# Appendix B. Market Assessment

Key objectives for this Options Paper are to consider whether and why advanced nuclear projects require government intervention to succeed and, if so, how best to structure support in the most effective and efficient way. To underpin this assessment, this appendix provides an overview of past and current advanced nuclear projects and government programs in other jurisdictions, both abroad and in the US, as well as lessons learned.

The New York State Energy Research and Development Authority (NYSERDA) and the Department of Public Service (DPS) acknowledge the contribution of The Brattle Group in conducting the analysis described in this appendix.

## B.1 Completed Projects

### Barakah 1 – 4 (United Arab Emirates)

Barakah Nuclear Power Plant (BNPP) Units 1-4 are the first APR1400s built outside of South Korea, and the design and construction approach were based on Korean Electric Power Corporation's (KEPCO) successful recent Shin-Kori units 3 & 4.[1] Construction started on Unit 1 in 2012, Unit 2 in 2013, Unit 3 in 2014, and Unit 4 in 2015; COD was attained in 2021, 2022, 2023, and 2024, respectively.[2]

*Ownership, financing, and support*: BNPP is a joint venture between the state-owned Emirates Nuclear Energy Corporation (ENEC) and the Korean-government-backed KEPCO, with ENEC having majority ownership (through a $3.9 billion equity investment), and KEPCO having a minority ownership (through a $846 million equity investment) and serving as the designer and engineering, procurement, and construction (EPC).[3] The project was also financed with a $19.7 billion consortium of loans, with the majority of debt coming from the Department of Finance of

[1] "Nuclear Power in the United Arab Emirates" Nuclear Power in the United Arab Emirates—World Nuclear Association, Updated July 23, 2025, https://world-nuclear.org/Information-Library/Country-Profiles/Countries-T-Z/United-Arab-Emirates.

[2] *Ibid*;
*See also* "KEPCO and ENEC enhance cooperation in nuclear energy—World Nuclear News," November 21, 2025, https://www.world-nuclear-news.org/articles/kepco-and-enec-enhance-cooperation-in-nuclear-energy.

[3] World Nuclear Association, "Nuclear Power in the United Arab Emirates," https://world-nuclear.org/information-library/country-profiles/countries-t-z/united-arab-emirates, 82% and 18% split of the $4.7 billion in equity commitments.

Abu Dhabi, effectively carrying a government guarantee through the sovereign backing.[4] Similarly, $2.5 billion of the loans were provided by the Export-Import Bank of Korea (KEXIM). This collectively enabled a relatively low capital carrying cost for the project.

*Risk allocation***:** While limited public information is available on the allocation of cost overrun risk, it appears that the initial $20.4 billion EPC contract was mostly a fixed-price and fixed-schedule EPC contract with KEPCO.[5] Price adjustments could occur only under predefined circumstances. This meant that KEPCO, as EPC contractor and minority equity holder, bore construction performance risk, while the UAE government absorbed most of the risk during operations.

*Offtake*: In 2016, the state-owned Emirates Water and Electric Company signed a Power Purchase Agreement (PPA) for all BNPP generation for 60 years at a price that has not been made public.[6]

*Cost Outcomes and Effects on Parties:* Total costs of the project are not fully transparent based on public materials, but there were indications of limited cost overruns and delays. KHNP, a contractor hired by KEPCO, requested cost adjustments during the construction of the project, citing rising costs due to the pandemic and the war in Ukraine, and there is now an ongoing dispute between KHNP and KEPCO over about $1 billion in cost overruns.[7] Each reactor was initially planned to start commercial operation 5 years after commencing construction, with the first reactor construction beginning in 2012 and planned to come online in 2017 and the fourth reactor beginning construction in 2015 with a planned online date of 2020.[8] The first reactor encountered delays, achieving commercial operation in 2021. Due to the staggered nature of the deployment schedule, these delays carried over to the timeline of the subsequent reactors, though these do not seem to have encountered additional delays, with the fourth reactor coming online in 2024.

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[4] *Ibid*

[5] S. Kim and J. Keppler, "Case Studies on Financing and Electricity Price Arrangements: The Barakah Nuclear Power Plants, The United Arab Emirate," OECD Nuclear Energy Agency, September 2013, https://www.oecd-nea.org/ndd/workshops/wpne/presentations/docs/4_2_KIM_%20Barakah%20presentation.pdf.

[6] Emirates Water and Electricity Co., "Barakah Nuclear Energy Plant". https://www.ewec.ae/existing-plant/barakah-nuclear-energy-plant.

[7] C. Jae-hyun, J. Jae-hee, and K. Mi-geon, "Barakah nuclear dispute between KEPCO, KHNP heads to international court," *The Chosun Daily*, May 8, 2025, https://www.chosun.com/english/industry-en/2025/05/08/EYE5F6EEHFDUDPYIXVQPGXPQIY/.

[8] S. Kim and J. Keppler, September 2013.

**Lessons Learned**

This project is notable for realizing substantially lower costs and less delay than other recent projects outside Asia, albeit with some cost overrun even relative to a planned premium over the Korean model it was built on. This success may be attributable to a combination of factors:

- Selecting a proven, repeat-build reactor design (APR-1400) reduces costs and cost risk. While there were some construction issues and required design changes that arose during construction, the use of a proven reactor design previously constructed by KEPCO, along with an experienced workforce and proven supply chains aided in the project staying close to budget. Effective management and a consistent, repeatable design was reported to lead to cost reductions of 40% reduction in labor costs between the first and fourth unit.[9]
- Building projects at scale with multiple reactors enables rapid learning that can aid in the construction of each subsequent reactor, reducing costs and avoiding delays.[10]
- Allocating cost risk largely to the EPC contractor incents them to manage the project well; and KEPCO was willing to accept risk because it had the experience to know that they could deliver within the budget and benefited from backing by the Korean government. As will be observed in case studies further below, EPC contractors in the US are unlikely to accept this level of risk allocation going forward, at least not until more experience completing projects has been gained in the US.[11]
- Strong sovereign sponsorship, including majority ownership by ENEC, direct government financing, and export-credit support from Korea, lowers the cost of capital and shields the project from regulatory and financing uncertainty.

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[9] OECD/NEA, "Unlocking Reductions in the Construction Costs of Nuclear: A Practical Guide for Stakeholders," 2020, p. 65, https://www.oecd-nea.org/upload/docs/application/pdf/2020-07/7530-reducing-cost-nuclear-construction.pdf
*See also* ENEC, "Quality Assurance in Action at Barakah Nuclear Energy Plant," Press Release, April 12, 2018, https://www.enec.gov.ae/news/announcements/quality-assurance-in-action-at-barakah-nuclear-energy-plant/%20and%20provided/
*See also* J. Buongiorno, J. Parsons, M. Corradini, *The Future of Nuclear Energy in a Carbon Constrained World*, An Interdisciplinary MIT Study, 2018, p. 37, https://energy.mit.edu/wp-content/uploads/2018/09/The-Future-of-Nuclear-Energy-in-a-Carbon-Constrained-World.pdf.

[10] *Ibid.*

[11] A. Morrison, "How to Build Low-Cost Nuclear: Lessons from the world," *The Centre for Independent Studies*, April 11, 2024, https://www.cis.org.au/publication/how-to-build-low-cost-nuclear-lessons-from-the-world/.

- Clear and effective contracts between parties are necessary to define project structure, leadership, risk allocation, and responsibilities, which allow projects to be executed well.

## Olkiluoto 3 (Finland)

Olkiluoto-3 (OL3) is a 1,600 MW European Pressurized Reactor (EPR), also referred to as the Evolutionary Power Reactor, constructed on Olkiluoto Island, Finland. It began construction in 2005 and achieved commercial operation in 2023.

*Ownership, financing, and support*: The OL3 project was sponsored by Teollisuuden Voima Oy (TVO), a non-profit consortium of large Finnish electric utilities and customers, including municipal utilities and industrial companies, that came together to jointly build and operate nuclear power plants. This approach is known as the "Mankala" model.[12] Under the Mankala model, each shareholder owns a portion of the plant and is entitled to a matching share of the electricity the plant produces, at cost. TVO as an entity does not make any profit; instead, it simply passes through the costs of building, running, and maintaining the plant to the owners (albeit with the EPC contractors absorbing most of the cost risk, as discussed below).

