from the FAA model for nuclear innovation are:**

1. **The use of a multi-year trust fund enables revenue certainty and staff flexibility.** This enables relatively rapid adoption of rules for innovative activities liked unmanned drones, without constraints imposed by fees levied on existing licensees.
2. **By imposing fees on the end user, the costs of safe air travel is levied broadly on the many who benefit.** Such a model minimizes regulatory barriers to innovation by designers and manufacturers.
3. **A well-established and defined regulatory pathway focused on the most safety-relevant considerations enables relatively rapid certification on new aircraft designs.**

[66] "Unmanned Aircraft Systems: FAA Should Improve Drone-Related Cost Information and Consider Options to Recover Costs." GAO-20-136, *Government Accountability Office*, December 2019, https://www.gao.gov/products/gao-20-136.
[67] Elias, Bart, and Rachel Y. Tang. "Short-Term FAA Extension in Place, but Legislative Debate Continues." *Congressional Research Service*, 18 December 2017, https://crsreports.congress.gov/product/pdf/IN/IN10795.

c. Case study: FDA's Predictable Processes and User Fees

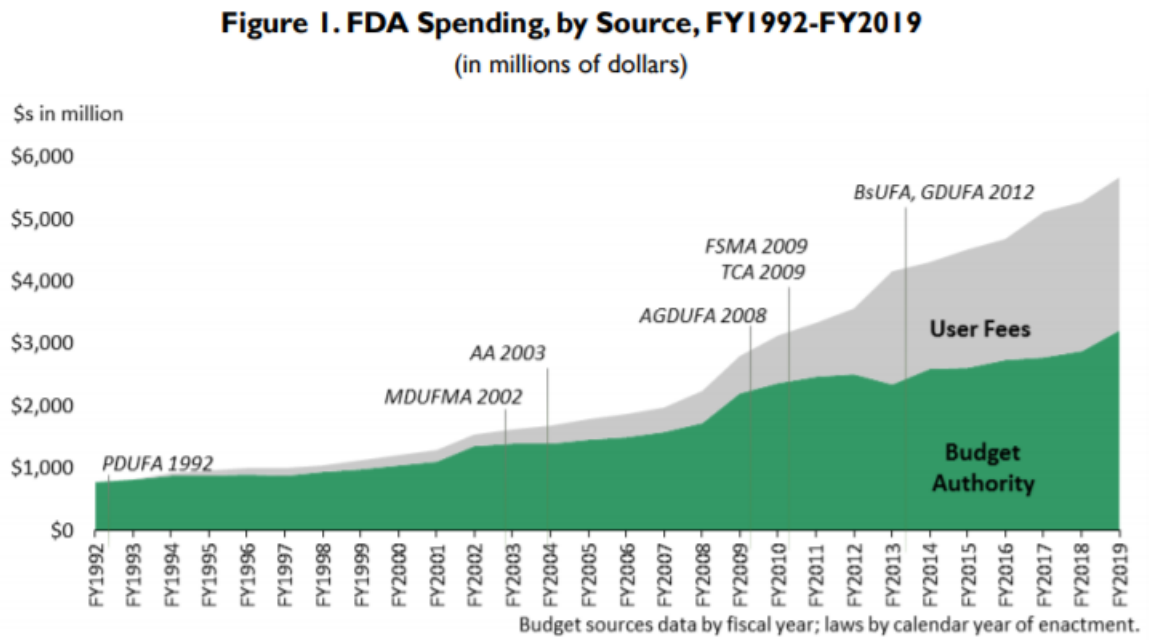
Summary

- FDA charges a variety of user fees for the review of new drug safety.
- Although approvals are subject to user fees, the fees are less than 50% of agency funding.
- Unlike NRC, the FDA model has clear and established processes that facilitate rapid and affordable review of drugs, making the system effective.
- User fees at FDA increased the overall funding and resources available to the agency, unlike NRC where fees have not increased overall resources and instead NRC's overall budget and FTEs have decreased.

