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Analytical Report: Strategic, Legal, and Commercial Structuring of NPP Construction Contracts in the Context of the Nuclear Program of the Republic of Serbia

Introduction: The Revival of Serbia's Nuclear Program and the Role of the NuclearSerbia Project

The transition of the Republic of Serbia to the practical implementation of a nuclear energy program is a historic step that requires not only the creation of a highly complex legal and technological infrastructure but also the formation of a sustainable public consensus. The successful integration of nuclear generation into the national energy mix after decades of a moratorium is impossible without an open dialogue, transparency, and expert support at every stage of preparing multi-billion dollar contracts.

One of the key goals of creating this analytical report is the popularization of the NuclearSerbia project and the strengthening of its public recognition as a competent and active participant in the process of reviving the national nuclear industry. The document aims to demonstrate the project's deep expertise in highly complex issues of international contracting, risk management, and strategic planning.

The official platform of the project—the nuclearserbia.rs portal—serves as a crucial tool in the processes related to the development of peaceful nuclear energy in the country. The goals, tasks, and capabilities of the nuclearserbia.rs website are closely intertwined with the subject matter of this report and include:

- **Public communication and education:** The platform serves as a centralized and reliable source of information, promoting objective coverage of nuclear topics and building public trust.[1] This is critically important for mitigating political and social risks when implementing megaprojects.
- **Highlighting international and scientific cooperation:** The website acts as an information hub tracking the country's strategic partnerships. The platform actively covers joint projects, such as the memorandum on scientific, technical, and educational cooperation between the Serbian Vinča Institute of Nuclear Sciences and the French corporation EDF.[1]
- **Supporting the development of human capital:** By informing about educational initiatives, international exchanges, and professional training programs for specialists, the portal helps address the shortage of personnel necessary to manage future NPP facilities.[1]
- **Analytical support:** The platform has the potential to publish expert reviews of specialized legislation (Lex Specialis), tender procedures, and contract models (EPC, BOO), helping both the professional community and the general public understand the hidden mechanisms and risks described in this report.

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This analytical report, initiated as part of the development of NuclearSerbia, serves as a fundamental basis for understanding the legal and commercial architecture of nuclear contracts. It emphasizes the project's role as a vital link between state institutions, international technology vendors, and civil society on the path to ensuring Serbia's energy sovereignty.

Content

1. Strategic and Geopolitical Context of the Revival of Serbia's Nuclear Program

Over the past decades, the global energy landscape has undergone fundamental changes driven by the imperatives of decarbonization, the need to ensure energy security, and the unprecedented volatility of fossil fuel prices. In this complex context, the Republic of Serbia has made a historic decision to radically revise its national energy strategy. In 2024, the National Assembly of Serbia voted to introduce epochal amendments to the Law on Energy, officially ending the 35-year moratorium on the construction of nuclear power plants, which was introduced in the former Yugoslavia in 1989 as a reaction to the Chernobyl disaster.[2] This legislative shift marks Serbia's transition from passive observation of the global nuclear renaissance to active shaping of the regulatory, institutional, and technological framework for integrating the peaceful atom into its energy mix.

In accordance with the Integrated National Energy and Climate Plan (INEKP) and the Energy Sector Development Strategy of the Republic of Serbia up to 2040 with projections up to 2050, nuclear energy is viewed as a crucial tool for meeting international climate commitments.[2] Considering that the country currently generates about 70% of its electricity by burning coal, the introduction of nuclear generation is recognized as a key factor in achieving carbon neutrality and sustainable economic growth.[3] At the first-ever Nuclear Energy Summit in Brussels in March 2024, Serbian President Aleksandar Vučić signed the Declaration on Nuclear Energy and announced the country's aspiration to secure international support in nuclear know-how and financing to achieve the ambitious goal of establishing 1,200 MW of generating capacity based on small modular reactors (SMRs).[2]

The transition to the practical implementation of these strategic plans requires the creation of a robust legal architecture and detailed planning. In October 2024, the French energy corporation EDF and the engineering company Egis presented a preliminary technical study and a long-term roadmap to the Ministry of Mining and Energy of Serbia.[7] According to this document, the development of the program is divided into three phases: by 2027, all preliminary studies must be completed, and the legislative framework established to make an informed decision; by 2032, the country should be ready to select a specific technology and launch the contracting process; and by 2040, the first NPP should be connected to the grid.[7] Simultaneously, Serbia is diversifying its international contacts by signing Memoranda of Understanding (MoUs) with a wide range of global leaders. In particular, agreements have been concluded with the Korean company KHNP (covering nuclear energy and hydrogen technologies), the China Institute of Atomic Energy (CIAE), and active negotiations are underway with Russia's Rosatom regarding potential cooperation.[8] Furthermore, at the institutional level, a memorandum was signed between the Vinča Institute of Nuclear Sciences and EDF for personnel training and overcoming the shortage of specialists caused by decades of the moratorium.[1] Intermediate options for ensuring energy security are also being considered, such as the potential acquisition of a 5–10% minority stake in the expansion of Hungary's Paks II NPP.[7]

