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Impact of COVID-19 on the nuclear fuel cycle in Brazil and repercussions on the uranium market.

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1. Introduction

The disease caused by coronavirus 2019 (Covid-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The pandemic has resulted in governments around the world taking drastic measures that have had an impact on much of society.

Keeping the electricity supply reliable and keeping the lights on was vital. Nuclear generation provides about 10% of electricity worldwide and contributes to electricity generation in more than 30 countries. In many countries, employees in the nuclear sector were identified as one of the key workers essential to maintaining important infrastructure during the pandemic. For example, in the US, the critical infrastructure designation has been extended to nuclear power plant, supply chain, fuel services and outage support personnel. [1]

While demand increased in the year 2020, supply decreased during this year of 2021. A series of consistently lower prices between February 2011 and December 2017 led some operators to close mines or suspend operations, reducing production of uranium around the world. This has led to a significant increase in interest in risk management from electricity producers and project developers looking to protect their exposure to the price of nuclear fuel. The changing nature of the physical uranium market is ensuring that market participants are increasingly focused on managing price risk.[2]

2. Development

The development of this work was based on the demands of nuclear fuel cycle companies in Brazil in relation to the production and acquisition of external uranium services. In this way, it is possible to consider that the market is mainly composed of transactions between:

- ✓ Producers or suppliers (uranium miners, converters, enrichers, or nuclear fuel manufacturers).
- ✓ Public and private nuclear-electric installations or fuel consumers.
- ✓ Various other uranium market participants who buy and sell uranium (agents, traders, investors, intermediaries).

To achieve the objective, it was necessary to understand the production chain and its components in relation to the demand and supply of uranium. Much more than that, it is necessary to establish the relationship of the world uranium market and how the perspective of the Nuclear Industries of Brazil - INB (holder of the uranium monopoly in Brazil) occurs regarding the eventual break of this monopoly, resumption of ore production of uranium in 2020 and how are the projections to meet the demand for PNE 2050. That is, if there are enough reserves to reach the goals of our nuclear program.

Low uranium prices, government-driven trade policies and the COVID-19 pandemic continued to have an impact on the security of supply in our industry. In addition to the decisions that many producers, including lower cost ones, have made to preserve long-term value by leaving uranium in the ground, there have been several unplanned supply disruptions related to the impact of the COVID-19 pandemic on mining activities and uranium processing.

In this environment, the risk to uranium supply is predicted to be greater than the risk to uranium demand and is expected to create a renewed focus on ensuring long-term supply availability to power nuclear reactors. Over time, this focus on security of supply is expected to provide the market signals that producers need and help offset any short-term costs we may incur because of current business disruptions.[3]

The world needs electricity around the globe, there is an increasing focus on electrification for several reasons (Figure 1). There are countries looking to install baseload power, while others are looking for a reliable replacement for fossil fuel sources such as renewable energy sources (energy transition) and finally there is a new demand for things like electrification of transport and production of hydrogen.[4]