Public Funding Balanced with User Fees Provides Sufficient Resources at FDA

User fees to fund reviews at FDA had been debated for decades. In response to growing drug review times, Congress passed the Prescription Drug User Fee Act (PDUFA) in 1992, leading to the first fees on FDA applicants. These fees provided new funding streams for FDA and allowed them to overcome resources limitations that were holding up applications. Since then, Congress has expanded the scope of activities subject to fee recovery. As illustrated in Figure 4 below, the share of FDA's budget coming from fees has grown rapidly since the early 2000s.

Figure 4. CRS Figure of FDA Spending, FY92-FY19



Source: Figure created by CRS using the FY1992 through FY2021 FDA CJs. [68]

[68] United States, Congressional Research Service. "The Food and Drug Administration (FDA) Budget: Fact Sheet." 2 April 2020, https://crsreports.congress.gov/product/pdf/R/R44576.

As of FY2019, user fees were responsible for just above 40% of the total agencies budget. *Critically, imposing user fees led to an increase in FDA's overall budget.* Due to continued demands to monitor imported drugs and food and other requirements, the FDA faced a funding crisis in the early 2010s. The split of funding between user fees and public funding was able to resolve this crisis by splitting the increased costs between industry and the public.[69] Comparably, NRC's budget was flat or declining when full fee recovery was first required and did not substantially increase NRC's resources or capabilities. Further, before NEIMA the fee structure at NRC limited its ability to conduct innovative activities like preparations for advanced reactor regulation (and the revised system still has limitations).

Generally, user fees have been considered successful at FDA. Olson (2002) describes how the initial PDUFA reform reduced the review times for new drugs due to increased fee revenues.[70] Critical to the overall success of user fees at FDA has been consistent Congressional attention to how fees impact incentives in the market. In 2012, Congress passed the Generic Drug User Fee Amendments, which tied fee funding from generic manufacturers to an FDA commitment to performance goals. When the fee structure was found to erect barriers to entry that favored incumbent manufacturers, a subsequent amendment was passed that reduced such incentives.[71] While providing resources for faster reviews, other changes also assisted in reducing review times. Ceccoli (2003) describes how a concurrent transformation in the FDA's drug review philosophy reduced review times, increased applicant certainty, and led to more drug reviews.[72]

Compared to nuclear regulation, the fee model at FDA has been successful in enabling innovation. **Three important lessons from the FDA model for nuclear innovation are:**

1. **A balance between user fees and public funding can ensure the regulator has sufficient resources to meet new challenges.** As with food and drug regulation, the public benefits from nuclear power and public funding can increase NRC capabilities.
2. **Predictable processes facilitate clear licensing costs and pathways.** With clearly established rules and processes, industry can plan expenditures with certainty.
3. **Use fees to increase overall agency resources.** User fees were initially implemented to address a backlog in reviews at FDA. Over time they have expanded, greatly increasing the overall budget for the agency, increasing agency resources, reducing review times, and enabling successful private industry.

---

[69] Alphonse, Judith, et al. "The FDA Funding Crisis." *Journal of Pharmacy Technology*, vol. 30, no. 2, Apr. 2014, pp. 57–60, *Sage Journals*, https://journals.sagepub.com/doi/abs/10.1177/8755122513505224.
[70] Olson, Mary K. "How Have User Fees Affected the FDA?." edition 20, *Health & Medicine*, Spring 2002, *HeinOnline*, https://heinonline.org/HOL/LandingPage?handle=hein.journals/rcatorbg25&div=12&id=&page=.
[71] Berndt, Ernst R., et al. "The generic drug user fee amendments: an economic perspective." vol. 5, no. 1, *Journal of Law and the Biosciences*, May 2018, pp. 103-141, *Oxford Academic*, https://academic.oup.com/jlb/article/5/1/103/4968039?login=true.
[72] Ceccoli, Stephen J. "Policy Punctuations and Regulatory Drug Review." *Journal of Policy History*, vol. 15, no. 2, 2003, pp. 157-191. *Project MUSE*, https://muse.jhu.edu/article/41485/summary.

