

BCCC Sectoral Analysis - Energy

1. Executive Summary

The Brazilian Energy Sector is prepared to a prompt growth after a challenging-backbreaking gap characterized by political and economic externalities influencing business stability and attractiveness. This scenario prediction relies, for example, on the results of the last auction of public-private projects in the energy sector as well as customer requirements and technological advance that are creating-bringing on countless investment opportunities.

Brazil's energy market has been experiencing successful cases regarding international trades with Canadian players, suppliers, and investment boards such as Brookfield and CPPIB, influencing positively the sector and achieving their goals in an unlimited segment of the economy.

The objective of this sectorial report is to present a brief overview and projections of the Brazilian energy sector, including its opportunities and threats for forthcoming investments.

2. Introduction to the sector in Brazil

2.1. Sector overview and evolution

The Brazilian Energy Sector can be considered a major success case given its diverse matrix background based on strategic policies, availability of natural resources, and long-term goal planning. According to the national Energy Research Office (EPE 2017), Brazil recently became an associate member of the International Energy Agency (IEA), which Canada is a current member of, resulting in a more prominent worldwide leadership role in this matter that could become a milestone in the domestic energy business.

Consolidated energy production data emphasises that the evolution of renewable sources is a focal asset in the Brazilian market. By 2016 (Figure 1), it represented almost 60% of the national energy produced (MME, 2017a). Electricity-wise, Brazil presents a matrix primarily of renewables, with hydropower suppling 68.1% of the total generation (Figure 2). Adding imports, 81.7% of the Brazilian electricity supply derives from renewables operations (MME, 2017a).





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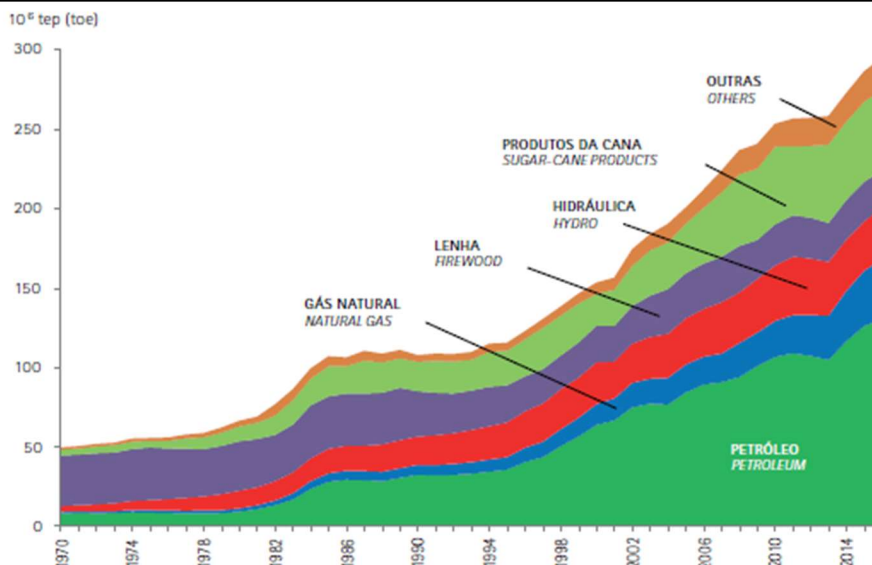


Figure 1: Primary energy production between 1970 and 2016 (Source: MME, 2017a).

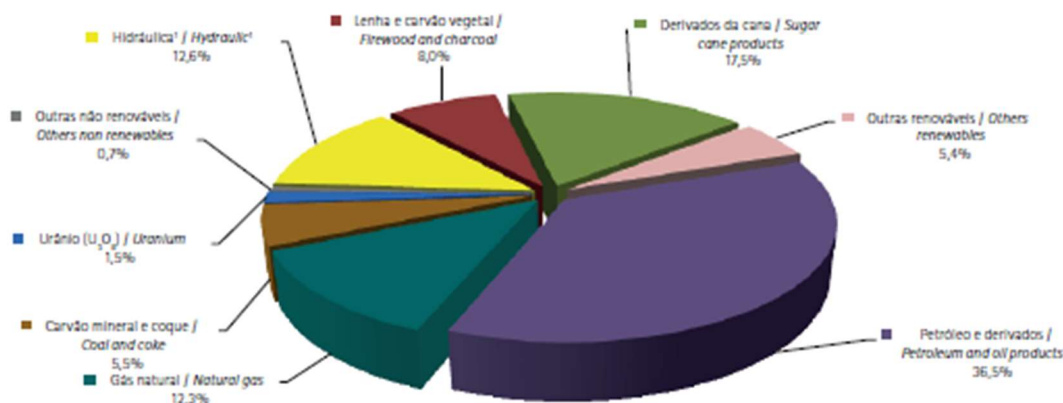
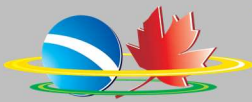


