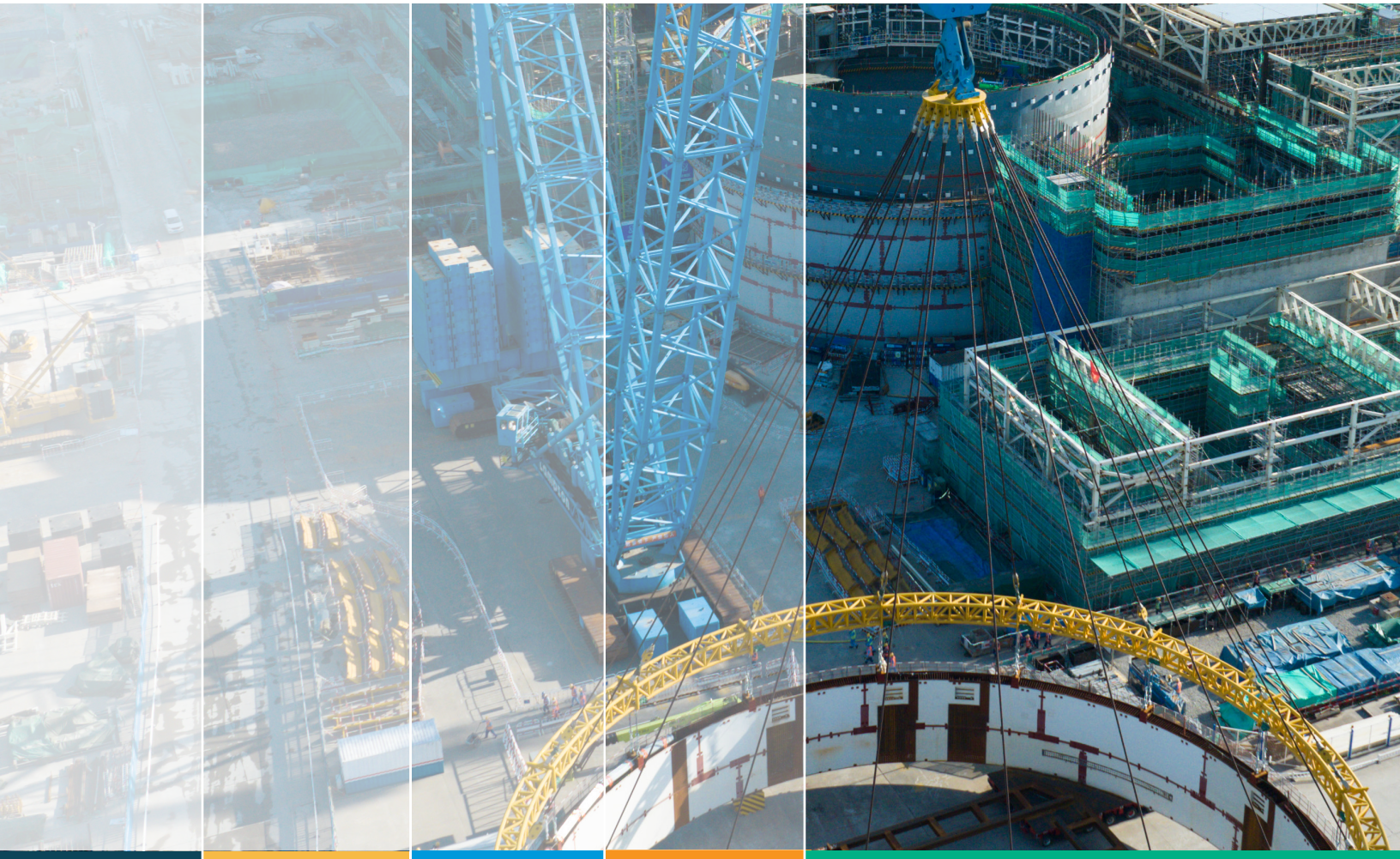
BREAKTHROUGH INSTITUTE

# ACCELERATING COMMERCIALIZATION THROUGH INCENTIVIZING ON-TIME NUCLEAR (ACTION)

## A Milestone-based Program to Address Nuclear Energy Project Risk



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## WHO WE ARE

The Breakthrough Institute is an environmental think tank that is pro-growth, pro-technology, and pro-development. We are bipartisan and advance durable solutions grounded in empirical and cutting-edge research.

# EXECUTIVE SUMMARY

Nuclear energy plays a critical role in achieving national energy security, meeting clean energy goals, and fostering technological innovation. However, nuclear projects have historically experienced schedule delays and cost overruns, often tied to high financing costs. To address these challenges, this proposal recommends a Milestone-Based Financing Incentive Program administered through the Department of Energy's Loan Programs Office (LPO).

## 1. ADDRESSING PROJECT RISK

Nuclear energy is an important source of clean firm energy that the nation needs to ensure energy security, meet increasing demand from strategic sectors such as AI, promote national security, and compete internationally. Cost overruns at recent projects, namely Vogtle Units 3 and 4, have fueled skepticism about the feasibility of deploying nuclear energy projects on time and on budget.

Unforeseen challenges or problems that may arise during the construction process are typically addressed with contingency costs. These costs are typically included in the initial budget to provide a financial buffer, as a portion of total costs, against unexpected issues encountered during construction. This decreases the financial risks associated with such uncertainties, serving as a partial warranty against budget overruns and delays. Contingencies have not been sufficient to mitigate project costs for multiple reasons. Contingency costs address the symptom (i.e., an overrun), not the cause of the overrun. Developers are incentivized to reduce contingency costs as much as possible to reduce overall project costs, which drives them to shift or pancake risks on other stakeholders. The result is that the overall costs and the likelihood of failure increase. Causes of project delay and failure are due to systemic project management and planning challenges, or external factors out of the developer's control, not component-specific problems and rework that contingencies are designed to address.

The delays and cost overruns in nuclear projects stem from decades of not building plants. This gap eroded supply chains, workforces, and institutional knowledge that once kept costs low and timelines on track. Without consistent follow-up orders, the industry lost economies of scale and efficiency, driving up costs and slowing deployment. These challenges have made buyers hesitant to be first-movers and created financing challenges for buyers who are willing to be early adopters.

Looking backward does not provide sufficient clarity on what is needed to jumpstart new construction. Timeline projections, MOUs, and non-binding commitments for new nuclear projects so far have been insufficient to instill confidence in buyers, public utility commissions, and financing decision-makers within the current landscape. Without the demonstration of on-time and on-budget projects since Vogtle, little has changed to assuage first-mover risks, apart from substantial government grants for FOAK demonstrations.

A cohesive national and state-level nuclear deployment strategy does not currently exist. Without a strategy, it is not realistic to have a federal program that covers all of the project risk or simply reimburses developers for all of the overrun costs. Even if there was a national strategy for deployment, state-level PUCs would decide how regulated utilities, and ultimately rate-payers, absorb an overrun. There are risks inherent in every investment. That does not mean risks cannot be mitigated; a build-own-operate model coupled with a PPA, or delivery of a turnkey completed plant to a buyer, can avoid project risk for a premium cost. However, a program that guarantees a utility will be "made whole" under any overrun scenarios cannot exist given the current electricity market, the financing of the nuclear projects, and the limited budget of the federal government.

Appropriate project planning and investment in resources upfront are essential to address the key drivers of delays, uncertainty, and inefficiencies. However, that level of up-front project planning is expensive, difficult, and often sidestepped without a firm order, particularly for projects that require large capital investment in the early stages. Government support is vital to restoring industry confidence, streamlining deployment, and building a robust order book within today's environment by focusing on the cause of challenges, not the symptoms. Contemporary industry challenges call for incentivizing investment in appropriate early planning and consistent project execution to create confidence that the project will be delivered on time.

## 2. PROPOSAL

To accelerate American nuclear energy development, the status quo will not suffice; action must be taken. There have been many attempts to reignite a nuclear renaissance; many of them have been haphazard or ill-timed. This proposal brings together the best ideas from what has worked in the past and coalesces them into a unified approach, drawing not only from the nuclear industry but also from other infrastructure projects, government programs, and financial arrangements. The result is a novel approach that encourages the construction of new nuclear and incentivizes the on-time and on-budget completion of nuclear projects through a single mechanism. The proposal does not initiate direct outlays of public funds to developers or require mandatory spending.

Furthermore, the program could be implemented with a smaller budget than the one modeled in this proposal and then scaled over time.

Through new legislation, the government should create a milestone-based program for advanced nuclear energy projects that incrementally reduces interest rates through credit subsidies when project milestones are achieved on time. When developers achieve milestones, they tangibly demonstrate lower project financial risk, justifying a reduced interest rate than initially estimated. Under this program, nuclear developers who meet technology-neutral milestones within specified timeframes will be eligible for a 25 basis point interest rate reduction after each milestone. The program utilizes four milestones total for a maximum 100 basis point reduction. The resulting lower cost of capital provides a strong financial incentive for on-time project delivery.

This approach would:

- Incentivize on-time and on-budget projects that can **save up to $780 million** on nominal project finance costs.
- Achieve scale to reach commercialization by **supporting over 25 projects simultaneously.**
- Efficiently leverage government funds for large project impacts.
- Enable economically sound projects and incentivize developers to meet deadlines. Exceeding project timelines due to delays contributes to the two largest drivers of cost overruns - ballooning finance and labor costs.
- Mitigate risks and costs for taxpayers by allowing for a diverse portfolio of designs, projects, and technologies while significantly lowering project costs for buyers, utilities, and developers of all sizes.

# 1. THE STATE OF THE NUCLEAR INDUSTRY

The current U.S. nuclear fleet is aging. While many plants are receiving license extensions, some have and will retire due to economic pressures or age. Expanding, not just maintaining, the U.S. fleet is crucial to delivering firm, carbon-free electricity amid rising demand and sustaining long-term American energy goals. The completion of Vogtle Units 3 and 4 in Georgia, the first new reactors built in the U.S. in decades, was a major milestone that proved large-scale nuclear power can still be built. However, its cost and schedule overruns serve as an anchor point and cautionary tale for many would-be investors.

Building a large nuclear power plant requires billions of dollars of investment over many years before the plant generates any revenue. This is a huge financial commitment. Regulatory approval generally takes several years, and a significant amount is spent on regulatory fees spanning pre-application engagement with the Nuclear Regulatory Commission (NRC), to formal application reviews, to the developer receiving a license to construct and operate. Construction takes many years and requires significant upfront capital costs. From decision to operation, developers are faced with years, up to a decade or more for large plants, of upfront investment of resources. This long duration increases financing costs and exposure to market changes, regulatory shifts, or unforeseen events. The history of nuclear construction, epitomized by Vogtle, is replete with projects exceeding budget and schedule, sometimes dramatically. Once operational, plants have an initial 40-year license and a potential 80-year life in contrast to a typical 30-year finance period. This makes predicting the final cost and return on investment more difficult.

New designs may bring opportunities for relatively lower financial commitment due to the smaller and more advanced designs. Yet, inherent risks associated with unproven construction processes, supply chains, and potential design tweaks needed during construction remain. These first-of-a-kind (FOAK) barriers drive the types of delays and overruns seen by Vogtle, despite the promise of nth-of-a-kind (NOAK) projects being cheaper and faster as developers achieve economies of scale and learning. Potential buyers want to "wait and see" how other FOAK projects go before they commit to firm orders. Investors and lenders look for predictable returns within reasonable timeframes. Historically, nuclear has shown the opposite: highly unpredictable in cost and schedule, making private financing extremely challenging without substantial government backstops or policy interventions. New designs are addressing these concerns with a mix of approaches, including modular designs and factory-built construction at scale, but still have FOAK challenges.

The primary source of cost overruns created by this landscape is delays. Failing to meet deadlines increases financial costs, and interest accrues regardless of whether work progresses. Delays disrupt the planned flow of work, leading to scheduling conflicts, waiting time, steps being completed out of the planned order to keep work moving, and overall reduced productivity, making the remaining work take longer and cost more. Every week, month, or year of delay means paying millions more in interest payments and labor costs without any offsetting income. Financing costs can account for two-thirds of a project's total cost in the nuclear industry and are highly sensitive to the cost of capital, such as the interest rate on debt.[1] It is unique compared to other energy sources, characterized by high capital costs, high construction and regulatory risks, and high financing costs and risk premiums on loan rates. This has led to an atmosphere of uncertainty and hesitancy when it comes to investing in new nuclear power plants.

Past forms of federal assistance for building new nuclear have aimed to reduce the overall cost of the project through tax credits or grants, or alleviate the symptoms of cost overruns and delays, namely protecting buyers and developers from ballooning costs. A milestone-based program proposes a different approach: focus on the source of excess costs by encouraging on-time and on-budget nuclear deployment by offering incentives for projects that meet targets on time. On-time delivery of a project also has a secondary benefit: it increases overall confidence that nuclear energy projects can be successful and financeable.

# 2. THE MILESTONE PROGRAM

A milestone-based federal financing incentive program (which will also be referred to as *The ACTION Program* or *ACTION*) stems from the need to address the reality of challenges facing the nuclear industry at its core. In order for new projects to get built at the scale the U.S. demands, the federal government must provide aid in a targeted and nuanced manner. It is not enough for the government to simply provide the funds; it must provide an effective mechanism. ACTION does both. It is constructed in a way that addresses one of the key reasons new builds go over budget in the short term while also containing forward-thinking provisions that will enable the continued development of new nuclear energy in the long term, long past the program's tenure. It incentivizes success while simultaneously addressing the largest single cost—the financing cost, generating a virtuous cycle that addresses the root cause of cost overruns and delays. Milestones are an effective mechanism in various infrastructure projects and will be equally effective in nuclear projects.[2,3,4] The milestone program reduces the interest rate incrementally as the developer achieves each of the scheduled milestones. The successful completion of each milestone is indicative of a reduction in risk, and the interest rate reduction mechanism both reinforces and compensates for the risk reduction.

## 2-1. Qualification, Funding, and Diligence

The milestone program has a broad set of eligibility criteria. The program does not select any one nuclear technology but aims to enable the deployment of a variety of nuclear reactors to meet market needs, ranging from small modular reactors to large gigawatt-scale reactors. A project is defined as a deployment of fission technology to generate energy through one or more advanced nuclear reactors[5] at a single location. The minimum cost of any project will be no less than $2 billion. This low project cost barrier allows smaller developers and buyers to enter. Each project must submit a Class 3[6] cost estimation with its application. Requiring a Class 3 cost estimate acknowledges the reality that applicants' acceptance into this program is pivotal to reducing finance risk and ensuring financial viability. Many firms would not invest significantly in site-specific planning, cost estimation, and firm delivery contracts unless there is confidence of acceptance into this program. Therefore, an initial Class 3 cost estimate avoids creating a barrier to application, while the program function has checks to ensure that accepted projects perform well.

The ACTION Program utilizes the Department of Energy's Loan Programs Office (LPO) to administer the program. Specifically, loans will be made under 1703 with additional funding opportunities under 1706 if certain provisions are changed to remove geographic constraints or enable support for

system adequacy or reliability needs. Cost estimates for large projects are commonly separated into "classes" of estimates defined primarily by the degree of definition.[7] First-of-a-kind nuclear reactors will need no less than Class 3 cost estimations, meaning their supply chains will not have had time to fully develop, and cost estimations will not be as accurate as projects with more developed supply chains. Existing reactor designs with successful deployments will need to provide no less than Class 2 cost estimations to the LPO. Qualification for the milestone program will automatically qualify the project for the 1703 loan program.

