

Cooperation Is Not a Purchase Order: Participation Pathways and Assessment of Project Progress in SMR Projects Involving U.S. Design Developers

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1. Introduction

The market environment for small modular reactor (SMR) projects involving U.S. design developers is characterized by simultaneous and conditional interactions among regulatory requirements, national-security-related technology controls, and domestic-content preferences. Korean firms have announced participation in such projects for several years. These announcements, however, vary greatly in commercial significance.

In practice, the term “SMR cooperation” covers very different things. It is used for equity investment, front-end engineering design (FEED), reserved manufacturing capacity, project-specific orders and actual fabrication alike. Treating these as a single category may blur the distinction between early-stage participation signals and firm commercial commitments and may overstate how far a project has actually progressed.

Participation should therefore not be understood as entry into a single market. Rather, it involves passage through different institutional conditions, whose relevance and timing vary according to the role a firm seeks to perform. A firm participating through project development or EPC encounters a different set of requirements from a component supplier.

This study therefore asks three questions. First, how can participation signals be distinguished from project-specific commitment and physical execution? Second, how do the project-development/EPC and manufacturing-supply pathways differ in their institutional conditions and observable milestones? Third, what is the highest publicly observable level reached in the selected cases as of 31 July 2026? These questions are addressed across Sections 3-5.

2. Method and Data

This exploratory comparative analysis uses public documents covering 1 January 2019 through 31 July 2026. The unit of analysis is the participation pathway formed between a U.S. SMR design developer and a Korean firm. Eligibility is based on the identity of the design developer rather than the project location, so projects located outside the United States remain within scope.

Statutes, regulations and regulatory or statutory filings were treated as the strongest evidence. Corporate

announcements were used only to confirm that an agreement existed and to identify its publicly disclosed scope, and “not confirmed” means not identified in the records reviewed rather than shown to be absent. Cases were included where the parties were publicly identified the form of participation could be classified, and at least one subsequent milestone or termination event was recorded. Because inclusion required at least one observable follow-up milestone or termination event, the sample favors information-rich pathways. It is therefore not statistically representative of the broader population of announced SMR collaborations, and the study makes analytical rather than statistical generalizations. Pathways are classified by the firm’s principal expected role—project development, EPC or construction integration (Path A); equipment manufacturing, component supply or capacity provision (Path B)—as analytical categories that are not mutually exclusive.

3. Two Participation Pathways and Three Institutional Layers

Participation is shaped by three cross-cutting institutional layers: nuclear cooperation and technology control; industrial policy and procurement; and corporate contracting and qualification. Layers denote the legal, policy and contractual environments surrounding participation; gates denote pathway-specific observable conditions whose relevance and timing vary by pathway (Fig. 1). The layers do not exhaust project-specific requirements; licensing events are treated separately as milestones.

Under the first layer, the Korea–U.S. Agreement for Cooperation provides the bilateral framework. DOE’s 10 CFR Part 810 governs certain assistance to foreign atomic-energy activities, and the EAR governs transfers of controlled items and technology [1]. Technology-control requirements may arise on both pathways, but through different activities: in Path A they concern access to and transfer or retransfer of design information, whereas in Path B their relevance depends on the nature and scope of non-public technical information or assistance provided to the supplier.

Under the second layer, 2 CFR Part 184 applies domestic-content preferences to projects receiving federal financial assistance, subject to the funding instrument, product classification and available waivers [2]. In the cases examined, its practical relevance is most evident in component sourcing under Path B.

The third layer operates differently on each pathway. In Path A, the third layer concerns contracting and partner qualification. In Path B, it concerns supplier qualification: direct regulatory responsibility generally rests with the relevant license applicant or license

holder, depending on the applicable licensing framework, while component suppliers are generally subject to relevant requirements through the purchaser's procurement documents, quality-assurance program, and supplier-qualification process [3].

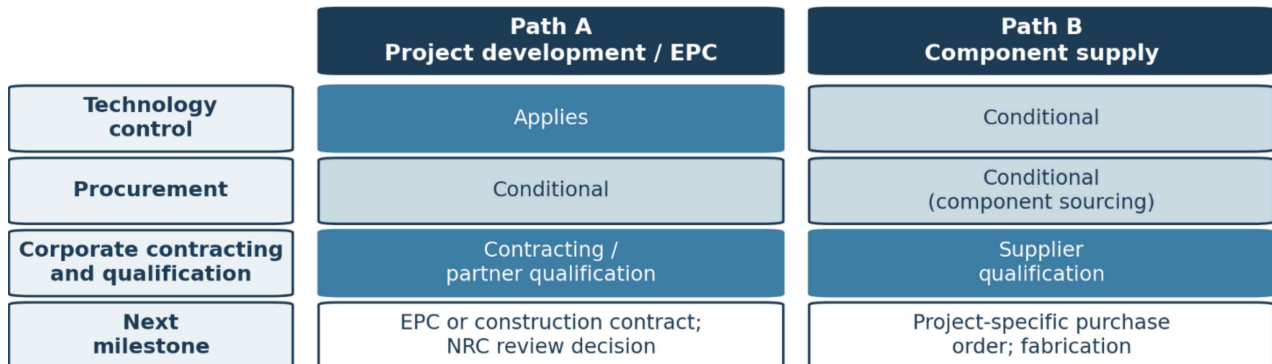


Fig. 1. Cross-cutting institutional layers and observable milestones on the two pathways.