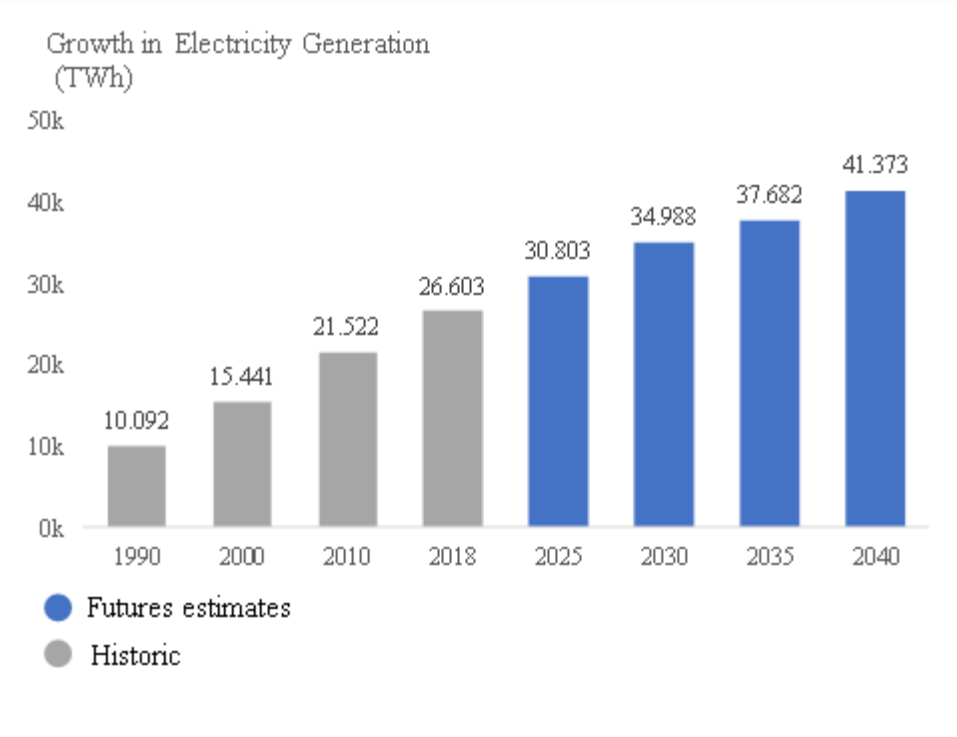

Figure 1 – Electricity generation World

The increase in demand is occurring while countries and companies around the world are committing to net zero carbon targets. This has led to the recognition, from a political point of view, that nuclear energy will be needed as one of the great options for achieving the electrification and decarbonization goals in a sustainable way. Many countries, states and utilities continue to announce net zero carbon targets and many of the plans include an important role for nuclear power. The Brazilian government is part of this group that seeks to implement nuclear energy as a tool to achieve its zero carbon goals.

3. Results and Discussion

The demand gap left by premature and forced shutdowns of nuclear reactors since March 2011 was partially filled in 2018. According to the International Atomic Energy Agency, there are currently 443 reactors operating globally and 54 reactors under construction. With several reactor construction projects recently approved and many more planned, the demand for uranium is growing. This growth is taking place mainly in Asia and the Middle East. [5]

This dynamic is also growing for non-traditional commercial uses of nuclear energy, such as the development of small modular reactors and advanced reactors, with several companies and countries looking for projects. In the long term, these projects have the potential to open new fuel cycle opportunities and demand for uranium, including Brazil as a supplier of uranium ore. In the medium term, reactor life extensions are increasing demand, and, in the short term, unplanned demand has come from junior uranium companies and financial funds buying on the spot market. Policy decisions to support the continued operation of existing reactors also have the potential to increase short-term demand.

Prices are expected to increase slowly during the outlook period. Uranium prices have been volatile in recent quarters, reflecting some competitive pressures. Cuts in supply by major producers generated initial price gains in 2019, however, their impact was largely offset by the slowdown in global electricity demand after the outbreak of the COVID-19 pandemic. Global electricity use remains limited, although with some recovery evident in the final months of 2020, especially in China.

To estimate the calculation of electricity generation potential from the availability of measured and inferred reserves, the assumptions of PNE 2030 [6] were maintained. However, only the recoverable part of the measured and inferred reserves and the 60-year supply (40-year plant life with a 20-year extension) were considered.

In this sense, given the knowledge of current uranium reserves (309,000 t of U_3O_8) and its recoverable share of mines in exploration (187,000 t of U_3O_8 at a cost of less than 80 US$ / kg U), the maximum potential of up to 10 new units generators (including Angra 3), in addition to the existing park (Angra 1 and Angra 2), as shown in Table 1, which can increase by 4 times considering the predicted and speculated potential.[7]

Table 1 – Nuclear potential generation

Recoverable uranium (t U_3O_8)	
Caetité (BA)	80,000
Santa Quitéria (CE)	107,000
Total	187,000
Uranium demand (t U_3O_8) for the nuclear power plants lifetime (60 years)	
Angra-1	4,800
Angra-2	16,00
Angra-3	19,200
New nuclear power plants (9 units/ 1000 MW)	135,000
Total	175,000
Demand versus Supply (t U_3O_8)	
Available	187,000
Demand	160,000
Balance	12,000

4. Conclusions

The global population is increasing and there is an increasing focus on electrification and decarbonization. With the worldwide need for energy from a safe, clean, and reliable base, nuclear energy continues to be an important part of the energy matrix. With increasing demand due to restarts and new reactors, and supply becoming less certain because of low prices, production cuts, lack of investment and end of reserve life, unplanned production outages, reduced secondary supplies and trade policy issues, continuing to expect a market transition.

Through these scenarios, it is imperative that INB, together with the Ministry of Mines and Energy, promote the acceleration of projects that increasingly encourage Brazilian autonomy in the production of uranium ore and in other stages of the nuclear fuel cycle over the long term, reducing the impacts of uranium price volatility.

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