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A review of Brazilian natural gas industry: Challenges and strategies

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ABSTRACT

The aim of this paper is to present the main challenges for the development of the natural gas industry in the Brazilian state of Espírito Santo; in so doing, the paper identifies the strategies that are currently employed by industry players to encourage the use of this resource and to thus diversify the state's energy matrix. For these purposes, the following methodology was adopted: (i) analyzing bibliographic references that address the issues of infrastructure industry, regulation and the natural gas industry in Brazil – including in the Brazilian states; and (ii) employing secondary data from governmental and regulatory institutions to demonstrate the evolution of this industry in recent years in Brazil and particularly in Espírito Santo. The study concludes that, although there are challenges in expanding the gas transportation (carrier) and distribution segments ("natural monopolies") and the formation of a "consumption-anchor" for natural gas, the present is the right time to use public policies to encourage the use of natural gas and renewable sources for technological, environmental and energy security reasons.

1. Introduction

The importance of the energy sector for socioeconomic development is undeniable; in today's world, we cannot imagine a developed country without adequate access to energy. Moreover, it is notable that the energy matrix should be diversified and as clean as possible for strategic, environmental and energy security reasons. In this context, the use of public policies to encourage the production and use of natural gas and other energy resources might lead to greater diversification of the state of Espírito Santo's energy matrix and to the inclusion of less-polluting sources from more efficient technologies. One such energy resource used in Espírito Santo is biomethane, which may come to be distributed by BR Distribuidora in their distribution pipelines as the result of public policy incentives to encourage the development of renewable energy sources. Such policies would reduce the state's solid waste and thus permit greater compliance with Brazil's National Solid Waste policy while effecting an increase in the gas supply.

However, there are still many difficulties for the insertion of natural gas into the state's energy matrix, including the following:

- regulation, which includes regulatory uncertainty and the concession contract for the distribution of piped natural gas with BR Distribuidora that was executed in 1993 (which was prior to Law # 8.987/1995 - Concession Law for Public Services) and before the creation of the state regulatory agency);
- the lack of resolution of controversial issues, which include the availability of natural gas, the resolution of the dispute between thermoelectric generation and industry regarding the order of priority in natural gas consumption, and the expansion of the access to natural gas, which might replace more polluting non-renewable sources of energy, particularly coal and oil; and
- financial-economic reasons, which include the need for substantial investments into expanding the gas pipeline, the lack of competition in a market dominated by large vertically integrated companies, and the weak expansion of competition in this sector even following the free consumer figure [1,2] created by the Gas Law (Law # 11.909/2009) and regulated in Espírito Santo by ARSP (Agência de Regulação de Serviços Públicos do Espírito Santo [3]) with respect to the gas distribution segment of this sector.

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However, regulatory problems and the lack of investments are present in the entire Brazilian natural gas industry. In the case of regulation, for instance, even with the definitions of transfer pipeline, transport pipeline and distribution pipeline, many conflicts were not resolved by the regulatory agency and currently await a solution from the judiciary branch, which requires a large amount of resources and time. As for investments, in order that the supply of natural gas expands, investments should be made into its exploration and production in the country, in the expansion of the transport network, in projects of international pipelines and in the infrastructure necessary for the regasification of liquefied natural gas (LNG). This occurs owing to its characteristics: (1) high investments in fixed and specific assets; (2) unit costs sensitive to the transported volume and to the number of users; and (3) not having a captive market, which means it could be replaced by many energy sources.

Its use as a resource in thermoelectric generation, in its turn, is fundamental to complement hydroelectric generation (when facing a hydric crisis and in meeting peak demands) and the generation from unconventional and intermittent renewable sources such as wind and solar power. However, for that to occur, the source needs to become as competitive as the others, replacing diesel oil and coal (responsible for the highest emissions of greenhouse gases).

The objective of this paper is to present the main challenges in developing the natural gas industry in Espírito Santo, which involves identifying the strategies that are used by industry players to encourage the use of this resource and to diversify the state's energy matrix as a result. For this purpose, the second section of this paper presents the main characteristics of the infrastructure industry and of the regulations designed to mitigate problems arising from anti-competitive conduct that might inhibit investment and thereby reduce the welfare of a substantial portion of the population. In addition, the second section describes the natural gas industry, in which competition is allowed with respect to certain activities (Exploration and Production (E & P), Processing, Storage and Trading), whereas competition is permitted only in special situations with respect to other activities (transport and distribution) that are considered "natural monopolies" and that are managed by the state as regulator (such as free access to the transport network). The third section presents information regarding the energy market of Espírito Santo, with an emphasis on the natural gas industry. The fourth section identifies opportunities to develop the natural gas industry in Espírito Santo and the challenges that must be overcome in that regard, including those relating to the formation of a consumer market and a distribution infrastructure. In the final section, the paper presents some concluding remarks.

