

Fact sheet on nuclear expenditure in Brazil (2004-2014)

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1. Introduction

It is a well-known fact that Brazil has undertaken major efforts to develop indigenous nuclear technology or otherwise acquire it. Since the 1970s, the country has pursued nuclear autonomy, developing competencies in all major stages of the nuclear fuel cycle: uranium mining and milling, conversion, enrichment, fuel fabrication and electricity generation.

Currently, there are two nuclear power reactors in operation, Angra 1 and Angra 2, which together are responsible for roughly 2.5% of all electricity produced in the country. Additionally, nuclear technology is used in Brazil for medical, health, industry, agriculture and research purposes.

In recent years, plans to expand the applications of nuclear technology in all fields were put in motion, as the government resumed the construction of nuclear power reactor Angra 3, took up the project of a nuclear-propelled submarine and decided to build a multipurpose nuclear reactor.

All these Big Science projects demand large-scale, long-term and complex research and development efforts. Likewise, this type of enterprise usually requires large sums of money. In financial terms, how much does the nuclear spending amount to? How has the nuclear budget evolved throughout the past decade? The fact sheet intends to explore these questions, based on the data provided by the Brazilian government available online.

2. Main trends and significant events

As Figure 1 shows, the budget of the main nuclear institutions in Brazil has increased in the past decade. Apart from this trend, there seems to be no other pattern that can characterize the evolution of the budget of the nuclear establishment in Brazil: the National Nuclear Energy Commission (CNEN); the Nuclear Industries of Brazil (INB); the Nuclebras Heavy Equipment (NUCLEP); and the Blue Amazon Defense Technologies (AMAZUL). Since 2004, all these organizations have undergone significant variations regarding their funds, but these fluctuations were not always comparable.

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BUDGET OF THE BRAZILIAN NUCLEAR INSTITUTIONS (2004-2014)

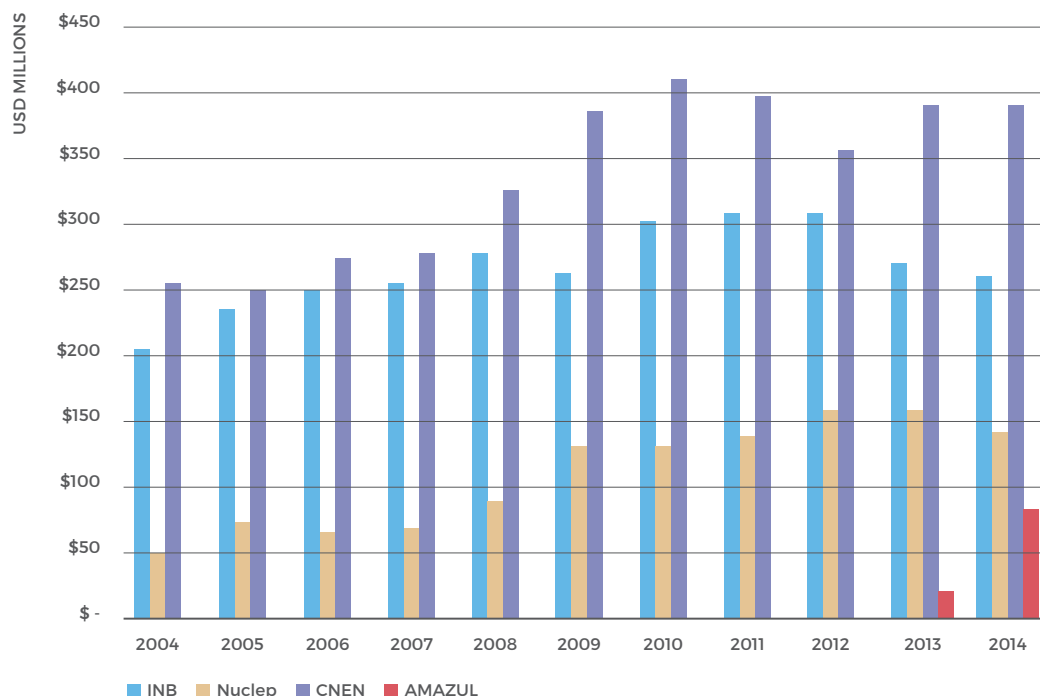


Figure 1 - Numbers in USD at constant 2014 prices and average exchange rate of 2014

Over the past eleven years, INB had an average increase of 7% in its budget. There was a retraction of roughly 5% from 2008 to 2009, but that was followed by a growth of approximately 15% in 2010. After this recovery the budget has been decreasing since 2011.

