DOCTRINE: NUCLEAR SOCIOLOGY (Closed Circuit)

DIRECTIVE #3. Scale Traps: A Critical Audit of the Small Modular Reactor (SMR) Concept

Document status: Technical and political brief

Target audience: Ministry of Energy, strategic planners, relevant deputy prime ministers, national regulators

Subject: Assessment of socio-economic and political risks in choosing small modular reactor (SMR) technology as the basis for a national nuclear program

Content

1. Introduction to the problem: The context of the global energy transformation

The global architecture of electricity generation and distribution is undergoing an unprecedented period of structural transformation. The imperatives of decarbonization, tightening climate policy, and the exponential growth of electricity demand driven by the electrification of transport, the development of artificial intelligence (AI), and the expansion of data centers are returning nuclear energy to the epicenter of strategic planning. [1] In a context of growing geopolitical instability, where access to traditional fossil fuels is becoming a tool of political pressure, nuclear generation is seen as the only guarantor of energy security, capable of providing a reliable and independent baseload. [3]

Against the backdrop of this renaissance (the so-called "nuclear renaissance"), small modular reactor (SMR) technology is being aggressively promoted and conceptualized in the global energy market. [1] According to the International Atomic Energy Agency (IAEA) classification, SMRs are nuclear power plants with an electrical capacity of up to 300 MW, designed for serial factory assembly and subsequent transportation of completed modules to the site. [7] Vendors, transnational technology corporations, and a number of political institutions are positioning SMRs as a technological panacea designed to solve the historical problems of the traditional nuclear industry: astronomical capital costs, multi-year construction delays, and the difficulties of integrating large-scale capacity into local energy systems. [6]

The claimed advantages of the concept include low entry barriers for investors, high deployment speed, flexibility for remote locations, and unprecedented scalability. [11] However, a detailed techno-political audit reveals that this marketing narrative contains fundamental vulnerabilities. When confronted with the reality of society's socioeconomic expectations, the laws of physics, system economics, and the psychology of risk perception, the SMR concept reveals hidden threats. Relying on low power without conducting a critical, comprehensive audit could destroy the fragile public consensus around nuclear energy, lead to colossal financial losses, and ultimately provoke the loss of national technological sovereignty. [12]

This Directive presents a comprehensive, multi-level analysis of the socio-economic, psychological and geopolitical risks associated with the integration of SMRs into national energy strategies and formulates specific management mechanisms to mitigate them.

2. The illusion of a quick solution and the crisis of economies of scale

In the global market, SMRs are touted as an innovative, rapid, and affordable solution capable of enabling the transition to a carbon-free economy while minimizing investment risks. [11] The developers' theoretical business model assumes that moving the key stages of reactor construction from the construction site to a controlled factory environment will radically reduce costs and mitigate the risks inherent in the construction of traditional gigawatt nuclear power plants. [8] However, empirical data, the history of early projects, and the basic laws of industrial economics categorically refute these optimistic forecasts.

2.1 Fundamental Laws of Physics and Economies of Scale

Heavy industry, including chemical engineering and nuclear reactor design, follows a strict physical-economic principle known in engineering design as the "six-tenths rule." [14] According to this rule, the capital cost of constructing an industrial facility increases proportionally to its capacity raised to the 0.6 power. [14] This reflects the simple geometry of the systems: the volume of reactors and tanks increases as the cube of the volume, while surface area and material costs increase as the square of the volume. Furthermore, a significant portion of the system costs—design, licensing, safety systems, control room construction, supervision, and site preparation—are "indivisible" and remain virtually fixed regardless of the size of the reactor itself. [14]

Consequently, reducing the physical size of a reactor reduces its absolute cost, but leads to a sharp increase in the specific cost of each megawatt produced. A reactor with a capacity of one-twelfth that of a standard gigawatt-sized power unit (e.g., 77 MW versus 1000 MW) will cost not twelve times less, but approximately four times less (according to the formula 12^0.6). [14] This means that the specific cost per kilowatt of installed capacity (CAPEX) for SMRs inevitably and significantly exceeds that of traditional large-capacity reactors. [17] According to estimates by the International Energy Agency (IEA), the specific capital cost of SMRs in Europe could reach $10,000 per kW, which is significantly higher than $6,600 per kW for large conventional reactors. [17]

To compensate for this failure in economies of scale, the SMR concept relies heavily on "learning by doing"—continuous, mass-produced production in specialized factories. [17] However, this poses an insoluble "chicken and egg" problem. [13] Without mass-produced SMRs, they will never achieve the theoretical cost reductions required to make them competitive. At the same time, without pre-determined cost reductions, no rational investor or power generation company will place orders (hundreds of modules) large enough to recoup the cost of building the factories themselves. [1]

2.2 Empirical Failure: The Anatomy of the Carbon Free Power Project (CFPP) Collapse

The illusory nature of SMR vendors' marketing promises is most vividly and dramatically illustrated by the recent collapse of the flagship Carbon Free Power Project (CFPP) in the United States, which was being implemented by NuScale Power in partnership with the Utah Associated Municipal Power Systems (UAMPS) consortium of municipal power companies. [12] Launched in 2015 with unprecedented financial and political support from the US Department of Energy (DOE), this project was intended to become a global benchmark for SMR commercialization. [21]

The original plan called for the construction of 12 reactor modules with a total capacity of 600 MW by 2023, with an expected overnight cost of approximately $3 billion. [19] However, as the project progressed from conceptual drawings to actual design and licensing, it encountered catastrophic cost escalation. By 2023, the design was forced to change: the number of modules was reduced to six, and their individual capacity was increased to 77 MW (462 MW total) in an attempt to improve economics. [19] Despite this, the overall cost estimate rose to an astronomical $8.03 billion. [12] The target cost of electricity produced, initially stated at $58 per MWh, has skyrocketed to $89 per MWh, and this is taking into account colossal federal subsidies, without which the price would have exceeded $119 per MWh, making energy completely uncompetitive against renewable energy and natural gas. [23]

Financial gravitational pull made the project unviable. The municipal entities that comprised UAMPS were unable to shoulder the risk. Subscription rates for future electricity stalled at 26%, making it impossible to reach the 80% target strictly required for continued funding. [12] In November 2023, after it became clear that the economics of the first-of-its-kind (FOAK) project were not working out, the project was officially cancelled. [20]

2.3. Public Administration Failures and Audit Findings

Government intervention in the form of subsidies not only failed to save the unviable economic model but also led to significant budget losses. An audit conducted by the U.S. Department of Energy's Office of Inspector General (DOE OIG) after the project's closure revealed critical institutional failures in management. [12]

According to the audit, the government spent approximately $183 million in grant funds "without achieving key results." [12] The auditors found that the Department of Energy failed to effectively assess the fundamental risks of the "signature" funding model during the project review phase, failed to implement adequate performance measures, and improperly front-loaded funds. [12] This put an additional $143.5 million in taxpayer funds at risk of non-repayment. [12] Project management was characterized by a pro forma approach: quarterly reports were incomplete, and semi-annual audits were ignored. [12]

This precedent mathematically proves that SMRs are not a "quick and cheap" solution. First-generation technologies (FOAK) carry all the classic risks of nuclear megaprojects: regulatory uncertainty, technological challenges with new components (e.g., steam generators [13]), cost overruns, and multi-year delays. Investing in an unproven concept without strict government oversight leads to direct capital destruction and a loss of public confidence in the nuclear program as a whole.