For OL3, the four TVO shareholders are a mix of entities (some of which are Mankalas themselves), including municipally owned utilities, regional energy cooperatives, and industrial energy consumers: Pohjolan Voima Oy (60.2%), Oy Mankala Ab (8.2%), EPV Energia Oy (6.6%), and Fortum Power and Heat Oy (25%), a subsidiary of majority state-owned Fortum Oyj.[13] The project was financed through a combination of equity capital and subordinated shareholder loans raised from TVO's owners, as well as external debt financing from European lenders, including a €570 million loan backed by a French export-credit guarantee administered by Coface, motivated by Areva's role in the project.[14] In 2023 and 2024, roughly coinciding with

[12] J. Korteniemi, "Mankala principle: A concept to finance large clean energy investments in Finland," Ministry of Economic Affairs and Employment, November 2018, https://www.ifnec.org/ifnec/upload/docs/application/pdf/2018-11/s3_3_fin_korteniemi.pdf. The name "Mankala model" is based on the first company, Oy Mankala Ab, to develop a hydroelectric power plant in the 1960s.

[13] TVO, https://www.tvo.fi/en/index/company/administrationandmanagement/tvogroup.html. *See also* V. Ialenti, "Mankala Chronicles: Nuclear Energy Financing and Cooperative Corporate Form in Finland," *American Nuclear Society,* December 2020, https://sppga.ubc.ca/wp-content/uploads/sites/5/2021/04/ialenti-NT-mankala.pdf.

[14] European Commission, "State aid: Commission concludes that French state guarantee for Finnish nuclear power plant operator TVO does not constitute aid," IP/07/1400, September 26, 2007, p. 1, https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_07_1400/IP_07_1400_EN.pdf.

COD, TVO issued a variety of green bonds and private placements for refinancing, including a €600 million, seven-year green bond, totaling €970 million to refinance OL3.[15]

*Risk allocation*: TVO had a contract with a consortium formed by Areva and Siemens to construct OL3 as a fixed-price turnkey project. Under the fixed-price turnkey contract model, the vendor consortium (Areva and Siemens) — not TVO — was contractually responsible for any cost overruns.[16] Areva acted as the primary EPC contractor, while Siemens was responsible for turbine systems and supporting infrastructure.[17]

*Offtake*: As noted above, each shareholder has a right to its proportionate share of output, at cost. The utility owners among them—EPV Energia Oy, Oy Mankala Ab, and Fortum Power and Heat Oy—may in turn pass the electricity and its costs onto their ratepayers, while Pohjolan Voima Oy supplies its share directly to its industrial shareholders.

*Cost Outcomes and Effects on Parties:* OL3 was originally planned to come online in 2009.[18] However, the project suffered delays and technical complications, ultimately entering commercial operation 13 years behind schedule. Estimates suggest that cost overruns of roughly €8 billion occurred.[19] It appears that these additional costs were absorbed by the vendor consortium under the contract's risk allocation terms. Siemens exited the consortium in 2011 and shortly thereafter announced its complete withdrawal from the nuclear sector.[20] Following severe financial strain exacerbated by the OL3 project, Areva Group was bankrupt by 2015.[21]

**Lessons Learned**

The Mankala model presents an interesting alternative way of financing a large infrastructure project. However, as implemented for the Olkiluoto project it only offers limited insight into opportunities to address construction risk through this structure, since in this project – and

[15] TVO, "2024 Green Bond and Notes Report," 2024, pp. 8-9, https://www.tvo.fi/material/sites/tvo/sijoittajasivut/icsrutfa1/Green_Bond_Report_2024.pdf.
[16] TVO, "2023 Report of the Board of Directors and Financial Statements," 2023, p. 9, https://www.tvo.fi/material/sites/tvo/pdft/kjqs0hi5r/TVO_Financial_Statements_2023.pdf.
[17] Areva, Finland, n.d., https://www.sa.areva.com/group-finland-the-first-country-to-operate-a-generation-iii-reactor
[18] TVO, "Olkiluoto 3—Basic Facts," 2006, p. 5, https://www.tvo.fi/uploads/File/OL3perustiedot-ENG%281%29.pdf.
[19] S&P Global Ratings, "Finnish Nuclear Producer Teollisuuden Voima Upgraded to 'BBB-' From 'BB+' on OL3 Plant Commissioning; Outlook Stable," April 26, 2023, https://www.spglobal.com/ratings/en/regulatory/article/-/view/sourceId/12714176.
[20] World Nuclear News, "Siemens quits the nuclear game," September 19, 2011, https://world-nuclear-news.org/Articles/Siemens-quits-the-nuclear-game (Accessed on December 10, 2025).
[21] The World Nuclear Industry Status Report 2023 (HTML), https://www.worldnuclearreport.org/The-World-Nuclear-Industry-Status-Report-2023-HTML.

similar to the approach observed in the Barakah project above – construction risk appears to have been borne primarily by the EPC contractors. This feature may not be replicable for First of a Kind(FOAK)/Between of a Kind (BOAK) projects in the US, with the EPC industry having now observed the hazards of accepting large portions of the cost risk in constructing several of the West's recent FOAK/BOAK projects, including Olkiluoto 3, as well as Vogtle, Flamanville 3, and Hinckley C, all reviewed below.

Debt finance constitutes a critical part of nuclear project finance. The ability to access market-rate debt with state backing along with the issuance of green bonds at project completion for re-financing reduced financing costs and helped maintain funding through extended delays.

## Vogtle 3 & 4 (Georgia, USA)

Vogtle 3 and 4 are two new Westinghouse AP1000 reactors completed in 2023 and 2024, respectively, at an existing nuclear site in Waynesboro, Georgia. These were the first nuclear reactors constructed in the U.S. in 35 years, and the new design was intended to be more modular, have a smaller footprint, and be simpler to install than prior designs.[22]

*Ownership, financing, and support*: Vogtle is owned by Georgia Power, Oglethorpe Power, MEAG Power, and Dalton Utilities, and was approved by the Georgia Public Service Commission (G-PSC) to receive regulated costs recovery from the utility ratepayers, subject to prudence reviews, and including Construction Work in Progress (CWIP) that allows recovery of costs for the project from rate papers during the construction of the project. The U.S. government guaranteed $8 billion in loans, eventually increased to $12 billion, from the Department of Energy Loans Program Office enabling low cost of capital.[23] Other federal support includes production tax credits (PTC).[24]

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[22] S. Johnson, "Plant Vogtle Unit 4 begins commercial operation," US Energy Information Administration (EIA), May 1, 2024, https://www.eia.gov/todayinenergy/detail.php?id=61963.

[23] Environmental and Energy Study Institute, "Obama Awards $8.3 Billion Loan Guarantee for First New Nuclear Plant in 30 Years," February 16, 2010, https://www.eesi.org/articles/view/obama-awards-8.3-billion-loan-guarantee-for-first-new-nuclear-plant-in-30-y;
*See also* P.W. Davidson, "Financing Vogtle: A Major Achievement for the Loan Programs Office," US Department of Energy, June 24, 2015, https://www.energy.gov/edf/articles/financing-vogtle-major-achievement-loan-programs-office;
*See also* D. Proctor, "Vogtle Loan Guarantees Praised, Criticized," *Power Magazine* , March 23, 2019, https://www.powermag.com/vogtle-loan-guarantees-praised-criticized/.

[24] Southern Company, "Georgia Power praises move by U.S. Congress to extend production tax credits for Vogtle nuclear expansion," PRNewswire, February 9, 2018, https://www.southerncompany.com/newsroom/financials/georgia-power-vogtle-production-tax-credits.html;

*Risk allocation*: This utility cost-of-service project subjected Georgia ratepayers to all prudently incurred cost overruns not absorbed by the EPC contractor. The EPC contractor, Westinghouse, initially agreed to a "substantially fixed price" agreement with Georgia Power to "design, engineer, procure, construct, and test" the two units. In March 2017, after Westinghouse filed for bankruptcy, the agreement was restructured so that Westinghouse would provide "facility design and engineering services, procurement and technical support and staff augmentation on a time and materials basis."[25]

*Cost Outcomes and Effects on Parties:* The project was originally estimated at $14 billion for the two reactors, with planned online dates of 2016 and 2017 for Units 3 and 4, respectively. After repeated cost increases and several years of delays, the project ended up with an installed cost of approximately $35 billion (2023$).[26] Multiple factors contributed to these outcomes, particularly those related to design readiness, supply-chain immaturity, and FOAK complexity. Years into construction, Westinghouse, the original EPC contractor and designer, filed for bankruptcy after incurring billions in losses on the Vogtle and V.C. Summer projects. Toshiba, the parent company of Westinghouse, paid out about $3.7 billion.[27] The bankruptcy of Westinghouse caused further delays and cost increases, which were only partially covered by the guaranteed payout from Toshiba. This event also triggered additional oversight from the G-PSC, resulting in a cost recovery cap for Georgia Power, a reduced allowed return on equity during construction, and additional stipulations on the companies' returns should the project continue to miss milestones and cost targets.[28] The cost cap caused Georgia Power to have to absorb several billion dollars of the costs, however the majority of the cost remained paid for by customers.