NUCLEP's budget experienced ups and downs, but the average growth in the period has been of approximately 15.1%. One of the biggest increases took place from 2008 to 2009, when the budget grew 48%, from around \$90.2 to \$133.5 million. The budget has remained at a similar level since then, going through timid increases in the following years. From 2013 to 2014 there was actually a decrease of 11%.

In the period, the funds managed by CNEN have experienced an average increase of 4.7%. Despite the overall growth, the Commission's budget underwent retractions in 2005, 2011, 2012, and 2014.

In its first year, AMAZUL had a relatively small budget of roughly \$21.8 million. In the next year, this number almost quadrupled, reaching more than \$83 million. It should be interesting to observe whether or not this degree of investment will continue.

Considering the four institutions, the overall nuclear expenditure grew throughout the selected period, as demonstrated by Figure 2. The biggest increases occurred in 2008 and 2009, when the Lula administration decided to revitalize the Brazilian nuclear program.

Figure 3 refers to a shorter time span, since only after 2009 the data on the contribution to international nuclear organizations has been grouped into the same budget program ("Special Operations: Management of Participation in International Organizations").

BRAZILIAN NUCLEAR EXPENDITURE, BY INSTITUTION (2004-2014)

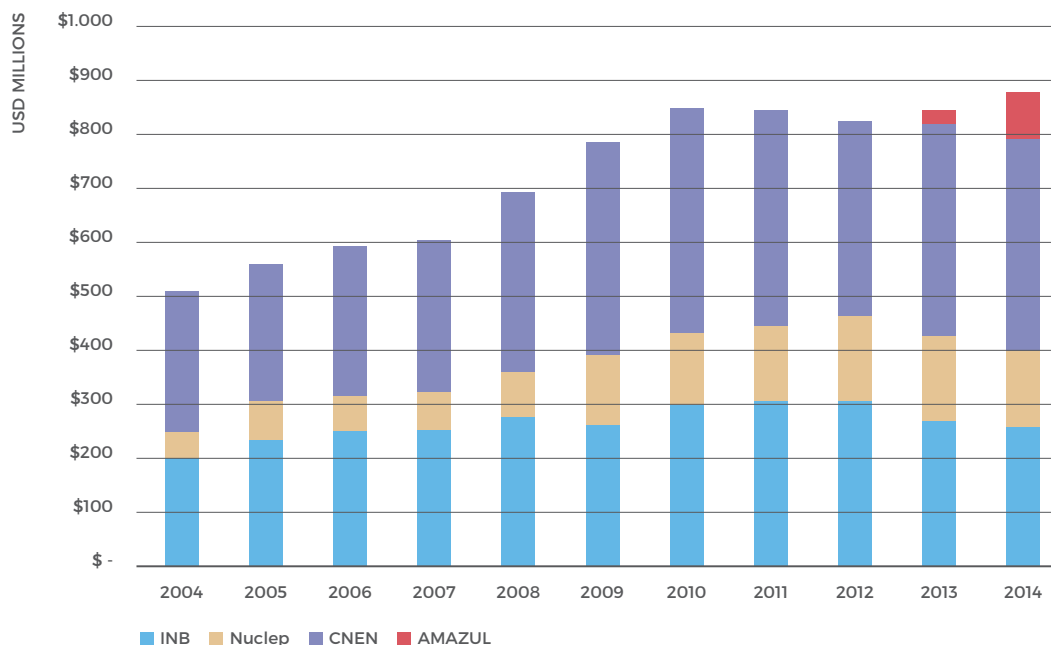


Figure 2 - Numbers in USD at constant 2014 prices and average exchange rate of 2014