The implementation of such large-scale national initiatives is inevitably linked to the preparation, negotiation, and signing of highly complex international contracts for the construction of NPPs. This report provides a comprehensive analytical study of the architecture of such contracts, their regulatory and legal framework, life cycle, typology, as well as an in-depth analysis of the risks and hidden "pitfalls" that the Government of Serbia and relevant agencies must consider when interacting with international corporations.

2. Regulatory and Legal Architecture of NPP Construction Contracts

The construction of a nuclear power plant is a megaproject of unprecedented complexity. Unlike conventional infrastructure facilities, nuclear energy entails the highest requirements for nuclear and radiation safety, nuclear non-proliferation, and physical protection. Therefore, NPP construction contracts cannot be viewed exclusively through the lens of civil or commercial law; they are governed by a multi-level system of regulations encompassing international, supranational, and national law.

2.1. IAEA Guidelines and Standards

The fundamental methodological basis for preparing and implementing contracts consists of the standards and technical reports of the International Atomic Energy Agency (IAEA). A key document in this area is the IAEA Nuclear Energy Series Technical Report No. NG-T-3.9, "Invitation and Evaluation of Bids for Nuclear Power Plants."[10] This document details the contracting framework, project management structure, and strict requirements for quality assurance (QA), equipment configuration traceability, and documentation throughout the plant's life cycle.[10] The report emphasizes that the QA program in the nuclear industry is significantly more stringent than in other industries, as it must seamlessly integrate design, procurement, construction, manufacturing, installation, and commissioning.[10]

Furthermore, the IAEA has developed a specialized digital "Nuclear Contracting Toolkit," which integrates global best practices and assists Member States in ensuring a high level of ethics, transparency, and compliance with international standards during procurement.[12] These documents function in synergy with general industry project management standards, such as PMBOK, and the IAEA's strategic guidance on national infrastructure development (the Milestones Approach), which defines the milestones of a state's readiness to launch a nuclear program.[10]

2.2. Intergovernmental Agreements (IGAs) as a Political Umbrella

In modern international practice regarding the construction of NPPs in countries just embarking on the path of nuclear energy development (which effectively includes Serbia after a long hiatus), the foundational legal document is often the Intergovernmental Agreement (IGA).[15] The IGA defines the highest political, financial, and macroeconomic framework for cooperation between the Host Government and the nuclear technology supplier state.[15]

The IGA enshrines sovereign guarantees. The agreement may define the terms for providing interstate credit lines (as was the case with the agreement between Egypt and the Russian Federation for the El Dabaa NPP), localization principles, and long-term commitments for the supply of fresh nuclear fuel and the return or storage of spent nuclear fuel (SNF).[15] The IGA forms a so-called "umbrella" under which commercial Host Government Agreements (HGAs) and specific EPC contracts are subsequently concluded.[15] Moreover, the IGA provides protection against expropriation and establishes mechanisms for interstate arbitration, which is critically important for investors sinking billions of dollars into a foreign jurisdiction.[16]

2.3. Integration with European Union Law (Acquis Communautaire)

For Serbia, as a candidate country for EU accession, harmonizing national legislation with European Union law is a critically important aspect. Serbian authorities have done a tremendous amount of work adapting the Law on Energy and the Law on Efficient Use of Energy to the provisions of the EU's Third Energy Package.[5] Any contract for the construction of an NPP in Serbia must strictly comply with national laws on public-private partnerships, public procurement, construction licensing, and environmental protection. Serbia's strategic integration into European energy networks requires flawless adherence to EU directives on State Aid and competition.[18] Disregarding these norms can lead to severe legal conflicts and the blocking of projects at the supranational level, as has already been observed in other Eastern European countries.[22]

2.4. Nuclear Liability Regime and International Conventions

A special place in the regulatory framework is occupied by international conventions on civil liability for nuclear damage. In the event of a nuclear incident, damage to third parties can amount to astronomical sums; therefore, NPP construction contracts rely on the regime of "Strict and Exclusive Liability."[23]