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*See also* Southern Company, "2024 Annual Report," April 1, 2025, p. 39, https://s27.q4cdn.com/273397814/files/doc_financials/2023/ar/2024-annual-report.pdf; *See also* Congressional Research Service (congress.gov), "Nuclear Power Tax Credits," June 4, 2025, https://www.congress.gov/crs-product/IN12557.

[25] Oglethorpe Power Corporation, "Form 10-Q," September 30, 2019, p. 25, https://www.sec.gov/Archives/edgar/data/788816/000104746919006284/a2240034zf1_10-05.pdf.

[26] K. Shirvan, "2024 Total Cost Projection of Next AP1000," MIT Center for Advanced Nuclear Energy Systems, MIT-ANP-TR-201, July 2024, https://web.mit.edu/kshirvan/www/research/ANP201%20TR%20CANES.pdf.

[27] Toshiba, "Toshiba Completes Full and Early Payment of Guarantee Obligations for the Vogtle Nuclear Power Plant Project in Georgia, U.S.A," News Release, December 14, 2017, https://www.global.toshiba/ww/news/corporate/2017/12/pr1401.html.

[28] Georgia Public Service Commission, "PSC's Public Interest Advocacy Staff and Georgia Power Reach Agreement on Vogtle Prudency Review," Press Release, August 30, 2023, https://psc.ga.gov/site/assets/files/7668/media_advisory_8_30_23_vogtle_prudency_stipulation.pdf

**Lessons Learned**

The cost overrun experienced by Vogtle has been studied intensively by stakeholders and industry experts. The takeaways from those analyses focus on several major factors, some attributable to project management inherent to building a FOAK reactor design in an eroded U.S. nuclear industry following a 35-year hiatus in construction.[29] The key factors contributing to Vogtle's cost overruns and delays are understood to be:

- *Constructing without a complete design*: A critical issue at Vogtle was the decision to begin construction without a fully complete and validated EPC design. Starting construction with an incomplete design, especially for FOAK technologies, greatly increases the risk of cost overruns and schedule delays. This resulted in substantial additional reworking and construction issues during development.
- *Poor project management*. Technology provider Westinghouse also took on roles in respect of EPC and project development with insufficient experience in these areas.
- *Difficulty hiring enough workers* with necessary skills, as there were very limited trained workers with experience in nuclear development and construction.
- *Reliance on immature or eroded suppliers*, due to the lack of proven nuclear supply chains. The project relied on adapting existing, non-nuclear factories, primarily that served the oil and gas industry, which led to quality issues and repeated rework.
- *Limited experience* across both the project developer and the broader U.S. nuclear industry, resulted in design immaturity, supply-chain failures, and labor productivity problems that caused delays and cost increases. [30]

Vogtle also illustrates challenges in allocating risks among parties and offers lessons in this respect. Although the EPC contractor was supposed to provide a largely fixed-price result, their limited ability to absorb cost overruns left other parties exposed. EPC contractors should share in cost overrun risks, but allocating a disproportionate share to them may simply require other parties to step in at a later stage. Transparency on a realistic allocation of such risk between all parties, including ratepayers or taxpayers is important.

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[29] R. Spangler, S. Qin, et al., "Potential Cost Reduction in New Nuclear Deployments Based on Recent AP1000 Experience: Systems Analysis & Integration Campaign," INL/RPT-25-84701, Prepared for U.S. Department of Energy Systems Analysis & Integration Campaign, June 12, 2025, p. 39, https://sai.inl.gov/content/uploads/29/2025/06/M3_SAI-AP1000_Lessons_Rev6-nocomments-002.pdf.

[30] *Id.,* p. 35

## Flamanville 3 (France)

Flamanville 3 is a 1,600 MW EPR reactor in Normandy, France, launched in 2007 by France's Électricité de France (EDF) and completed in December 2024.[31]

EDF financed Flamanville 3 completely through their corporate balance sheet with an initial expected cost of €3.3 billion (2007€). EDF had successive capital raises which were used to fund Flamanville 3, among other corporate activities. Additionally, Italy's Enel was an equity investor for 12.5% ownership of Flamanville 3; however, Enel terminated its participation in 2012.[32] While the project was developed on the balance sheet of EDF using corporate debt and equity, the French government was the ultimate financial backstop given its majority ownership in both EDF and Areva (100% in EDF since 2023).

*Cost Outcomes and Effects on Parties:* Similar to other projects with FOAK EPR designs, the project encountered delays and cost overruns. Cost overruns appear to have been fully borne by EDF and, with EDF being owned by the French government, in turn were likely ultimately borne by France as a public cost.

**Lessons Learned**

Flamanville 3 illustrates the risk of pursuing a FOAK nuclear project, particularly in the absence of a strong supply chain or recent construction experience. This project therefore emphasizes the importance of the best practice lessons noted above in respect of the Vogtle project.

Indeed, France's new Evolutionary Power Reactor 2 (EPR2) program for a series of six new reactors beginning construction in 2028 builds on lessons from Flamanville 3. The new program features simplified plant design, workforce development, and commitment to a pipeline of projects at existing nuclear sites. Further, the projects' economics will be supported by low-interest government loans and by revenue guarantees through Contract for Differences (CfD)

[31] EDF, "Update on the Flamanville EPR: the reactor produces its first electrons on the national electricity grid," December 21, 2024, https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/update-on-the-flamanville-epr-the-reactor-produces-its-first-electrons-on-the-national-electricity-grid (Accessed on December 11, 2025);
*See also* EDF, "Construction of Flamanville EPR begins," *World Nuclear News*, December 4, 2007, https://www.world-nuclear-news.org/Articles/Construction-of-Flamanville-EPR-begins (Accessed on December 11, 2025).

[32] Enel, "Enel and EDF Terminate their Cooperation on EPR in France," Press Release, December 4, 2012, https://www.enel.com/media/explore/search-press-releases/press/2012/12/enel-and-edf-terminate-their-cooperation-on-epr-in-france (Accessed on December 11, 2025).

whose costs will be allocated to customers.[33]

## B.2 Projects Under Development

This section addresses three Western nuclear projects under construction, presented in order of planned online date: Hinkley Point C and Sizewell C in the United Kingdom (UK), and Ontario Power Generation (OPG) Darlington in Ontario, Canada.

### Hinkley Point C (United Kingdom)

The Hinkley Point C (HPC) project is adding two new 1,600 MW EPR large light-water reactors in Somerset, England, with an expected online date between 2029 and 2031. Progress is being closely watched as the first nuclear project in the UK since the 1980s.

The HPC project is essentially an independent power producer (IPP) project supported by a long-term CfD revenue contract offered by the UK government on behalf of ratepayers. The project is led by France's EDF as constructor and majority owner, originally with a 66.5% stake, and China's General Nuclear Power Corporation (CGN), as a 33.5% minority investor.[34] Other than the CfD, there were no UK government subsidies or loan guarantees for HPC. EDF funded Hinkley Point C on its balance sheet, utilizing corporate-level debt rather than project-financed debt.

Under the fixed CfD structure, cost overrun responsibility was completely allocated to the owners. In reality, both EDF and CGN were nationally owned by France and China, respectively, placing the overrun risk indirectly on those governments.

Construction formally began in 2017. The first unit was expected to be operational in 2025; however, similar to other FOAK EPR projects, HPC has encountered delays and is expected to be online between 2029 and 2031.[35] Expected costs increased due to engineering and planning delays resulting from regulatory differences between France and the UK, from labor and material shortages, from inflation, and other impeding factors. To support the completion of Hinkley

[33] R. Gaster, "Lessons from France's Nuclear Program," prepared for Information Technology & Innovation Foundation Center for Clean Energy Innovation, September 2025, pp. 6-8, https://www2.itif.org/2025-french-nuclear-lessons.pdf.

