

BRAZIL'S STRATEGIC ROLE IN THE GLOBAL NUCLEAR SUPPLY CHAIN IN THE ERA OF SMALL MODULAR REACTORS (SMRs)

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1. OPENING: Brazil's perspective

Good morning, ladies and gentlemen.

It is a great pleasure to be here in Nashville, representing ENBPar and bringing a Brazilian perspective to the discussion on small modular reactors and the transformation of the global nuclear industry.

ENBPar, a state-owned company responsible for managing the Brazilian Federal Government's strategic holdings in the energy sector, monitors and supports initiatives aimed at strengthening governance, energy security and the sustainability of Brazil's nuclear supply chains.

In this presentation, I will share a technical and institutional perspective based on public information and initiatives currently under development in Brazil's nuclear sector. This is not an announcement of a procurement decision, the selection of a technology or the definition of a deployment schedule.

When we discuss Small Modular Reactors, or SMRs, it is natural to focus our attention on the reactors themselves: the technologies, business models, licensing, costs, schedules, and, specially, the supply-chain of the fuel.

Today, however, I would like to propose a slightly different perspective.

If SMRs reach the scale projected for the coming decades, where will their fuel, components, engineering capacity and the qualified professionals needed to sustain this expansion come from?

This is, essentially, a supply chain issue.

And this is precisely where **Brazil brings together capabilities that deserve attention**. The country may be considered not only a potential market for new nuclear technologies, but also a possible partner in the future global nuclear supply chain.

Brazil has strategic uranium resources, mastery of isotopic enrichment, nuclear fuel fabrication capacity and operational experience in nuclear power generation.

2. A NEW PHASE FOR THE NUCLEAR INDUSTRY

The global energy system is undergoing a profound transformation. Electricity demand is rising, and countries need to expand their energy supply while strengthening energy security and ensuring the reliability and resilience of their power systems.

At the same time, the electrification of the economy, the expansion of data centers, artificial intelligence, hydrogen production and new industrial processes are expected to increase demand for continuous and reliable electricity.

In this context, nuclear energy has once again gained prominence in the international energy debate because of its capacity to provide firm and reliable power. SMRs add a new dimension to this movement. We are experiencing a profound transformation of the global energy system. We need to expand the energy supply and ensure the security and reliability of power systems.

One of their potentially transformative features is the possibility of expanding standardization, modularization and serial manufacturing. As a result, a greater share of construction could move from project sites to controlled industrial environments.

If SMRs are deployed at scale, we will not merely be facing a new reactor market. We will be witnessing the emergence of a new global nuclear industrial supply chain, requiring reliable suppliers of fuel, components, engineering, specialized services and qualified professionals.

3. BRAZIL'S NUCLEAR FOUNDATION

Brazil is not starting this discussion from scratch.

The country has decades of experience in the nuclear sector, operating generation at Angra 1 and Angra 2, research institutions, universities, engineers, specialized technicians and an industrial structure developed over time.

Brazil also has its own uranium resources. According to public information from Indústrias Nucleares do Brasil – Brazil's state-owned nuclear fuel company -, the country

has more than 232 thousand tons of identified resources, and less than one third of the national territory has undergone detailed geological surveys for this mineral.

In addition to its geological potential, the country has experience in mining and beneficiation, proprietary ultracentrifuge isotopic enrichment technology, fuel fabrication and nuclear power plant operation.

This combination of natural resources, technological knowledge, institutions and human capital is uncommon in the international landscape.

All these activities are intended for peaceful purposes and must comply with Brazilian law, safety requirements, safeguards and the international commitments undertaken by the country.

This foundation enables Brazil to participate in the discussion on SMRs with practical experience and accumulated knowledge.

4. FROM URANIUM TO NUCLEAR FUEL

When we talk about the nuclear supply chain, it is important to understand where value lies.

In simplified terms, the fuel cycle can be represented as follows: uranium, mining and beneficiation, conversion, enrichment, fuel fabrication, reactor and power generation.

Brazil participates in significant stages of this chain. INB operates from the production of uranium concentrate to the fabrication of the fuel assemblies used by Brazilian nuclear power plants. Conversion is still contracted abroad, which represents a gap in the domestic supply chain.