However, *qualification* for the milestone program and the 1703 loan does not automatically translate into *acceptance* to the program. Developers will have to apply for ACTION and perform due diligence via appropriate cost estimations before the LPO considers their entry into the program. Applicants will need to meet a variety of criteria, including but not limited to:

1. Being located in the United States.
2. It is a nuclear energy-generating project.
3. Has a minimum initial cost of $2 billion.
4. Has a reasonable prospect of repayment.
5. Submits Class 3 cost estimations for FOAK projects and Class 2 for projects beyond FOAK.
6. Deploys a technically feasible and commercially ready technology.
7. Does not benefit from prohibited federal support.

The "new and innovative" criterion in the 1703 loan program will need to be amended to include projects beyond the current definition and that qualify for the ACTION program to enable support for second-, third-, and nth-of-a-kind projects. ACTION will welcome projects from developers who have previously achieved success.

The LPO will need direction to prioritize and issue a loan to all applicants subject to qualification and funding. In addition to the LPO issuing the loan itself, the office will need to play a larger role over the duration of the loan than it currently does; Section 4 goes into more detail regarding the changing role of LPO necessary to conduct this program, as well as the resource needs. There are no direct outlays or mandatory spending created by ACTION; the transaction between the LPO and the FFB is a transfer from one government agency to another. The interest rate subsidy is paid through discretionary funding, which does not need to be available in its entirety at the outset of the program. Lower costs per project allow for more flexibility in initial budget allocations.

Once accepted into the program, the total loan amount will cover the cost of the project, less any outside capital or third-party funding the developer secures, similar to current LPO loans. Rather than financing the loan in a lump sum, the financing and disbursement will be structured in tranches, tied to achieving specific project milestones per developer. LPO provides loan guarantees and further loan authorization is needed for LPO to provide new loans under ACTION. The program can be funded through already existing or new appropriations, starting with a nominal budget, with additional allocations necessary to further the effectiveness and scale of the ACTION program.

The program is intended to incentivize and accelerate the early adoption of nuclear energy projects that are accepted into the program by 2035 or achieve 20 GW of capacity, whichever occurs later. The sunset encourages near-term progress while limiting government expenditure after deployment reaches scale. Sunsets are a necessary part of incentive programs. Failing to include an end date or goal may result in a perpetual fund that fails to incite progress and utilizes more taxpayer funds than is necessary.

## 2-1. Financing Structure

To incentivize timely progress and strong project execution, the LPO will pay credit subsidies directly to the Federal Financing Bank (FFB), lowering the loan's effective interest rate incrementally as milestones are met. FFB requires the LPO interest rate to be set at the prevailing treasury rate plus a liquidity spread of no less than 37.5 basis points. This proposal will reduce the interest rate by 25 basis points each time a milestone is successfully reached within the agreed-upon timeframe. However, the interest rate reduction structure could also be stratified by milestones.[8] Doing so does not significantly impact savings or the number of projects funded, but negotiation costs related to the rate reductions will increase with a variable rate reduction. This proposal recommends equal rate reductions across milestones to avoid excess costs and delays (See Appendix B-6 for details). Successful completion of a milestone will result in a reduction in the effective interest rate through subsidies paid by the LPO to the FFB or the Treasury.

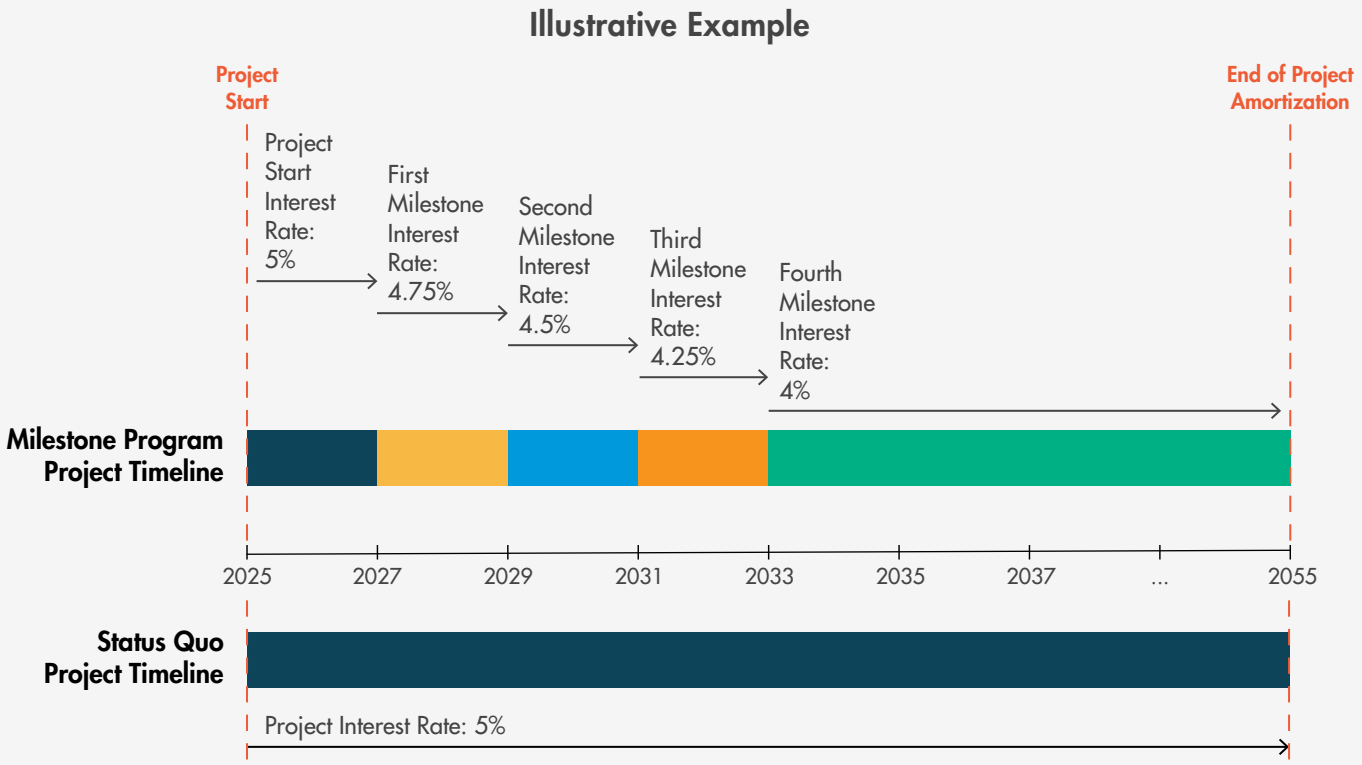


***Figure 2-1:*** *Illustration of the rate reduction milestone program compared to the normal LPO program.*

Figure 2-1 illustrates how a milestone program might be implemented in relation to a standard LPO loan. In this illustration, the base Treasury interest rate is assumed to be stable throughout the disbursement period; however, these loans will most likely be issued at different rates as time passes. The 30-year Treasury rate can be volatile; a developer cannot assume they will receive the same Treasury rate for disbursements of loans in Year 3 as they did in Year 1. Even if the interest rate changes, the interest rate reduction will remain stable throughout the life of the loan.

This approach is not without precedent. The USDA's Rural Utilities Service (RUS) already operates with a dual mandate: it issues both direct loans funded by the Treasury and loan guarantees backed by the FFB and provides interest subsidies. The success of the RUS demonstrates that it is both feasible and administratively manageable for a federal agency to fulfill this expanded role in supporting infrastructure development.

## 2-3. Determining Milestones

In addition to LPO issuing the loan itself, the office will determine the four appropriate milestones compatible with the project and technology, and monitor progress during the duration of the loan. The LPO should consult with other federal offices and departments that have experience implementing milestone-based programs to reduce knowledge gaps and inefficiencies and build internal expertise (e.g., NASA's Commercial Orbital Transportation Services).

The LPO could learn from or adopt best practices used by other agencies. A standardized evaluation document or template could be used to streamline the review process at each milestone, drawing inspiration from NASA's NPR-7123 systems engineering review framework, which provides the staff with a documentation framework that can be replicated across projects. Developers can contribute to efficiency by preparing materials and evidence in a consistent and organized manner, reducing the workload on both sides. NASA has found that a digital inventory repository has been effective in keeping track of programs while eliminating excessive paperwork.

A well-designed milestone program must prioritize measurable performance outcomes, such as physical construction progress, commissioning of specific systems, or achievement of regulatory approvals, to establish credibility and align incentives around timely execution. The specifics of milestone checkpoints should be flexible, accommodating the unique characteristics of different project types and technologies. While the initial milestones can be written in general terms, they should become more precise as the project matures and uncertainties are resolved.

The most important issue to avoid is what is called the "one-ton nail problem." We do not want developers to secure milestones by neglecting their due diligence or subverting the construction process. This issue with Vogtle 3 is well known. The developer installed components out of planned order in the construction process driven by financial incentives; this caused redundant work during the later stages of the development because it was installed out of turn. Their failure to follow best practices increased costs and pushed back timelines. Milestones must be designed so they avoid principal-agent problems and asymmetric information where possible and practicable.

Technology-neutral milestones are the best practice in this endeavor. No matter the individual technology, geography, or timeline, each nuclear project will be subject to similar events during the project lifecycle. An example set of milestones might include:

1. **Regulatory:** NRC Combined Operating License issuance or Construction Permit
2. **Site:** Breaking ground on the nuclear island or the first nuclear concrete pour

3. **Testing:** Fuel load, first achievement of criticality, ITAAC
4. **Operation:** Interconnection and grid synchronization

Each of these milestones will apply to all nuclear reactors or technologies, irrespective of variations in design and technical details.

Quarterly or semi-annual check-ins between the LPO and the developer's project team can serve as natural opportunities to review progress, refine upcoming milestones, and ensure alignment between both parties. These reviews should be agreed upon in advance and specified in the loan agreement. However, the operational details—such as timing, location, and documentation requirements—can be determined closer to the actual milestone date, allowing for flexibility. This approach enhances transparency and enables DOE to support a diverse set of projects without requiring a large administrative burden, while also giving developers room to manage their construction schedules without undue oversight.

## 2-4. Failure to Reach a Milestone

Acceptance into the ACTION Program does not guarantee that a project will successfully meet the construction target requirements. The program seeks to fund high-quality projects, but the future is uncertain. Failure to reach an agreed-upon construction milestone within the specified timeframe will result in the project foregoing the next reduction in interest rates. If the project fails to meet a milestone, the project rate freezes at the lowest achieved interest rate. If a project fails to achieve any milestones on time, it will be financed at the LPO's 1703 interest rate. This is to help prevent attrition and lower the probability of unfinished projects.

Unexpected events, such as severe weather, economic downturn, and supply disruptions, may make it impossible for a developer to meet a predetermined milestone despite appropriate project planning and execution. The developer may then ask the LPO for an amendment to the timeline. The timeline and respective milestones may be amended at the discretion of the LPO. An important factor the LPO will have to consider is that each amendment lessens the credible commitment of the program and the LPO. Amendments to milestones and timelines are not inherently detrimental to the program, but they must be used sparingly and only when delays are unavoidable.

In the event that a milestone is missed but subsequent milestones are met on schedule, the loan tranches between those milestones (i.e., from A to B) would be issued without the associated interest rate reduction. However, funding for the next interval (i.e., B to C) would still be eligible for the incentive and subsequent interest rate reductions at future milestones, provided the next milestones

are achieved on time. A project that meets all four milestones will have a 100 basis point reduction in interest, three milestones 75 basis points, two milestones 50 basis points, and one milestone 25 basis points. This structure maintains continuous incentives, even when unforeseen challenges disrupt the project, and reinforces a performance-based financing model that adapts to real-world complexities.

To maintain the integrity and effectiveness of the milestone-based lending approach, it may be necessary to incorporate a recapture mechanism or a refinancing provision. In particular, if a project falls significantly off track, misses critical milestones, or demonstrates substantial underperformance, the loan terms may be reevaluated, and the interest rate may be refinanced at a higher level to reflect the increased risk. This helps ensure that the program remains incentive-compatible and discourages strategic behavior or complacency once favorable loan terms have been secured.

## 2-5. Commercialization and Scale

To help achieve scale and commercialization, the milestone program will have lower barriers to entry for existing developers and designs. If a developer has been accepted into the ACTION Program, additional projects submitted by that developer to the milestone program will undergo an expedited application process. Developers seeking subsequent projects would have to meet the following qualifications:

1. The project and developer must meet all the standard milestone program application criteria.
2. The developers must be in good standing with LPO on current or previous loans.
3. The proposed project would have the same (or similar) core design.[9]

Allowing for a streamlined application process not only incentivizes timely completion but also helps incentivize the creation of an order book or a list of several committed projects for any one developer. Such an order book will reduce costs via learning by doing, process innovation, and economies of scale. The program acceptance of multiple projects will reduce the first mover disadvantage because there is value in getting a second, third, and NOAK project on the books more quickly. This also increases the incentives for any developer to acquire either scale or multiples.

The projects must have the same or similar design to help lower costs. Similar designs may be included because there may be innovations in the design as more reactors are built. It will be up to the LPO to discern the tolerances on design similarity. Allowing for innovation will diminish technological lock-in and path dependence, allowing for greater efficiency as improvements are made

in both manufacturing processes and reactor design. The program will have a preference for applications with multiple projects that have a reasonable prospect of achieving technological learning, repeatable construction, and cost reduction. However, that does not preclude applicants who may initially undertake FOAK projects. The goal is for some applicants to pursue 5-10 projects while others take on as many projects as are economically and contractually viable. ACTION is an accelerator program for nuclear, but it is unreasonable to expect all developers to have a ready-made order book upon applying.

# 3. ADVANTAGES OF THE MILESTONE PROGRAM

There are several advantages achievable through the milestone-based incentive program. The primary advantage of the program is that it incentivizes the completion of new nuclear power plants on schedule and within budget targets. Several additional benefits stem directly and indirectly from the program's creation.

## 3-1. Direct and Indirect Benefits

ACTION can incentivize on-time and on-budget projects, with different project sizes, initial project costs, and designs. It can **save $160 million to $780 million** on nominal project finance costs, depending on the initial project cost. See Figure 3-1.