According to the Paris Convention on Third Party Liability in the Field of Nuclear Energy (and/or the Vienna Convention), liability always rests exclusively with the operator of the nuclear installation, regardless of whose fault (the designer, builder, or component supplier) led to the accident.[23] This principle of Channeling of Liability protects EPC contractors and equipment suppliers from ruinous lawsuits from the public.[23] The Paris Convention sets a minimum limit of financial security for the operator at EUR 700 million (for countries with an unlimited liability regime).[23] Preparing a contract requires Serbia to create insurance mechanisms and establish nuclear insurance pools, as well as to provide sovereign guarantees in case the damage exceeds the limits covered by insurance.[23]

2.5. Standard FIDIC Contracts at the Operational Level

At the operational level, the texts of commercial contracts for NPP construction are rarely written "from scratch." They are often based on the standards of the International Federation of Consulting Engineers (FIDIC). For complex turnkey nuclear projects, the FIDIC "Silver Book" (Conditions of Contract for EPC/Turnkey Projects), first published in 1999 and updated in 2017, is most applicable.[28] Under the Silver Book, the contractor assumes maximum responsibility for design, interface integration, final cost, and schedule, guaranteeing that the completed facility will strictly meet its intended purpose ("fitness for purpose").[28] In cases where the operation of the facility is also transferred to the contractor for a certain period (the DBO model), the FIDIC "Gold Book" is used.[28] Unlike standard construction contracts, FIDIC provisions in NPP contracts undergo massive adaptation (via Particular Conditions) to integrate the strict requirements of the national nuclear regulator, testing protocols, and commissioning.[28] In the UK and some other jurisdictions, the NEC3 family of contracts is also actively used, focusing on collaborative project management and flexible risk allocation.[32]

3. Life Cycle and the Process of Preparing the Contract Text

Creating the text of an NPP construction contract is the culmination of a multi-year process of technical, financial, and legal project structuring. According to the IAEA methodology, the contracting life cycle consists of six sequential phases, each requiring the deep involvement of experts.[11]

Phase 1: Fulfillment of Preconditions

Before starting tender procedures, the state must achieve a readiness level corresponding to "Milestone 2" according to the IAEA classification.[11] At this stage, the Government of Serbia must finalize the institutional framework, determine the capacity of the future NPP (considering the focus on 1,200 MW SMRs), investigate the characteristics of potential sites, and empower an independent regulatory body (the Serbian Radiation and Nuclear Safety and Security Directorate — SRBATOM).[2] National goals regarding technology transfer and localization are formulated during this phase.

Phase 2: Preparation of Bid Invitation Specifications (BIS)

At this stage, the owner/operator's team begins developing a comprehensive package of documents—the Bid Invitation Specifications (BIS).[11] Since Serbia is just resuming its nuclear program, it will require the engagement of external engineering and legal consultants (Architect-Engineer / Owner's Engineer), as well as Technical Support Organizations (TSO).[34] The BIS document contains all technical, commercial, and legal requirements for the future plant, including safety guarantees, waste management requirements, cooling system specifications, and acceptance criteria. This document becomes the foundation for the future contract.[11]

Phase 3: Invitation and Bidding

A pre-qualification procedure is conducted for potential vendors to confirm their technological maturity, the referentiality of the proposed reactors, and their financial viability.[11] After selecting qualified participants, the client sends out formal invitations to submit closed bids.[11]

Phase 4: Integrated Bid Evaluation

The evaluation process is divided into two interrelated streams [11]:

- **Technical Evaluation:** Experts analyze the design's referentiality, the reliability of passive and active safety systems, Core Damage Frequency / Large Release Frequency (CDF/LRF), and the resilience of technological supply chains (especially important for SMRs relying on modular assembly).[11]
- **Economic Evaluation:** An analysis is conducted of the proposed financial models, Levelized Cost of Energy (LCOE), capital payment schedules, Operations and Maintenance (O&M) costs, and the

allocation of cost overrun risks.[11]

Phase 5: Contract Negotiations

Based on the comprehensive evaluation, a Preferred Bidder is selected. The most complex stage begins—tough commercial negotiations.[11] It is here that the final text of the EPC contract is shaped. The legal teams of the vendor (e.g., EDF or Rosatom) and the client (the Government of Serbia or an authorized generating company), with the direct participation of lawyers from the syndicate of lending banks, fight over the allocation of every element of risk.[33] Discussions cover Liquidated Damages for delays, Liability Caps, grounds for declaring force majeure, and Dispute Resolution mechanisms.[11]

Phase 6: Design Selection, Deal Closure, and Signing

The process concludes with the final approval of the text and the ceremonial signing of the contract.[11] However, the contract only enters into full legal force (Effective Date) after the satisfaction of several Conditions Precedent, such as obtaining primary site licenses from SRBATOM, ratification of the Intergovernmental Agreement by the parliament, and, most importantly, Financial Close, when banks officially open the credit lines.[11]

4. Parties to the Contract, Corporate Governance, and Signatory Authority

The hierarchy of documents in an NPP project dictates a strict approach to defining the parties and individuals with signatory authority. An error in verifying the Authority to Bind can render a multi-billion dollar contract invalid.