BRAZILIAN FINANCIAL CONTRIBUTION TO INTERNATIONAL NUCLEAR COOPERATION ORGANIZATIONS (2009-2014)

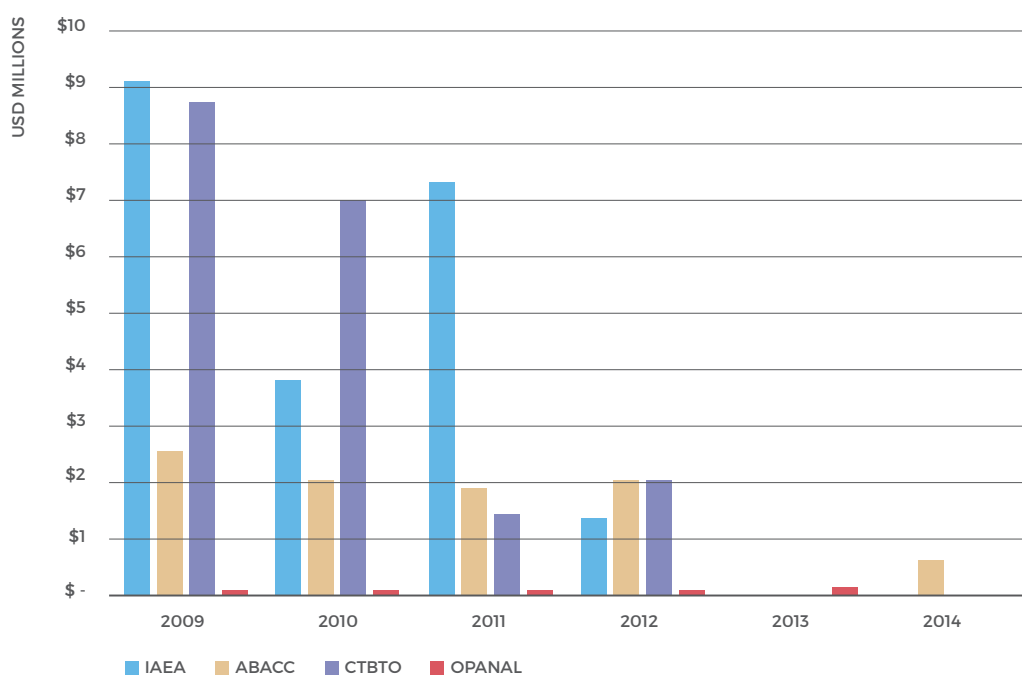


Figure 3 - Numbers in USD at constant 2014 prices and average exchange rate of 2014

From 2009 to 2012, the average contribution to the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) was around \$2.1 million. In 2013, the agency did not receive its share from the Brazilian government and in 2014 this number was drastically reduced to half million.

The contribution to the International Atomic Energy Agency (IAEA) varied greatly: \$9 million (2009); \$3.8 million (2010); \$7.2 million (2011); \$1.3 million (2012). Since Brazil had not made any further contributions in 2013 and 2014, the country actually lost its right to a vote in the agency in 2015. In late April 2015, it was reported that Brazil had paid a share of its debt to the IAEA, referring to the contribution of 2013, which was enough to regain its right to vote.¹

With regards to the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), there are similar variations: \$8.7 million (2009); \$6.9 million (2010); \$1.4 million (2011); \$2 million (2012). No contributions were made in the past two years.

The contributions to the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL) have been smaller and more stable. The average amount from 2009 to 2013 was \$69,000. However, even this modest contribution was not made in 2014.

This recent trend to cut down or postpone the payments to international organizations significantly affects the Brazilian position in regional and multilateral politics. Evidently, it can have practical implications, such as the loss of the right to vote and the cancellation of international cooperation projects.

The case of the ABACC has been the most critical, since this agency relies solely on Brazilian and Argentinean contributions. The uncertainty about its resources can lead to lower investments in technical capacity, which could hamper ABACC's ability to stay up-to-date in the field of nuclear safeguards.

As Figure 4 shows, starting in 2009, the nuclear share of the Navy's budget was enhanced through the program "Modernization and Adaptation of the Brazilian Navy", which includes actions devoted to setting up the shipyard and naval base for the construction and maintenance of nuclear and conventional submarines and the actual construction of the nuclear-propelled submarine.