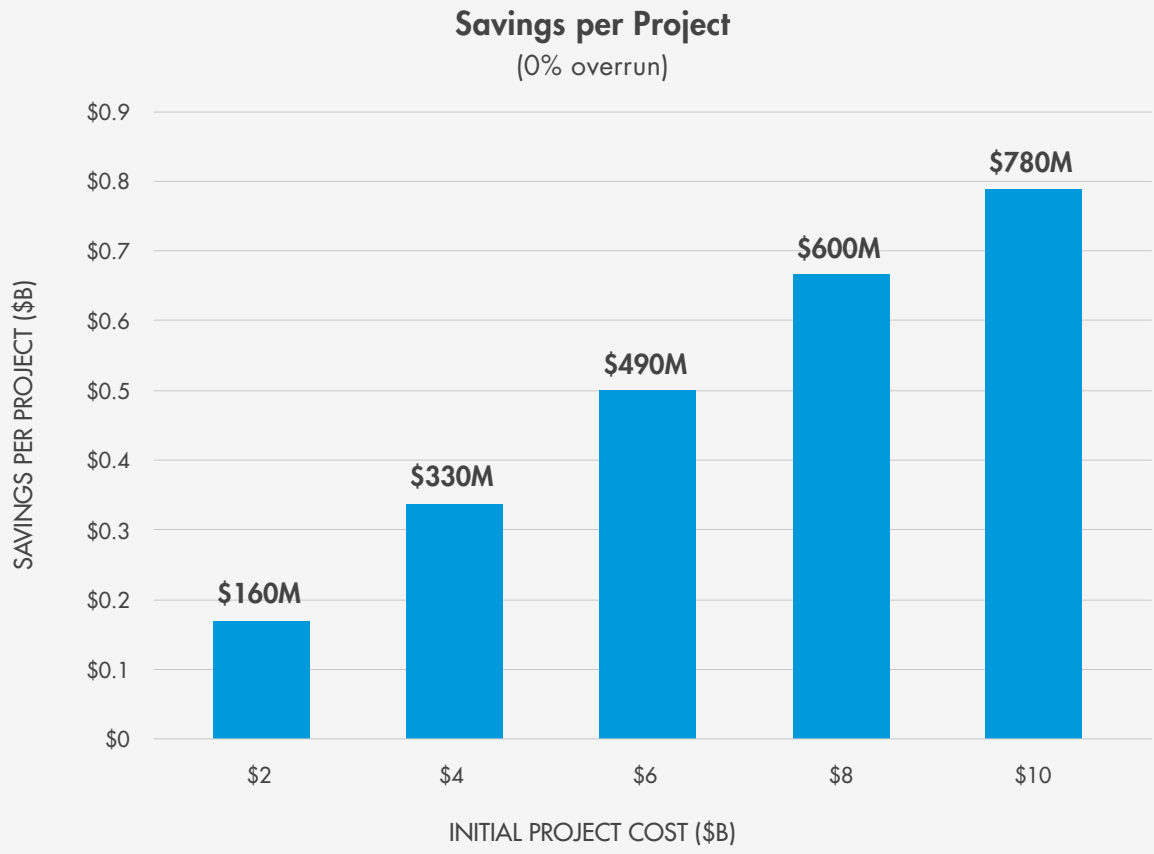


***Figure 3-1:*** *Savings per project compared to a normal LPO loan, with 0% overrun for projects with different initial project costs, ranging from $160 million to $780 million.*

ACTION can help build an order book to reach commercialization by **supporting over 25 projects simultaneously.** See Figure 3-2.

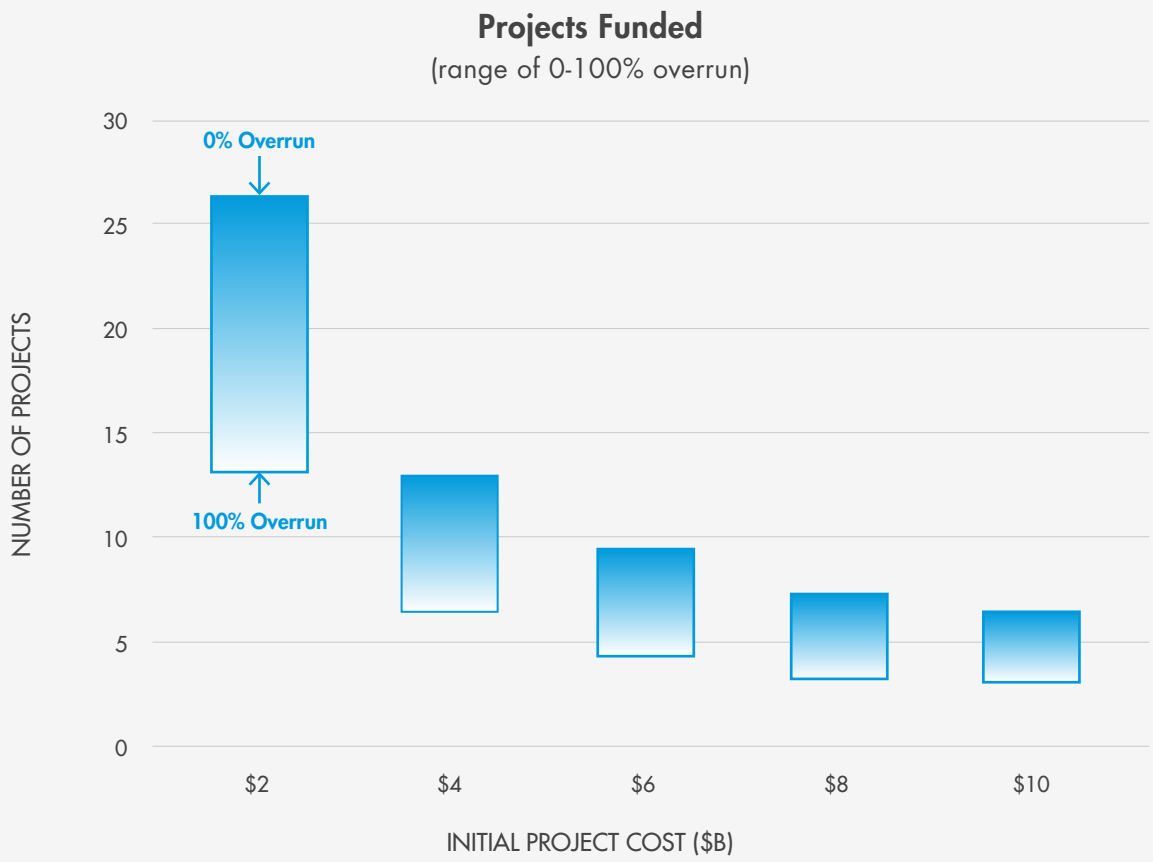


***Figure 3-2:*** *Number of projects that can be funded by the milestone program, with 0%-100% overrun for projects with different initial project costs.*

ACTION strategically utilizes government funds to maximize the impact on large-scale projects, effectively resulting in an impact multiplier of 1.38 savings for developers (and indirectly for ratepayers) per government funding. By focusing on fostering economically sound projects and incentivizing developers to meet deadlines, the program aims to avoid costly project delays. Such delays are among the leading causes of cost overruns, primarily driven by escalating finance and labor costs.

The program also mitigates risks for taxpayers by enabling a diverse range of designs, projects, and technologies, all while significantly lowering project costs for developers, buyers, and utilities of various sizes. By reducing financing costs, the program makes it easier to attract private capital, offering more attractive options for non-public financing.

Furthermore, ACTION encourages the development of a reliable nuclear supply chain by incentivizing developers to commit to multiple projects, helping to build and strengthen the supply chain over time. This approach also supports the U.S.'s leadership in nuclear technology. With higher deployment rates, the United States will bolster its influence within the international nuclear industry.

Beyond these economic benefits, the milestone program contributes to meeting the nation's environmental targets. Nuclear power, which produces clean firm energy with the highest capacity factor, is a key tool for states striving to meet their clean energy goals. Incorporating nuclear power into the energy mix will help accelerate the achievement of these vital targets.

## 3-2. Mitigating Cost Overrun

The ACTION Program does not seek to lessen the impacts of cost overruns; the primary focus is to prevent delays that lead to overruns. However, a developer may find it necessary to incur additional costs to meet a milestone. Were this to happen, the extra costs would be financed at the prevailing program rate. The milestone program would not provide any backstop or cushion to the overrun, but it would alleviate some financing costs through the reduced interest rate. Our analysis indicates that most cost overruns are mitigated through the investment tax credit (see Appendix B-8 for a breakdown). Cost-overrun insurance envisioned by some stakeholders may be beneficial to developers only when the overrun percentage exceeds 20%, but it increases financial risk for taxpayers.

The ACTION Program can curate a diverse portfolio of firms, partners, and technologies by being technology-neutral. The milestone approach allows small-, medium-, and large-sized firms to operate under the same program without undue competition—there is no immediate crowding out effect or first mover advantage in securing the program. The ACTION Program is more resilient to supply chain issues or shocks. A supply chain disruption may cripple a cost-overrun insurance program if none of the projects can move forward and the projects start accruing unexpected delays and costs. Supply chain disruptions may affect a few milestone projects, but not all of them if there is sufficient diversity. Additionally, the milestone program will enable greater geographic dispersion of projects, thereby reducing localized shocks.

The ACTION Program, as currently defined, can mitigate up to 8% of cost increases regardless of the overrun percentages. In other words, the program does not incentivize overruns but rather alleviates the financial burden if the overrun percentage is higher than expected. See Figure 3-3.

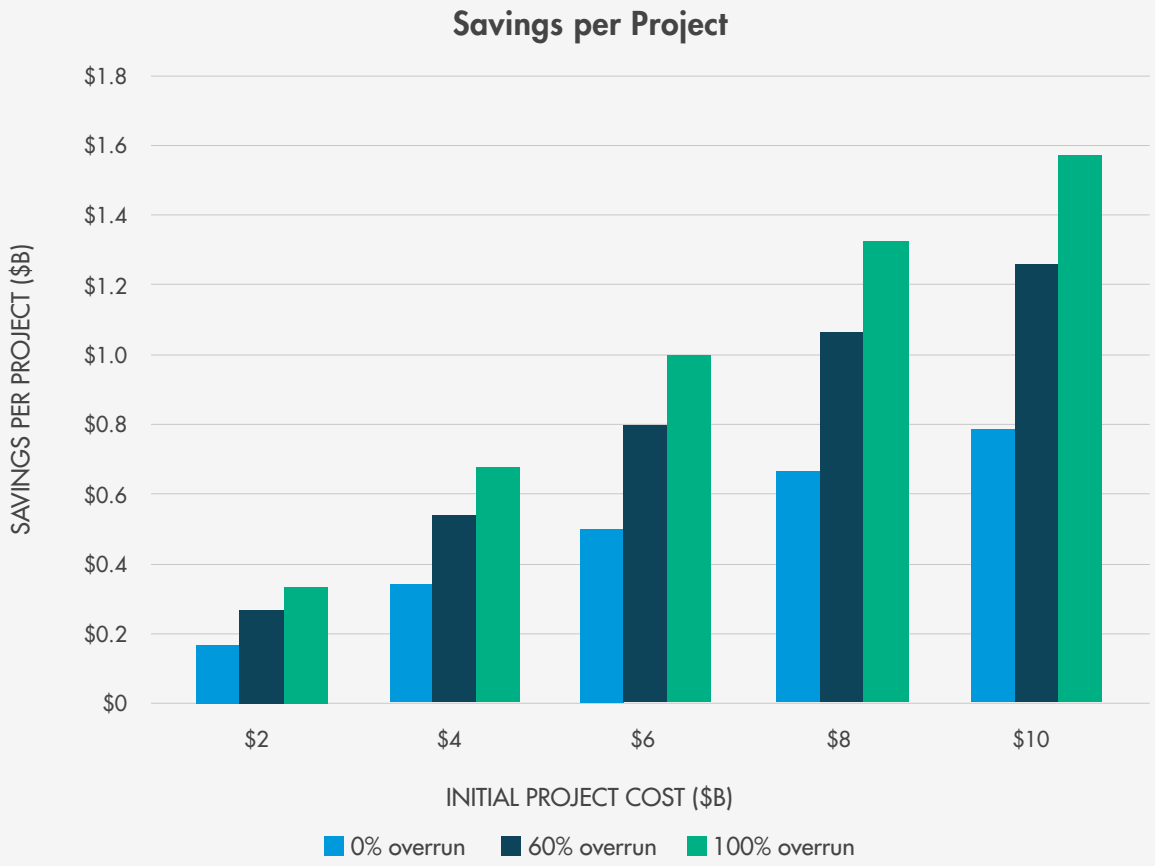


***Figure 3-3:*** *Savings per project compared to the normal LPO program, with 0%, 60%, and 100% overrun for projects with different initial project costs.*

## 3-3. Sequenced Deployment and the Creation of an Order Book

The ACTION Program can maximize economies of scale and learning. Rather than supporting one-off projects, it can reward projects that stay on time and on budget, thus supporting not just the individual builds but the creation of a repeatable deployment model. The milestone program reduces the first-mover disadvantage when constructing new nuclear; the program is designed in such a way that encourages successful developers to undertake multiple projects, leading to the creation of an order book.

An order book functions as both a demand signal and a risk reduction mechanism. It enables suppliers to invest in capacity, allows the workforce to grow with firm employment prospects, and helps capital providers view nuclear as a repeatable and financeable asset. The U.S. had a glimpse of this model. Vogtle Units 3 and 4, built in parallel, benefited from applying lessons learned in real time,

resulting in cost savings, construction improvements, and reduced project risk. With insights continuously fed back into the next project, this approach turns FOAK risks into NOAK progress.

Similarly, developers utilizing the program should see reductions in costs and risks as they complete milestones and projects. The DOE estimates that 5 to 10 reactors should be enough for a single design to reach scale and achieve commercialization.[10] The ACTION Program can help in forming an order book, and the program sunsets at a scale that enables multiple designs to reach maturity. By targeting timely, cost-effective performance, such a program lowers overall project risk, helps build investor confidence, and lays the foundation for a self-reinforcing order book.

To overcome the persistent challenges of cost, delay, and investment uncertainty, the U.S. needs a deliberate effort to create an order book: a pipeline of multiple projects committed to building, learning, and iterating. The milestone program encourages and enables that effort.

## 3.4 Benefits Across Scenarios: Sensitivity Analysis

We have performed a sensitivity analysis on the initial base cost, overrun percentages, project construction periods, debt ratio, rate reduction levels, varied rate reduction for each milestone, and different spend curves (see Appendix B for details). Overall, the effectiveness of the program was not sensitive to changing the above factors and assumptions. Generally, higher initial base costs, higher overrun percentages, shorter project construction periods, higher debt ratios, larger or varied rate reductions, or accelerated spend curves reduce the number of projects the milestone program can cover but result in more savings per project. Only a minimal effect was observed for changes in construction periods, varied rate reduction, and different spend curves. It is worth noting that the normal LPO program (4-5% interest rate) already provides significant savings in financial cost compared to private loans (10% interest rate).

Successful developers and their projects will reap the benefits of being on time and on schedule. Besides reducing financing costs, developers can fund additional projects sooner with a streamlined application process. This reduces the first-mover disadvantage problem facing the industry now and paves the way for lower construction costs due to economies of scale and multiples. The milestone program has the potential to continue benefiting the industry long after it has sunset; innovations today can translate into cumulative efficiency gains 10 and 20 years in the future.

# 4. THE CHANGING ROLE OF THE LPO

The milestone program will require the expansion of the role and purview of the DOE's Loan Program Office. It will cease to function as a tertiary observer of loans and utilize its technical expertise to help facilitate the next era of nuclear deployments.

## 4-1. LPO at Present

The current structure and statutory authority of the Department of Energy's Loan Programs Office are not well-suited to implement a milestone-based loan incentive program. As presently configured, the LPO primarily serves as a screening and advisory body, conducting due diligence, assessing project risks, and advising the FFB. However, the LPO itself is not a party to the final loan agreement. The formal loan note is executed directly between the borrower and the FFB, and the LPO often lacks access to the granular details of that final loan structure.