6. Fee models at nuclear regulators in other countries

Summary

- Globally, nuclear regulators have a broad mix of funding designs, ranging from full industry funding like the United States to full government funding in places like Russia and China.
- Differences in regulatory transaction costs could make other markets more attractive than the United States, particularly if they already have established, performance-based systems.
- Reducing or removing licensing fees concurrently with increasing public funding and the continued establishment of performance-based standards could encourage innovation and increase the deployment of carbon-free nuclear energy.

Regulatory Frameworks as Basis for Global Competition

While the U.S. was a commercial leader in global nuclear power markets when the fee recovery model was first initiated, recent developments have led to it falling behind geostrategic competitors. Russia and China are emerging as leaders in global markets, using state-owned enterprises and attractive financing packages to build conventional nuclear power in many countries. U.S.-based advanced reactors could restore U.S. competitiveness through designs that are safer, more economic, and quicker to build, but their successful commercialization is partially dependent on efficient regulatory processes. The attractiveness of regulatory frameworks is an important component of global nuclear competition. Compared to other global regulators in allied countries, the NRC fee model may disadvantage American companies in global markets and lead to innovators moving elsewhere.

The two countries that the U.S. most closely collaborates with on advanced reactor innovation, Canada and the United Kingdom, also use fee models to fund their regulators. However, both already have performance-based licensing systems, which increases applicant certainty and reduces costs through efficient review. Further, Canada only requires 70% of its budget to be recovered by fees.[73] Many advanced reactor developers have operations in both the United States and Canada – the attractiveness of Canada's performance-based licensing and reduced fee system is a factor that influences decisions about where to get licensed.

Countries that incorporate fee funding for their nuclear regulators can face budgetary issues and pressures, which have been alleviated with public funding. In the United Arab Emirates, a law to require costs for the regulator to be reimbursed by the emerging industry strained the resources and growth of the regulator even as it had to regulate its first nuclear reactors.[74] In Pakistan, the Nuclear Regulatory Authority, which relies on fees for 25% of its

[73] Williams, Laurence G. "Overview of International Nuclear Safety Regulation and Licensing." Reference Module in Earth Systems and Environmental Sciences, 2020, *ScienceDirect*, https://www.sciencedirect.com/science/article/pii/B9780124095489123802?via%3Dihub.
[74] Bratt, Duane. "Nuclear Regulation in New Jurisdictions: The United Arab Emirates in Comparative Perspective." *Canadian Political Science Association*, 31 May 2016, https://cpsa-acsp.ca/documents/conference/2016/Bratt-Rayner.pdf.

funding, was only able to support ambitious expansion by non-fee funding.[75] As described by the IAEA:

> "PNRA [Pakistan Nuclear Regulatory Authority] adopted a very active resource management strategy to secure appropriate financing for its rapid expansion and did not rely only on increased annual budgets from the Federal Government or increase[s from] the licensing fees. Funds from Public Sector Development Projects significantly contributed to meet financial requirements of PNRA for very ambitious capacity building and institutional strengthening."

In addition to directly promoting nuclear power with state-owned enterprises, Russia and China fund their nuclear regulators with public funds and do not impose application fees.[76, 77] While the innovation models in both countries are different from the U.S., any innovative designs in these countries do not need to deal with the high upfront costs associated with fees for new applications. Technology and business model innovation is a competitive advantage for the United States. The current structure of the fee model can thus pose a burden on one of the primary competitive advantages the U.S. can use to reestablish itself in global nuclear power markets.

[75] "Integrated Regulatory Review Service (IRRS) Report to Pakistan" *International Atomic Energy Agency*, 2014, https://www.iaea.org/sites/default/files/documents/review-missions/final_report.pdf.
[76] Williams, Laurence G. "Overview of International Nuclear Safety Regulation and Licensing." Reference Module in Earth Systems and Environmental Sciences, 2020, *ScienceDirect*, https://www.sciencedirect.com/science/article/pii/B9780124095489123802?via%3Dihub.
[77] Matthews, Timothy P., and Ester K. Park. "Regulatory independence and accountability: a survey of international nuclear regulatory regimes." *International Journal of Nuclear Law*, 11 February 2013, *InderScience Online*, https://www.inderscienceonline.com/doi/abs/10.1504/IJNUCL.2013.052041.