[34] EDF Hinkley Point C Media Team, "Agreement for construction of HPC nuclear power station," Press Release, October 21, 2015, https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/news-views/agreements-in-place (Accessed December 10, 2025).

[35] EDF, "Hinkley Point C Update," January 23, 2024, https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/hinkley-point-c-update-1 (Accessed on December 10, 2025).

Point C as delays and overruns continue, Apollo Global, a US-based asset management firm, announced in June 2025 that it would provide £4.5 billion in financing, likely as unsecured debt with an interest rate near 7%.[36]

CGN halted equity contributions to the project in late 2023 after cost overruns reached a threshold that contractually allowed it to cap its investment and after the UK government decided to take over its share in Sizewell C.[37] Consequently, EDF has had to cover remaining overruns, which will grow their equity share beyond 66.5% as overruns continue.

**Lessons Learned**

The Hinkley project indicates that government revenue support, in this case in the form of a CfD arrangement, offers an important foundation for financial viability of a FOAK advanced nuclear projects.

While the UK government does not seem to have taken on significant risk beyond such revenue support, the experience from this project and other projects discussed further above shows that allocation of risks largely to a single party – in this case and as with Flamanville, EDF – does not appear sustainable as an approach for future projects. The UK, EDF, and the industry appear to have learned that the next projects are more likely to be viable with alternative financing and risk-sharing approaches, rather than allocating all construction cost risk to the owner and/or EPC contractor.[38] This lesson was embodied in the very different approach to the subsequent Sizewell C project (see below).

## Sizewell C (United Kingdom)

Sizewell C is pair of 1,600 MW EPRs under construction since January 2024 at an existing nuclear power station on the Suffolk coast in the UK, with expected completion in the mid-to-late 2030s. The project is physically similar to HPC, using the same reactor technology and design specifications. However, the project aims to benefit from the lessons learned during HPC's

[36] Reuters, "Apollo to fund UK's Hinkley Point nuclear project with $6 billion loan," June 20, 2025, https://www.reuters.com/business/apollo-provide-6-billion-funding-uks-hinkley-point-nuclear-project-ft-reports-2025-06-20/ (Accessed on January 8, 2026).

[37] F. de Beaupuy, "China's CGN Halts Funding for UK's Hinkley Nuclear Plant," *Bloomberg,* December 14, 2023, https://www.bloomberg.com/news/articles/2023-12-13/hinkley-point-nuclear-plant-in-uk-stops-getting-funding-from-china-s-cgn (Accessed on December 11, 2025).

[38] UK National Audit Office, "Hinkley Point C," Report by the Comptroller and Auditor General, HC 40 SESSION 2017-18, June 23, 2017, p 1, ¶ 16, https://www.nao.org.uk/wp-content/uploads/2017/06/Hinkley-Point-C.pdf.

development and construction and has accordingly taken a different approach to the business model and public support mechanisms.

Government financial support for Sizewell C has been more involved and active in the development and construction phases than it was for HPC. The UK government is taking an initial 44.9% equity stake, as the largest shareholder in the project, alongside La Caisse (20%), Centrica (15%), EDF (12.5%), and Amber Infrastructure (7.6%).[39] Debt was raised from the UK's National Wealth Fund.[40] The government has also designated the project as a low-carbon, sustainable asset that has made it eligible for green financing, which allowed the project to secure a £5 billion debt facility through BpifranceAE.[41]

The project is being developed under the UK's new Regulated Asset Base (RAB) model. The RAB model allows the project owners to earn a regulated return on investment, with customer rates adjusted accordingly for any cost overruns deemed prudent by the Office of Gas and Electricity Markets (Ofgem), the UK regulator.[42] Owners are allowed to earn a return on investment during construction, which spreads lower payments out over more years. Payments are funded by charges to electricity "suppliers" (comparable to our load-serving entities) that then pass those costs to consumers.

**Lessons Learned**

The Sizewell C model is still in the early stages of development and construction. However, the project demonstrates how early, direct public involvement and the new RAB model de-risks construction enough to enable partial inclusion of private capital. This risk sharing approach contrasts with the Hinkley Point C project where a majority of the risk was borne by the developer.

[39] UK Department for Energy Security and Net Zero, The RT Hon Rachel Reeves MP, and The RT Hon Ed Miliband MP, "Sizewell C gets green light with final investment decision," Press Release, July 22, 2025, https://www.gov.uk/government/news/sizewell-c-gets-green-light-with-final-investment-decision.

[40] National Wealth Fund, "National Wealth Fund backs UK nuclear ambitions with milestone Sizewell C financing," News Release, July 22, 2025, https://www.nationalwealthfund.org.uk/news-and-publications/news/national-wealth-fund-backs-uk-nuclear-ambitions-with-milestone-sizewell-c-financing/.

[41] Sizewell C, "Sizewell C reaches Financial Close, with £5 Billion export credit backed debt raise and strong investment grade credit rating," News Release, November 4, 2025, https://www.sizewellc.com/news-views/sizewell-c-reaches-financial-close-with-5-billion-export-credit-backed-debt-raise-and-strong-investment-grade-credit-rating/ (Accessed on December 11, 2025).

[42] Ofgem, "Guidance: Our approach to the Economic Regulation of Sizewell C," August 20, 2025, ault/files/2025-08/Our-approach-to-the-Economic-Regulation-of-Sizewell-C.pdf.

## OPG Darlington (Canada)

Darlington Nuclear Project, led by the OPG utility, will deploy the first GE-Hitachi BWRX-300 small modular reactor (SMR) at the existing Darlington Nuclear Generating Station east of Toronto. OPG plans to build four BWRX-300 SMRs, for a combined 1,200 MW of new capacity. OPG began site preparation work in late 2022 and received its license to construct the first unit in 2025.[43] The first reactor is targeted to be in service by the end of 2029, with the remaining three reactors planned to come online in the mid-2030s.[44]

At least the first of these SMRs is being financed, and will be owned and operated, by OPG, a provincial Crown Corporation. The project will be largely funded by debt and equity investments from the Governments of Canada and Ontario. OPG plans to finance the remaining project costs through internal cash flow, corporate debt, and other capital raised shareholders and green bonds. Financing arrangements for the subsequent units are still in development.

The Darlington SMR project financing is supported by the promise of cost recovery through a regulated-utility model, in which approved capital expenditures will ultimately be recovered through electricity rates. There is also a proposal at the Ontario Energy Board (OEB) to establish the Concurrent Cost Recovery mechanism to allow OPG to recover debt interest during the construction period, along with indication from the Province that they will continue to develop ways to "minimize ratepayer impacts and identify additional sources of cash to ensure sufficient funds are available to finance these projects."[45]

For the construction of Darlington, OPG, GE Vernova Hitachi, SNC-Lavalin, and Aecon are employing an Integrated Project Delivery model, in which the four entities each fill a distinct role in the project development, aiming to streamline decision making and reduce risk. OPG is the licence holder and bears the overall responsibility for the project; GE Vernova Hitachi is the technology developer responsible for design, engineering, and procurement of major components; SNC-Lavalin is the architectural engineer; and Aecon is responsible for construction.[46] OPG has already been working with SNC-Lavalin and Aecon on the ongoing

[43] "Canada greenlights Darlington SMR construction," *Nuclear Engineering Magazine,* April 2025, https://www.neimagazine.com/news/canada-approves-bwrx-300-construction/.

[44] Ontario Power Generation (OPG), "2023 Integrated ESG and Annual Report," p. 25, https://www.opg.com/reporting/integrated-esg-and-annual-report/.

[45] OPG, "OPG Management's Discussion and Analysis 2025 Third Quarter Report," November 11, 2025, p. 17; *See also* Environmental Registry of Ontario, "Regulatory amendments to support financing for Ontario Power Generation's major nuclear projects," updated May 12, 2025, https://ero.ontario.ca/notice/025-0501.

[46] S.C. Patel, "Canada Approves First Grid-Scale SMR Construction at Darlington," Nuclear, *Power Magazine*, April 10, 2025, https://www.powermag.com/canada-approves-first-grid-scale-smr-construction-at-darlington.

Darlington refurbishment project. It is not clear from public documents how the specific roles each party plays in project delivery apply to cost sharing and financial responsibility.