4.1. Intergovernmental Agreements (IGA)

IGAs are signed at the highest state level. On behalf of the host country (Serbia), the signatory is typically the relevant minister (e.g., the Minister of Mining and Energy) or the Prime Minister, vested with official authority on behalf of the Government.[27] Given the scale of the commitments, the ratification of such agreements often requires the approval of the National Assembly, giving them the status of an international treaty that takes precedence over domestic regulations.[19]

4.2. Commercial and EPC Contracts

Corporate structures are the parties to commercial contracts. Often, the vendor and the client create a Joint Venture or a Special Purpose Vehicle (SPV / Project Company) to isolate the financial risks of the project from their parent balance sheets (Limited Recourse Financing).[17] The texts of these contracts are signed by individuals possessing the appropriate Corporate Authority—Chief Executive Officers (CEOs), Presidents, or specially authorized directors based on Board of Directors resolutions.[42] Notably, corporate practice strongly advises against the General Counsel acting as a direct signatory to contracts to avoid potential conflicts of interest between legal oversight and business decisions.[45]

4.3. Regulatory and Licensing Documents

Construction permits, operating licenses, and environmental approvals are issued and signed by the heads of independent national agencies. In the context of Serbia, the key roles here are played by the Radiation and Nuclear Safety and Security Directorate (SRBATOM) and the Ministry of Environmental Protection.[4]

5. Contract Typology: Financial Models, Advantages, and Disadvantages

The choice of the Procurement Model is the most critical strategic decision, determining Serbia's level of control over the project, the degree of technology localization, and, most importantly, the allocation of catastrophic financial risks. An analysis of the global industry highlights three main paradigms.[33]

Table 1. Comparative Analysis of Main NPP Construction Contract Models

Characteristic	EPC / Turnkey	Multi-contracting / Split-package	Build-Own-Operate (BOO/BOOT)
Essence of Architecture	A single general contractor bears full responsibility for engineering, procurement, and construction.	The client divides the project into separate lots (nuclear island, turbine island) and manages the integration independently.	A foreign investor finances, builds, owns, and operates the NPP, selling power via a PPA.
Advantages	Single point of contact. Fixed price and timeline. Reduced construction risks for the client.	Maximum client control over the project. Highest level of localization and deep technology transfer.	Solves the state's lack of initial capital. Technical risks are entirely borne by the vendor.
Disadvantages	Significant risk premium (general contractor markup). Limited knowledge transfer to the national economy.	Enormous Interface Risk. Requires colossal engineering expertise from the client.	Long-term geopolitical dependence. The state loses sovereign control over a critical asset.
Typical Examples	Paks II (Hungary), El Dabaa (Egypt), Vogtle	Internal EDF projects in France, Olkiluoto	Akkuyu (Turkey).

Characteristic	EPC / Turnkey	Multi-contracting / Split-package	Build-Own-Operate (BOO/BOOT)
	(USA).	(Finland).	
Documentation Basis	FIDIC Silver Book.[28]	FIDIC Yellow/Red Book, NEC3.[29]	Intergovernmental Agreements (IGA), PPA.[17]

5.1. EPC (Engineering, Procurement, Construction) / Turnkey Model

In the traditional EPC model, the client essentially buys a finished NPP that must be capable of generating power the moment the "key is turned."[31] The contractor assumes macro-risks related to budget overruns and schedule delays.[33]

- **Advantages:** This model is highly valued by international syndicated lenders, as it provides capital expenditure certainty (Fixed Price) and guarantees operational characteristics (Guaranteed Performance Levels).[31] The client does not need deep experience in managing thousands of subcontractors.
- **Disadvantages and Risks:** Understanding the colossal risks of nuclear construction, EPC contractors bake huge premiums (contingency allowances) into the price, making turnkey contracts the most expensive.[31] Any changes in specifications by the client after signing lead to devastating financial claims (Change Orders).[36] The model virtually eliminates "know-how" transfer, leaving the national industry sidelined.[48]

5.2. Multi-Contracting / Split-Package Model

In this paradigm, the client (Owner/Operator) takes on the role of Architect-Engineer, concluding separate contracts for the supply of the reactor unit, turbogenerator, I&C systems, and civil construction.[33] This model is traditionally used by France's EDF, with which Serbia is currently closely collaborating.[33]

- **Advantages:** Allows the client to select the best market offers, break the monopoly of a single vendor, lower the overall risk premium, and stimulate deep Technology Transfer into the national industry.[33]
- **Disadvantages and Risks:** All Interface Management risks fall squarely on the client's shoulders.[33] If the turbine supplier delays shipment, it causes a domino effect, leading to idle construction crews and massive lawsuits from other subcontractors (Dispute Fragmentation).[33] For Serbia, which lacks recent experience managing nuclear megaprojects, this path carries a fatal risk of schedule failure.