The country has also developed its own ultracentrifuge enrichment technology. INB is licensed to enrich uranium to up to 5% uranium-235 and reports that its installed capacity corresponds to approximately 70% of Angra 1's annual reload requirement.

The strategic issue for the coming years is not merely to recognize what Brazil is already capable of doing. It is to assess how these capabilities can be strengthened safely, economically and in alignment with the planning of the Brazilian Nuclear Program.

There is a significant economic difference between supplying only a mineral raw material and participating, in a qualified manner, in the more technologically sophisticated stages of the supply chain.

It is therefore important to strengthen domestic production, reduce supply vulnerabilities and pursue greater value addition in fuel, engineering, components, services and technology.

This movement must respect the Federal Government's monopoly over nuclear minerals, Brazil's legal framework, the decisions of the competent authorities and the country's international commitments.

The expansion of SMRs will drive new global demand for nuclear fuel, industrial components, specialized services and reliable suppliers.

5. WHY BRAZIL IS EVALUATING SMRs

The Brazilian power system has its own particular characteristics. We have a high share of renewable sources, especially hydropower, wind and solar.

For this reason, Brazil's nuclear discussion need not be presented as a choice between nuclear energy and renewable energy. The issue is how these sources can complement one another.

As the share of variable sources grows, the importance of resources capable of providing firm power and contributing to system reliability also increases.

Depending on the technology and the viability of each project, smaller reactors may also be studied for industrial applications, hydrogen production, isolated systems, mining activities and the replacement of fossil fuel-based generation.

Each possibility will depend on specific analysis of safety, siting, licensing, fuel, waste management and economic viability.

Brazil is conducting this assessment in a structured manner. Within the Committee for the Development of the Brazilian Nuclear Program, Working Group 19 is analyzing the technical, regulatory and institutional aspects required for the potential introduction of SMRs and microreactors in the country.

Therefore, Brazil's interest reflects a willingness to study these technologies responsibly, rather than a prior decision concerning models, suppliers or schedules.

Few countries simultaneously possess significant uranium resources, proprietary enrichment technology, nuclear fuel fabrication and operational experience in nuclear power plants.

6. REACTOR TECHNOLOGY AND FUEL AVAILABILITY

The acronym SMR encompasses different designs and technologies. Therefore, these reactors cannot be assessed as though they represented a single solution.

Many light-water reactor designs use uranium enriched to less than 5% and are closer to Brazil's existing fuel-cycle experience.

Other concepts may require fuels with different characteristics, including high-assay uranium, known as HALEU, or specialized fuels such as TRISO.

These alternatives require different production, fabrication, qualification, transportation and licensing capabilities.

For this reason, any eventual technology selection must consider the combination of the reactor, the fuel and the infrastructure required for its safe and continuous operation.

The sector's economic potential lies not only in mineral production, but mainly in adding value throughout the more advanced stages of the nuclear fuel cycle.

7. DOMESTIC INDUSTRY AND TECHNOLOGY COOPERATION

Modularization may expand the participation of international supply chains and create opportunities for countries that are not the original developers of a particular technology but have the capacity to participate in its production.

Brazil has experience in metallurgy, heavy engineering, mining, oil and gas, the offshore industry, electrical equipment, automation and major infrastructure projects.

Naturally, supplying the nuclear industry requires extremely high standards of quality, traceability, safety and qualification. The existence of an industrial base does not imply automatic qualification, but it provides a relevant starting point.

The question we must ask is which components and services in the future SMR supply chain could, after the necessary qualification and licensing processes, be developed competitively in Brazil.

This discussion must involve government, companies, universities, research centers and international partners.

Future partnerships may include professional training, joint research and development, licensed manufacturing, technology cooperation and the participation of Brazilian suppliers.

These possibilities must be defined on mutually agreed terms, with respect for intellectual property, commercial contracts, applicable controls, safeguards and national and international commitments.

The objective is not to restrict the participation of foreign suppliers, but to build lasting relationships that combine competitive supply, safety, local capability development and shared benefits. We also aim to prepare the country for future investment decisions and participation in the new global nuclear supply chain.