**Lessons Learned**

OPG has emphasized that the design leverages simplified systems and modular construction techniques intended to reduce the risk profile relative to large traditional reactors.[47] The project is intended to serve as a FOAK commercial deployment that can provide a basis of learning for successive reactors within the project, then beyond to future SMRs in Ontario and other provinces. OPG has referenced significant learnings from the refurbishment of the existing Darlington nuclear units, including continuing to work with the same construction and architectural engineering partners. They intend to build the four SMR reactors sequentially so that the experience and learnings from each unit can be applied to the construction of subsequent reactors.[48] This approach is consistent with the evidence from other multi-reactor projects which have demonstrated cost and timeline savings across the construction of reactors within a project.[49] It appears that to date the project is largely on time and on budget, emphasizing the opportunity for future projects to tackle the issue of risk primarily through best practice approaches to reduce the amount of risk, which in turn would be expected to help with the adoption of a structure for sharing remaining risk among the project parties.

This project does not appear to offer significant lessons or different approaches on the topic of risk sharing beyond those already observed for other projects discussed above. The OPG project relies on finance from and risk allocation to primarily a single source, in this case a combination of public backing from the Canadian federal government, the Ontario government and OPG and its ratepayers. Contrary to the Sizewell C project, private sector finance has not been included to a significant extent.

Issuance of green bonds should be highlighted as a potentially significant financing opportunity that can be observed also in a number of other projects discussed further above.

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[47] OPG, "DNNP Construction License Application, October 2022," pp. 37-38. https://www.cnsc-ccsn.gc.ca/eng/reactors/new-reactor-power-plant-projects/new-reactor-power-plant-facilities/darlington-new-nuclear-project/

[48] A. Hunt, "Canada's first SMR project: How is CAD20.9 billion cost calculated?," *World Nuclear News*, May 23, 2025, https://world-nuclear-news.org/articles/what-is-the-budget-for-canadas-first-smr-project.

[49] Organisation for Economic Co-Operation and Development (OECD) and Nuclear Energy Agency (NEA), Nuclear Technology Development and Economics, "Unlocking Reductions in the Construction Costs of Nuclear: A Practical Guide for Stakeholders," 2020, p. 65, https://www.oecd-nea.org/upload/docs/application/pdf/2020-07/7530-reducing-cost-nuclear-construction.pdf.

## Terrapower/Kemmerer (Wyoming, USA)

Kemmerer Power Station Unit 1 is a first-of-its-kind 345 MW Natrium Demonstration Reactor, a sodium-cooled fast reactor with an integrated molten-salt thermal storage system that can enable up to 500 MW of output for over 5.5 hours.[50] The project is located near Kemmerer, Wyoming, adjacent to PacifiCorp's retiring Naughton coal plant. As the first reactor built by TerraPower and the first non-light-water nuclear reactor in the Western Hemisphere to progress from design toward construction, Kemmerer serves as a first-of-a-kind proof-of-concept for both the design and for the novel High-Assay Low-Enriched Uranium (HALEU) fuel.[51] Preliminary non-nuclear construction activities began in June of 2024, and construction of the nuclear island began in April 2026 shortly after the Nuclear Regulatory Commission (NRC) issued a construction permit in March, 2026.[52] The project is planned to come online in 2031.[53]

To fund the construction of the Kemmerer I, the project is receiving $2 billion in grants from the Department of Energy (DOE) Advanced Reactor demonstration Program (ARDP) after being selected through a competitive solicitation process. A further $2 billion in funding is coming from TerraPower and its partners.[54] It appears that the equity investors will be responsible for any cost overruns, although no specific information on risk allocation has been identified.

While the plant will provide power to PacifiCorp customers, there is not currently an agreement for any cost recovery of the project cost from ratepayers, and it appears that the plant will be owned by TerraPower and sell power to PacifiCorp**.**

[50] S.C. Patel, "Kemmerer 1—TerraPower's Pioneering Fourth-Generation Nuclear Project—Hits Key NRC Milestone Ahead of Schedule," Nuclear, *Power Magazine*, February 27, 2025, https://www.powermag.com/kemmerer-1-terrapowers-pioneering-fourth-generation-nuclear-project-hits-key-nrc-milestone-ahead-of-schedule/.

[51] TerraPower, Wyoming, "The Natrium Reactor is more than an idea", https://www.terrapower.com/wyoming/

[52] TerraPower, "TerraPower Begins Construction on Advanced Nuclear Project in Wyoming". June 10, 2024, https://www.terrapower.com/terrapower-begins-construction-in-wyoming;
*See also* S.C. Patel, "Kemmerer 1 Breaks Ground: A Look at TerraPower's Natrium Fast Reactor Nuclear Power Plant," Nuclear, *Power Magazine*, June 13, 2024, https://www.powermag.com/kemmerer-1-breaks-ground-a-look-at-terrapowers-natrium-fast-reactor-nuclear-power-plant/;
*See also* TerraPower, "TerraPower Commences Construction on America's First Utility-Scale Advanced Nuclear Power Plant". April 23, 2026, https://www.terrapower.com/TerraPower-Commences-Construction-on-Americas-First-Utility-Scale-Advanced-Nuclear-Power-Plant.

[53] S.C. Patel, "Kemmerer 1—TerraPower's Pioneering Fourth-Generation Nuclear Project—Hits Key NRC Milestone Ahead of Schedule," Nuclear, *Power Magazine*, February 27, 2025, https://www.powermag.com/kemmerer-1-terrapowers-pioneering-fourth-generation-nuclear-project-hits-key-nrc-milestone-ahead-of-schedule/.

[54] TerraPower, "Natrium: The Plant". https://www.terrapower.com/natrium/.

**Lessons Learned**

The development and funding structure of Kemmerer I is largely motivated by the opportunity to demonstrate the deployment of the new reactor technology from a new company, with the expectation that additional opportunities at other sites will follow.

The project is still in early stages of construction and regulatory review, but it offers some early insights into how developers of advanced reactors are attempting to mitigate construction risk. Aiming to mitigate supply chain risk, TerraPower is establishing two separate supply chains: one regulated under NRC nuclear-quality requirements for reactor components, and a broader commercial-grade supply chain for balance-of-plant systems, including the thermal storage and power conversion systems. Additionally, the Natrium design's low-pressure cooling system expands the pool of potential suppliers by avoiding the high-pressure nuclear-grade component constraints, which is expected to help reducing supply chain risks.[55] Since the project is still in early stages of development, it remains uncertain how effective these strategies will be in preventing cost increases and delays.

As a model of sourcing finance and sharing construction-related risks, this project is unlikely to be replicable, since it relies on federal funding from a program that is currently not available for further projects as well as Terrapower's own funding backing from Bill Gates, which may have been provided on terms that would also not be available for subsequent projects.

## Doicești (Romania)

The Doicești SMR project aims to install six 77 MW NuScale SMRs (totalling 462MWe of capacity) at the site of a decommissioned coal plant in Doicești, Romania. The Doicești project is jointly owned and equity financed by Nuclearelectrica (Romania's state-owned nuclear plant operator), Nova Power and Gas, and South Korea's DSPE Beta private equity fund.[56] Debt financing will be provided via $4 billion of loans from the U.S. International Development

[55] S.C. Patel, "Kemmerer 1—TerraPower's Pioneering Fourth-Generation Nuclear Project—Hits Key NRC Milestone Ahead of Schedule," Nuclear, *Power Magazine*, February 27, 2025. https://www.powermag.com/kemmerer-1-terrapowers-pioneering-fourth-generation-nuclear-project-hits-key-nrc-milestone-ahead-of-schedule/.

[56] Nuclearelectrica, "DSPE to invest EUR 75 million in RoPower to develop the Doicesti SMR Power Plant in Romania," Press Release, July 5, 2013, https://nuclearelectrica.ro/snn/en/2023/07/05/dspe-to-invest-eur-75-million-in-ropower-to-develop-the-doicesti-smr-power-plant-in-romania/.

Finance Corporation (DFC) and Export-Import Bank (EXIM), covering the majority of the $7 billion in expected total project costs.[57]

On February 13, 2026, Nuclearelectrica announced that it had reached a Final Investment Decision (FID) on the Doicești project.[58] While Nuclearelectrica's FID has been reached, it is unclear whether other equity investors have reached the same decision point. Moreover, DFC and EXIM have only issued letters of credit to date and have yet to determine the exact loan structures and terms with the project company.