Figure 2: Domestic energy Supply by Source (Source: MME, 2017a).

According to the International Ranking of Energy and Socio-Economy (MME, 2017b), only five nations with GDP per capita equivalent to or higher than Brazil have a greater share of their energy matrices based on renewable sources (Figure 3). None of these countries have more than 4% of the Brazilian population - reinforcing the prioritization of this subject in Brazil (Figure 4).





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GDP PPP per capita and Energy Demand per GDP PPP

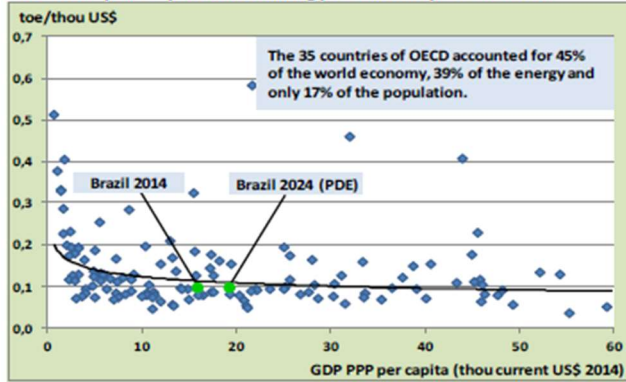


Figure 3: GDP PPP per capita and energy demand per GDP PPP (Source: MME, 2017b).

GDP PPP per capita and External Energy Dependence

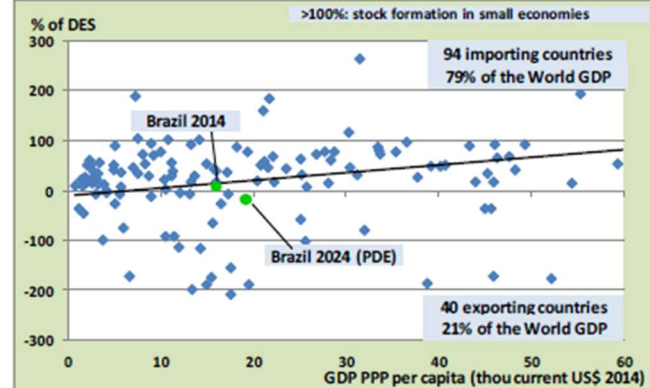


Figure 4: GDP PPP per capita and external dependence (Source: MME, 2017b).

Current data (Figure 5) also demonstrates a significant decrease of the Brazilian external dependence on energy, especially among renewable sources (MME, 2017a), corroborating the country's aptitude and positive environment in the field for development and investments.