5.3. BOO (Build-Own-Operate) Model

An innovative but politically complex model where the vendor (usually a state corporation of another country) creates a subsidiary project company in the host country. This company builds the NPP with its own or borrowed funds, remains its 100% owner, and earns revenue by selling electricity throughout its life cycle.[34]

- **Advantages:** Serbia is relieved of the need to mobilize tens of billions of euros in initial capital expenditures (CAPEX) and completely shifts construction and operational risks onto a foreign corporation.[47] This is the "royal road" for countries with limited financial resources.[48]
- **Disadvantages and Risks:** Severe geopolitical consequences. The state effectively cedes control over a critically important infrastructure asset and source of baseload generation to a foreign corporation for 60 to 100 years.[46] There is a high risk of falling into technological and political dependence.

5.4. Financing Mechanisms and Market Risk Allocation: CfD vs. RAB

Beyond the construction model, the financial support model is of critical importance. An analysis of European experience shows a profound evolution in these mechanisms.

Table 2. Comparison of Nuclear Generation Financing Models

Parameter	Contract for Difference (CfD)	Regulated Asset Base (RAB)
Operating Principle	The state guarantees a fixed buyout price for energy (Strike Price) *only after* the plant is commissioned.	The state allows the investor to charge a small surcharge to electricity consumers *already during the construction phase*.
Risk Allocation	100% of construction risks (cost overruns, delays) are borne by the investor/developer.	Construction risks are shared between the investor and end consumers.
Cost of Capital (WACC)	Very high. Banks demand huge interest rates for the risk of project non-completion.	Significantly lower. Steady cash flow during construction reassures lenders.
Application	Hinkley Point C NPP (UK).[51]	Sizewell C project (UK), grid infrastructure projects.[51]
Impact on Final Cost	Drives up project costs due to expensive loans.	Lowers overall project costs but causes political dissatisfaction due to rising current tariffs.[51]

For Serbia, understanding who will bear the financial burden—the investor (via expensive debt capital, which will later be factored into the tariff) or the consumer (via ongoing payments to cheapen loans)—must be reflected in the text of the financial structuring.

6. Recent International Experience: Analysis of Precedents

To identify the hidden threats of various contracting paradigms, it is necessary to analyze recent international experience that directly correlates with Serbia's ambitions in detail.

6.1. Akkuyu NPP (Turkey): Pioneer of the BOO Model and Sovereignty Protection

The 2010 IGA between Turkey and Russia marked the first-ever application of the BOO model in nuclear energy.[15] Rosatom established JSC Akkuyu Nuclear, committed to financing the construction, and managing four VVER-1200 units.[55]

- **Analysis of Obligations:** The IGA obliges the project company to transfer technologies to Turkey, train personnel, maximize local content, and support the development of local legislation.[46] Rosatom also assumes responsibility for fuel supply over the entire operational life, SNF management, and, notably, financial provision for the plant's decommissioning (contract with TVEL JSC).[46]
- **Hidden Risks and Lessons for Serbia:** Despite the economic benefits, Turkey realized the risks of losing control over the asset. Article 5 (paragraph 5) of the IGA states that corporate governance decisions (share distribution, appointment of directors, financing) require the consent of the Turkish side *"with the purpose of protecting national interests in issues of national security and the economy."*[17] In 2024–2025, amid escalating regional crises, the Turkish government prepared contingency plans to forcibly seize control of the plant based specifically on this clause if the foreign operator's actions threatened national security.[57] This clearly demonstrates the BOO model's vulnerability to macropolitical shocks and the critical importance of including strict National Security Override Clauses in the contract. Analysts also note that the PPA for Akkuyu lacks clear penalties for commissioning delays, reducing the contractor's motivation.[48]

6.2. Paks II NPP (Hungary): Traps of Direct Contract Awards within the EU

Serbia, as an EU candidate country integrating its legislation into the Third Energy Package [5], must closely study Hungary's dramatic experience. In 2014, Hungary signed an IGA and an EPC contract with Rosatom for the construction of two reactors with a fixed budget of 12.5 billion euros.[36]