**Lessons Learned**

Information currently publicly available on this project does not allow lessons to be learned. Details on the financing arrangements will be of interest but are not currently available. However, the reference to debt funding by export banks or agencies highlights a potentially important opportunity to access financing or support from these types of organizations where a project would consider using a foreign nuclear technology.

# B.3 Select US Federal and State Programs

## DOE First Mover Team Support & Fast Follower Deployment Support

In March 2025, the US DOE reissued a solicitation for $900 million in funding to facilitate development and deployment of FOAK Gen III+ SMRs.[59] The solicitation included two tiers of funding:

- **Tier 1 First Mover Team Support:** $800 million for up to two consortium bids to develop a first-of-a-kind grid-scale Gen III+ SMR plant that is "reliable, licensable,

[57] U.S. Department of State, Office of the Spokesperson, "The United States and Multinational Public-Private Partners Look to Provide Up To $275 Million to Advance the Romania Small Modular Reactor Project; United States Issues Letters of Interest for Up To $4 Billion in Project Financing," Media Note, May 20, 2023, https://2021-2025.state.gov/the-united-states-and-multinational-public-private-partners-look-to-provide-up-to-275-million-to-advance-the-romania-small-modular-reactor-project-united-states-issues-letters-of-interest-for-up-to/; *See also* Reuters, "Planned SMR nuclear power plant to cost $6-7 billion, Romanian PM says," February 13, 2026, https://www.reuters.com/business/energy/planned-smr-nuclear-power-plant-cost-6-7-billion-romanian-pm-says-2026-02-13/.

[58] Nuclearelectrica, "The Doicești Small Modular Reactors (SMR) project obtains the Final Investment Decision and enters the third stage of development," Press Release, February 12, 2026, https://nuclearelectrica.ro/snn/en/2026/02/12/the-doicesti-small-modular-reactors-smr-project-obtains-the-final-investment-decision-and-enters-the-third-stage-of-development/.

[59] U.S. Department of Energy, Office of Nuclear Energy, "$900 Million Available to Unlock Commercial Deployment of American-Made Small Modular Reactors," March 24, 2025, https://www.energy.gov/ne/articles/900-million-available-unlock-commercial-deployment-american-made-small-modular-reactors.

commercially viable, financeable, and [has] a demonstrated path towards a multi-reactor orderbook."[60] Awardees' consortiums must include, at minimum, a U.S.-based Gen III+ SMR technology vendor and a U.S.-based EPC contractor.

- **Tier 2 Fast Follower Deployment Support**: $100 million for design, licensing, supply chain, and site preparation work for additional Gen III+ SMR deployments.

On December 2, 2025, the Tennessee Valley Authority (TVA) and Holtec were each awarded $400 million of Tier 1 grants.[61] Both awardees are currently in discussion with the DOE on project milestones and the distribution of grant funding.[62] TVA received its grant to support a GE BWRX-300 SMR at the Clinch River site in Tennessee, while Holtec's grant supports two SMR-300 reactors at the Palisades Nuclear Generating Station in Michigan.[63, 64]

On May 14, 2026, the DOE announced the selection of eight companies to be awarded funding under Tier 2.[65] Two of the eight were selected for SMR site selection and permitting: Constellation ($17 million) and Nebraska Public Power District ($28 million). NYSERDA was an application partner with Constellation seeking the funding to support efforts on early site permits for deployment of advanced reactors at Nine Mile Point Clean Energy Center.[66] The remaining six companies received roughly $49 million in funding for SMR supply chain development across the country.

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[60] FedConnect, "Generation III+ Small Modular Reactor Pathway to Deployment, BAA Solicitation No. DE-FOA-0003485," p. 18, https://www.fedconnect.net/FedConnect/default.aspx?ReturnUrl=%2fFedConnect%2f%3fdoc%3dDE-FOA-0003485%26agency%3dDOE&doc=DE-FOA-0003485&agency=DOE.

[61] U.S. Department of Energy, "Energy Department Selects TVA and Holtec to Advance Deployment of U.S. Small Modular Reactors," December 2, 2025, https://www.energy.gov/articles/energy-department-selects-tva-and-holtec-advance-deployment-us-small-modular-reactors.

[62] Tennessee Valley Authority, "U.S. Department of Energy Selects TVA to Advance Next-Gen Nuclear Energy," Media Release, December 2, 2025, https://www.tva.com/news-media/releases/u.s.-department-of-energy-selects-tva-to-advance-next-gen-nuclear-energy.

[63] *Ibid.*

[64] Holtec International, "Holtec Receives Coveted "Tier 1 First Mover Award" from the USDOE to Accelerate Deployment of its Dual-Unit SMR-300 Plant at the Company's Palisades Energy Site," December 2, 2025, https://holtecinternational.com/hh-40-24/.

[65] U.S. Department of Energy, "Energy Department Awards $94 Million to American Companies to Help Expedite the Deployments of Small Modular Reactors in the United States," May 14, 2026, https://www.energy.gov/articles/energy-department-awards-94-million-american-companies-help-expedite-deployments-small.

[66] Constellation, "New York Joins Constellation in Pursuit of Energy Department Funding for Advanced Nuclear Reactor," Press Release, January 15, 2025, https://www.constellationenergy.com/news/2025/new-york-joins-constellation-in-pursuit-of-energy-department-funding-for-advanced-nuclear-reactor.html.

**Lessons Learned**

While the award of Tier 1 grants to two projects can be expected to increase the likelihood that these projects can be financed successfully, they do not appear to include an incremental federal contribution to construction risk sharing. Details on the wider finance and risk sharing arrangements for these projects are not yet publicly known. It also remains to be seen whether these one-time federal contributions can help to drive a broader pipeline. As it stands, this federal program is not accepting further applications from other projects. Accordingly, the impact of this program in driving a sustainable business model may be limited.

## Texas Early Development Grants

In June 2025, Texas enacted House Bill 14, establishing the Texas Advanced Nuclear Energy Office (TANEO) and creating a $350 million Advanced Nuclear Development Fund.[67] The initiative is designed to incentivize the early stages of advanced reactor development within the state. The program provides cost-sharing grants to reimburse up to 50% of eligible expenditures. There are two tiers of support available through the fund:[68]

- Grants for 50% of expenses for project and supply chain development, including technology development, feasibility studies, front-end engineering design, site and environmental characterization, early site permit work, fuel processing and manufacturing, and developing manufacturing capacity and readiness, up to a maximum of $12.5 million.
- Grants for 50% of expenses for construction readiness, including expenses for regulatory review, procurement of long-lead components, and construction activities related to manufacturing, fabrication, installation, or testing of advanced reactors, up to a maximum of $120 million.

**Lessons Learned**

Without any projects having yet been selected, it is too early to assess lessons learned. Yet it is instructive to consider that the Texas Advanced Nuclear Reactor Working Group recommended the creation of a nuclear energy fund "to overcome the funding valley project developers face in

[67] *See* H.B. No. 14 (as enrolled). Governor Abbott signed the legislation on June 20, 2025 with an effective date of September 1, 2025;
Texas Advanced Nuclear Energy Office, "Texas Advanced Nuclear Energy Office". https://gov.texas.gov/taneo.

[68] *Id.,* at Sec. 483.203 "Project Development and Supply Chain Reimbursement Program" and Sec. 483.204 "Advanced Nuclear Construction Reimbursement Program".

Texas."[69] They note that some states have created some form of public funding available to nuclear developers, "recognizing the chasm between regulatory uncertainty and early project financing for novel ANRs as well as the imminent need for clean, firm, reliable energy."[70]

The structure of the program highlights that government support might be beneficial in catalyzing project development at the pre-construction phase—where capital can be difficult to raise but essential for ensuring project success. The Texas model indicates ways to address early-stage project risks through government support. It can help advance projects to the next stage but without anyone having to yet commit to the entire cost of a nuclear plant. However, it remains to be seen whether the lack of clarity on any support Texas may offer for construction or operation may hamper the success of the program.

## B.4 Selected Government Programs Abroad

### Sweden

In May 2025, the Swedish government adopted a financing framework aimed at enabling the development of approximately 5,000 MW of new nuclear generation by 2045.[71] This effort is nominally technology neutral but is expected to focus on Gen III+ and potentially SMRs.