Once a loan is approved and issued, the FFB disburses funds directly to the borrower per the loan terms, typically at interest rates tied to prevailing U.S. Treasury securities. These rates may fluctuate over the life of the loan in response to changes in Treasury yields. Notably, the FFB does not have the statutory authority to lend below the Treasury rate. This constraint limits its ability to offer borrowers meaningful financial incentives based on project performance or milestone achievement.

The LPO's core mandate is to serve as a bridge to bankability for innovative clean energy and advanced automotive technologies, helping to deploy these technologies at scale within the United States when private lenders are unable or unwilling to fully finance them alone. To help deploy the next generation of nuclear energy while offering incentives for on-time completion, the role of the LPO will need to change.

## 4-2. Potential Pathways

To implement a milestone-based financing model effectively, structural changes—or at a minimum, operational flexibility—would be necessary. Several options exist for how such a program could be structured:

1. **Interest Rate Buy-Down via Credit Subsidy Fund:** Under this model, the LPO would use its credit subsidy authority to reduce the effective interest rate paid by borrowers on FFB-originated loans. The LPO would not need to be directly involved in negotiating interest

rates, as it would simply pay a fixed number of basis points per loan to subsidize interest costs. This approach mirrors existing federal infrastructure programs and could be implemented with relatively modest administrative reform. It preserves the existing FFB lending framework while enabling project-specific interest incentives tied to milestone achievement.

2. **LPO as Intermediary Lender:** Alternatively, the LPO could serve as an intermediary financial institution, borrowing directly from the FFB or Treasury and re-lending to project developers at rates it determines. This would allow the LPO to offer loans below the Treasury rate if necessary, using its credit subsidy fund to cover any interest rate differential or potential losses. In this arrangement, the LPO would assume a more active financial role, managing disbursement schedules, risk, and repayment, ultimately enhancing its ability to design and implement performance-based financing structures. This approach would require statutory clarification or expanded administrative authority, but would significantly increase the LPO's operational flexibility.

3. **FFB Lending Below Treasury Rates:** A more radical alternative, which avoids changing LPO authority, is to grant the FFB direct authority to issue loans at rates below Treasury rates. While technically feasible, this approach carries significant risk. The FFB is bound by its statutory obligation, established in the Federal Financing Bank Act of 1973, to coordinate with the Department of the Treasury. Undermining the Treasury's control over borrowing costs could introduce distortions in federal credit markets and raise concerns about fiscal discipline. While subsidized interest rates are already a market distortion to some extent, directly subverting the Treasury rate could amplify unintended consequences, enabling the financing of projects that might otherwise be economically unjustifiable.

## 3-3. The LPO Reimagined

Given these considerations, this proposal recommends that the LPO be granted maximum flexibility in administering milestone-based loan programs. A hybrid approach—combining elements of the first two models—would allow the LPO to reduce the effective interest rates on FFB loans through interest subsidies and, when appropriate, offer direct loans by borrowing from the FFB itself. This would align the LPO's authority with its technical expertise, enabling it to manage project risk and incentivize performance directly. Congress would need to grant LPO explicit, broad authority to issue direct loans specifically for the construction and potentially long-term financing of nuclear power projects. This would require dedicated funding authorization, but allocations to pay for the program would not be from direct outlays or mandatory spending.

The LPO's current role is misaligned with its capabilities. While it is often the entity most familiar with the technological, regulatory, and financial challenges facing energy infrastructure projects, it currently acts only as a consultant or advisor. In contrast, the FFB, lacking deep expertise in the energy sector, assumes the financial risk. Restructuring the relationship between LPO and FFB would correct this misalignment and allow the LPO to better steward public funds in pursuit of national energy goals.

The LPO would need the authority to clearly define eligible borrowers as nuclear project developers, utilities purchasing the power (perhaps via Power Purchase Agreements that support financing), and/or consortia building nuclear plants. The current 1703 loans focus on innovation; the LPO would need to shift the focus to include the deployment of commercially ready or near-ready nuclear technologies that are accepted into the ACTION Program. This would include FOAK reactors and beyond. Congress would have to authorize LPO to offer specific, potentially more favorable terms for these nuclear loans, such as:

- Interest rates are fixed at or near the U.S. Treasury rates for the loan duration.
- Extended repayment periods to 30-40 years, matching the operational life of nuclear plants.
- Tailored collateral requirements recognizing the unique nature of nuclear assets and the borrowers.

The LPO must calculate the "credit subsidy cost"—the estimated long-term cost to the government based on the risk of default— for direct loans as it currently does for loan guarantees. Congress would have to appropriate sufficient funds, either upfront or on a regular basis, specifically earmarked to cover the credit subsidy costs for the direct LPO nuclear loans, acknowledging they might be higher risk or offer lower-than-market returns initially. The allocations would have to be renewed through the program's sunset.

The current LPO mandate focuses on bridging finance gaps for innovative clean energy and advanced vehicle technologies. Its mandate would need to be amended to explicitly include the strategic deployment of nuclear energy as a core objective, justifying the provision of more direct financial assistance. In essence, the LPO would become a national strategic infrastructure bank for energy projects.

# 5. CONCLUSION

Accelerating Commercialization Through Incentivizing On-time Nuclear Program represents a strategic and innovative approach to address the historical challenges of nuclear energy project deployment. By directly incentivizing on-time and on-budget project completion through incremental interest rate reductions, this program tackles the root causes of cost overruns and delays, namely, ballooning finance and labor costs. This approach saves significant amounts on nominal project finance costs and efficiently leverages government funds to achieve substantial impacts for developers and ratepayers alike.

This program can foster a robust and reliable nuclear supply chain by encouraging multiple projects from the same developer and numerous projects across multiple developers, thereby strengthening the industry's capacity and expertise. It also supports U.S. technological leadership in the international nuclear industry and helps achieve critical emissions targets by promoting the deployment of clean, reliable energy. By reimagining the role of the Loan Programs Office to provide greater flexibility and direct involvement in managing project risk and incentives, this proposal ensures that public funds are effectively stewarded and national energy goals are advanced.

The program offers a pathway to revitalize the nuclear energy sector, restore investor confidence, and secure a resilient energy future. By prioritizing measurable performance outcomes and technology-neutral milestones, this program ensures accountability, transparency, and efficiency while mitigating risks for taxpayers and fostering a diverse portfolio of projects. With its sunset provision, the program encourages near-term progress and caps government expenditure, ensuring a focused and impactful initiative. This proposal is an important step towards accelerating nuclear energy deployment and realizing its full potential in meeting our nation's energy security and clean energy objectives.

# APPENDIX

## A. BASE MODEL CONSIDERATIONS AND ASSUMPTIONS

The total funding of ACTION used throughout the proposal is $3.6 billion. This is comparable funding to other programs that are being discussed.

### A-1. Project Costs

We look at different project sizes, assuming that various technologies and reactor sizes will need to finance amounts in line with their cost projections. We break the loans into separate trenches: $2, $4, $6, $8, and $10 billion. Doing so covers a wide array of projects and technology types.

The base model assumes a debt-equity ratio of 50%, which is a typical case for LPO's portfolio.[11] This is below the LPO maximum (80%) and average (65%).[12]

### A-2. Discount Rate and Calculating Net Present Value

The government cost is calculated using the net present value (NPV) and the Treasury rate corresponding to 25the loan length. This differs from other federal cost-benefit analyses because a subsidy must be calculated using a "subsidy cost" formulation. Under the Federal Credit Reform Act, subsidy cost is calculated on an NPV basis using nominal interest rates. In Title VII, the Ag bill defines Subsidy amount as, "the amount of budget authority sufficient to cover the estimated long-term cost to the Federal Government of a guarantee, calculated on a net present value basis, excluding administrative costs and any incidental effects on Government receipts or outlays, in accordance with the provisions of the Federal Credit Reform Act of 1990 (2 U.S.C. 661 et seq.)." FCRA 661a states, "In estimating net present values, the discount rate shall be the average interest rate on marketable Treasury securities of similar maturity to the cash flows of the direct loan or loan guarantee for which the estimate is being made."

The current OMB Circular A-11, Section 185.5 on calculating the subsidy estimate confirms that the subsidy cost is determined on a net present value basis when the obligation is incurred. The discount rate for the NPV calculation "[f]or direct loan obligations and loan guarantee commitments,

and modifications made in or after 2001, the cash flow estimated for each year (or other time period) is discounted using the interest rate on a marketable zero-coupon Treasury security with the same maturity from the date of disbursement (or point of modification) as that cash flow." The calculations are done using nominal rates. OMB Circulars 4 and 94 may require agencies to use real rates in some of their calculations, but this happens for determining regulatory impacts, not for providing credits or subsidies. The current 30-year rate in the OMB A-94 Appendix C is 4.4%.

Nominal dollars are used to calculate savings for developers, not NPV.

## A-3. Financing Timelines

A 30-year amortization period for nuclear projects, from the initial disbursement of funds to the final note payoff, is used as the base loan timeline.

## A.4. Construction Timelines

In the base model and the following sensitivity analysis, the assumption is that the $2 and $4 billion projects are completed within 4 years, the $6 and $8 billion projects are completed within 6 years, and the $10 billion projects are completed within 8 years.

## A-5. Milestone Placements

In our base model and the following sensitivity analysis, the assumption is that the $2 and $4 billion projects are completed in 4 years and have milestones at 12-month intervals. This means that the first milestone is set for the end of 12 months, the second milestone is set at 24 months, the third at 36 months, and the fourth at 48 months. The $6 and $8 billion projects are completed within 6 years and have milestones at 12, 24, 48, and 72 months. The $10 billion projects are completed in 8 years and have milestones at 24, 48, 72, and 96 months.

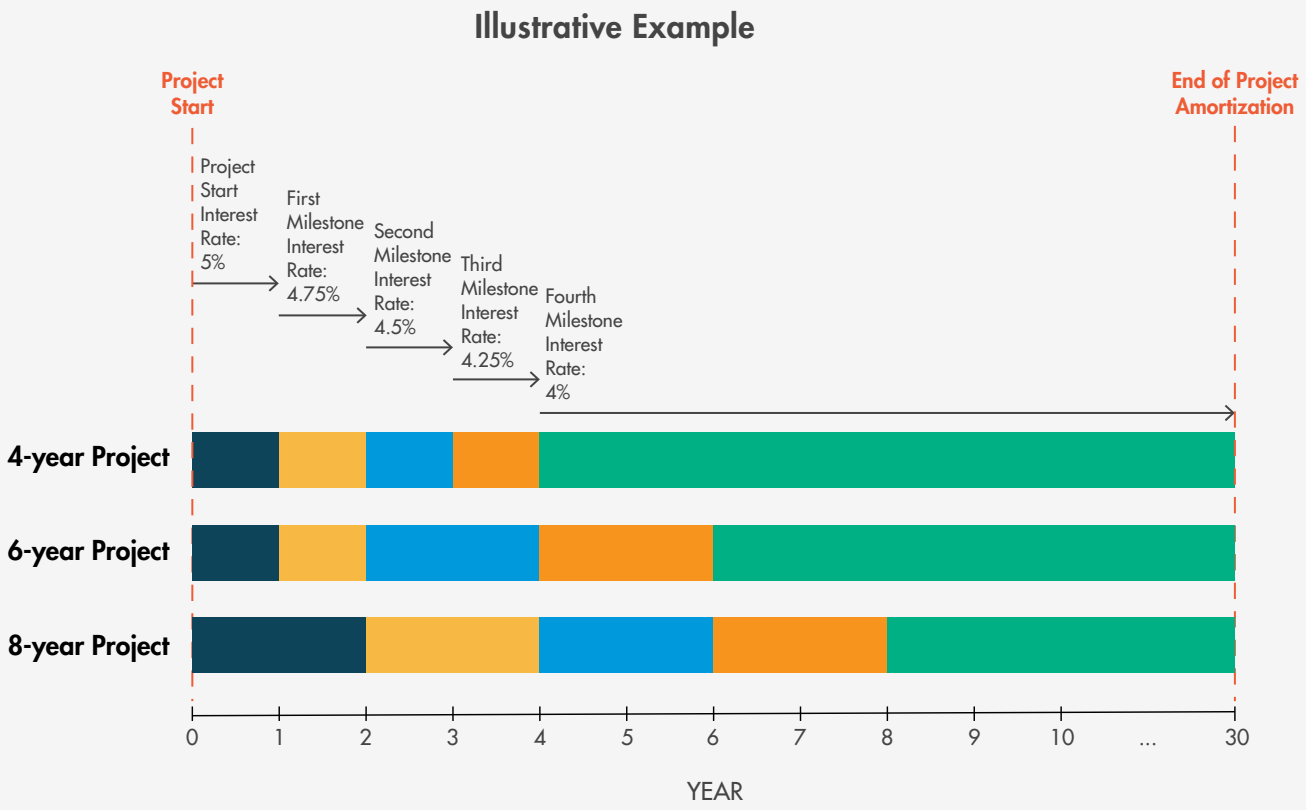


***Figure A-1:*** *Illustrative Example of the construction timelines and milestone placements of a 4-year, 6-year, and 8-year project.*

## A-6. Interest Rate

The interest rate is set at 4.40%, the prevailing treasury rate at the time of writing. The FFB requires a liquidity spread of no less than 37.5 basis points for well-qualified developers, bringing the initial interest rate to 4.775%. We assume a private interest rate of 10%. Upon completing a milestone, the project will receive an interest rate reduction of 25 basis points for the next set of loans. The resulting interest rates will be 4.525%, 4.275%, 4.025%, and 3.775% for each respective milestone.

# B. SENSITIVITY ANALYSIS

| FACTORS | ASSUMPTIONS FOR BASE CASE | SENSITIVITY ANALYSIS |
|---|---|---|
| Milestone program total funding | $3.6 billion | |
| Private sector interest rate | 10% | No LPO case |
| Federal treasury rate | 4.40% | |
| FFB liquidity spread | 0.38% | |
| Milestone interest rate reduction | 0.25% | 0.125% and 0.5% |
| | | Accelerated: 0.4%, 0.3%, 0.2% and 0.1%<br>Decelerated: 0.1%, 0.2%, 0.3% and 0.4% |
| Discount rate (government) | 4.40% | |
| Initial base cost for developer | $4 billion | $2, $4, $6, $8, $10 billion |
| Debt ratio | 50% | 10% and 80% |
| Loan term | 30 years | |
| Capital tranches | 5 tranches, evenly distributed | Accelerated and decelerated spend curves |
| Construction period | $2 and $4 billion projects are competed within 4 years, $6 and $8 billion projects are completed within 6 years and $10 billion projects are completed within 8 years. | Compared to all projects within 4-years, 6-years and 8-years |
| Milestone intervals | 4-year: year 0, 1, 2, 3, 4;<br>6-year: year 0, 1, 2, 4, 6;<br>8-year: year 0, 2, 4, 6, 8. | |
| Overrun percentages | 0% | 0%-100% |

**Table B-1:** *Factors, Assumptions for the base case and sensitivity analysis.*

## B-1. Project Size and Base Cost

A range of project sizes, namely $2, $4, $6, $8, and $10 billion, are evaluated in the following scenarios. This covers various technology designs, from SMRs to AP-1000s. See Figure B-1.