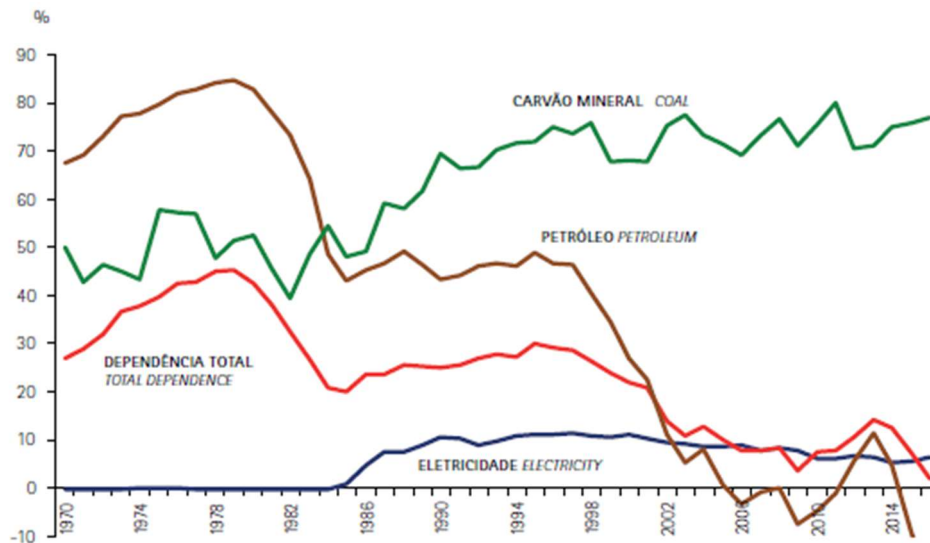


Figure 5: External dependence of energy (Source: MME, 2017a).

In 2016, the total consumption and production of energy were almost equivalent, meaning that any given demand enhancement must be supported by an increase of supply (Figure 6) – and this reinforces the opportunities for potential investors in the sector. The share of renewable sources has been increasing



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throughout the years, while fuel oil has been lately representing a lower share of the market demand. (MME, 2017a).

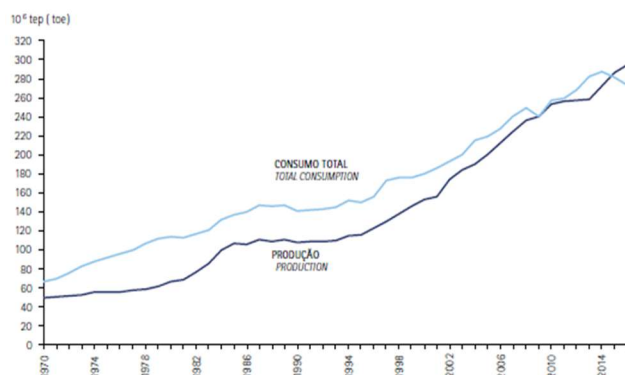


Figure 6: Primary energy (Source: MME, 2017a).

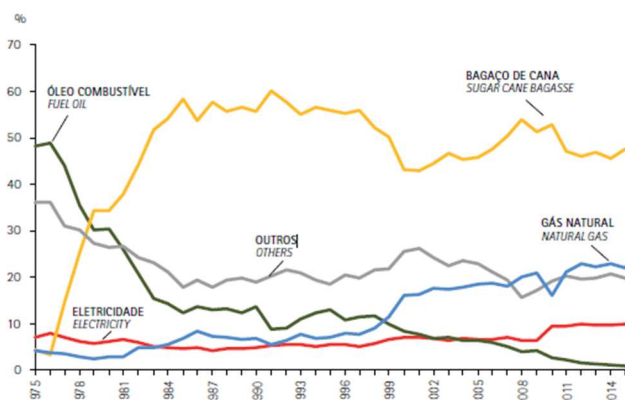


Figure 7: Participation in the Energy Sector Consumption (Source: MME, 2017a).

Moreover, the Brazilian Energy Research Office (2017) foresee that internal economic and sociodemographic changes as well and a positive international scenario might lead to not only population and GDP growth but also economic increase through exports. This scenario will influence the supply vs demand equilibrium, boosting energy demand in almost 2% per year until 2026. Industrial and transportation segments will be responsible for more than 60% of the total energy market usage by this period.

2.2. Market structure and regulations

The Brazilian Energy Sector is ruled by several agencies under the Ministry of Mines and Energy (MME) such as the National Electric System Operator (ONS), Energy Research Office (EPE), National Agency of Electricity (ANEEL), National Council for Energy Policy (CNPE), and National Agency of Petroleum, Natural Gas and Biofuels (ANP). All those agencies dictate specific rules, policies, strategic plans, supervision, and control – depending on their mandate.

The Brazilian Energy Sector is composed by a myriad of national and international players that reinforce its attractiveness. State Grid, China Three Gorges, Brookfield, Engie, EDP, EDF, Enel, Volitalia, Gas Fenosa, Isolux Corsan, Sterlite Power Group are some of the major foreign players that are sharing and succeeding in a market formerly exclusive to Eletrobras, CEMIG, CPFL, Petrobras, TAESA and others consolidated domestic organizations - revealing how the Brazilian market is currently accessible and open for international companies.