8. RESILIENCE AND PARTICIPATION IN THE GLOBAL SUPPLY CHAIN

Events in recent years have demonstrated that supply chains are not merely a matter of economic efficiency. They are also a matter of security and operational continuity.

Uranium, conversion, enrichment, fuel and nuclear components have once again come to be regarded as strategic assets. In this environment, the geographic diversification of suppliers is becoming increasingly important.

Brazil has natural resources, established nuclear institutions, engineering capacity and a tradition of peaceful nuclear energy use. It also maintains dialogue and cooperation with different international partners.

This combination may support Brazil's future participation in international supply chains.

A first step is to expand knowledge of the technical requirements of the different designs and identify which domestic capabilities have the potential to qualify and compete.

In the long term, after national needs have been considered and provided that legal, regulatory, commercial and safeguards requirements are met, Brazil may expand its presence in the international supply of nuclear products and services.

This prospect should be understood as a possibility for future development, rather than as a previously established commitment.

The availability of nuclear fuel may become a decisive factor in the sustainable expansion of SMRs worldwide.

9. A POSSIBLE PARTNERSHIP AGENDA

Brazil brings together relevant assets for dialogue with international partners: uranium resources, fuel-cycle experience, specialized institutions, qualified professionals, engineering capacity and a large energy market.

International partners can contribute experience in SMR projects, licensing, financing, professional training, supplier qualification and integration into manufacturers' global supply chains.

Each partnership must be evaluated on its technical, economic and institutional merits.

Safety, safeguards, waste management, environmental protection and public confidence must be integrated into these discussions from the outset.

The key word is cooperation: long-term relationships with clearly defined responsibilities and shared benefits.

Brazil's participation may take place through component manufacturing, specialized engineering, supplier qualification, applied research and skilled workforce development.

10. CONCLUSION

Ladies and gentlemen, I would like to conclude by returning to the question I raised at the beginning.

What contributions can Brazil make in this new nuclear era?

Brazil can become a significant market for advanced nuclear technologies. However, it does not intend to limit its participation to that of a buyer of equipment or a supplier of raw materials.

The country brings together uranium resources, expertise in the nuclear fuel cycle, engineering capabilities, research and innovation institutions, industrial suppliers, and qualified professionals.

Brazil can also offer reliable, long-term partnerships guided by the exclusively peaceful use of nuclear energy and by respect for safety standards, safeguards, and international commitments.

The emergence of SMRs gives us an opportunity to view the nuclear industry not merely as a succession of national projects, but as a global and interconnected industrial ecosystem.

In this context, Brazil is open to cooperation with companies, governments, and institutions interested in developing partnerships that promote technology transfer, professional training, joint research, supplier qualification, and the effective participation of Brazilian industry.

The objective is to progressively expand national capabilities across all stages of the nuclear value chain: from uranium production and the nuclear fuel cycle to component manufacturing, engineering, specialized services, and technological innovation.

With the development of these capabilities and compliance with the applicable technical, legal, regulatory, and commercial requirements, Brazil may participate not only as a market for SMRs, but also as a producer and supplier of components, services, and potentially nuclear fuel for these reactors.

This participation should be built through balanced partnerships that combine access to advanced technologies with the strengthening of Brazilian industry and generate tangible benefits for all parties involved.

SMRs therefore represent an opportunity to integrate Brazil into global high-technology value chains while contributing to the security and diversification of the international nuclear supply.

Any progress must comply with Brazil's legal framework, nuclear safety requirements, intellectual property rights, safeguards, and the international commitments undertaken by the country.

In the era of small modular reactors, the question will not only be who will build the reactors. It will also be who will supply the fuel, components, services, and knowledge required for the development of this new industry.

Brazil brings together the natural resources, technological knowledge, industrial capacity, and institutional experience needed to participate across this entire value chain—as a market, a technology partner, a producer, and a potential international supplier.

It is with this vision of cooperation, industrial development, and mutual benefit that Brazil intends to build its role in the new nuclear era.

If you have any questions, please feel free to send them to ENBPar's institutional email address: **contato@enbpar.gov.br**

Thank you very much.