## B-2. Overrun Percentages

Project cost overrun levels from 0% to 100% are evaluated. The more projects that have overrun, the fewer projects that can be accepted in the milestone program. A few $2 billion scale projects with overruns will have a much lower effect on the program's efficacy than a few $10 billion scale projects with substantial overruns. See Figure B-2.

## B-3. Project Construction Period

Project costs are typically sensitive to changing construction timelines due to increasing labor, rework, and finance costs. This sensitivity analysis isolates increasing finance costs and the impact on this program. It does not attempt to estimate labor, rework, or other costs in each scenario, which is considered in a separate overrun analysis.

For the base case, the assumption is that the $2 and $4 billion projects are completed within 4 years, the $6 and $8 billion projects are completed within 6 years, and the $10 billion projects are completed within 8 years. Sensitivity analyses have been performed for 4-year, 6-year, and 8-year construction periods. These ranges are consistent with published timelines and discussions with advanced reactor developers.

The savings per project increased by 7% and 6% under 4-year and 6-year construction durations, respectively, compared to the 8-year duration. See Figure B-1.

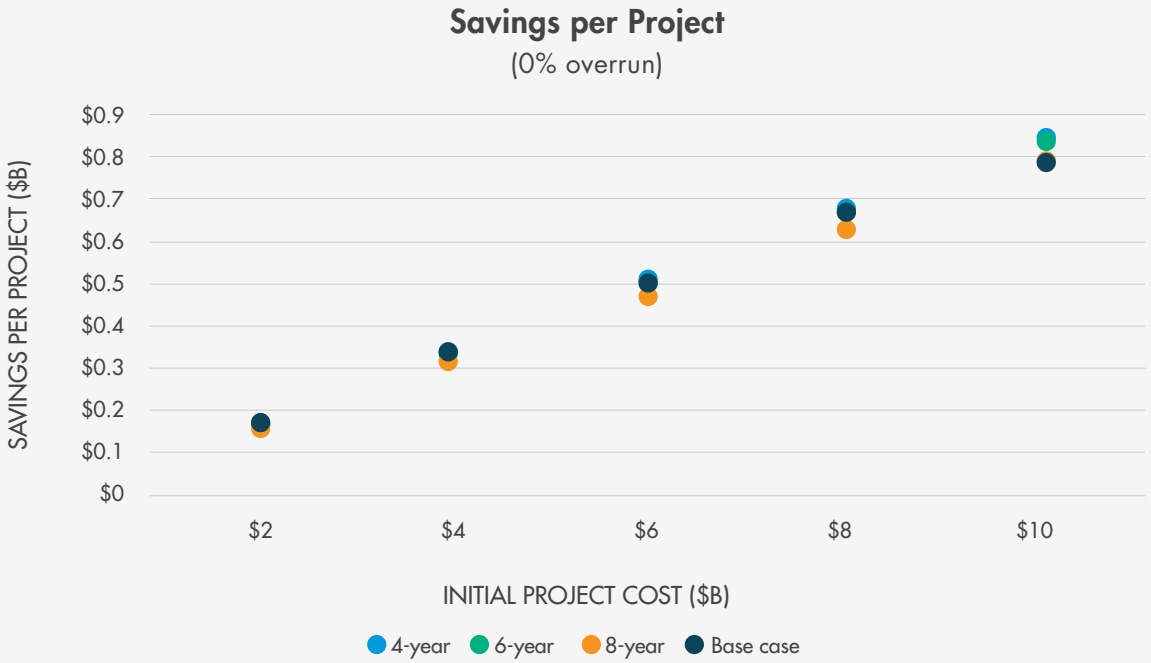


***Figure B-1:*** *Savings per project compared to the normal LPO program, with 0% overrun for projects and different initial project costs under 4-year, 6-year, and 8-year scenarios (base case is colored in black).*

The 4-year construction period decreased the number of projects funded by 17% compared to the 8-year scenario, while the 6-year construction duration decreased the number of projects funded by 12%.

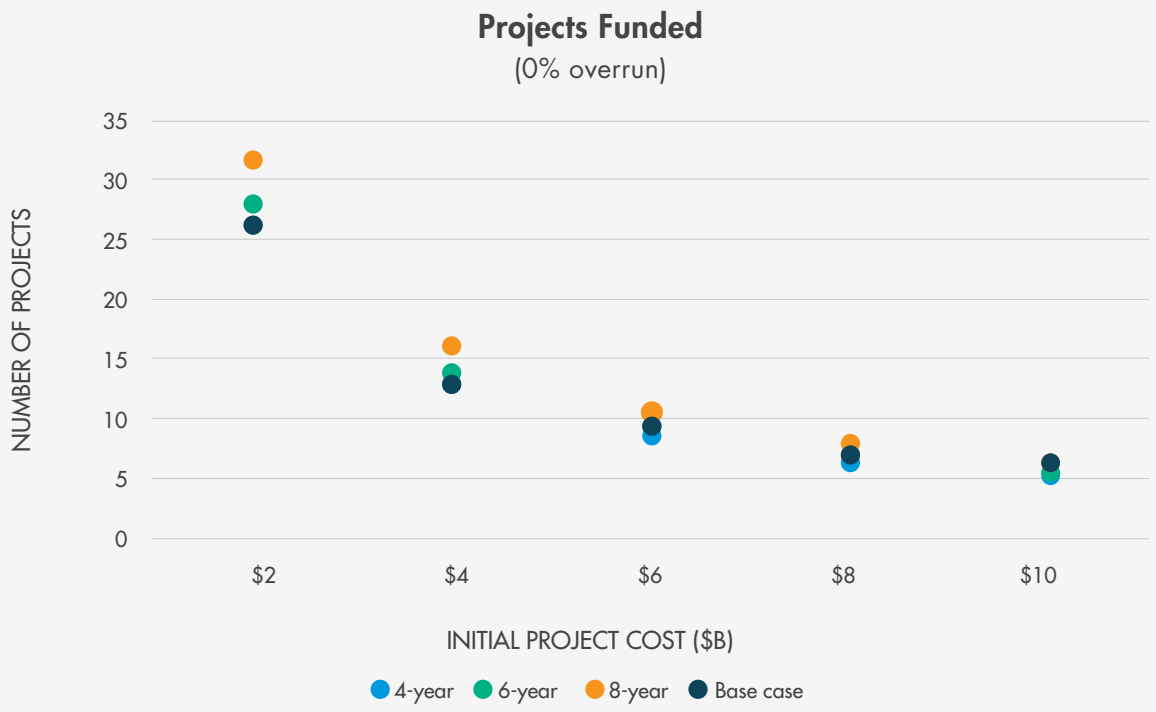


***Figure B-2:*** *Number of projects that can be funded by the milestone program, with 0% overrun for projects and different initial project costs under 4-year, 6-year, and 8-year scenarios (base case is colored in black).*

The total amount of savings (savings per project times the number of projects funded) is $4.4 billion, $4.6 billion, and $5 billion under 4-year, 6-year, and 8-year construction durations, respectively. Changes in the construction period do not have a large impact on outcomes. The program is robust to variation in the program construction period and would provide the intended function across the evaluated variable range.

## B-4. Debt Ratio

To replicate a general case, the base model uses a 50% debt-to-equity ratio. Sensitivity analyses have been conducted for the 10% debt ratio (for public utilities) and the 80% debt ratio (for the private sector, which is also the upper limit for LPO loans).

The savings per project decreased by 80% under the 10% debt ratio scenario, while they increased by 60% under the 80% debt ratio scenario.

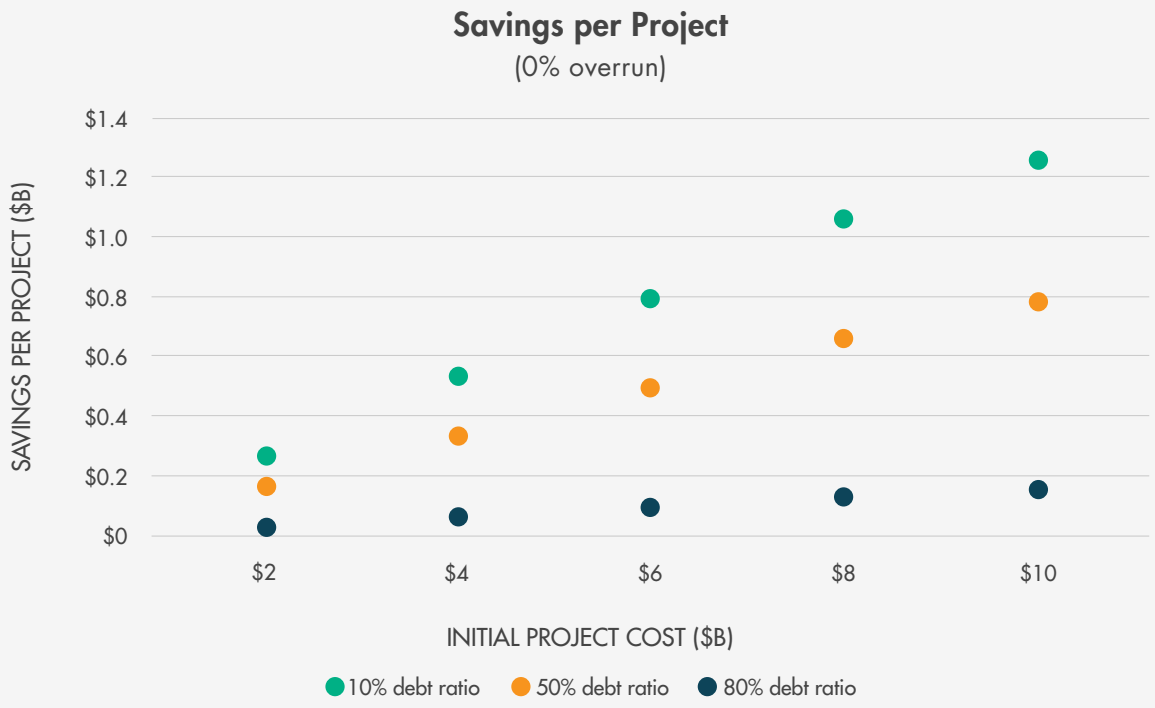


***Figure B-3:*** *Savings per project compared to normal LPO program, with 0% overrun for projects and different initial project costs under 10%, 50%, and 80% debt ratio scenarios (base case is 50% debt ratio).*

As shown in Figure B-4, a 10% debt ratio increased the projects funded by 400% compared to the base model (50% debt ratio), while an 80% debt ratio decreased the projects funded by 38%. The total amount of savings (savings per project multiplied by the number of projects funded) is unchanged at $5 billion. Changes in the debt ratio have a relatively large impact on outcomes, especially with the 10% debt ratio decreasing the savings per project by 80%. This suggests that public utilities with a lower cost of debt may have a lower financial advantage to apply for the ACTION Program, compared to private companies. The program is robust to variation in the debt ratio from 50% to 80% and would provide the intended function across the evaluated variable range.

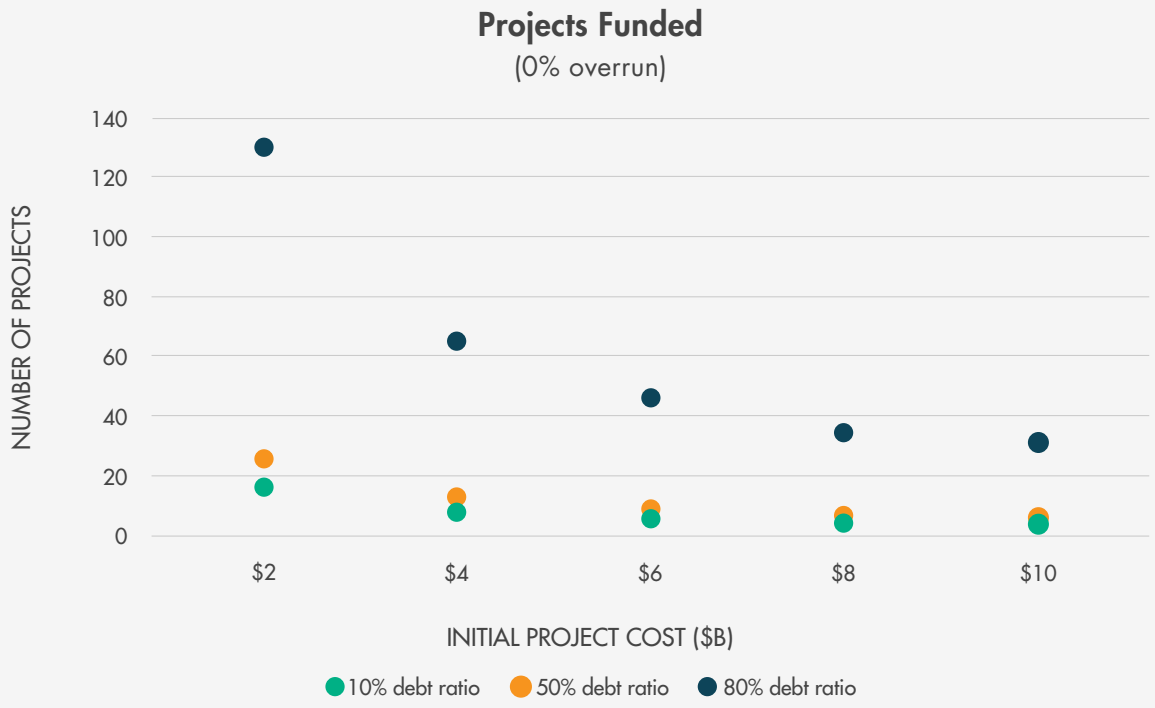


***Figure B-4:*** *Number of projects that can be funded by the milestone program, with 0% overrun for projects and different initial project costs under 10%, 50%, and 80% debt ratio scenarios (base case is 50% debt ratio).*

## B-5. Rate Reduction Levels

The base model uses a 25 basis point rate reduction for each milestone. The sensitivity analyses have been performed regarding a 12.5 basis point rate reduction and a 50 basis point rate reduction for each milestone.

The savings per project decreased by 49% under the 12.5 basis point scenario, while they increased by 95% under the 50 basis point scenario.