Economic parameter	**Marketing declarations of MMR vendors**	**Empirical Reality (NuScale CFPP Case)**
Capital expenditures (CAPEX)	Low entry threshold, strict cost control thanks to modularity	Escalation from $3 billion to $8.03 billion before excavation work began [12]
Deployment timelines	Quick assembly, launch within a few years	The launch was postponed from 2023 to 2029, then the project was completely cancelled
Levelized cost of ownership (LCOE)	Competitiveness with gas/renewable generation	The target price increased by 53% even taking into account large government subsidies [23]
State risks	Attracting private capital, minimizing budget participation	Loss of $183 million in direct grants, risk of loss of $143.5 million [12]

3. The paradox of proportionality of benefits (The breakdown of the PIMBY mechanism)

The successful implementation of any large industrial facility, and especially a nuclear one, requires what's known as a "social license to operate"—an informal but critically important political agreement by the local community to long-term proximity to a source of potential radiation hazard. [27] Historically, this complex social consensus has been achieved through the PIMBY (Please In My Backyard) mechanism, which is a positive inversion of the well-known NIMBY (Not In My Backyard) syndrome. [27]

The essence of the PIMBY strategy is to provide the region with unprecedented, transformative socioeconomic benefits whose scale more than compensates for the local population's instinctive fear of nuclear energy. [27] However, the transition to the small modular reactor concept disrupts this established perception economy, creating a dangerous social paradox: while economic incentives are radically reduced, levels of psychological stress and rejection among the population remain at their previous peak.

3.1. Anatomy of Risk Perception (Dread Risk and Affective Heuristics)

Engineering, physics, and public administration operate within the concept of actuarial (or statistical) risk. From this strictly mathematical perspective, nuclear power is one of the safest baseload generation options in the world, second only to some renewable energy sources in terms of fatality rate per terawatt-hour. [29] However, the general public perceives risk quite differently—through the lens of so-called "affect heuristics" and visceral emotional reactions. [31]

Long-term research in risk psychology by Paul Slovic and his colleagues demonstrates that the perception of danger in the public consciousness does not correlate with statistics, but is structured around two key factors: "dread risk" and "unknown risk." [33] The "dread risk" factor is characterized by an individual's lack of personal control over the situation, enormous catastrophic potential, fatal consequences, involuntary nature of the impact, and an uneven distribution of benefits and threats. [30] For decades, nuclear energy, radiation, and the nuclear waste problem have occupied the absolute maximum on the dread risk scale. [33]

For the average person, the threat of radiation is absolute and binary. Psychological reactions are not susceptible to mathematical or linear scaling. A local resident will experience the same level of existential fear regardless of whether a giant 1200 MW reactor or a compact 77 MW small module is being built near their city. [30] Vendors' arguments that SMRs offer increased passive safety, a smaller core volume, and a narrower emergency planning radius [11] are dashed against the wall of irrational perception. [27] If a hypothetical accident at an SMR were to release even 25% of the radiation emitted by a large unit, the perceived risk-to-benefit ratio would remain catastrophically unacceptable to the public. [37]

3.2. Shrinking the Shining Shadow (Loss of the Local Economic Multiplier)

Large Generation III+ nuclear power plants (e.g., EPR, AP1000, VVER-1200) generate a colossal economic multiplier, creating a "shining shadow" of prosperity over the entire region where they operate. A single government decision to build a large-scale plant triggers a mechanism for the complete economic and infrastructural transformation of a municipality ·

3. 2 .1. The "Shining Shadow" Concept (Term Specification)

The term "spillover effect" is a socio-economic and political metaphor describing the enormous spatial multiplier effect (spillover effect) and agglomeration benefits that a super-large infrastructure facility - in particular, a full-scale nuclear power plant - projects onto the host region [1] .

Unlike the radiation or ecological "shadow" (which the population instinctively fears), the "shining shadow" consists of concentrated prosperity, tax excesses, and long-term social stability.

From an academic and economic point of view, this concept is decomposed into three main channels of influence [2] :

1. Radical employment and income multiplier (Induced effect) *A full-scale nuclear power plant generates not only direct jobs for engineers, but also triggers a powerful process of indirect (through local contracts) and induced (through the spending of highly paid employees) enrichment of the territory [2] . Empirical data on large nuclear clusters show that the average employment multiplier is 2.8: that is, every 10 jobs created at the plant itself automatically generates another 18 additional jobs in related*

> *industries and the service sector of the host region [3] .*
>
> ***2. Budget Miracle (Tax Localization)*** *The "shining shadow" covers local municipalities in the form of excess revenue. For example, the French Gravelines Nuclear Power Plant has paid approximately €3.6 billion in local taxes over its 30 years of operation, which has enabled the radical modernization of the entire social infrastructure around the plant [4] . Similarly, the Hinkley Point C Nuclear Power Plant under construction in the UK has already left £5.3 billion in regional suppliers during the construction phase and increased the overall productivity of the local municipality by 10% [5] .*
>
> ***3. A Tool for Overcoming Dread Risk*** *From a mass psychology perspective, radiation falls into the category of "dread risk"—an invisible, fatal, and uncontrollable threat [6] . The population is unable to evaluate such threats linearly, and fear of them is absolute. The only way to force society to voluntarily agree to live next to such an object (the transition from NIMBY to PIMBY syndrome) is to place the community in a "shining shadow" [6] . Enormous, physically tangible benefits act as the only working counterweight to existential fear.*
>
> ***Why is this concept critical for assessing Small Modular Reactors (SMRs)?*** *In the case of SMRs, a dangerous "shining shadow compression" occurs. Because small reactors require modular factory assembly far from the installation site, the local region loses gigantic construction contracts, thousands of jobs, and commensurate taxes [7] . Meanwhile, residents' fear of radiation remains unchanged. By demanding that a region accept a nuclear facility without providing it with the "shining shadow" of full-scale economic benefits, the state risks encountering insurmountable social resistance.*

Empirical evidence supports this thesis. For example, a large-scale study of the nuclear industry's economic impact in five southeastern US states found that the sector generates an annual economic impact of $42.9 billion, supports 152,598 jobs, and provides $3.7 billion in tax revenue to state and local governments. [40] Analysis using input-output models (e.g., IMPLAN) shows that the average employment multiplier for large nuclear power plants is 2.8: for every 10 high-skilled jobs directly created at the plant, an additional 18 jobs are created in related industries and local services. [40] Wages in the nuclear sector are, on average, 36% higher than the average wage in the local market. [39] These unprecedented financial injections allow regions to develop transportation infrastructure, schools, and hospitals, fully compensating society for the so-called "price of fear."