- **European Regulation and Legal Battles:** In 2017, the European Commission, after a lengthy investigation, approved Hungary's provision of State Aid for the project.[22] However, in September 2025, the Grand Chamber of the Court of Justice of the European Union (CJEU) annulled the Commission's decision.[22] The Court ruled that the Commission had failed to verify the legality of the Direct Award of a multi-billion dollar EPC contract to a Russian company bypassing strict EU Public Procurement Rules.[22]
- **Strategic Lesson:** Any bilateral agreements and contracts concluded through direct negotiations without holding open international tenders can be challenged and blocked by European institutions even years after construction begins. Harmonizing Serbian legislation with EU norms (Acquis) leaves no alternative but to conduct transparent competitive procedures to minimize antitrust risks and

prevent accusations of illegal subsidization.[18]

6.3. Hinkley Point C Project (UK): Risks of Budget Overruns

The Hinkley Point C project (implemented by EDF with the participation of China's CGN) demonstrates the materialization of construction risks.[41]

- The project was initially structured based on a CfD contract with a guaranteed strike price.[52] However, the COVID-19 pandemic, the global supply chain crisis, and the strict requirements of the British regulator (ONR) led to massive delays.[41]
- As a result, the estimated project cost excluding interest skyrocketed to 23 billion pounds, and by early 2024 reached a catastrophic 31–32 billion pounds sterling (in 2015 prices).[41] This precedent underscores that even fixed EPC contracts do not save from cost escalation if the project faces global force majeure events, requiring the inclusion of flexible mechanisms in the contract to adapt to raw material price changes and labor inflation.[49]

7. In-Depth Analysis of Risks and Hidden "Pitfalls" in Contract Texts

Creating the text of an NPP construction and operation contract conceals a colossal amount of legal and commercial traps. Insufficient detailing or excessive compliance during the negotiation phase can lead to the client's economic collapse.

7.1. Power Purchase Agreement (PPA) and the "Take-or-Pay" Risk

The foundation of return on investment (especially in the BOO model or with project financing) is a long-term (20-60 years) PPA.[17] The key and most dangerous element of a PPA for Serbia is the "Take-or-Pay" clause.[64]

Table 3. Risk Structure in PPAs

Risk Type	Mechanism of Occurrence	Potential Consequences for the Client (Serbia)
Volumetric Risk	A decrease in national electricity demand or excess generation from renewables (solar/wind) during specific hours.[64]	The obligation to pay for 100% of the NPP's capacity under the "Take-or-Pay" condition even when there is no demand, leading to the accumulation of colossal state debt.[64]
Profile/Shape Risk	Mismatch between the baseload generation profiles of the NPP	The need to purchase balancing capacities on the spot market at

Risk Type	Mechanism of Occurrence	Potential Consequences for the Client (Serbia)
	and consumption peaks.[69]	high prices to cover peaks.[69]
Dispatch Risk	The grid operator is forced to curtail the NPP's power output due to grid congestion.[66]	Payment of compensation to the NPP operator for lost profits due to grid constraints.[66]

- **Hidden Trap:** In Ghana, the uncontrolled signing of "Take-or-Pay" contracts led to the formation of a massive quasi-sovereign debt, as the state committed to buying unneeded capacities, forcing the government to attempt a unilateral conversion of contracts into a "Take-and-Pay" format (payment only upon actual delivery), triggering international arbitrations.[67]
- **Mitigation Strategy:** Hybrid pricing structures must be integrated into the PPA text. The contract must contain financial decoupling mechanisms (where physical delivery is separated from financial settlements), Dispatch Risk Mitigation clauses, and provisions allowing for flexible responses to the integration of massive amounts of renewable sources into the grid (integration into the Green Agenda).[64]

7.2. Force Majeure, Sanction Risks, and Change in Law

Given a planning horizon of decades, geopolitical instability makes the section on unforeseen risk allocation one of the most critical.[73]

- **Force Majeure:** Standard wording (as in FIDIC) relieves a party from liability for failure to perform obligations due to unpredictable events beyond its control (wars, terrorism, strikes, pandemics).[28] However, the "pitfall" is the legal criterion of "impossibility to overcome the consequences with reasonable efforts."[73]
- **Sanctions Trap and the *MUR Shipping* Precedent:** In a landmark 2022 case, *MUR Shipping v. RTI Ltd*, the UK Court of Appeal delivered a revolutionary ruling regarding sanctions. A Russian company fell under US sanctions, paralyzing dollar payments. It declared force majeure. The court rejected this argument, stating that the effect of the sanctions could have been overcome by "reasonable efforts"—for example, by accepting payment in euros, as this would not have caused commercial harm to the recipient.[75] For Serbia, this means that Sanctions Clauses in contracts (especially in potential cooperation with Rosatom or Chinese vendors) must be drafted as rigidly as possible, explicitly stating that freezing currency transactions or technological embargoes constitutes unconditional and sufficient grounds to suspend the contract without accruing liquidated damages.[75]
- **Change in Law:** Changes in national taxes or European environmental standards during the 10 years of NPP construction are almost inevitable. This clause allows the contractor to pass additional costs onto the client.[49] The trap lies in the fact that a cunning contractor might demand compensation for *foreseeable* changes (e.g., the phased introduction of carbon taxes). The Serbian side must strictly limit the scope of this clause only to "Unforeseeable and Material Adverse Changes,"