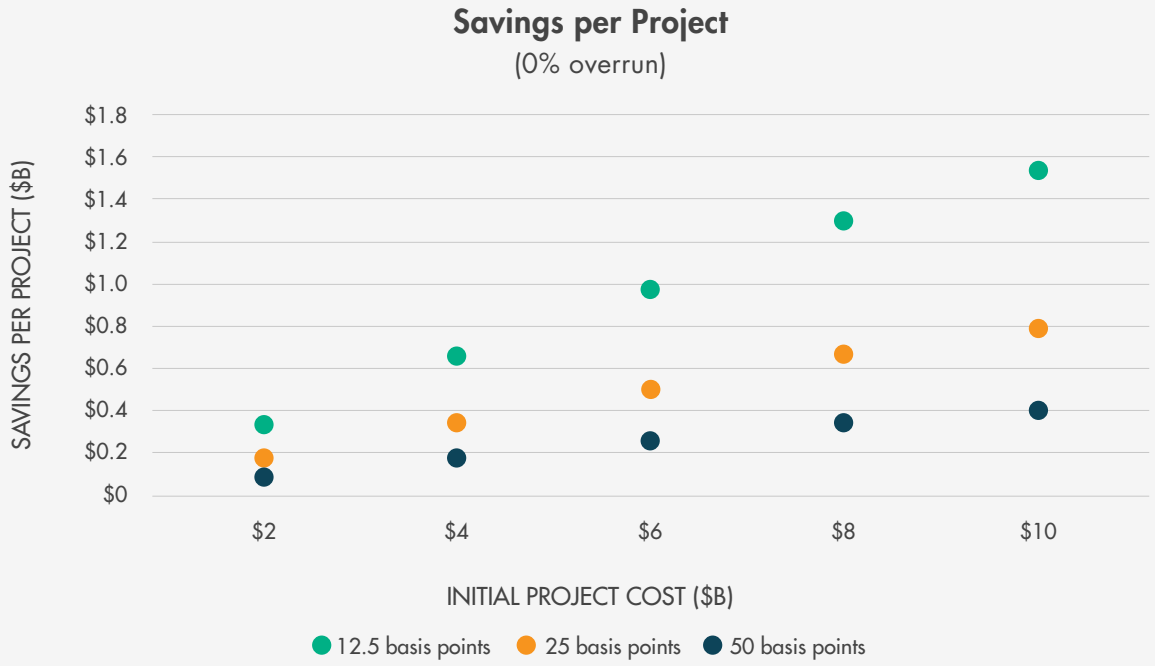


***Figure B-5:*** *Savings per project compared to the normal LPO program, with 0% overrun for projects and different initial project costs under 12.5, 25, and 50 basis points rate reduction scenarios (base case is 25 basis points).*

As shown in Figures B-5 and B-6, a 12.5 basis point scenario increases the number of projects funded by 100% compared to the base model (25 basis points), while a 50 basis point scenario decreases the number of projects funded by 50%.

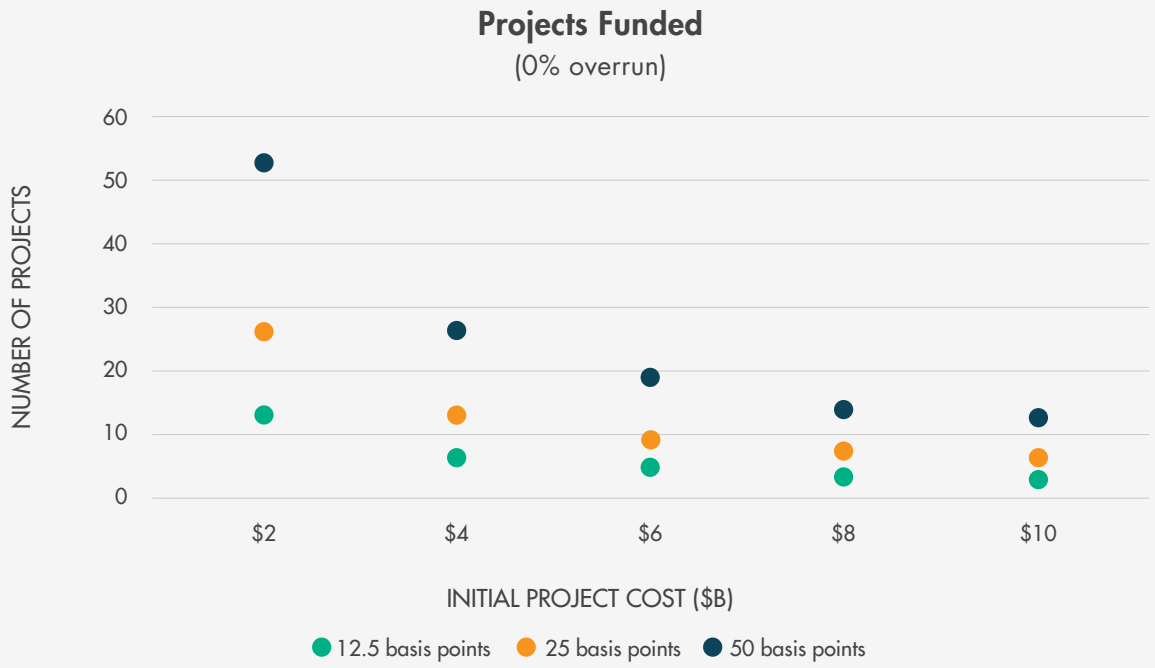


***Figure B-6:*** *Number of projects that can be funded by the milestone program, with 0% overrun for projects and different initial project costs under 12.5, 25, and 50 basis points rate reduction scenarios (base case is 25 basis points).*

The total amount of savings (savings per project multiplied by the number of projects funded) is 1% higher under the 12.5 basis point scenario and 3% lower under the 50 basis point reduction scenario for all projects with different initial project costs.

Changes in the debt ratio have a relatively large impact on outcomes. The savings per project nearly doubled under the 50 basis point, while the number of projects funded dropped to 3 or 4 for large projects (>=$ 6 billion). On the other hand, a 12.5 basis point rate reduction doubled the number of projects funded but halved the savings per project. If the rate reduction is too large, the milestone program cannot incentivize an order book of different designs as intended. Conversely, if the rate reduction is too small, individual developers are less incentivized to apply for the program. The program is robust to variation in the rate reduction of around 25 basis points and would provide the intended function across the evaluated variable range if the rate reduction for each milestone is designed scientifically.

## B-6. Varied Rate Reduction

In addition to the different levels of rate reduction tested above, varied rate reduction scenarios have also been evaluated. The accelerated case features a 40, 30, 20, and 10 basis point rate reduction at each milestone, while the decelerated case shows a reversed 10, 20, 30, and 40 basis point rate reduction at each milestone; the base model is still a 25 basis point rate reduction at each milestone.

The savings per project decreased by 2-4% under the accelerated scenario, while they increased by 2-4% under the decelerated scenario.

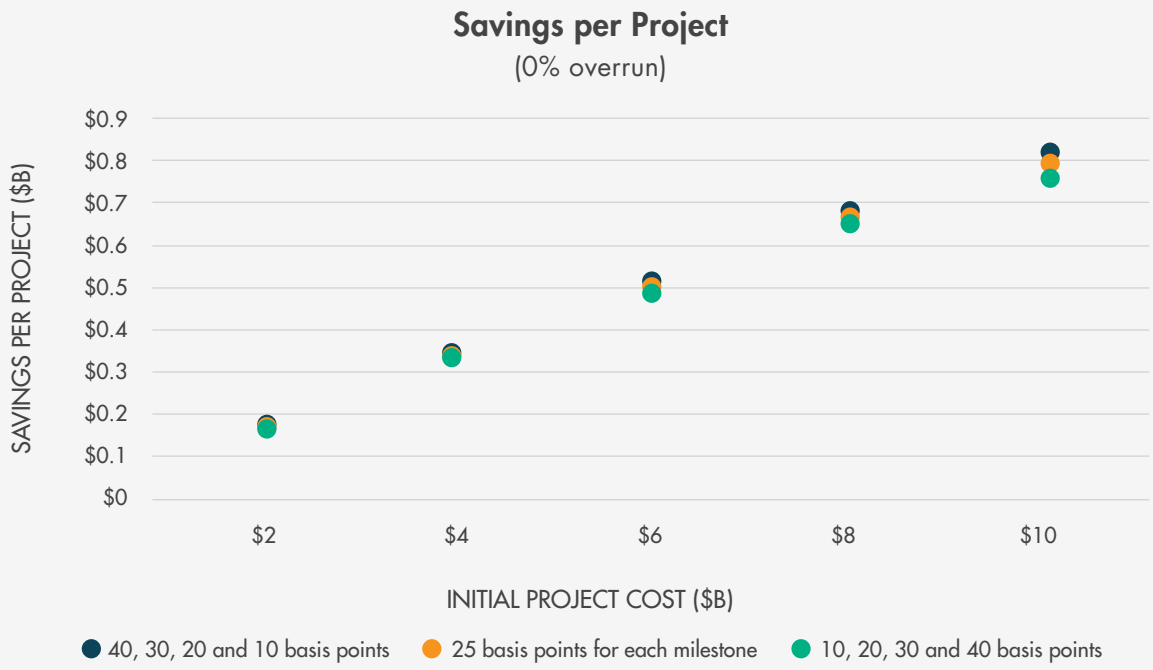


***Figure B-7:*** *Savings per project compared to normal LPO program, with 0% overrun for projects and different initial project costs under accelerated, base, and decelerated rate reduction scenarios (base case is 25 basis points).*

As shown in Figure B-8, an accelerated scenario increases the number of projects funded by 2-4% compared to the base model, while a decelerated scenario decreases the number of projects funded by 2-4%. The total amount of savings is very similar to the base case under either the accelerated or decelerated scenarios.

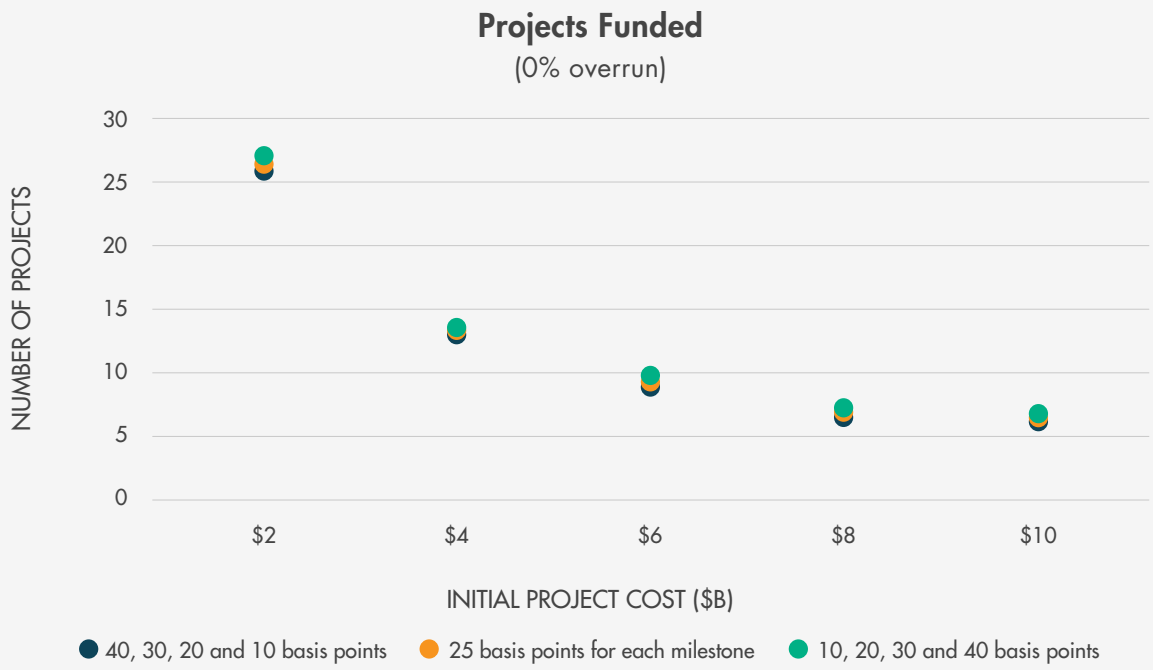


***Figure B-8:*** *Number of projects that can be funded by the milestone program, with 0% overrun for projects and different initial project costs under accelerated, base, and decelerated rate reduction scenarios (base case is 25 basis points).*

A varied rate reduction would significantly slow the negotiation timelines between the developers and LPO, while not resulting in much difference in terms of the final savings or projects that can be funded. Therefore, an equivalent rate reduction across milestones, rather than a variable rate, will be the standard for the milestone program.

## B-7. Different Spend Curves

Capital expenditures occur throughout the project timeline, often referred to as spend curves. Three spend curves in Table B-2 are evaluated to determine sensitivity—based, accelerated, and decelerated models on top of different project construction periods. The evaluated spend curves were reviewed by multiple advanced reactor developers and are considered to include expected project scenarios.

| | CAPITAL TRANCHES (PERCENTAGE OF THE TOTAL LOAN AMOUNT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Base | | | Accelerated | | | Decelerated | | |
| YEAR | 4-year project | 6-year project | 8-year project | 4-year project | 6-year project | 8-year project | 4-year project | 6-year project | 8-year project |
| 0 | 20% | 20% | 20% | 30% | 30% | 30% | 5% | 5% | 5% |
| 1 | 20% | 20% | | 30% | 30% | | 5% | 5% | |
| 2 | 20% | 20% | 20% | 30% | 30% | 30% | 30% | 30% | 5% |
| 3 | 20% | | | 5% | | | 30% | | |
| 4 | 20% | 20% | 20% | 5% | 5% | 30% | 30% | 30% | 30% |
| 5 | | | | | | | | | |
| 6 | | 20% | 20% | | 5% | 5% | | 30% | 30% |
| 7 | | | | | | | | | |
| 8 | | | 20% | | | 5% | | | 30% |
| 9 | | | | | | | | | |
| … | | | | | | | | | |
| 30 | | | | | | | | | |

***Table B-2:*** *Accelerated, decelerated, and basic spend curves with different capital tranches distributions throughout the construction timelines.*

The following graphs show the normalized spend curves for projects with different construction periods. The new capital tranches are issued evenly, acceleratedly, or decelerated by hitting each milestone. Due to the normalization, the 8-year graph matches the 4-year graph, while the first two milestones come up more quickly, and the last two milestones have more separation in the 6-year graph.