7. Recommendations for Legislative and Regulatory Action

Summary

- Congress and NRC can reduce the burden of user fees on nuclear innovation by increasing public investment and implementing the following recommendations.

a. Legislative Options to Reduce Fees as a Barrier

Recognizing emerging limitations in charging fees for new licenses, Congress should consider alternative approaches that can support nuclear innovation activities. *Each of these would require an increase in off-fee funding from general revenues.*

Table 1. Legislative Recommendations to Reform NRC Fees

Option	Rationale and Implications
Completely eliminate licensing fees for new reactors. Provide public funding of NRC review of license applications for advanced reactors.	• Nuclear innovation drives decarbonization, brings economic benefits, supports national security, and improves overall public safety. • Can enable rapid buildout of nuclear power and establish a competitive domestic industry. • Ensure NRC has the resources needed to review reactor applications expeditiously, consistent with rapid decarbonization.
Exclude some aspects of new licenses from fees: • **Pre-application** • **Topical reports** • **First-movers** • **NEPA compliance** Provide public funding for the activities excluded from fees.	Due to current regulatory structure, multiple components of new license applications accrue benefits other than to the licensee. Removing these aspects from licensing fees is fair, balanced, and properly allocates public and private costs and benefits. Excluding pre-application activities from fees may have the greatest benefit on efficient reviews.
Provide a maximum fee cap, or a flat application fee. Provide public funding for costs above the cap.	• Improve predictability and align costs and benefits. • Applicant is limited to paying for estimated private benefit. • Public benefits, like above, are covered by the public.
Fee deferral for Part 170 fees. Defer fee collection until a plant is operating. Provide public funding to cover NRC costs in the interim.	• Deferral of fees can align timing of private benefit (operations allowed) with cost. • Need mechanism to deal with unsuccessful licenses.
Licensing prizes or other DOE funding for NRC licensing.	Can encourage competition for public funds but entails some transaction costs and does not address inherent issues with fee process.
Exclude licensing fees for microreactors.	Enables microreactors as an option (e.g. for remote, energy-poor communities). Will need to determine what qualifies as a microreactor.

Although these pathways may better support nuclear innovation, they have implementation challenges. Perhaps most critically, any activities taken out of license fees will require public funding to replace them. Accordingly, any such pathway needs to be accompanied by a commitment to provide sufficient appropriations for nuclear regulatory innovation activities. Notably, such appropriations are fair, as they more closely align nuclear regulatory costs with those imposed on other energy sources and in non-energy sectors.

There is also a potential concern that removing licensing fees or portions thereof could lead to frivolous applications, wasting taxpayer dollars while not supporting actual innovation. In NIA's view, this is an unlikely outcome. Before NRC dockets a license application, it performs an acceptance review to determine if the application contains sufficient information for the staff to conduct review. Even with expanded off-fee funding, NRC's budget would still need to be used wisely, and NRC would need to maintain stringent acceptance criteria. Further, while regulatory fees are an additional burden, most licensing costs come from engineering costs related to design and regulatory compliance on the part of the license applicant. An applicant would need to be able to provide sufficient resources to both pass acceptance review and conduct ongoing engineering in response to NRC staff requests for additional information. Doing so will likely require a customer or sufficient private sector capital to support future projects. Another option to address this concern would be to require a fixed application submittal fee, which would further reduce the likelihood of frivolous applications.

b. Regulatory Options to Reduce Fees as a Barrier

While legislative options would be most effective, NRC can also act under its existing authority to mitigate the negative impacts of the fee model on regulatory efficiency and nuclear innovation. NRC could include certain innovative activities, such as actions related to staff training or other capacity building, as fee relief activities per section 102(b)(1)(B) of NEIMA. Subsection (i) gives the Commission the ability to identify fee relief activities and request funds to cover those activities through the net appropriations portion of NRC. Beyond building internal capabilities, certain other innovative activities, such as pre-application or topical reports could fall under this categorization. In addition, the Commission should investigate what existing authorities it has to provide exemptions or deferral for cost recovery, such as for small businesses.