Building a nuclear submarine has been for long a goal of the Navy, but it was only after 2008, when Brazil and France established a partnership on defense, that this project took off. In this partnership, France agreed to work with Brazil in the construction of four conventional submarines and a nuclear-propelled one. The contract, however, excludes cooperation on the development of the nuclear reactor for the submarine, which is supposed to be accomplished by the Brazilian navy solely.

Since 2009, the construction of the shipyard and naval base has cost roughly \$3.2 billion. From 2010 onwards, over \$500 million have been devoted to the construction of the nuclear-propelled submarine.

In 2012, these two actions became part of the program "National Defense Policy", which also included activities that used to be a part of the program "Technology for Naval Use", such as research for the development of nuclear fuel cycle and construction of the nuclear reactor prototype.

¹ See Chade, Jamil. "Brasil recupera voto na AIEA, mas continua devedor". O Estado de S. Paulo, 30 April 2015. Available at: <http://internacional.estadao.com.br/blogs/jamil-chade/brasil-recupera-voto-na-aiea-mas-continua-devedor/> [accessed on 8 May 2015].

Thus far, the nuclear submarine remains in the design phase and therefore its construction has not yet started. According to the information available at the navy's website, all construction work should be concluded in 2015. The first conventional submarine is expected to be ready in 2016, while the nuclear one should be set for sea trials in 2023.^{2 3}

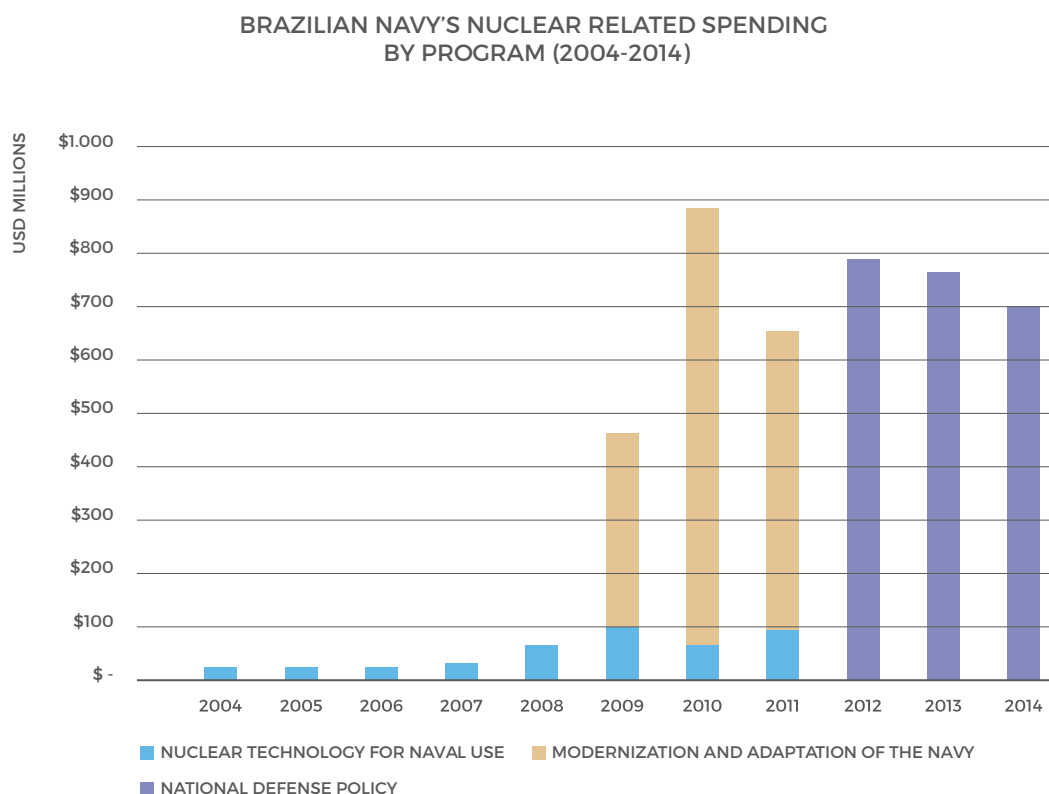


Figure 4 - Numbers in USD at constant 2014 prices and average exchange rate of 2014

3. The purpose of the data

The main purpose of the data on nuclear expenditure is to provide estimates and measures of the scale of resources absorbed by the nuclear sector. The 11-year timespan is intended to allow comparisons and to offer a temporal perspective.