The objectives of the financing framework are to reduce financing costs, expand access to capital for early projects, and ensure that consumers share in potential upside as well as downside risks. Government support is provided in three ways: government loans, CfDs, and risk sharing and profit mechanisms.[72]

*Ownership and financing*: To lower the cost of debt financing and the project's overall cost of capital, the Swedish government will provide subsidized, low-interest loans for significant

[69] Texas Advanced Nuclear Reactor Working Group, "Deploying a World-Renowned Advanced Nuclear Industry in Texas: Considerations and Recommendations for Action". November 2024, p. 23, https://gov.texas.gov/uploads/files/press/TANRWG_Advanced_Nuclear_Report_v11.17.24c_.pdf.

[70] *Id*., p. 8.

[71] Government Offices of Sweden, Ministry of Climate and Enterprise, Ministry of Finance, "Legislation to enable applications for state aid for investments in new nuclear power," Press Release, June 27, 2025, https://www.government.se/press-releases/2025/06/legislation-to-enable-applications-for-state-aid-for-investments-in-new-nuclear-power/ (Accessed on December 16, 2025).

[72] Government Offices of Sweden, "How the support model for financing new nuclear energy works," updated June 26, 2025, https://www.government.se/government-policy/nuclear-financing/how-the-support-model-for-financing-new-nuclear-energy-works;
*See also* Government Bill 2024/25:150, "Financing and risk-sharing for investments in new nuclear power," March 27, 2025. https://www.government.se/globalassets/government/dokument/finansdepartementet/nuclear-financing-temasida/financing-and-risk-sharing-for-investments-in-new-nuclear-power.pdf

portions of the costs to construct new nuclear reactors. The amount of subsidized loans available will depend on the terms of each project and can be increased (even disproportionately) in the event of cost overruns. Loans are available even before construction begins for project planning and preparatory measures.[73] All government loans will begin to be repaid once the facility reaches commercial operation and must be fully repaid within the project operational life. Once the plant is operational, the government may increase the interest rate on the loans to incentivize refinancing the project with market-rate loans.

*Offtake*: The Swedish government will also provide CfDs to operational reactors to guarantee revenue support. The CfDs will provide predictable earnings that will incentivize private investment in the construction and operation of the facilities that might otherwise be uncertain about entering into the project. The CfDs can be denominated on either a production (per MWh) basis or a capacity basis assuming a predetermined reference capacity factor and average market price. While the exact financing of the CfDs is still under consideration, it is understood that the costs will be borne by customers (and potential compensation passed through to customers if the strike price is below market prices).

*Risk Allocation*: Complementing government loans and CfDs is a specific risk- and profit-sharing mechanism. The terms of the government loans and CfDs can be altered based upon the private entities' return. If their return, measured by the internal rate of return (IRR) on invested equity in the project company, is below a predetermined minimum, then the government may make the terms of their support more favorable (e.g., lower interest rate on loans or higher CfD strike price). If the return is above a predetermined maximum, then the government may tighten the terms (e.g., increase interest rates or lower the strike price). After the loan and CfD terms have expired, it is possible that the Swedish government may require lump-sum transfers if the project company realizes excessive returns (which is defined between the project company and the central government).

In addition to the broader financing framework, the Swedish government has also proposed direct state equity participation in an early SMR project company. Under Government Bill 2026/26:99, the government would acquire a 60 percent ownership and voting share in Videberg Kraft AB, a newly formed company intended to develop approximately 1,500 MW of

[73] Government Bill 2024/25:150, "Financing and risk-sharing for investments in new nuclear power," March 27, 2025, p. 25. https://www.government.se/globalassets/government/dokument/finansdepartementet/nuclear-financing-temasida/financing-and-risk-sharing-for-investments-in-new-nuclear-power.pdf

new nuclear reactors.[74] The government claims that majority state ownership is necessary because the existing owners cannot absorb the project's expected debt without impairing their creditworthiness in a way that could prevent the project from proceeding. The proposal authorizes an initial capital injection of up to SEK 1.8 billion (approx. $190 million) in 2026–2027 and additional commitments of up to SEK 34.3 billion (approx. $3.6 billion) to support capital injections or ownership adjustments through project implementation.

**Lessons Learned**

The Swedish government determined that "to enable investment in new nuclear reactors at a reasonable cost in order to generate electricity, a specifically adapted form of aid is needed that addresses the risks surrounding investment in new nuclear power."[75] They note that developer profitability is highly uncertain given potential overrun risk, and that risk-sharing mechanisms by the government are necessary to reduce the cost of building and operating successful nuclear projects.

The innovative risk-sharing mechanism is somewhat modeled on incentive-based rates for cost-of-service regulated utilities. Unlike a simple cost-sharing grant, it more definitively limits investor risk by promising upfront that it will earn at least a minimum IRR on costs related to negotiated terms between the developer and the government; and the collar on realized IRRs also provides upside to the public. Such a mechanism would necessarily entail, however, an open-book examination of costs and prudence reviews.

The proposed equity ownership in Videberg Kraft AB suggests that even substantial loan and revenue-support mechanisms may be insufficient where early nuclear projects create balance-sheet or creditworthiness constraints for project owners. Direct state equity participation therefore can function as an additional de-risking tool.

## South Korea

South Korea has been one of the world's most active nuclear energy producers over the past few decades, now with 25.6 GW of nuclear capacity across 26 reactors, and an additional 2.7 GW

[74] Bill 2025/26:99, "1:17 Capital injections in state-owned enterprises – Videberg Karft AB," April 13, 2026, p. 69-72, . https://www.government.se/globalassets/government/dokument/finansdepartementet/nuclear-financing-temasida/excerpt-from-government-bill-2025_26_99.pdf

[75] *Id.,* p. 15.

of capacity under construction currently.[76] South Korea is most remarkable for the low costs it has achieved building recent nuclear plants, with overnight capital costs estimated around $3,000/kW (2023$),[77] substantially below the estimated costs elsewhere in the world except for China with comparable costs. It has also become a major nuclear exporter, exporting their nuclear capabilities in the Barakah nuclear project in the UAE.

The nuclear program is run primarily by KEPCO, the country's single unified utility that is government-controlled and vertically integrated. The first Korean designed reactors came online in the mid-1990s, and South Korea has steadily been building additional reactors since then. All reactors that have come online in South Korea since 2000 have been KEPCO's OPR-1000 or APR-1400.

South Korean nuclear projects are generally owned and operated by subsidiaries of KEPCO, primarily Korea Hydro & Nuclear Power Company (KHNP). KEPCO recovers costs from customers through electricity sales.

KEPCO has established a number of practices to reduce their costs and increase operational efficiency in order to minimize electricity costs. This has also enabled KEPCO to generate earnings that it has retained, enabling it to grow its nuclear program and to access foreign loans at low rates based on their financial stability.[78]

Sustained government support for South Korea's civilian nuclear sector enabled the development of a mature domestic supply chain, centered on KEPCO, the utility, and its subsidiaries for plant ownership, operation, and reactor and safety system design. This core structure has been complemented by major industrial firms such as Hyundai Engineering and Construction and Samsung C&T, which have participated regularly as EPC contractors responsible for site preparation and non-nuclear components of plant construction for nuclear projects. The country has also built out a substantial skilled nuclear workforce because of the ongoing nuclear industry as well as government policies designed to support training and education programs.[79]

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[76] International Atomic Energy Agency Power Reactor Information System, "Republic of Korea," last updated May 27, 2026, https://pris.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=KR (Accessed on May 28, 2026).

[77] H. S. Moon, S. Baik, W. Young Park, "Assessing the levelized cost of energy in South Korea," *Energy Strategy Reviews*, Vol 62, 2025, https://www.sciencedirect.com/science/article/pii/S2211467X25002603.

[78] S. Choi, et al. "Fourteen lessons learned from the successful nuclear power program of the Republic of Korea," *Energy Policy* (37)12, 2009, p. 5502. https://www.sciencedirect.com/science/article/pii/S0301421509005990.

[79] IAEA, "Country Nuclear Power Profiles 2022 Edition: Republic of Korea," updated 2022, https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2022/countryprofiles/KoreaRepublicof/KoreaRepublicof.htm.