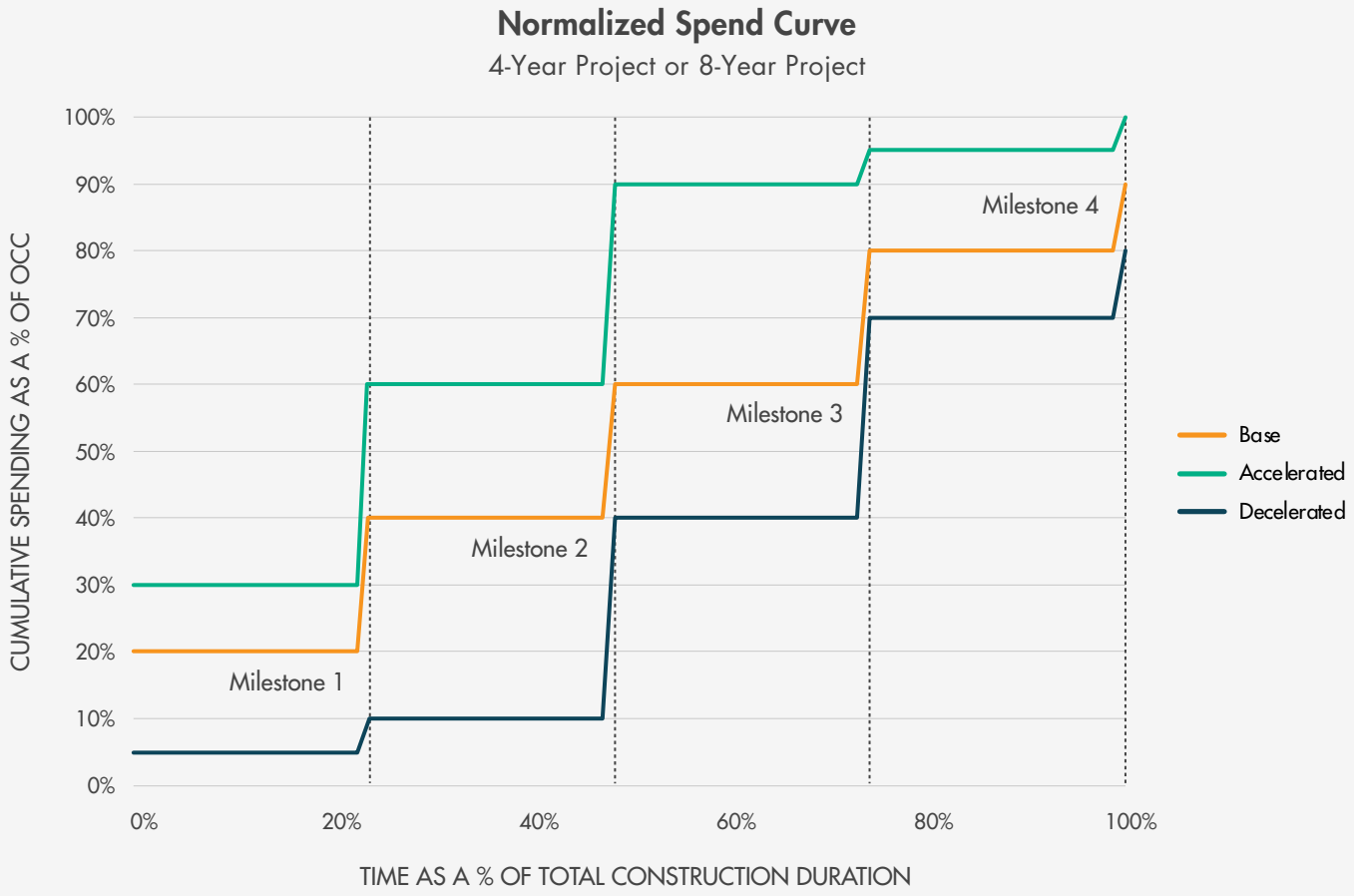


***Figure B-9:*** *Normalized Spend Curve for 4-year and 8-year projects, under base, accelerated, and decelerated capital tranch distributions.*

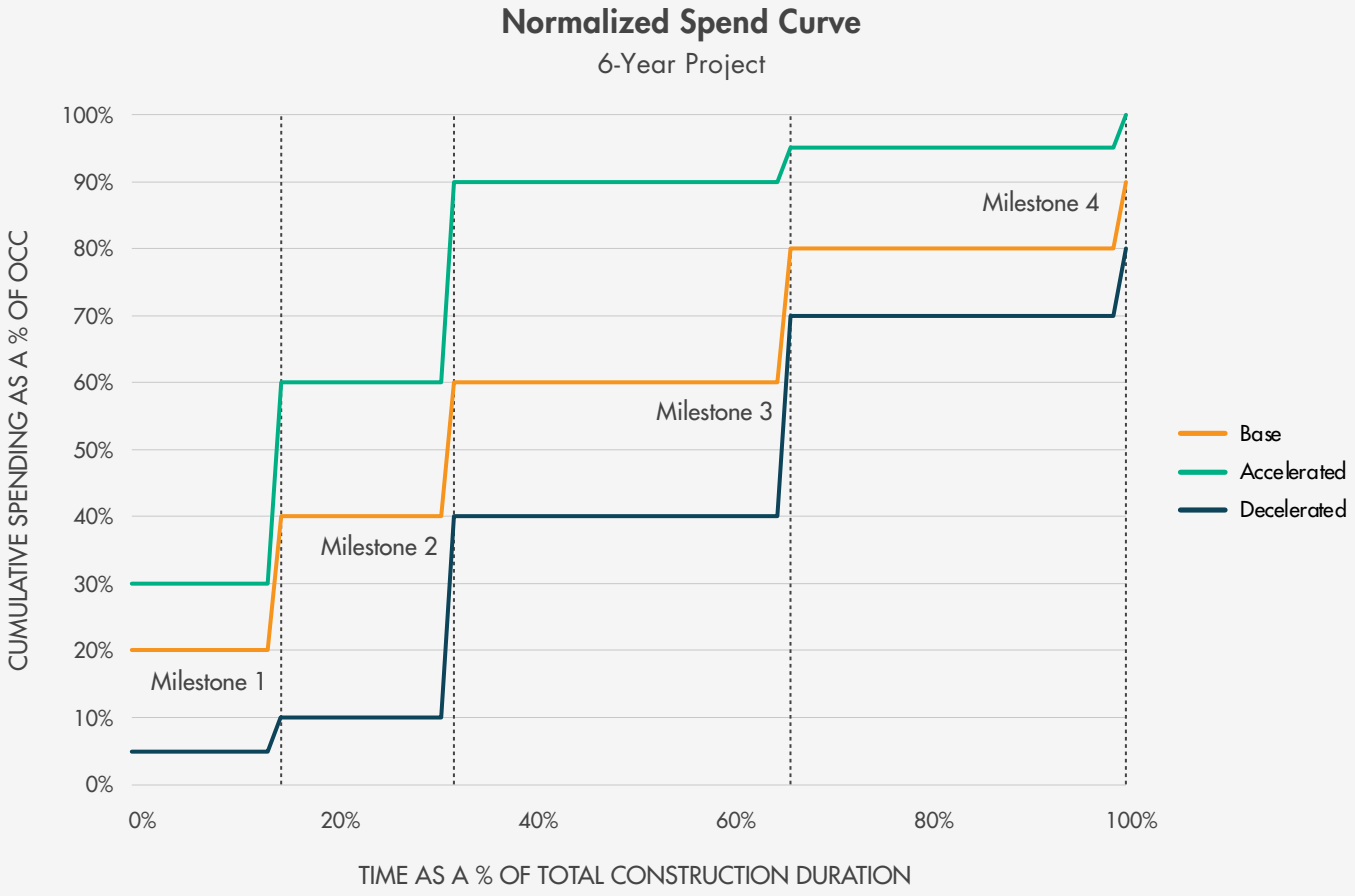


***Figure B-10:*** *Normalized Spend Curve for 6-year projects, under base, accelerated, and decelerated capital tranch distributions.*

Changes in spending curves have a minimal impact on outcomes. The program is robust to basic, accelerated, and decelerated spending curves and would provide the intended function across the evaluated spend curve ranges. The difference between both projects can be funded, and the savings per project between the basic model and the accelerated and decelerated ones are within +/- 5%.

This indicates that the program is flexible for a variety of construction scenarios where a greater or lesser portion of components are ordered ahead or manufacturing is completed early in a factory setting, compared to more conventional on-site construction. It also indicates that the program does not create an unintended incentive to shift costs compared to the optimal.

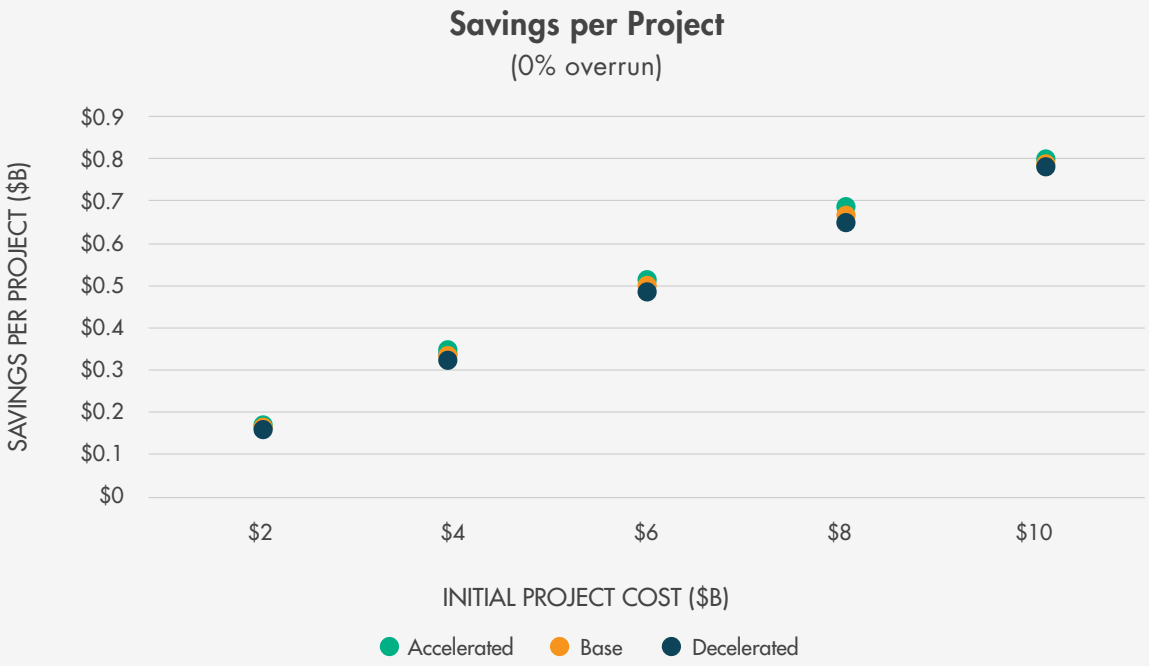


***Figure B-11:*** *Savings per project compared to the normal LPO program, with 0% overrun for projects and different initial project costs under accelerated, base, and decelerated spend curve scenarios.*

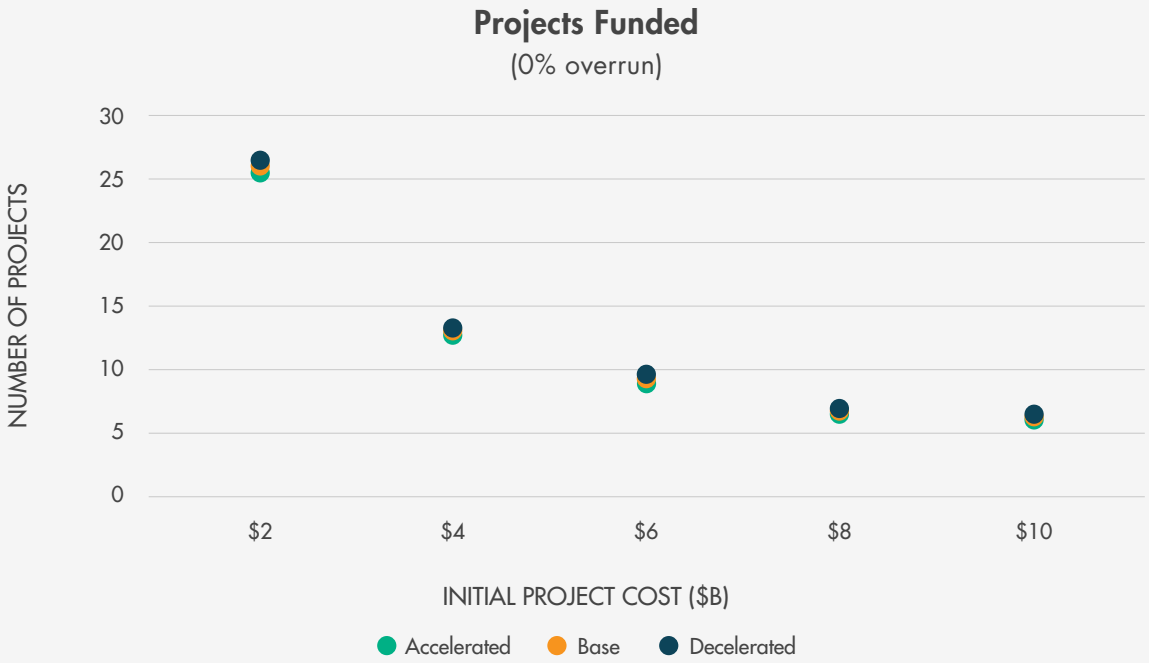


***Figure B-12:*** *Number of projects that can be funded by the milestone program, with 0% overrun for projects and different initial project costs under accelerated, base, and decelerated spend curve scenarios.*

## B-8. Comparing Savings Across ACTION, LPO, and Private Loans

A standard LPO loan, which serves as the benchmark for this proposal, provides significant benefits compared to private financing for nuclear projects. However, most projects would not qualify for a LPO 1703 loan without the provisions in the ACTION Program. Therefore, it is appropriate to consider the entire savings in this analysis to be attributed to the ACTION Program for most projects.

The LPO loan results in a 58% savings in financing costs compared to private financing with a private interest rate assumption at 10% and a 4.8% rate for LPO. For comparison purposes, both types of loans are structured in five capital tranches. Just by utilizing LPO, developers save 58% in interest of its financing costs per project compared to a 10% private loan.

A project that utilizes the ACTION Program would receive a 22% savings in financing costs relative to a standard LPO loan. When compared to private financing, the milestone program saves the developer 67% in financing costs. Figure B-13 displays how the ACTION program reduces financing costs by more than $6B for a $10B nuclear project. Instead of paying around $9.2B in interest over the lifetime of a private loan, the developer would only pay about $3B in interest under the milestone program.

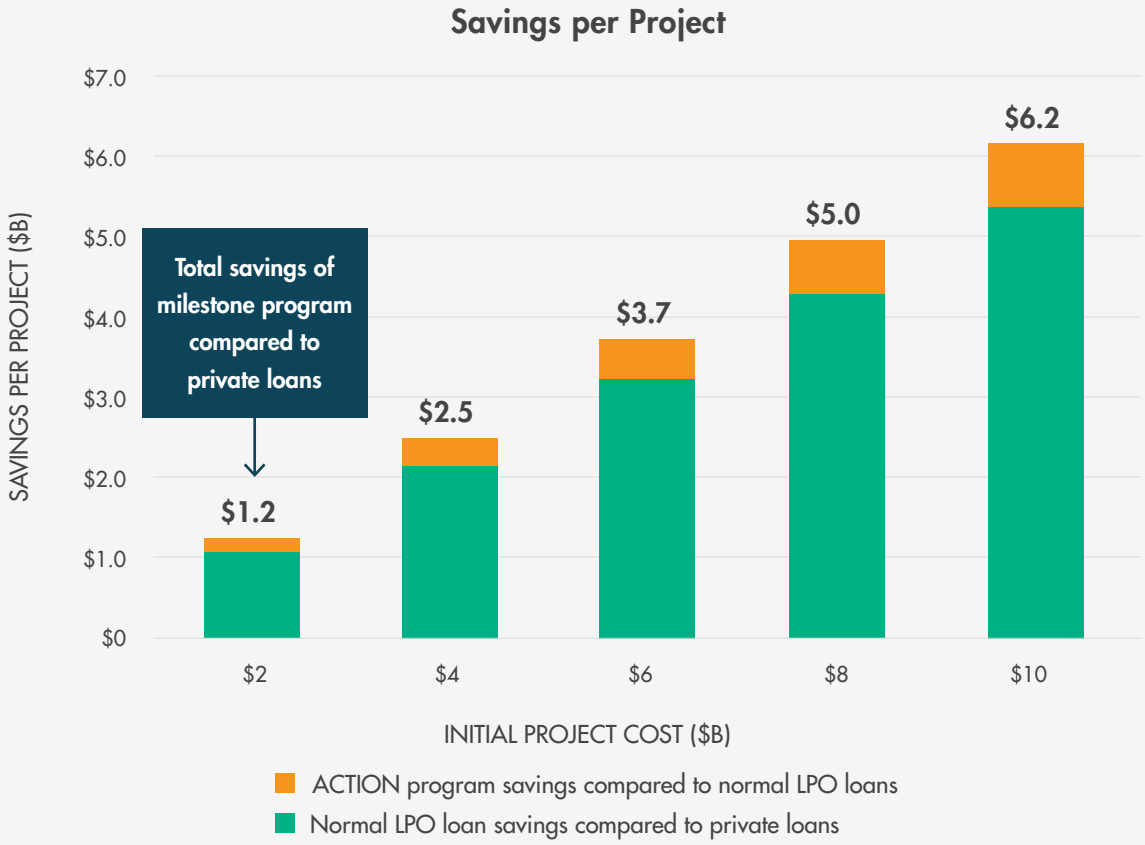


***Figure B-13:*** *Savings per project compared to private loans and normal LPO loans, with 0% overrun for projects.*

## B-9. How Federal Policies Can Alleviate Cost Overrun Burden

It is important to understand which federal policies save the most money for developers in comparison to ACTION, should a cost overrun occur—tax credits such as the ITC (investment tax credit), overrun insurance, or the milestone program.