8. Conclusion

With changing market conditions, regulatory modernization, and new technologies, the legacy basis of the NRC fee model is in doubt. Congress should reevaluate the overall model considering the public need for reactor innovation to mitigate climate change. Full user fees for license applicants were initially imposed only after all existing reactors in the U.S. were operating or under construction. Further, reactor developers have historically been large multinational corporations with large, investor-owned utilities as customers. The emerging advanced reactor industry consists of many companies, most of which are smaller than their historical counterparts. Many potential advanced reactor customers are also smaller, with interest from entities such as small cities, industrial users, or remote communities. With this changing industry structure, applicant fees are now a greater economic hurdle to new reactor projects. Finally, fee reform can build a globally competitive environment for innovators.

Any changes to the fee model must be accompanied by increases in public investment through appropriations. As shown by FAA's model, ensuring sufficiency and predictability of regulatory resources is essential. As shown by FDA's model, balancing user fees and public funding can unlock innovation. In comparison to NRC, both FAA and FDA have better specified, more targeted and more efficient processes for approving new technologies. An alternative NRC fee model that incorporates the best aspects of the FAA and FDA fee models could better support staffing and organizational growth, enabling NRC's regulatory modernization into a leading 21st century nuclear safety regulator. Other features, such as an analog to the FAA trust fund where fees are focused on economic activities, could be similarly effective.

Accordingly, the Nuclear Innovation Alliance makes the following recommendations to Congress regarding NRC fees for new reactor license applications:

1. **Expand public funding for advanced reactor regulatory infrastructure.** Recent increases in off-fee funding at NRC have helped NRC prepare to review advanced reactor designs, but individual license applications are also innovation activities. Large increases in non-fee funding are needed to develop the regulatory infrastructure to maintain NRC as a world-leading nuclear regulator. Just as Congress is considering infrastructure funding for roads and bridges, so too does the nuclear regulatory infrastructure deserve support.
2. **Significantly reform, modify, or replace the user fee cost recovery model to exclude or substantially reduce fees for new license applicants at NRC.** Multiple aspects of U.S. nuclear regulation bring benefits to the public and entities other than the applicant. Reduced fees, especially for new designs and innovative technologies, can reflect these broad benefits. Increasing the fraction of the NRC's budget that is funded from general revenues can incentivize more innovation, improve regulatory efficiency, and ensure the American regulatory environment remains competitive. If fees are not completely replaced, excluding pre-application, topical reports, and environmental reviews from fees can still bring substantial benefits. Alternative fee designs, such as fixed fees or deferred fees, could also offer flexibility compared to the current model.

3. **Alternatively, expand options for Department of Energy (DOE) funding of advanced reactor licenses.** Although the Nuclear Energy Innovation Capabilities Act authorized a program for DOE funding for advanced reactor licenses, it does not appear the program has yet funded AR licensing activities. While this would not fully address the challenges of the current NRC structure, Congress could consider funding this authorization, as well other measures such as licensing prizes, fee caps, flat fees, or fee deferrals.

More broadly, the Nuclear Innovation Alliance recommends a reevaluation of the whole fee recovery model at NRC with an eye towards limiting negative impacts on innovation. Reactor developers should have certainty about the duration and expected fees for license reviews to facilitate budgeting and limit investment uncertainty. Congress should consider special treatment for microreactors, for which current fee levels are especially burdensome. While this report did not specifically analyze annual fees for existing reactors, reforming annual fees could be important to ensuring nuclear energy competes on a level playing field with other energy technologies.