South Korea's nuclear program is organized around a vertically integrated public utility group structure, in which ownership, operation, and core engineering functions are housed within KEPCO and its subsidiaries. As a result, the majority of construction and financial risk is effectively held by the utility, and thus is in part held by the government since KEPCO is a majority government owned entity. It is not clear exactly how much risk of cost overruns is borne by customers, and whether the contractors ever absorb cost increases. In response to projects deviating from the budget or timeline earlier on, South Korea has introduced some incentive systems tied to on-time delivery through contractual mechanisms to allocate some risk to suppliers and contractors.[80]

**Lessons Learned**

The Korean government has made a concerted effort to build a nuclear industry and development program since the 1960s, which has resulted in the development of mature policy, governance and oversight organizations, as well as a robust industry. South Korea has made significant investments in the localized development of nuclear technology, supply chains, and expertise in nuclear technology, construction, and development. Some key factors include:

- *Continuous nuclear industry over several decades*: South Korea's steady and active nuclear industry since the 1970s, building just Korean-developed reactor technology since the 1990s, has enabled the development of a robust industry with mature supply chains and extensive expertise in the design and development of nuclear reactors.
- *Standardization and localization are key long-run risk reducers*: Korea's deliberate transition to standardized, domestic designs and a mature domestic supply chain helped shift the program from "import and build once" to be able to repeatably deliver. This is one of the central reasons the Korean model is often cited as comparatively successful.[81] (While the cited public source dates to circa 2009, the underlying lessons remain applicable).
- *Centralized planning and organization of reactor development* by NEPIO and KEPCO provides stable, experienced governance and project management
- *Early-stage nuclear programs financed by sovereign and state-utility credit support can absorb risk when industry or technology is immature*: In early stages of the nuclear

[80] S. Choi, et al, "Fourteen lessons learned from the successful nuclear power program of the Republic of Korea," *Energy Policy* (37)12, 2009, pp. 5496-5497, https://www.sciencedirect.com/science/article/pii/S0301421509005990.
[81] *Ibid.*

program, South Korea provided government loan guarantees to help de-risk the first projects by directly supporting creditworthiness and investment priority.

The lessons from Korea's recent successes—built on decades of building and refining the designs, supply chain, workforce, and construction practices—are difficult to translate to New York and the nascent industry it finds itself in. Perhaps the most relevant lesson is the promise that low costs may be achievable in the long run given a decades-long commitment and an emphasis on repeatability.

## UK SMR Framework

The current United Kingdom Government views nuclear energy as a core technology for achieving the country's zero-carbon goals. In order get projects build and create a robust nuclear ecosystem in the United Kingdom, the government is pursuing direct public investment as well as financial supports and processes to catalyze private investment.[82]

Direct public investment includes government equity investment in a large-scale light-water reactor under construction at Sizewell C, as described above; and planned investment in SMRs, starting with Wylfa on Anglesey.[83] For that project, the U.K. government allocated more than £2.5 billion and Great British Energy – Nuclear (GBE-N), a state-entity, selected Rolls-Royce SMR to build the SMRs.[84] In April 2026, GBE-N and Rolls-Royce SMR signed a contract formally commencing technology design activities.[85]

In parallel, the new Advanced Nuclear Framework focuses on types of public support that incentivize private sector investment. Under the Advanced Nuclear Framework, the UK will establish the UK Advanced Nuclear Pipeline (the Pipeline) and the Project Readiness Assessment (PRA) process, both aiming to create a standardized process of review and endorsement that signals project viability to capital sources. The Pipeline will be an identified set of projects which

[82] Department for Energy Security and Net Zero, "Advanced Nuclear Technologies," Policy Paper, updated February 4, 2006, https://www.gov.uk/government/publications/advanced-nuclear-technologies/advanced-nuclear-technologies.

[83] Great British Energy – Nuclear, "Wylfa Confirmed as Site for UK's First Small Modular Reactor," Press Release, November 13, 2025, https://www.gov.uk/government/news/wylfa-confirmed-as-site-for-uks-first-small-modular-reactor.

[84] UK Department for Energy Security and Net Zero, "Advanced Nuclear Technologies," Policy Paper, updated February 4, 2006, https://www.gov.uk/government/publications/advanced-nuclear-technologies/advanced-nuclear-technologies.

[85] Great British Energy – Nuclear, "Great British Energy—Nuclear and Rolls-Royce SMR Sign Contract," Press Release, April 13, 2026, https://www.gov.uk/government/news/great-british-energy-nuclear-and-rolls-royce-smr-sign-contract.

have received a "limited, in-principle, endorsement."[86] To join the Pipeline, a project proposal goes through the PRA, which is a government review, led by the Department for Energy Security and Net Zero (DESNZ), of the maturity and viability of the project.

Once a project has joined the Pipeline, it can begin discussions with DESNZ and the National Wealth Fund (NWF) about revenue mechanisms. DESNZ can offer revenue support (for example, a CfD) or insurance-style products for the unique, uninsurable risks of nuclear projects (described as "high-impact, low probability risks"), on a case-by-case basis. The NWF can provide debt, equity, or hybrid instruments designed to "crowd-in" private investment.

Beyond financial support, the UK is working to remove other barriers that SMR industry development could face, including through a number of nuclear innovation and workforce development initiatives in place to improve "UK capabilities."[87] The UK government, through GBE-N and the Nuclear Decommissioning Authority (NDA), has acquired potential SMR development sites. The UK has announced up to £300 million to establish a HALEU supply chain and detailed plans for nuclear waste management. Lastly, the government is working to streamline planning and regulatory frameworks that recognize the differences in SMRs vs LLWRs.

**Lessons Learned**

It remains to be seen if the UK can successfully cultivate an SMR industry that can be sustained without large investments of public capital. If this program does in fact attract private capital as intended, it will prove several lessons that could be relevant for NYS:

- *Integrated package of interventions*: while specific details are not provided in the Framework and will be determined on a case by case basis through negotiations, the Framework identifies a number of components that will be on offer, namely government involvement in debt and/or equity finance, alongside private sector finance; the possibility of insurance or a guarantee related to "high impact, low probability" risks; and CfD-type revenue support.
- *Combination of standardized procurement and flexible negotiations:* the Project Readiness Assessment process provides a degree of clarity to all concerned, and the endorsement resulting from it may help to encourage private investment; a

[86] UK Department for Energy Security and Net Zero, "Advanced Nuclear Framework," February 2026, p. 12, https://assets.publishing.service.gov.uk/media/698483397da3dc19896c7ddc/advanced-nuclear-framework.pdf.
[87] *Id.,* pp. 25–29.

subsequent process of negotiations to determine the level of government involvement maintains project-by-project flexibility.

## B.5 Conclusions

Based on the market assessment presented above, this appendix offers the following key findings:

- **Need for government support**. FOAK and BOAK advanced projects are not yet commercially viable without a level of government support. All projects that moved forward have had at least some form of government support.
- **Cost reductions**. In order to achieve cost sustainability going forward, cost reductions are needed. Cost reductions can be achieved most effectively through repeatability, as evidenced by South Korea's program for deployment. Even where projects included only a small number of units, staggered deployment of these is observed to unlock significant cost reductions (for example in the case of Vogtle, with 20% cost improvement from unit 3 to 4). Repeatability also leads to efficiencies in supply chains and workforces.
- **Reduce cost overrun risk**. In addition to high project costs, the second key challenge is the uncertainty of cost and the risk of cost overruns. Recent deployed nuclear projects—including Olkiluoto 3, Vogtle 3 & 4, and Flamanville 3—experienced substantial delays and cost escalation driven by FOAK complexity, incomplete designs, weak supply chains, labor and project management challenges, and unrealistic risk allocation to EPC contractors.
- **Share residual cost overrun risk**. Risk allocation approaches range from regulated cost recovery mechanisms (e.g., the UK's Regulated Asset Base model for Sizewell C, and cost-of-service recovery at Vogtle and Darlington), to direct public ownership or balance-sheet exposure (e.g., Barakah, South Korea's domestic program, and EDF's state-backed ownership at Flamanville), to hybrid risk-sharing frameworks that explicitly limit downside while preserving incentives (e.g., Sweden's planned ROE collar with open-book cost review). These structures differ in how much risk is borne by ratepayers or taxpayers, but all materially reduce financing costs relative to models that rely on private risk absorption alone. Structures that have allocated risk to a single private sector party, in particular EPCs, have not proven sustainable. Allocating risk exclusively to the government is also not a sustainable solution. An optimal approach involves risk sharing between multiple parties, with government

participation at least for initial projects and an expectation of greater private sector participation as the technologies mature.

- **Integrated government support**. Some examples show government taking on effectively all risk. Other examples show government only making limited commitments at this stage (e.g., only early development support). An integrated government intervention approach that provides clarity across all project development stage while striking the right balance of combining both public and private sector commitments and contributions at each of the stages appears as the most promising and sustainable way forward.