4. Levels of Project Progress and Four Cases

The framework rests on contractual commitment and execution rather than on the type of activity undertaken. L1 denotes a formal relationship or strategic commitment for which public records identify no project-specific obligation to design, manufacture, purchase or deliver. L2 denotes project-development, licensing, design or manufacturing preparation that is not accompanied by a project-specific commitment meeting the L3 criteria.

L3 denotes a project-specific binding EPC, construction, purchase or supply agreement whose parties, scope and obligations are identified clearly enough to distinguish it from non-binding cooperation or from a capacity reservation. L4 denotes confirmed physical execution of a project-specific scope under an L3 agreement or an

equivalent binding obligation.

The four levels form an ordinal scale rather than a uniform contractual sequence. Where physical execution is publicly confirmed but the underlying contract is not fully disclosed, the execution evidence and the available evidence of contractual commitment are reported separately without inferring undisclosed commercial terms. Delivery, acceptance, and revenue recognition do not constitute an additional level; instead, they are treated as subsequent commercial outcomes that may depend on project-level commercial viability as well as supplier readiness and contract execution. A binding capacity reservation may define a material scope, yet it is assessed as L2 because the records reviewed identify no project-specific purchase order or delivery obligation of the kind L3 requires.

Table 1. Highest observed participation level and next observable milestone in the four cases

Participation pathway	First public signal and elapsed time	Highest publicly observed level and current status	Next publicly observable milestone
A	Samsung C&T–NuScale July 2021, equity investment (approximately 5 years)	L2 — July 2024, Romanian SMR FEED; continuing; no project-specific EPC or construction contract identified [4]	Project-specific EPC or construction contract
	Hyundai E&C–Holtec Nov. 2021, teaming agreement (approximately 4 years and 8 months)	L2 — Dec. 2025, Part 1 of the phased construction permit application with an LWA request; docketed Feb. 2026, under NRC review [5]	NRC review decision, then authorized early construction
B	Doosan Enerbility–Nu Scale July 2019, collaboration agreement (approximately 4 years and 4 months)	L4 — late 2022, project-specific long-lead-material order (L3); 2023, forging work commenced; terminated Nov. 2023; delivery and revenue not confirmed [6]	No further milestone after termination
	Doosan Enerbility–X-energy Aug. 2021, manufacturability engineering (approximately 4 years and 11 months)	L2 — Dec. 2025, binding reservation agreement for main power system steel components for 16 Xe-100 units and an announced plan for a new fabrication facility; no project-specific purchase order identified [7]	Project-specific purchase order

Note: Each case is assigned the highest level observed, not its final outcome; observed periods are contextual rather than comparative. Next milestones differ in type—contractual, regulatory or physical—and need not correspond to a level transition; within Path A the type varies with the mode of entry.

The three continuing pathways had not reached their next project-specific milestones, although their preparatory activities differed in regulatory, engineering and manufacturing significance. Only the Doosan Enerbility–NuScale pathway progressed to a project-specific manufacturing order and confirmed physical execution. The cited disclosures identified subscriber shortfalls and rising cost estimates as project-level reasons for termination; the reviewed records do not identify supplier performance as a cause, and no supplier causation is inferred.

5. Interaction among the Institutional Conditions

The three layers do not operate independently. Domestic-content procurement preferences and technology-control requirements may interact: where compliance with domestic-content requirements entails U.S. assembly, inspection or local suppliers that need access to controlled design or process information, the number of such entities may increase, potentially expanding the scope of technology-control review and supplier-qualification work.

For this reason, the requirements of 2 CFR Part 184, 10 CFR Part 810, and the EAR may need to be considered together rather than as independent compliance checklists, although whether they interact in a given case depends on the funding structure, item classification and authorization arrangements. This reading follows from the structure of the requirements themselves, not from a causal relationship observed in the four cases. In the Doosan Enerbility–X-energy pathway, for instance, the observed response was a plan for a new domestic fabrication facility rather than a relocation of production [7].

Certain activities may require specific authorization under Part 810. Separately, the EAR may apply to controlled items or technology, including releases of controlled technology to certain foreign persons in the United States that may be treated as deemed exports. Where specific authorization requires a technology control plan (TCP) or equivalent documentation, access controls and information barriers among organizational units should be defined and documented in advance.

6. Conclusion and Policy Implications

Cooperation is not a purchase order and reserved capacity is not a delivery contract. Progress should be assessed not by whether a firm is “participating”, but by the pathway followed, the highest level observed and the next observable milestone. The two pathways

involve different capability and institutional requirements: Path A emphasizes project development, licensing interfaces, and EPC integration, whereas Path B emphasizes supplier qualification, quality assurance, and progression from manufacturing readiness to project-specific purchase or supply orders.

Three policy implications follow. First, progress indicators should report cooperation, preparation, binding project-specific contracts and contract execution separately, so that preparatory milestones are not misinterpreted as firm project-specific orders. Second, support priorities should differ by pathway: for Path A, overseas licensing interfaces, project development and EPC contracting; for Path B, quality assurance appropriate to the applicable safety classification, NQA-1-based or equivalent quality-assurance and supplier-qualification arrangements where applicable, and readiness for testing, inspection, and supplier audits. Third, a policy priority is to improve the predictability of technology-control procedures and related access-control guidance; because public records do not reveal the full authorization process, this recommendation concerns procedural clarity rather than evidence of regulatory delay.

This study is limited by public-document evidence and purposive sampling; further research should validate the framework using Part 810 authorization cases, project-specific purchase-order records, and stakeholder interviews.

REFERENCES

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