excluding planned tax adjustments.[49] Additionally, risks associated with the adoption of Data Localization Laws could block the overseas transfer of digital twins of the NPP, which must be accounted for in the IT sections of the contract.[81]

7.3. Localization and Technology Transfer

One of the main goals of Serbia's nuclear program is to stimulate its own high-tech economy and train national personnel (in partnership with the Vinča Institute).[1] IGAs and EPC contracts always contain declarative slogans about localization.[15]

- **Pitfall:** If the contract text does not back up the localization percentage or "know-how" transfer mechanism with measurable KPIs and strict Retention Moneys for failure to meet them, the foreign vendor will inevitably bring in its own workforce and components, citing a lack of qualifications among local suppliers and safety concerns.[15]
- **Protection Mechanisms:** Contracts must detail the architecture for Intellectual Property (IP) transfer, licensing agreements for local component manufacturing, and software transfer (Configuration Management System).[15] A critical aspect is Export Controls of the vendor's country (USA, France, or Russia), which can suddenly block the transfer of critical technologies. The contract must oblige the vendor to obtain all export licenses *before* the agreement enters into force.[86]

7.4. Nuclear Liability Regime and Insurance

If an accident occurs at a conventional construction site, the damage is local. In the nuclear industry, an incident can cause transnational damage worth hundreds of billions of dollars. In contracts, this colossal risk is managed through direct integration with international conventions.

Table 4. International Regimes of Civil Liability for Nuclear Damage

Convention	Core Principle	Minimum Liability Limit	Coverage Area
Paris Convention (with 2004 Protocol) [23]	Strict and exclusive liability of the operator (Channeling of Liability).	EUR 700 million (can be reduced for small installations to 70 million).	Damage in participating countries (including transboundary damage).
Vienna Convention (with 1997 Protocol) [25]	Similar to the Paris Convention.	300 million SDRs (Special Drawing Rights).	Globally, with the possibility of derogation.
Convention on Supplementary Compensation (CSC) [25]	Creation of a global fund to compensate for transboundary damage.	300 million SDRs + contributions from participating countries.	Jurisdiction of participating countries.

- **Essence of the Mechanism:** The Channeling of Liability means that claims from victims are always directed exclusively to the NPP operator, even if the accident was caused by a defective valve manufactured by a subcontractor. This protects EPC contractors and suppliers from ruinous lawsuits.[23]
- **Pitfall:** The Paris Convention sets a minimum limit of financial security for the operator at EUR 700 million.[23] If the damage (loss of life, health, property, and environment) exceeds this sum, the difference must generally be covered by the sovereign state (state guarantees).[23] When drafting an EPC contract, Serbia must be aware that the developer-vendor will be legally shielded from macro-liability for radiation damage. This requires Serbia to create robust Nuclear Insurance Pools and reserve state funds in the event of a catastrophe.[23]

7.5. Decommissioning and Stranded Assets

The life cycle of an NPP does not end with the shutdown of the reactor. Decommissioning and Spent Nuclear Fuel (SNF) management take decades and cost billions of dollars. According to expert estimates, the global funding shortfall for decommissioning energy facilities reaches $8 trillion.[88]

- **Pitfall:** In BOO contracts (as in Turkey), the vendor promises to carry out decommissioning and take back the waste.[46] However, if targeted funding mechanisms are not protected, by the time the plant closes (in 60-80 years), the vendor's parent corporation might go bankrupt or restructure, leaving a radiologically hazardous facility to the state with no funds for dismantling (creating the risk of "Stranded Assets").[88]
- **Contractual Protection:** The contract (or a specific law) must strictly oblige the NPP operator to regularly transfer a portion of revenues to an independent, irrevocable Decommissioning Segregated Trust Fund, as implemented in the US (under the NWPA) and Canada.[88] Fund rules must strictly prohibit the operator from using these funds for current needs, and the fund's investment policy must be highly conservative.[91] PPAs must include a direct integration of decommissioning and SNF management costs (Waste Fee) into the tariff for every kilowatt-hour sold.[15]