The purpose of the figures and table are as follows. Figure 1 shows the budget dedicated to each of the nuclear institutions and how these numbers evolved in the past decade.

Figure 2 shows the share of each agency in the overall budget of the core of the nuclear sector. It also displays the evolution of the budget throughout the years.

² Information available at: <https://www.marinha.mil.br/prosub2/revista.pdf> [accessed on 8 April 2015].

³ Even though this is the official schedule, these dates should not be considered as certain. In Brazil, delays are common in big engineering projects and the construction of the submarines will likely take longer than expected.

Figure 3 depicts the financial contributions made by Brazil to international agencies related to nuclear issues. The data starts in 2009, because since that year all the relevant information is consolidated in one governmental program, known as “Special Operations: Management of Participation in International Organizations”. Similarly to Figure 1, this graph shows the amount received by each international agency and the evolution of the annual contributions.

Figure 4 describes the nuclear activities reported in the budget of the Brazilian navy. It also shows the programmatic origins of the funds and it depicts the evolution of nuclear spending in the navy in the past eleven years.

4. The coverage of the data

The data contained in Figure 1 and Figure 2 refers to the total budget of the public agencies that are almost entirely dedicated to nuclear activities in Brazil and, thus, can be considered the core of the nuclear sector:⁴

- » CNEN is the National Nuclear Energy Commission. It is responsible for the promotion and development of the nuclear industry in Brazil as well as the supervision and regulation of the nuclear sector in the country. Additionally, CNEN contributes to the formulation of the National Policy on Nuclear Energy.
- » INB refers to the Nuclear Industries of Brazil. It has the monopoly of uranium in the country on behalf of the state. Thus, it operates in the production chain of uranium: from mining to fuel fabrication.
- » NUCLEP refers to Nuclebras Heavy Equipment. Its primary focus is on the construction of the equipment required for the operation of nuclear reactors.
- » AMAZUL is the Blue Amazon Defense Technologies. It was created in 2012 to promote, develop and maintain the technology necessary to the nuclear sector, including the naval nuclear reactor.

The data used in Figure 3 refers to the financial contributions made by Brazil to international organizations working with nuclear issues:

- » OPANAL is the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean;
- » CTBTO refers to the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization;
- » IAEA is the International Atomic Energy Agency;
- » ABACC is the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials.⁵

The data used in Figure 4 refers to the following activities reported in the budget of the Brazilian navy:

- » Construction of the prototype of the nuclear reactor (2004 - 2014);
- » Research for the development of the nuclear fuel cycle (2005 - 2014);
- » Setting up the shipyard and naval base for the construction and maintenance of nuclear and conventional submarines (2009 - 2014);
- » Construction of the nuclear-propelled submarine (2009 - 2014);
- » Technologies and products for the development of nuclear activities (2012 - 2014);
- » Navy’s nuclear technology (2013 - 2014).

⁴ The two exceptions are NUCLEP, which also produces equipment used mainly in the oil and gas and defense sectors, and AMAZUL, which should also support the development of the conventional submarines.

⁵ Although ABACC is a bilateral agency, it is listed under the budget program devoted to “Special Operations: Management of Participation in International Organizations”.

5. Source

All data used in this paper was obtained through the online system SIGA Brasil (<http://www12.senado.gov.br/orcamento/sigabrasil>). This information system gathers data from different information systems of the Federal Government. It was made available to the general public in December 2004 and, since then, it has been praised for serving as a transparency tool.

