Chapter 2

What are the obstacles to universal access to energy sources in Brazil?

Rossano Gambetta
Renato Carrhá Leitão
Marcelo Henrique Otenio
Airton Kunz

Introduction

The availability of energy is linked to the development of several societies, since they depend on the implementation of infrastructure necessary to achieve good quality of life indicators, such as: public health; quality education; potable water supply services; waste collection and treatment; and food preparation and preservation; among others.

The main dimensions that affect access to energy when it comes to distributed systems are: difference between the cost of *off-grid* and distributor energy; fuel availability (including price stability/predictability); modularity, flexibility and solution placement time; the technology's learning curve is higher than that of fossil fuels; solution reliability and robustness; improved health by reducing pollution indoors; contribution to climate change mitigation; reduction in deforestation and environmental degradation; positive effect on women's empowerment; and poverty reduction for vulnerable groups (Ren21, 2017).

Next, some obstacles to universal access to energy in Brazil will be discussed.

Access to energy sources

Modern society lives a digital revolution; information travels the world at a speed and ease never before imagined. However, access to energy is necessary. Its lack means that a significant part of the population does not have access to much-needed information for its development, which increases social differences.

The use of wood (firewood) by the populations that have no adequate access to energy (either due to location or cost) is still a reality mainly in the preparation of food, and is often a type of income generation, in the form of charcoal for sale in

urban centers. This activity is generally associated with the deforestation of native vegetation in the various regions of the country. At the same time, this practice is associated with health problems in the population exposed to the smoke produced inside the homes. Firewood and charcoal represent 8% of Brazilian domestic energy supply, including production for industries in various sectors (Balanço..., 2017).

Per capita energy consumption in terms of Tonnes of Oil Equivalent (TOE) in developing countries correlates strongly with quality of life indicators, such as life expectancy, infant mortality, illiteracy, and birth rate (Goldemberg, 1998). The same author points out that it is essential that per capita TOE per year exceeds the barrier of 1 for the development of society, since, as it reaches 2, a considerable increase in the quality of life occurs. The author also considers that, in 1998, Brazil had a per capita TOE per year of 1.3, with an expected growth in energy consumption of 4.6% per year, while population growth was at 1.3 % per year. Thus, it was estimated that, in 20 years, per capita TOE per year should reach values between 2.5 and 3, approaching the European Union average.

In 2016, the Brazilian population was estimated in 206,081,432 inhabitants and with an internal energy supply of 288,319,000 TOE, which leads to a per capita TOE per year of 1.40, well below expectations (Balanço..., 2017). This difference between the current value and the one projected by Goldemberg (1998) is due to the recent economic crisis, which left the gross domestic product (GDP) stagnant, while the population continued to grow. This caused the country to have growth rates lower than projected in the last decade, remaining stagnant when it comes to availability/consumption of energy and its consequent contribution to the quality of life.

The Human Development Index (HDI) – used by the United Nations (UN) and which considers life expectancy, education and gross national income – is another index that can be correlated with energy consumption. Brazil was classified in 2016 as a country of high human development, occupying the 79th position, with an HDI of 0.754. In 1990, the country had an HDI of 0.611. In 2002, this figure had already reached 0.699, passing through a period of fall and stagnation until 2006, when it began to recover and it reached its current level in 2013, followed by a new period of stagnation.

Steinberger (2016) presented a comparison between the HDI and per capita energy consumption using data for the year 2012. In this comparison, Brazil had an HDI of 0.74 and a per capita energy consumption of 63 gigajoules (GJ).

The author states that a high human development was reached, going from 50 GJ per capita, which equals an HDI above 0.7. The data shows that the energy consumption correlates with the HDI, as there is a saturation in which an increase of energy does not lead to significant HDI increases, and also that for the same energy consumption there is a great variation in the HDI, influenced by cultural factors in each country.

Brazil is already a prominent country in the production and use of renewable energies: 41.5% of the energy comes from sources such as hydroelectric reservoirs, wind (wind farms), sugar cane products (ethanol, bagasse and vinasse), oleaginous crops, animal fat and waste (biodiesel production), and firewood (thermal energy) (Balanço..., 2017). The data show that hydroelectric power generation has been stagnant in the last 10 years, during which there was a reduction in the consumption of firewood, a significant increase in the use of sugarcane and biodiesel, and a strong expansion in the production of wind energy. In recent years, photovoltaic energy has started being used and it tends to grow rapidly in the coming years. However, despite the increase in the use of renewable sources, there is still a need for public policies that prioritize investments in renewable and clean energy sources, seeking to achieve target 7.2, which addresses the increase of these sources in Brazil's energy matrix, from the promotion of research to the use of the newest technologies in the world.

Regarding access to energy, data from the 2010 IBGE Census indicate that of the 57,324,185 households in Brazil, 550,612 had some energy source other than the distribution company, while 728,512 had no access to energy (Table 1). The North region stood out from other regions of the country, both in the lack of access and in other ways to obtain energy.

The data show that access to energy in Brazil is, first of all, hampered by geographic issues and, secondly, by the population's own income, since in the absence of an electrical distributor, private solutions are adopted (Table 1).

In this case, government has to facilitate and cheapen access to distributed generation technologies compatible with each region. It should be noted that the existence of a specific solution to the energy supply, or even access to the energy of the electrical distribution company, does not necessarily provide adequate conditions to promote regional development on the basis of energy-dependent technologies.

Table 1. Households in Brazil with and without access to electricity.

Brazil and regions	Permanent private households	Existence of electric energy				Energy from another source (%)	No energy (%)
		Total	From a distribution company	From another source	No access		
Brazil	57,324,185	56,595,007	56,044,395	550,612	728,512	0.96	1.27
North	3,975,533	3,724,295	3,547,426	176,869	251,207	4.45	6.32
Northeast	14,922,901	14,583,662	14,460,942	122,720	339,087	0.82	2.27
Southeast	25,199,799	25,133,234	24,937,720	195,514	66,211	0.78	0.26
South	8,891,279	8,859,224	8,829,870	29,354	31,979	0.33	0.36
Midwest	4,334,673	4,294,592	4,268,437	26,155	40,028	0.6	0.92

Source: IBGE (2010).

Final considerations

Brazil has plenty of land and water, proven by its great agricultural production. In addition, it has plenty of sun light and wind in much of its territory. Agribusiness can produce biomass and waste that can be used for energy generation, which, together with wind and solar generation, allow energy to be generated away from the large centers of consumption and production (distributed generation).

In addition, the universalization of public electricity services has been addressed by the government since 2002, starting with the Programa de Incentivo às Fontes Alternativas de Energia (Incentive to Alternative Energy Sources Program – Proinfa) and in 2003 with the Programa Nacional de Universalização do Acesso e Uso da Energia Elétrica (Universal Access and Use of Electric Energy National Program – Luz para Todos), until recently becoming a responsibility of the respective local energy concessionaires/distributors.

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