The small modular reactor (SMR) critically disrupts this financial base. The very essence of the SMR logic is to transfer the maximum amount of complex engineering, installation, and construction work from the construction site to remote factories (factory fabrication). [8] This means that the plant's home region loses the lion's share of capital construction contracts. [14] The need for permanent personnel during the operational phase is also sharply reduced thanks to centralized management, automation, and digitalization. [41]

Economic and social parameter	Full-scale nuclear power plant (1000–1200+ MW)	Small modular reactor (50–300 MW)
Employment (construction stage)	5,000 – 10,000 seats (duration 7–10 years)	Minor (the main added value remains at the remote manufacturing plant) [16]
Employment (exploitation)	800 – 1,500 high-paying jobs	250 – 500 seats (concept of minimizing service personnel) [41]
Local Economy Multiplier	Very high (2.8+ direct and induced places) [40]	Low (limited local supply chains, short assembly phase)
Municipal tax base	Colossal (capable of covering the budgets of entire districts with a surplus)	Proportional to capital expenditure (drastically reduced)
Dread Risk	Maximum (existential fear of radiation) [33]	**Maximum** (fear of radiation does not scale linearly) [30]

The result of the breakdown of the PIMBY paradigm: A critical imbalance of fear and benefit arises. The state demands that a region host a nuclear facility, which de facto turns the territory into a long-term radioactive waste repository (due to the lack of centralized decisions on spent nuclear fuel for many new types of SMR fuel). [37] However, in return, the region receives only modest subsidies and minimal tax revenues. The "little battery" simply lacks sufficient financial resources for the large-scale enrichment of local communities. Faced with absolute nuclear fear (dread risk) and without adequate economic compensation, regional elites and the population quickly shift from NIMBY to NIABY (Not In Anyone's Backyard), forming a fierce political opposition to the project, leading to the paralysis of site allocation initiatives .

4. The syndrome of diminished scale (“The neighbor has more”)

Beyond the pragmatic technical and economic dimension, the choice of a technological platform for the development of nuclear energy carries profound geopolitical, ideological, and symbolic implications. Historically and politically, mastery of the nuclear cycle and the possession of nuclear technologies are markers of a state's membership in the technological elite, a tool for asserting national sovereignty and projecting power. [45] In international relations theory, this phenomenon is described through the prism of the "norm model," where complex nuclear technologies serve not only as a response to security challenges but also as a crucial symbol of modernity, national identity, and prestige. [45]

This political dynamic is particularly acute in macro-regions with dense geopolitical environments, historical competition, and an active transition from dependence to autonomy, such as the countries of Eastern Europe and the Balkan Peninsula. [50]

4.1. Nuclear power plant as an instrument of regional industrial dictate

In Central and Eastern Europe, energy infrastructure is inextricably linked to the concept of political sovereignty. [4] Following the structural reorientation of energy supplies, necessitated by the need to phase out Russian hydrocarbon imports and tightening European CO2 emission quotas (CBAM), countries in the region faced an existential choice. [4] Romania, Bulgaria, Poland, the Czech Republic, Slovakia, and Serbia turned to nuclear energy as the only reliable source of baseload power capable of ensuring long-term climate neutrality and energy independence. [3]

In this highly competitive context, a full-scale nuclear power plant is perceived not simply as a utilitarian megawatt-hour factory, but as a powerful geopolitical anchor and an instrument of "strategic connectivity." [54] The construction of giant power units guarantees the country's institutional integration into European energy systems with the prestigious status of a dominant net exporter. [54] Neighboring states operating powerful nuclear power plants gain real leverage over industrial power: they balance regional energy networks, dictate pricing, and attract energy-intensive industries to their territories, including giant data centers and computing clusters for artificial intelligence. [3]

4.2. Symbolic defeat of MMR: From innovation to surrogate

In the context of such intense competition for the status of regional energy leader, the government's proposal to limit itself to the installation of a "low-power module" is perceived by local elites and the population not as a far-sighted step toward an innovative future, but as a public admission of their own technological, financial, and institutional inadequacy. [50] This gives rise to a specific "syndrome of limited scale."

1. **The illusion of "surrogacy" and secondary status** : For developing countries, which have traditionally measured their economic progress and independence by the implementation of mega-infrastructure projects, replacing full-scale nuclear power plants with SMRs appears humiliating and forced. The average citizen and regional politicians look with envy at neighboring states that are implementing full-scale reactor construction programs (for example, Poland's plans to build giant AP1000 units or the expansion of CANDU capacity in Romania with multi-billion dollar US loans [3]), strengthening their economic hegemony . Against this backdrop, the proposal to install SMRs is perceived as a "consolation prize" or ersatz solution for the poor economies of the global South and Eastern Europe, which cannot afford a real, "adult" nuclear program.
2. **Loss of the "Nuclear Prestige" Concept** : Nuclear Prestige Theory postulates that the successful implementation of a complex, large-scale infrastructure project demonstrates a nation's ability to mobilize colossal intellectual, financial, and managerial resources. [45] SMRs, on the contrary, are actively promoted by their creators as ready-made, plug-and-play commercial products, fully assembled in factories abroad and only installed on-site. [1] Consenting to the import of such a module places the country in the humiliating position of a passive recipient of foreign technology (a consumer of a ready-made "battery"), rather than a full-fledged, respected member of the global nuclear club. [48]
3. **Loss of agency in international relations** : Eastern European and Balkan countries (e.g., Serbia, which lifted its 35-year moratorium on nuclear power plant construction in 2024) view nuclear energy as a fundamental basis for building long-term strategic partnerships with global powers (France/EDF, the United States, Russia, or South Korea). A major project obliges the vendor and its government to engage in extensive technology transfer, joint ventures, investments in research, and training of national personnel for decades to come. SMRs, due to their modularity, closed architecture, and focus on minimizing host participation, sharply limit the depth of such partnerships, devaluing the diplomatic weight of the customer country .