2. FRAMEWORK

2.1. INDUSTRY INFRASTRUCTURE

Socioeconomic development is closely connected to the implementation and proper use of transport infrastructure and to the supply of power, water, sewage treatment, housing, health, education and other sectors that result in both improving the quality of life and better use of resources. Infrastructure problems can be major "bottlenecks" because they discourage private investment and can also reduce the well-being of part of the population.

The supplies of electricity and natural gas are considered economic infrastructure sectors [4] but they have a substantial social impact as well. Thus, similarly to other infrastructure sectors, they have certain characteristics that should be taken into account when designing public policy incentives. The first feature to be highlighted is that infrastructural assets are indivisible: if they are not built as a whole, they are no longer effective. Additionally, infrastructural facilities should be sufficient to meet strong swings in demand and should always be oversized. [5].

The second feature is related to the high costs of implementation, the large maturation period and the relatively low cost of providing the product. For example, there is virtually no additional cost to providing an additional cubic meter of natural gas to an individual customer. Because of these aspects, these sectors operate with economies of scale and are considered "natural monopolies". In addition to these features, the positive externalities [6] related to the infrastructure sector and the "network economy"[7] are also noteworthy. With respect to positive externalities, for example, the installation of an urban natural gas and electricity distribution facility allows the marketing of new products (heating, lighting, etc.) and can encourage the development of new industries, which allows the further development of socioeconomic development processes. In the case of the "network economy", the same infrastructure can be used for other services or products, which is the case for biomethane in Espírito Santo because it can use BR Distribuidora's network of gas pipelines, thus expanding the renewable energy industry in the state.

The current strategies for the expansion of the natural gas industry in Brazil are: (1) expanding the natural gas supply (production in pre-salt layers and of unconventional gas resources; and importation (projects of international pipelines and of regasification infrastructure (LNG)); (2) expanding the network of transport pipelines, based on a stable regulatory framework, which plans (PEMAT - Expansion Plan of the Natural Gas Transportation - PEMAT) in compliance with other planning instruments of the national energy sector (PDE – Decennial Plan of Energy; PNE – National Plan of Energy; and National Zoning of Oil and Gas Resources); (3) encouraging the use of natural gas in thermoelectric generation to complement hydroelectric generation and the generation from intermittent renewable sources (wind and solar power). According to the IEA [03] and TOLMASQUIM [04], the expansion of thermoelectric generation from natural gas should occur prioritizing the use of combined cycle power plants; and (4) having competitive prices to motivate the replacement of other fossil fuels such as coal.

As for future perspectives,

> “In the long term, an increase of the natural gas supply is estimated with the production from the pre-salt layers and unconventional gas resources. Studies on energy demand consider the final natural gas consumption to expand from 55 million m^3/day in 2014 to 180 million m^3/day in 2050. The growing penetration of natural gas in Brazil's energy matrix stands out as it replaces the consumption of oil products in the industry and in households (especially fuel oil and liquefied petroleum gas – LPG), as well as the strong growth of the non-energy use of natural gas. The industry sector, the largest power consumer in Brazil, is responsible for the highest percentage of natural gas consumption. The final energy consumption of natural gas in the industry is estimated to evolve from 29 million m^3/day in 2014 to 103 million m^3/day in 2050, since a scenario of competitive supply is expected for the resource.” [04]

These sector features – and particularly the indivisibility of assets, economies of scale and scope, and positive externalities – led transmission and distribution of electricity and transportation and distribution of natural gas to be considered "natural monopolies". As such, they required direct state action (by establishing state-owned enterprises, as in the European model) or indirect state action (by creating regulatory agents, as in the US model) in their formation. In any of the adopted models, reasonable rates, energy security and universal access should be prioritized. However, the problem is to expand investments in the energy sector and thus prevent the interruption of socioeconomic development due to lack of power supply, as occurred in Brazil during the 2001/2002 rationing.

2.2. REGULATION OF INFRASTRUCTURE SECTORS

The concept of regulation can be understood as any government action that limits the freedom of choice of economic agents. This

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