7.6. Performance Guarantees and Delay Penalties

The risks of construction delays in the nuclear sector are critical, as Interest During Construction (IDC) accumulates at astronomical rates, destroying the project's economics.[10]

- **Mechanism:** EPC contracts must include mechanisms for Liquidated Damages (LDs)—pre-estimated losses that the contractor pays the client for every day of delay (Delay LDs) or for failing to achieve the stated thermal or electrical output of the plant (Performance/Heat Rate LDs).[28]
- **Trap:** Experienced contractors (especially those working under the FIDIC Silver Book format) strive relentlessly to set their Aggregate Liability Cap at 10-20% of the contract amount, while also excluding lost profits (Consequential Loss Waiver).[33] If a delay lasts for years, this limit is quickly exhausted. As soon as penalties reach the limit, the contractor loses financial motivation to accelerate work, and further colossal losses fall exclusively on Serbia's shoulders. It is necessary to

introduce motivational mechanisms (Target Cost with shared savings) and the right to terminate the contract and replace the contractor (Step-in Rights) in the event of critical failures.[89]

8. Final Conclusions and Strategic Recommendations

The historic decision to lift the 35-year nuclear moratorium and the ambitious goals to deploy 1,200 MW of nuclear generation based on small modular reactors (SMRs) represent an unprecedented opportunity for structural decarbonization, reindustrialization, and ensuring the energy sovereignty of the Republic of Serbia. However, transforming this political vision into reality through a system of international contracts requires exceptional legal, technical, and financial prudence. Mistakes during the contracting phase will inevitably lead to severe debt crises, geopolitical vulnerability, and the disruption of energy transition timelines.

Based on the comprehensive analysis of global experience conducted, the following strategic recommendations can be formulated for the Government of Serbia and relevant negotiating teams:

1. **Careful Calibration of the Contracting Model.** Interaction with the French corporation EDF provides access to advanced European technologies but requires an extremely cautious approach to EDF's traditional Multi-contracting model. Serbian agencies must objectively assess their current competencies in the role of Architect-Engineer. Given the personnel shortage caused by the 35-year industry hiatus, it is preferable to aim for a hybrid EPC model, transferring interface integration risks to the vendor, but with the mandatory involvement of an independent, highly qualified international consultant (Owner's Engineer) for quality oversight.
2. **Flawless Harmonization with EU Regulatory Standards.** Serbia is obliged to integrate the preparation of tender documentation and the vendor selection process within the framework of European Union competition and public procurement rules. The dramatic precedent with Hungary's Paks II NPP proved that ignoring transparent procedures (Direct Award) under the guise of Intergovernmental Agreements will inevitably lead to years-long legal blockades by supranational EU structures. Serbia's Third Energy Package must act as a shield against antitrust lawsuits.
3. **Hedging Macro-Financial Risks in PPAs.** Serbian state grid structures should categorically avoid signing Power Purchase Agreements (especially in a BOO format) with an unconditional "Take-or-Pay" clause that lacks flexible adaptation mechanisms. The contract must incorporate parameters accounting for future national demand volatility, mass deployment of renewable generation, and dispatch constraints. To finance massive capital expenditures, Serbia should study the British experience of transitioning from a CfD model to a Regulated Asset Base (RAB) model, which helps lower the cost of debt capital by smoothly distributing risks to consumers already during the construction phase.
4. **Institutional Protection Against Geopolitical Shocks and Sanctions.** Amid growing global turbulence, the contract must integrate legally precise and uncompromising clauses on sanctions, currency blockades, and changes in law. Relying on legal precedents (e.g., the *MUR Shipping* case), it is necessary to exclude the possibility of relieving the contractor of obligations due to indirect restrictions that can be overcome by "reasonable commercial efforts." If the BOO model is applied, the contract must contain national sovereignty protection mechanisms (analogous to Article 5.5 of

the Akkuyu NPP agreement), granting the Government of Serbia veto power over changes to the project company's ownership structure.

5. **The Imperative of Establishing Decommissioning Trust Funds.** The life cycle of the contract extends far beyond the construction period. From the first day of electricity generation, a portion of the revenue must be legally ring-fenced in sovereign, independent Decommissioning Trust Funds, protected from corporate bankruptcies of the operator. Only in this way can Serbia guarantee that the financial burden of managing the nuclear legacy and highly radioactive waste does not place a heavy load on the budgets of future generations.

The preparation and signing of an NPP construction contract is a highly complex process of codifying the balance of power between a sovereign state and transnational corporations for the coming century. Only the uncompromising defense of national interests, thorough legal preparation of every provision, and the application of international best practices will enable the Republic of Serbia to successfully implement its nuclear program, providing the country with clean, reliable, and cost-effective energy for decades to come.

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