Thus, the "scale-limited syndrome" creates a nearly insurmountable domestic political barrier. The proposal to use small and medium-sized industrial (SMR) power generation as the basis for a national generation development strategy fails to satisfy the ambitions of state-building and is predictably met with rejection by patriotic elites and the public, perceived as a capitulation in the regional energy race.

5. The risk of the "Single Module" and the loss of sovereignty

One of the most attractive commercial and marketing arguments that SMR developers use to convince governments and utilities is the flexibility of capital deployment. The paradigm is formulated as follows: "Invest minimally in one module today, and gradually acquire additional capacity tomorrow, solely as actual energy demand grows." [8] This logic of gradual capacity expansion (phased commissioning) does indeed appear financially attractive at first glance. [17] However, at the macroeconomic and national security levels, it poses a critical sovereign threat.

national economy in a tight technological and geopolitical vendor lock-in. Escaping this trap could cost the country's entire energy security.

5.1. Unconfirmed serial production and test site status

Currently, the concept of small modular reactors, despite the enormous media attention, lacks widespread commercial and operational credibility. As of today, the only operational projects that can be classified as SMRs are the Russian floating nuclear power plant Akademik Lomonosov (based on KLT-40S reactors) and the Chinese high-temperature gas-cooled reactor HTR-PM. [10] There are no operating commercial SMRs in Western markets, and their design and licensing face enormous regulatory and engineering challenges (as the audit of NuScale's failure clearly demonstrated). [37]

Consequently, a state that agrees to be the first to install a single module from a foreign vendor de facto voluntarily turns its sovereign territory into a free testing ground. [6] The recipient country assumes all unforeseen engineering risks, the risks of disruptions in immature supply chains, and the unforeseen costs of complexly integrating non-standard equipment into the grid. Vendors' optimistic claims that their innovative reactors will operate flawlessly and reliably "out of the box" do not hold water—the laws of nuclear engineering dictate that decades of real-world operational experience are required to identify, analyze, and eliminate hidden design flaws. [37]

5.2. Technological Hostage and the "Suitcase Without a Handle" Syndrome

A nuclear power plant is designed for 60 years or more of continuous operation. During this colossal period of time, tectonic shifts in the global economy, technology, and politics can occur. If a state purchases a single SMR with the expectation of future expansion within a decade, it has no legal or macroeconomic guarantees for the survival of the technology developer.

1. **Risk of Bankruptcy and Platform Switching** : The current SMR market in the US and Europe is overflowing with ambitious startups (such as NuScale, TerraPower, X-Energy, Holtec, Oklo, and others) that are critically dependent on venture capital and government grants. [15] If, within 7–10 years, the selected vendor runs out of liquidity (as happened with Babcock & Wilcox and its mPower project, which spent over $100 million in government funds before shutting down completely due to a lack of customers [13]), goes bankrupt, or decides to radically change the basic design of its module, the recipient country will find itself in a catastrophic situation.
2. **Geopolitical sanctions and supply chain bottlenecks** : Many advanced modular reactor (SMR) designs rely on specific, exotic nuclear fuels (e.g., highly enriched uranium (HALEU)) and unique metallurgical components. The production of such materials is currently monopolized or tightly controlled by a few countries (often China or Russia). [62] The installation of a single innovative reactor means the complete binding of the energy infrastructure to a single supplier of specific fuel, without the slightest possibility of diversifying supplies on the global market. [69]
3. **The Unique Facility Problem** : If any of the above-mentioned negative scenarios (vendor bankruptcy, imposition of international sanctions, discontinuation of a given model) materializes, the country is left alone with a unique, non-serial facility—a classic "suitcase

without a handle." This facility will be completely deprived of a standardized spare parts base, access to the global maintenance market, and an adapted fuel cycle. [37] Moreover, many SMR designs produce complex radioactive waste streams (e.g., molten salt reactors or liquid metal reactors). [43] Operator training, regulatory certification, and complex waste disposal processes will have to be funded and maintained solely for the operation of a single "little battery," [43] making operating costs astronomical and economically impractical.

Unlike standard high-power pressurized water reactors (VVER, PWR, EPR), for which a global, competitive market for fuel, engineering services, spare parts, and expertise has long been established worldwide, [61] the closed market for unique small modules creates an absolute asymmetry of bargaining power in favor of foreign suppliers.72 As a result, a country relying on a "single module" voluntarily renounces sovereignty in a strategically critical power generation sector.

Vector of threat to sovereignty	Single MMR Module Installation Strategy	Introduction of high-power reactors (Gen III+)
Supply chain maturity	Low (startups, dependence on unique components and grants) [13]	High (existing global ecosystem, diversification opportunities) [61]
Risk of object isolation (Lock-in)	Critical (in case of bankruptcy of the vendor, the station is left without spare parts) [37]	Minimal (standardized and replaceable components)
Fuel cycle vulnerability	High (specific HALEU fuel, complex waste) [43]	Low (standard fuel assemblies, intense competition among suppliers in the market)
The status of the state in the arena	Focal Area for Advanced Technologies (FOAK) [37]	Equal Sovereign Partner Implementing Proven Solutions (NOAK)

6. Management Summary and Solutions: The High-Power Imperative and the Fleet Approach

6 . 1. The illusion of a quick solution

In the global market, the concept of small modular reactors (SMRs) is being aggressively promoted by vendors as a panacea for protracted construction projects and funding gaps. Claimed advantages include low entry barriers, rapid deployment, and scalability. However, when confronted with the reality of society's socioeconomic expectations, this concept reveals fundamental vulnerabilities. Relying on SMRs without critical auditing could undermine public consensus and lead to the loss of technological sovereignty.

6. 2. The paradox of proportionality of benefits (Breakdown of the PIMBY mechanism)

As established in Directive No. 2, the social license to build a nuclear power plant is purchased through large-scale local benefits (the PIMBY strategy). A giant Generation III+ power unit generates colossal cash flow, taxes, and jobs capable of transforming the infrastructure of an entire region.

The small reactor breaks this perception economy:

- **Fear-benefit imbalance:** For the average person, the fear of radiation is absolute. A 300 MW reactor is just as frightening to a local resident as a 1200 MW reactor.
- **Shrinking the Shining Shadow:** Proportionally lower capital expenditures for MMR mean a critical reduction in the tax base, minimal construction contracts for local businesses, and meager tariff subsidies.
- **Result:** The state demands that the region accept the nuclear facility, but cannot pay full "compensation for fear" because the "little battery" lacks the resources to significantly enrich local communities.