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The sector is also composed by multiple key suppliers that creates a well-structured energy market regarding generation, distribution, and transmission. ABB, Siemens, Alstom, Watech, Bardella, Weg, GE, Gamesa, BYD, Schineder, Jungo are just few traders making business in Brazil.

Among all the players above, investment boards such as the Canadians CPPIB (Canadian Pension Plan and Investment Board) and OTPP (Ontario Teachers Pension Plan), have a major role capitalising the market and enlarging competitiveness and potential.

2.3. Sector assessment

The Brazilian Energy Sector framework requires expansion, decision-making improvements, and transmission gap reductions. The development of evaluation tools regarding renewable sources usage in the matrix are paramount to maximize system integration, aiming to predict realistic scenarios and avoid breakdowns. According to MME (2017a), the Brazilian Useful Energy Balance demonstrates that the increase of the energy production in the last 20 years was driven by advances in equipment' technology and adjustments in the energy matrix towards more efficient sources.

The Brazilian government in partnership with private stakeholders are working to improve attractiveness of energy auctions and general agreements that could result in more investment with diminished risk for players. Examples of these improvements are the withdrawal from the obligation of prior authorization from regulatory agency for all small dams, review of the maximum annual allowable revenue, and expansion of the construction period.

In view of the Brazilian extension and energy demand, the assessment on the contribution of natural gas and solar energy to the matrix is also an important matter for its flexibility, profitability, and integration. Solar PV is projected to guide renewable electricity capacity growth over the next five years, with an expansion of almost 150%. Likewise, wind power is going to increase more than 60% generation-wise.

Environmental licensing and impact evaluation of new projects, mainly in the Amazon Forest are challenges to be faced - given the ecological importance of this region and the investment needed to minimize liabilities considering the direct or indirect engagement of countless stakeholders. Trade-offs among environmental quality, operational security, and greenhouse emissions of coil industries must also be debated as a wider social matter (EPE, 2017).

3. Sector opportunities and threats in Brazil

According to PWC (Strategy&, 2017), the energy sector is facing a global revolution and disruption due to decentralized and sustainable offer, consumer empowerment, digitalization and connectivity, as well as technology and process innovation leading to a customer-focus strategy to attract more players. The Customers' request for more sustainable businesses challenges energy enterprises by affecting their internal structure and marketing strategies. Distributed Energy is growing globally based on lower cost and technological enhancement. Data gathering and analytics are assuming an even more important role



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in decision making process and customer achievement. These scenarios are shifting logistics and frameworks that will require not only investments but also organizational mindset adjustments.

Distributed energy generation and the increase of system management complexity will require substantial investments (Strategy, 2017). Nonetheless, Brazil entrepreneurship mindset, natural resources abundance, and well-prepared human capital are assets to thrive in this matter. Internal policies, such as ProGD Program, are being created to attract investors to a friendlier environment. Those inevitable advances will meet a market based on a huge renewable source diversity, high energy waste indexes, and increase of capacity requirements that will open opportunities for new business models and approaches.

Generation, distribution and transmission auctions are excellent investment opportunities given its long-term successful cases and the support of a supply chain composed by countless national companies with experiences in many different matters such as financial planning, business strategy, environmental licensing, construction, and operational management. Their know-how can be helpful in reducing risk and provide insights about the Brazilian Energy Sector system, its specific requirements and customers' expectations that might lead to a increase on reliability and profitability. According to Aneel (2017), transmissions auction promoted between 2000 and 2017 secured almost R\$ 15 billion (more than CAD 5 billion) for 91,171.75 km of powerlines, representing an average discount of 24.18%. Nonetheless, Castro & Brandao (2018) stated that Brazil still requires substantial investments in more than 20,000 km of transmission lines with predicted investment estimated in R\$ 22 billion (CAD 7 billion).

Brazil and Canada are traditional trade partners. And the current scenario presents several opportunities within the energy sector considering all the Brazilian external environmental changes described above, as well as the Canadian expertise in energy innovation, renewable energy sources, and sustainable production.

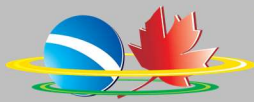
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