6. Methods

The first step was to access the online budget information, made available through SIGA Brasil. The relevant data from 2004 to 2014 was collected during the second half of February 2015. The selected numbers refer to expenses characterized as verified (*liquidadas*). This means that the expenses had been through two of the three stages of budget execution: commitment (*empenho*) and verification (*liquidação*). Thus, the Brazilian state recognizes its duty to pay those costs and the contracted parties have the right to receive that payment. The actual payment constitutes the third and last stage of budget execution. In some of the selected cases, however, payment was still pending.

Subsequently, the numbers were adjusted using the National Index of Consumer Prices (Índice Nacional de Preços ao Consumidor Amplo - IPCA), which is an indicator developed by the national statistics institute (Instituto Brasileiro de Geografia e Estatística - IBGE). This procedure, which is useful to grasp the evolution of values in real terms, is widely used to enable comparison.

After this adjustment, the data was converted from Brazilian Reals (BRL) to US Dollars (USD). The conversion was made based on the median exchange rate of 2014, calculated using the data provided by the Central Bank of Brazil (1 USD = 2.35 BRL). This should make the data intelligible for a broader audience, which is not necessarily familiar with the Brazilian currency, and more comparable across countries.

Following these procedures, the present work intended to provide estimates about nuclear expenditure in Brazil, in USD at constant 2014 prices and average exchange rate of 2014.

7. Limitations

Limitations of the data

This overview of the Brazilian nuclear sector is incomplete, mainly because it lacks detailed data for Eletrobras Eletronuclear - the state-owned company in charge of the construction and the operation of nuclear power plants, as well as the generation, transmission and commercialization of nuclear electricity.

As an independent state company - that is, one that does not require governmental resources to keep going -, the budget of Eletrobras Eletronuclear is not presented in the same manner as the budget of the other considered institutions. Through the online budget database SIGA Brasil, one can access the expenditures and revenues of Eletrobras Eletronuclear. However, the system does not contain information for all the years and the financial statements available do not explicitly indicate the share coming from state investments.

The nuclear power plant that is currently under construction, Angra 3, has been included among the federal government's initiative known as PAC, which is the acronym in Portuguese for "Program for Accelerating Growth". The latest PAC progress report was released in December 2014 and provides assessments of the different projects based on data gathered up to 31 October 2014.⁶ Regarding the nuclear power plant of Angra 3, the report affirms that 50.4% of the project has been concluded. It considers that Angra 3 will be completed on 30 June 2018. Additionally, the report offers the following information about the financial resources invested in the project under the PAC:

- » Accomplished Investment (2007-2010) R\$ 977 millions
- » Expected Investment (2011-2014) R\$4,4 billions
- » Expected Investment (post- 2014) R\$8,6 billions

Unfortunately, the report does not provide further details about expenses related to Angra 3 or any insight into the methods used to calculate those sums. To better understand the investments made in the construction of Angra 3, it would be necessary to explore the financial records of the PAC, which are also available at the SIGA Brasil platform. Additionally, it would be important to take into account the recent claims of corruption in the contracts of this project.⁷ Due to the limitations of this research, however, an in-depth analysis of state investments in Eletrobras Eletronuclear and the construction of Angra 3 will not be carried out.

Limitations of the methods

The methods rely in one source of data - the budget database SIGA Brasil - and are based on the reliability of this information system. For the purposes of this fact sheet, it was assumed that the government's financial system ensures the integrity, accuracy and reliability of accounting entries. Thus, there were no attempts to verify the accuracy of the numbers, the classification of expenses or the completeness of the data. Therefore, it is necessary to acknowledge the risks of such choices, like the possibility of errors or frauds in the information system.

It was also assumed that nuclear activities were declared as such. This analysis did not consider the possibility of nuclear research and development being conducted in a covert manner or, for instance, under the umbrella of some sort of special project.

⁶ The full text of the report is available at: <http://www.pac.gov.br/pub/up/relatorio/f9d3db229b483b35923b338906b022ce.pdf> [accessed on 03 April 2015].

⁷ Recently, the main newspapers and magazines have reproduced claims made by executives of the construction company Camargo Corrêa, who have promised to tell the federal investigators about frauds in the contracts of Angra 3. Camargo Corrêa is one of the many contractors working in the construction of the nuclear power plant.

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