6. 3. The syndrome of diminished scale (“The neighbor has more”)

In regions with a dense geopolitical environment and historical competition (for example, in Eastern Europe and the Balkans), a nuclear power plant is an instrument of industrial dictate and a symbol of national prestige.

- The average citizen and local elites look with envy at neighboring states that operate powerful stations that guarantee economic independence.
- The proposal to install a "low-power module" is perceived not as innovation, but as a public admission of financial and technological weakness. It is perceived as a substitute, incapable of satisfying national ambitions.

6. 4. The risk of the “Single Module” and the loss of sovereignty

The vendors' marketing promise— *"We'll deliver one module today, and you can buy the second one tomorrow when you need it"* —conceals a critical sovereign threat.

- **Unconfirmed serial production:** Currently, SMRs do not have a broad reference range. By agreeing to a pilot or single module, the state becomes a testbed.
- **Technological hostage:** There are no legal or political guarantees that in 7–10 years a specific vendor will not go bankrupt, change its technological platform, or be subject to sanctions.
- If this risk materializes, the country will be left with a unique, non-serialized object (“a suitcase without a handle”), deprived of a unified spare parts base and fuel market, which puts an end to energy independence.

7. Conclusions

The use of the MMR concept requires the utmost political caution. Investors and strategists should:

1. **Priority to high capacity:** If there is demand for base-load generation, preference should be given to proven high-capacity reactors (VVER-1200, EPR, AP1000, CANDU), which are guaranteed to trigger the mechanism of total economic transformation of the region (multiplier effect).
2. **Fleet Approach:** If SMRs are selected, contracts for "single modules" are prohibited. The national strategy should envisage the procurement of an entire "fleet" of such reactors, with a strict requirement for extensive localization of component production within the customer country.

Integrating the small modular reactor concept into the national energy system cannot and should not be viewed solely as a routine technical or environmental step toward decarbonization. It is a fundamental strategic decision, fraught with enormous socioeconomic risks, existential threats to regional political consensus (due to the breakdown of the PIMBY mechanism), and the potential loss of sovereign control over domestic generation infrastructure.

Based on a critical audit of recent failures (such as the multi-billion dollar collapse of the NuScale CFPP project [12]) and an in-depth analysis of psychological (dread risk) [33] and geopolitical factors [47] , the Ministry of Energy, strategic planners, relevant deputy prime ministers and national regulators are instructed to strictly adhere to the following fundamental decisions when forming a national nuclear program:

7 . 1. Unconditional priority for large-power reactors (Baseload Anchors)

If there is sufficient macroeconomic demand for base-load generation, as well as the corresponding technical capabilities of the power system (grid capacity, balancing capability), priority should be given unconditionally and without alternative to proven high-power reactors (1000–1200+ MW) of generation III+ (such as VVER-1200, EPR, AP1000, CANDU). [38]

- **Economic imperative:** Only a full-scale infrastructure megaproject can trigger a mechanism for the total economic transformation of a region (with an employment multiplier of 2.8 or higher). [40] Large-scale capital investments, thousands of high-paying jobs, and the enormous tax base generated for municipalities are the only effective counterbalance to the population's instinctive fear (dread risk) of radiation. This is precisely what ensures a sustainable and long-term "social license" for the facility's operation. [27]
- **Geopolitical weight:** The construction of a giant power plant asserts the nation's high status on the international stage, guarantees deep technological transfer, creates a long-term geopolitical anchor in the region, and completely eliminates the "scale disadvantage" in relation to competing neighboring countries. [46]

7. 2. Mandatory implementation of the “Fleet Approach” for SMR

In cases where objective infrastructure constraints (low capacity of regional networks, the need for local replacement of old coal-fired boilers in remote areas) make the choice in favor of SMR the only possible option [2] , government agencies are strictly **prohibited from concluding contracts for the supply of “single modules”** or acting in the dubious role of a site for pilot experiments without obtaining unprecedented sovereign financial guarantees.

The national strategy for the deployment of small reactors must be strictly and rigorously based on the Fleet Approach concept. [78] This management approach implies total standardization of deployment and centralized control:

- **Avoiding one-off deals:** The procurement of SMRs should be structured exclusively as a large-scale national program for the deployment of an entire “fleet” of reactors (for example, a series of 6-10 absolutely identical units) within the framework of a single strategic partnership with a selected vendor. [80]
- **Reducing unit costs (economies of scale): Only a wholesale, guaranteed order can economically justify the launch of a vendor's production** line . This will allow the purchasing country to transition the project from the high-risk FOAK (ultra-expensive first experiment) stage to the NOAK (projected cost of serial production) stage, realizing real economies of scale (nth plant effect).
- Institutional **efficiency:** The naval approach allows the state to create a unified regulatory framework, unify licensing procedures, standardize training programs, and build centralized technical support and cybersecurity (DevSecOps) chains. This eliminates the extremely costly "reinvention of the wheel" for each individual small project.

7. 3. The requirement for strict localization and technology transfer

To completely mitigate the threat of loss of national sovereignty and minimize the risk of “vendor lock-in” [69] , any international contracts for the supply of the SMR fleet must include uncompromising legal requirements for the localization of production.

- Although the basic concept of SMR relies on factory fabrication in the country of origin of the technology [8] , the national government is obliged to require deep localization of the production of critical components, the transfer of final assembly of modules and the integration of systems to its sovereign territory. [63]

- The creation of local production hubs not only forms its own powerful technological base (developing metallurgy, heavy engineering, IT infrastructure) [85] , but also partially compensates the region of location for the loss of those very economic multipliers that SMR takes away from the local construction sector compared to traditional large nuclear power plants. [60]

8. Final conclusion

Nuclear energy, as the foundation of national security, tolerates no illusions or superficial marketing decisions. Small modular reactors undoubtedly possess significant theoretical and technological potential, but their current immature economic model, the specific social perception of radiation risk, and the monopolized structure of supply chains pose existential threats to unprepared economies.

Focusing on large-scale baseload generation remains the absolute benchmark for state planning, ensuring national prestige, economic growth, and social stability. If the path to SMR integration is deemed the only alternative, it must be implemented exclusively through the instruments of strict state control: the application of a naval approach, a categorical rejection of the role of a test bed for startups, and an uncompromising demand for total technological sovereignty. Otherwise, the pursuit of fashionable energy innovation will inevitably lead to the degradation of infrastructure security and the erosion of fragile public trust in the nuclear industry.