Two scenarios are considered: 1) a $8 billion project with 100% overrun (e.g., Vogtle Units 3 & 4); and 2) a $4 billion project with 50% overrun (e.g., 200MW SMR). Under both scenarios, ITC provides the most overrun protection for the developers. The ITC amount is 30% of the final capital cost regardless of the funding source. Although the overrun insurance targets the overrun costs directly, the ACTION Program provides almost equivalent protection through financing costs, regardless of the overrun percentage.

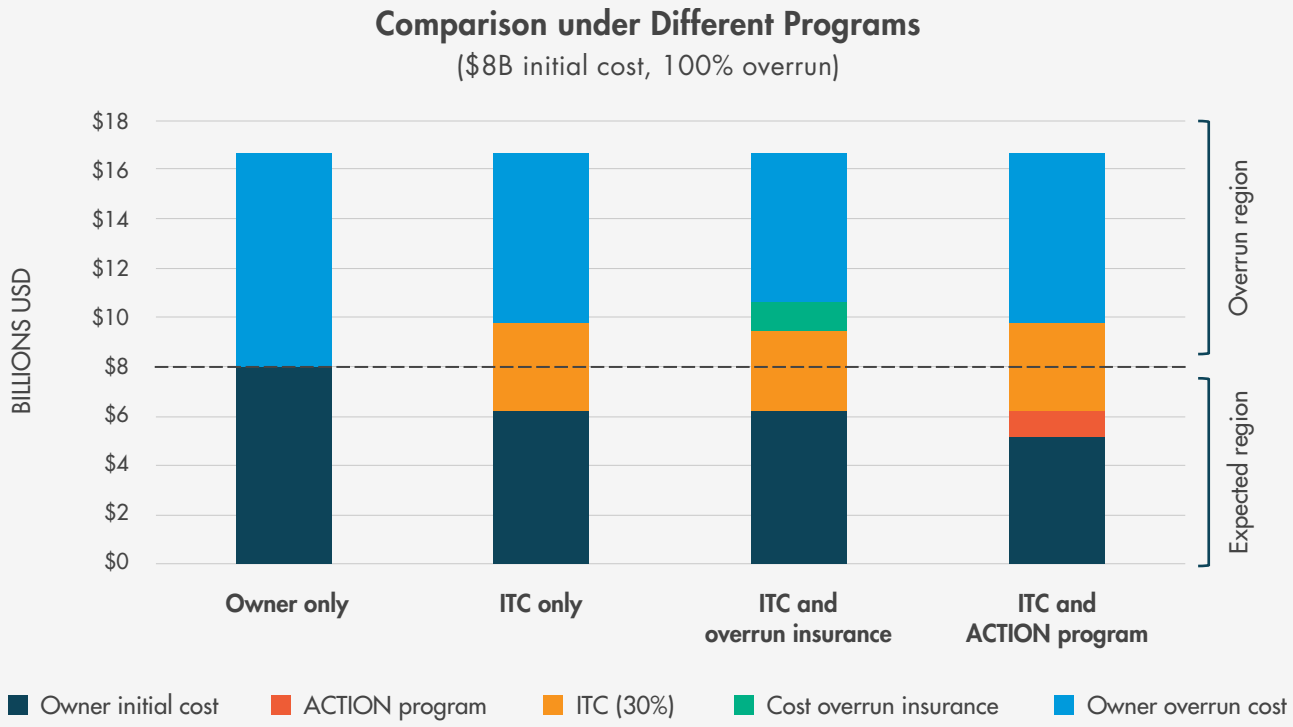


***Figure B-14:*** *The Breakdown of cost coverage under different programs for a $8B project with 100% overrun. Owner costs for the scenarios evaluated are $16.61, $13.01, $12.17, and $12.01 billion, respectively.*

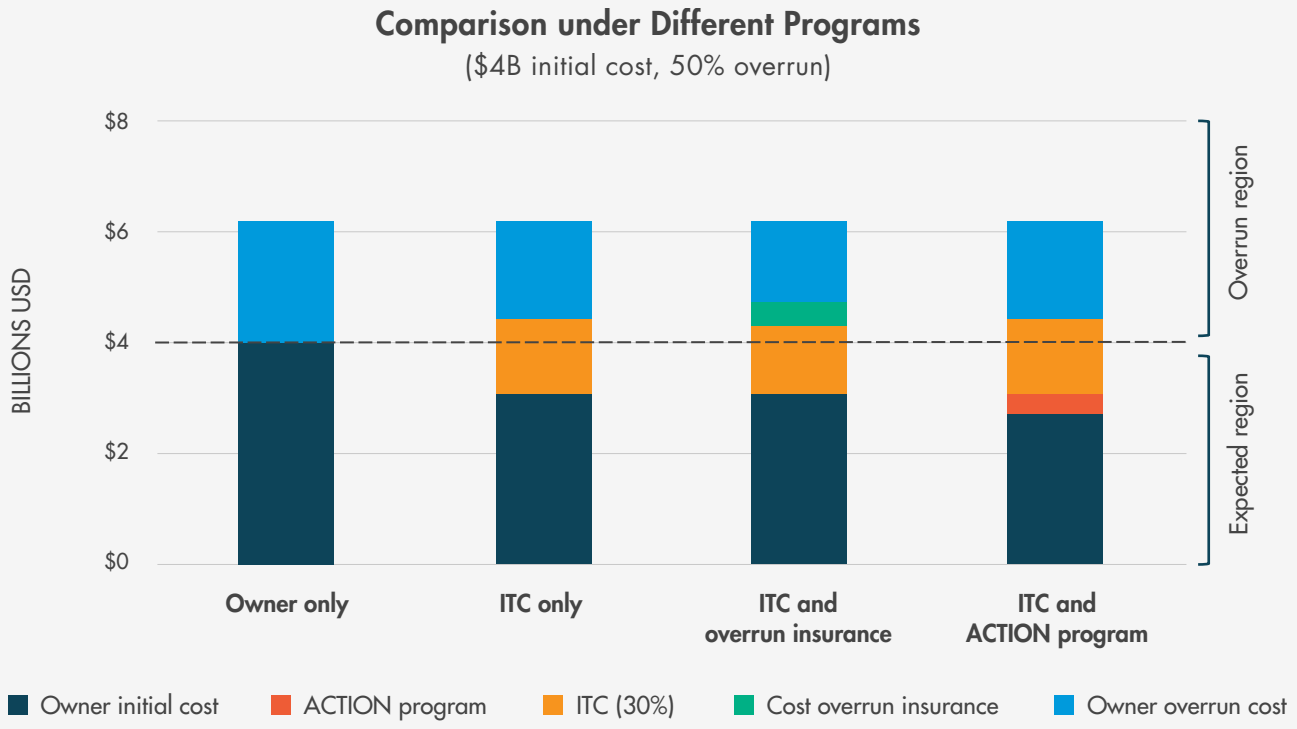


***Figure B-15:*** *The Breakdown of cost coverage under different programs for a $4B project with a 50% overrun. Owner costs for the scenarios evaluated are $6.19, $4.84, $4.53, and $4.47 billion, respectively.*

Assuming all milestones are achieved, ACTION provides similar coverage to overrun insurance. Developers can realize this benefit by being on time, regardless of whether there is a cost overrun or not. The overrun insurance does not reduce the overall cost at all when an overrun does not occur. Furthermore, the project has to go more than 20% over budget for cost overrun insurance to be impactful.

## B-10. Total Savings Across Program Success Scenarios

Within ACTION, there are 16 different scenarios in which the four milestones can be missed or achieved. The greatest savings occur when all the milestones are achieved, while the least savings occur when none of the milestones are achieved. The lowest cost reduction occurs when only the last milestone is achieved. This is because, even though all four milestones lower the interest rate equally base case, the last milestone lowers the interest rate for the shortest period of time as opposed to hitting one milestone earlier in the process. Therefore, the all-milestone and last-milestone-only cases effectively describe the maximum and minimum bounds of the program savings, respectively.

The savings for a project for the last-milestone-only scenario are approximately 24% of what would have been realized by meeting all milestones. Scenarios where some milestones are met and others are missed result in savings that fall between the bounds shown by the "Achieve only the last milestone" and "Achieve all milestones" scenarios in Figure B-16.

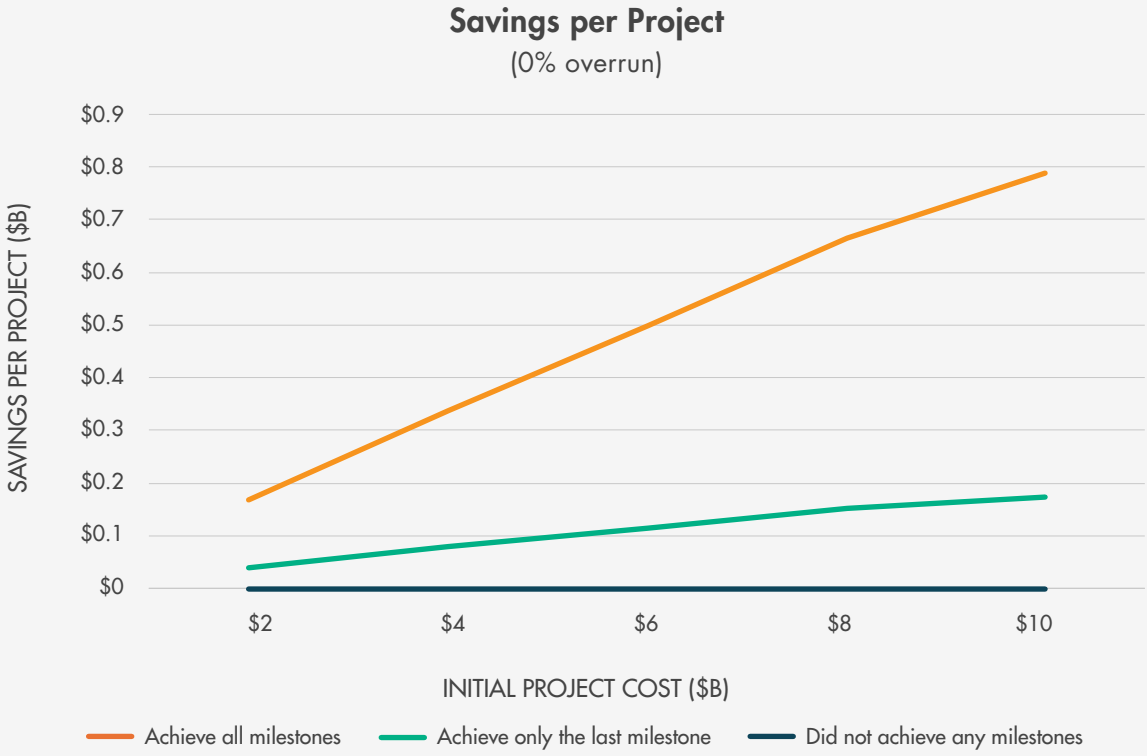


***Figure B-16:*** *Savings per project compared to the normal LPO program, with 0% overrun for projects and different initial project costs depending on the achievement of the milestones.*

# ENDNOTES


1 Nuclear Energy Agency, *Effective Frameworks and Strategies for Financing Nuclear New Build*, No. 7864, 2024, https://www.oecd-nea.org/upload/docs/application/pdf/2024-09/nea_publication_2_2024-09-18_16-50-13_471.pdf

2 Nuclear Energy Agency, *New Perspectives for Financing New Nuclear Build*, No. 7688, 2024, https://www.oecd-nea.org/upload/docs/application/pdf/2024-11/7688_financing_market_design_and_project_management.pdf

3 Bowen, Matt, NIA, *In Search of a SpaceX For Nuclear Energy*, 2019, https://nuclearinnovationalliance.org/search-spacex-nuclear-energy

4 Stein, Adam, et al., Breakthrough Institute, *Advancing Nuclear Energy*, 2022, https://thebreakthrough.imgix.net/Advancing-Nuclear-Energy_v3-compressed.pdf

5 The term "advanced nuclear reactor" is defined in section 951(b)(1) of the Energy Policy Act of 2005 (42 U.S.C. 16271(b)(1)).

6 There are five cost estimation classes ranging from least detailed (class 5) to most detailed (class 1). Class 3 is typically used for full project funding requests and becomes the control estimate that project costs are evaluated against. A Class 3 estimate is appropriate for use to determine project potential authorization, which directly aligns with the stage of decision making acceptance into ACTION and an LPO loan is needed before investing further into more detailed cost estimation. A Class 2 estimate is commonly known as the "bid" estimate where contractors have detailed contract values. Requiring firm contracts too early in the process or too far from a potential start date leads to inaccurate estimates from contractors and passing on or "pancaking" contract risk on subcontractors.

7 Angelini, Arnaldo, et al., *Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction for the Nuclear Power Industries*, Recommended Practice No. 115R-21, AACE International, (Rev. 2022/02/05).

8 Using incremental rate reductions of the same size reduces the potential for principal-agent issues. Placing larger rate reductions at any given milestone increases the chances that a developer will adjust construction timelines for some elements of a project in ways that are advantageous to the developer but not necessarily to the project as a whole. Variable interest rate reduction would also increase the negotiation process and cause complexity.

9 A "core design" is a commonly used term in engineering that enables innovation while maintaining major characteristics of the design. It is an important distinction from a "standard design" that, in regulation, means an "identical design." A core design approach is integral to enabling rapid innovation under the ADVANCE Act. See, ML24276A206.

10 Department of Energy, Kozeracki. Julie, et al., *Pathways to Commercial Liftoff: Advanced Nuclear*, 2024, https://liftoff.energy.gov/wp-content/uploads/2024/10/LIFTOFF_DOE_Advanced-Nuclear_Updated-2.5.25.pdf

11 Loan Programs Office, *Questions All Applicants Should Ask Before Applying to LPO*, December 10, 2023, https://www.energy.gov/lpo/articles/questions-all-applicants-should-ask-applying-lpo

12 Jackson, Lexi, Bipartisan Policy Center, *Financing Novel Energy Technologies: How the Loan Programs Office Advances American Competitiveness*, August, 01, 2019, https://bipartisanpolicy.org/blog/financing-novel-energy-technologies-how-the-loan-programs-office-advances-american-competitiveness/

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