Sources

1. What's holding up progress on small modular reactors? – GIS Reports, accessed May 9, 2026, https://www.gisreportsonline.com/r/smrs/
2. Executive Summary – The Path to a New Era for Nuclear Energy – Analysis - IEA, accessed May 9, 2026, https://www.iea.org/reports/the-path-to-a-new-era-for-nuclear-energy/executive-summary
3. Surging AI needs and geopolitical supply shocks renew attention on nuclear energy, accessed May 9, 2026, https://www.weforum.org/stories/2026/04/nuclear-energy-crisis-strait-of-hormuz-wef-small-modular-reactor/
4. The Renaissance of Nuclear Technology in Central Europe - Instytut Europy Środkowej - lublin.pl, accessed May 9, 2026, https://ies.lublin.pl/en/comments/the-renaissance-of-nuclear-technology-in-central-europe/
5. Nuclear Power in the European Union, accessed May 9, 2026, https://world-nuclear.org/information-library/country-profiles/others/european-union
6. Big Change Goes Small: Are Small Modular Reactors (SMRs) the Future of Nuclear Energy? - International Trade Commission, accessed May 9, 2026, https://www.usitc.gov/sites/default/files/publications/332/working_papers/smrs_fo_ma.pdf
7. Economic and employment impacts of small modular nuclear reactors, accessed May 9, 2026, https://www.nrc.gov/docs/ML1802/ML18023A166.pdf
8. Small Modular Reactors - World Nuclear Association, accessed May 9, 2026, https://world-nuclear.org/information-library/nuclear-power-reactors/small-modular-reactors/small-modular-reactors
9. small modular reactors - Aris (iaea.org), accessed May 9, 2026, https://aris.iaea.org/Publications/SMR_catalogue_2024.pdf
10. Making a Big Difference: Small Modular Nuclear Reactors - International Energy Forum, accessed May 9, 2026, https://www.ief.org/news/making-a-big-difference-small-modular-nuclear-reactors
11. Benefits of Small Modular Reactors (SMRs) - Department of Energy, accessed May 9, 2026, https://www.energy.gov/ne/benefits-small-modular-reactors-smrs
12. DOE-NE's handling of failed CFPP: Audit's key takeaways - American Nuclear Society, accessed May 9, 2026, https://www.ans.org/news/2026-04-14/article-7935/doenes-handling-of-failed-cfpp-audits-key-takeaways/
13. Why Small Modular Nuclear Reactors Won't Help Counter the Climate Crisis, accessed May 9, 2026, https://www.ewg.org/news-insights/news/why-small-modular-nuclear-reactors-wont-help-counter-climate-crisis
14. Small Modular Reactors vs. Large Nuclear: The Economics of Scale | by Shb | Medium, accessed May 9, 2026, https://medium.com/@bandarusreeharsha7/small-modular-reactors-vs-large-nuclear-the-economics-of-scale-8e8afabd80f4
15. 4 Pros and Cons of Small Modular Reactors (SMRs) - ABI Research, accessed May 9, 2026, https://www.abiresearch.com/blog/small-modular-reactors-pros-and-cons
16. The Economics of SMRs: Why Simplicity and Scalability Matter - NuScale Power, accessed May 9, 2026, https://www.nuscalepower.com/smr-insights-blog/the-

economics-of-smrs-why-simplicity-and-scalability-matter

17. Faster, Cheaper, Smarter? The Promise and Pitfalls of Small..., accessed May 9, 2026, https://www.globsec.org/what-we-do/commentaries/faster-cheaper-smarter-promise-and-pitfalls-small-modular-reactors
18. NAE Website - Chasing Cheap Nuclear: Economic Trade-Offs for Small Modular Reactors, accessed May 9, 2026, https://www.nae.edu/239267/Chasing-Cheap-Nuclear-Economic-TradeOffs-for-Small-Modular-Reactors
19. The collapse of NuScale's project should spell the end for small modular nuclear reactors, accessed May 9, 2026, https://www.utilitydive.com/news/nuscale-uamps-project-small-modular-reactor-ramanasmr-/705717/
20. Utah Associated Municipal Power Systems (UAMPS) and NuScale Power Agree to Terminate the Carbon-Free Power Project (CFPP), accessed May 9, 2026, https://www.nuscalepower.com/press-releases/2023/utah-associated-municipal-power-systems-and-nuscale-power-agree-to-terminate-the-carbon-free-power-project
21. Lessons learned from the recently canceled NuScale-UAMPS project - Clean Air Task Force, accessed May 9, 2026, https://www.catf.us/2023/11/lessons-learned-recently-cancelled-nuscale-uamps-project/
22. US DOE Mismanaged Landmark NuScale Nuclear Project, Says Audit - NucNet, accessed May 9, 2026, https://www.nucnet.org/news/us-doe-mismanaged-landmark-nuscale-nuclear-project-says-audit-4-4-2026
23. Nuclear Power's Newest Cautionary Tale | Cato at Liberty Blog, accessed May 9, 2026, https://www.cato.org/blog/nuclear-powers-newest-cautionary-tale
24. NuScale CEO Remains Upbeat After CFPP Cancellation - World Nuclear News, accessed May 9, 2026, https://world-nuclear-news.org/articles/nuscale-ceo-remains-upbeat-after-cfpp-cancellation
25. Small size, big problems: NuScale's troublesome small modular nuclear reactor plan, accessed May 9, 2026, https://www.ewg.org/news-insights/news/2023/07/small-size-big-problems-nuscales-troublesome-small-modular-nuclear
26. Idaho SMR project terminated - World Nuclear News, accessed May 9, 2026, https://www.world-nuclear-news.org/articles/idaho-smr-project-terminated
27. How Does Public Perception Impact SMR Deployment? - Energy → Sustainability Directory, accessed May 9, 2026, https://energy.sustainability-directory.com/question/how-does-public-perception-impact-smr-deployment/
28. What Are SMRs Effects on Local Economies? - Energy → Sustainability Directory, accessed May 9, 2026, https://energy.sustainability-directory.com/question/what-are-smrs-effects-on-local-economies/
29. Nuclear Fear Explained: Psychology Behind Public Anxiety Over Atomic Power - Discovery Alert, accessed May 9, 2026, https://discoveryalert.com.au/nuclear-energy-public-perception-psychological-responses/
30. Nuclear Power: Actuarial Versus Perceived Risks - The BYU Design Review, accessed May 9, 2026, https://www.designreview.byu.edu/collections/nuclear-power-actuarial-versus-perceived-risks
31. Science Current Directions in Psychological, accessed May 9, 2026, https://courses.washington.edu/pbafhall/514/514%20Readings/riskperceptionandaffect.pdf

32. Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, and Risk, accessed May 9, 2026, https://cancercontrol.cancer.gov/sites/default/files/2020-06/slovic.pdf
33. Perception of Risk - Paul Slovic - Division of Social Sciences, accessed May 9, 2026, http://socsci2.ucsd.edu/~aronatas/project/academic/risk%20slovic.pdf
34. Carbon-Free Power - RTI International, accessed May 9, 2026, https://www.rti.org/rti-press-publication/carbon-free-power-the-role-of-small-modular-nuclear-reactors/fulltext.pdf
35. (PDF) The Perception of Risk - ResearchGate, accessed May 9, 2026, https://www.researchgate.net/publication/325954197_The_perception_of_risk
36. Radiation Workers and Risk Perceptions: Low Dose Radiation, Nuclear Power Production, and Small Modular Nuclear Reactors - MDPI, accessed May 9, 2026, https://www.mdpi.com/2673-4362/4/1/20
37. Five Things the “Nuclear Bros” Don't Want You to Know About Small Modular Reactors, accessed May 9, 2026, https://blog.ucs.org/edwin-lyman/five-things-the-nuclear-bros-dont-want-you-to-know-about-small-modular-reactors/
38. Comparative assessment of small modular reactors versus large nuclear power plants for future electricity generation in Libya, accessed May 9, 2026, https://conferences.iaea.org/event/374/papers/30992/files/12826-comparative%20assessment%20of%20small%20modular%20reactors%20versus%20large%20nuclear%20power%20plants%20for%20future%20electricity%20generation%20in%20libya.pdf
39. The Economics of Small Modular Reactors - March 2021 - Nuclear Energy Institute, accessed May 9, 2026, https://www.nei.org/getContentAsset/75b1d5ed-c2a4-4c03-82ad-d2da080a7fbe/8d8ff8d6-b2ae-401b-a63c-f6b108e809d2/SMR-Start-Economic-Analysis-2021-(APPROVED-2021-03-22).pdf?language=en-US
40. New Study Reveals Remarkable Economic Impact of Nuclear Industry in the Southeastern United States, accessed May 9, 2026, https://www.usnic.org/news/new-study-reveals-remarkable-economic-impact-of-nuclear-industry-in-southeast-united-states
41. FEASIBILITY OF SMALL MODULAR REACTOR DEVELOPMENT AND DEPLOYMENT IN CANADA - OPG, accessed May 9, 2026, https://www.opg.com/documents/feasibility-of-smr-development-and-deployment-in-canada-pdf/
42. Feasibility Study Interim Report - Purdue University, accessed May 9, 2026, https://www.purdue.edu/operations/nuclear/wp-content/uploads/sites/6/2024/11/smr-feasibility-study-interim-report-compressed.pdf
43. Nuclear Small Modular Reactors: Key Considerations for Deployment - International Energy Forum - IEF, accessed May 9, 2026, https://www.ief.org/_resources/files/events/nuclear-small-modular-reactors-smrs-key-considerations-for-deployment/smr-report.pdf
44. Trust, Justice, and Expertise in Nuclear Waste Management: A Q-Method Analysis of Environmental Discourses in the United Kingdom - Taylor & Francis, accessed May 9, 2026, https://www.tandfonline.com/doi/full/10.1080/21550085.2024.2398966
45. Nuclear Weapons and National Prestige - EliScholar, accessed May 9, 2026, https://elischolar.library.yale.edu/cgi/viewcontent.cgi?article=2847&context=cowles-

discussion-paper-series
46. Nuclear Weapons and National Prestige | Request PDF - ResearchGate, accessed May 9, 2026, https://www.researchgate.net/publication/4775494_Nuclear_Weapons_and_National_Prestige
47. INR 392 International Politics in the Post-Cold War Era - NOUN, accessed May 9, 2026, https://nou.edu.ng/coursewarecontent/INR%20%20392%20International%20Politics%20in%20the%20Post%20Cold%20War%20Era.pdf
48. Nuclear Energy in Developing Countries | American Academy of Arts and Sciences, accessed May 9, 2026, https://www.amacad.org/publication/daedalus/nuclear-energy-developing-countries
49. WHY DO COUNTRIES WANT TO HAVE NUCLEAR WEAPONS? - Eurasian Research Institute, accessed May 9, 2026, https://eurasian-research.org/wp-content/uploads/2021/07/Weekly-e-bulletin-14.06.2021-20.06.2021-No-311.pdf
50. Nuclear Energy and Rationalized Power at the Borders of Europe - EuropeNow, accessed May 9, 2026, https://www.europenowjournal.org/2022/05/17/nuclear-energy-and-racialized-power-at-the-borders-of-europe/
51. Geopolitical Influences of External Powers in the Western Balkans - The Hague Centre for Strategic Studies, accessed May 9, 2026, https://hcss.nl/wp-content/uploads/2021/01/Geopolitical-Influences-of-External-Powers-in-the-Western-Balkans_0.pdf
52. Nuclear Geopolitics in the Balkans. What Stands Behind Serbia and Rosatom's Interests in Negotiations on the Construction of a Nuclear Power Plant? | Resurgam, accessed May 9, 2026, https://resurgamhub.org/analytics/europe/eu/nuclear-geopolitics-in-the-balkans-what-stands-behind-serbia-and-rosatom-s-interests-in-negotiations-on-the-construction-of-a-nuclear-power-plant-
53. Eastern Europe: Energy Security Through Diversification - USTDA, accessed May 9, 2026, https://www.ustda.gov/eastern-europe-energy-security-through-diversification/
54. Nuclear Energy in Serbia: Between Legislative Reforms and Regional Integration | Pupin Initiative · Пупин Иницијатива, accessed May 9, 2026, https://www.pupin.org/analysis/nuclear-energy-in-serbia-between-legislative-reforms-and-regional-integration
55. Why Some Nations Choose Nuclear Power - Kleinman Center for Energy Policy, accessed May 9, 2026, https://kleinmanenergy.upenn.edu/research/publications/why-some-nations-choose-nuclear-power/
56. The Balkan power map 2035: How Serbia's nuclear question ..., accessed May 9, 2026, https://cbam.rs/the-balkan-power-map-2035-how-serbias-nuclear-question-reorders-regional-alliances-and-cross-border-power-flows/
57. The Geopolitical Powerplay of Small Modular Reactors - Modern Diplomacy, accessed May 9, 2026, https://moderndiplomacy.eu/2023/12/27/the-geopolitical-powerplay-of-small-modular-reactors/
58. Is a US-China nuclear energy rivalry brewing in the Balkans? - YouTube, accessed May 9, 2026, https://www.youtube.com/watch?v=m5C-Td4FQMc
59. Small modular reactors may have climate benefits, but they can also be climate-vulnerable, accessed May 9, 2026,

https://www.sipri.org/commentary/blog/2024/holding-page-vitalys-blog-smrs-and-climate-vulnerability

60. Techno-Economic Comparison of a Large-Scale Nuclear Power Plant, Small Modular Reactors, and Wind and Solar Power Plant Deployment - MDPI, accessed May 9, 2026, https://www.mdpi.com/1996-1073/18/9/2355
61. PREPARATION OF PRELIMINARY TECHNICAL STUDY FOR THE CONSIDERATION OF THE PEACETIME APPLICATION OF NUCLEAR ENERGY IN THE REPUBLIC, accessed May 9, 2026, https://www.mre.gov.rs/extfile/sector/sr/150/77/PreliminaryTechnicalStudyRS-ENG.pdf
62. Small Modular Reactors: A Sustainable Future or a Geopolitical Gamble?, accessed May 9, 2026, https://www.indo-pacificstudiescenter.org/commentaries/small-modular-reactors
63. The Evolutionary Approach of the AREVA Reactors, accessed May 9, 2026, https://www-pub.iaea.org/MTCD/Meetings/PDFplus/2010/39798/Presentations/3/15.%20Areva%20-%20expectations%20regarding%20newcomers.ppt
64. Advances in SMR Developments 2024 - Scientific, technical publications in the nuclear field | IAEA, accessed May 9, 2026, https://www-pub.iaea.org/MTCD/Publications/PDF/p15790-PUB9062_web.pdf
65. Understand Small Modular Reactors, accessed May 9, 2026, https://understand-energy.stanford.edu/news/understand-small-modular-reactors
66. Small Modular Reactors: A Realist Approach to the Future of Nuclear Power | Reports & Briefings | Apr 14, 2025 | ITIF, accessed May 9, 2026, https://itif.org/publications/2025/04/14/small-modular-reactors-a-realist-approach-to-the-future-of-nuclear-power/
67. Small Modular Reactors: A Technical and Economic Assessment - Clean Air Task Force, accessed May 9, 2026, https://cdn.catf.us/wp-content/uploads/2023/11/22132144/small-modular-reactors-technical-economic-assessment.pdf
68. Strategic autonomy and the future of nuclear energy in the EU - European Parliament, accessed May 9, 2026, https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/757796/EPRS_BRI(2024)757796_EN.pdf
69. Sovereignty Through Portability: How to Avoid Vendor Lock-in - Arvato Systems, accessed May 9, 2026, https://www.arvato-systems.com/blog/sovereignty-through-portability-how-to-avoid-vendor-lock-in
70. AI'S HIDDEN DEPENDENCIES - Arthur D. Little, accessed May 9, 2026, https://www.adlittle.com/sites/default/files/2026-01/BLUE_SHIFT_AI_hidden_dependencies.pdf
71. Rockefeller Foundation Report Finds Nuclear Energy Could Deliver Up to 30% of Electricity Generation for Emerging Economies, accessed May 9, 2026, https://www.rockefellerfoundation.org/news/new-rockefeller-foundation-report-next-generation-nuclear-could-power-energy-abundance-for-emerging-economies/
72. Full article: Negotiating Nuclear Power Project Agreements in Emerging Economies—Safeguarding Local Community Interests - Taylor & Francis, accessed May 9, 2026, https://www.tandfonline.com/doi/full/10.1080/00295450.2026.2612756

73. Small modular nuclear reactors for developing countries..., accessed May 9, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC12893387/
74. Full article: Power and Nuclear Weapons: The Case of the European Union, accessed May 9, 2026, https://www.tandfonline.com/doi/full/10.1080/25751654.2020.1764260
75. In your opinion, are large reactors or small modular reactors better? : r/nuclear - Reddit, last accessed: May 9, 2026, https://www.reddit.com/r/nuclear/comments/1hxa4f6/in_your_opinion_are_large_reactors_or_small/
76. COAL-TO-NUCLEAR TRANSITIONS: - Department of Energy, accessed May 9, 2026, https://www.energy.gov/sites/default/files/2024-04/24_DOE-NE_Coal%20to%20Nuclear%20Report_04.01_digital%20%281%29.pdf
77. SMRs for Replacing Coal: Opportunities and Challenges for Small Modular Reactors - Nuclear Energy Agency (NEA), accessed May 9, 2026, https://www.oecd-nea.org/upload/docs/application/pdf/2025-10/7732_smrs_for_replacing_coal_rev.pdf
78. United States Launches Initiative for Fleet Deployment of Advanced Nuclear Energy Technology in Europe - US Embassy in Poland, accessed May 9, 2026, https://pl.usembassy.gov/united-states-launches-initiative-for-fleet-deployment-of-advanced-nuclear-energy-technology-in-europe/
79. NEI 24-06, Fleet Deployment Models for Standardized New Nuclear Deployments, accessed May 9, 2026, https://www.nei.org/resources/reports-briefs/nei-24-06-fleet-deployment-models-for-standardize
80. Nuclear Regulatory Review 2025 - GOV.UK, accessed May 9, 2026, https://assets.publishing.service.gov.uk/media/692080f75c394e481336ab89/nuclear-regulatory-review-2025.pdf
81. Chain Reactions -- February 2026 - Clean Prosperity, accessed May 9, 2026, https://cleanprosperity.ca/wp-content/uploads/2026/02/Chain-Reactions-February-2026.pdf
82. Advanced Nuclear Reactor Systems and Future Energy Market Needs, accessed May 9, 2026, https://www.oecd-nea.org/upload/docs/application/pdf/2021-12/nea_7566_arfem.pdf
83. ECONOMIC AND FINANCE WORKING GROUP SMR ROADMAP, accessed May 9, 2026, https://smrroadmap.ca/wp-content/uploads/2018/12/Economics-Finance-WG.pdf?x93402
84. What Economic Models Support SMR Deployment? - Energy → Sustainability Directory, accessed May 9, 2026, https://energy.sustainability-directory.com/question/what-economic-models-support-smr-deployment/
85. Full article: Infrastructural entanglement and cloud hyperscalers in contemporary warfare: Insights from Ukraine, Israel, and Taiwan - Taylor & Francis, accessed May 9, 2026, https://www.tandfonline.com/doi/full/10.1080/13523260.2025.2593247
86. Integrated Operations for Nuclear: Work Reduction Opportunity Demonstration - Light Water Reactor Sustainability Program - Idaho National Laboratory, accessed May 9, 2026, https://lwrs.inl.gov/content/uploads/11/2024/10/ION_WRO_Demo-1.pdf
87. Nuclear Energy Returns to the Global Stage — What It Means for Europe and Greece, accessed May 9, 2026, https://moderndiplomacy.eu/2025/07/30/nuclear-energy-

returns-to-the-global-stage-what-it-means-for-europe-and-greece/

88.