

Smart Grid in Brazil: perspective and possibilities

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Abstract

This article discusses the possibilities and the consequences of installing smart grid technology in Brazil. It also discusses why Brazilians seem to ignore the energy crisis although it directly affects many people. It brings us to the question why most people do not care about sustainability in Brazil and why it is so difficult to create a collective conscious to save energy and water resources. It also proposes a solution to help to solve this problem.

Keywords: energy, crisis, Smart Grid, Brazil, water, resource, solutions, hydraulic, conscious consume

1. Introduction

Since 1996, Brazil is struggling to redesign its energy sector, giving opportunity to private companies to invest and be responsible for the energy supply in the country. Four important organs compose the division of energy policy in Brazil¹. The CNPE (National Council for Energy Policy) is responsible for advising the government about the right policies and the right decisions about promoting the conscious use of energy resources in the country. The MME (Ministry of Mines and Energy) implements the political decisions taken by the CNPE. It is also responsible for defining prevent actions of security of the energy distribution systems in case of imbalances between supply and demand. The National Agency of Electric Energy (ANEEL) regulates and supervises the energy distribution systems with MME policies case of cyclical imbalances between supply and demand of energy. Finally, the Power Research Company (EPE) manages the research in energy sector in areas such as oil, natural gas, coal, renewable energy resources and energy efficiency. These researches are an important input to formulate the national energy policy. Although the effort in redesigning its sector, Brazil has shown a very inefficient way in dealing with the crisis scenario. In 1999, only four years after the creation of ANEEL (the first sign of effort in energy sector redesign), the blackout occurred. The lack of investment in equipment and technical features and the disorganization of the energy sector are the main reasons why the blackout happened. It hit 70% of the country and left about 76 million Brazilians without energy.² After this demonstration disorganization of the Brazilian government face to something so important to the development of the country, more investments were made in the sector. All of this accompanied by a blackout crisis, which forced the Brazilians to ration energy in the years that followed. The government shows that planning and organization are not a priority. First comes the crisis, and then the investment. Unfortunately, there is almost no planning, and when there is, most of it is to benefit the great energy companies and not the consumer. This year, Sao Paulo, the most important city in Brazil, faces one of the biggest hydric crisis of the past century. The main source of electricity in Brazil is the hydraulic. In November 2008, hydroelectric plants, regardless of size, respond, therefore, by 75.68% of the total installed capacity in the country³. A water crisis is also an energy crisis in Brazil.

¹ Natascha Trennepohl. Vorstellung des Energiemarkts in Brasilien. April 10th, 2014. Hannover, Germany.

² <http://noticias.r7.com/brasil/noticias/brasil-tem-terceiro-apagao-em-10-anos-20091111.html>, retrieved 06/02/2015.

³ Atlas de energia elétrica do Brasil / Agência Nacional de Energia Elétrica. Parte II – Fontes Renováveis. – Brasília. ANEEL, 2002.

2. Why is it difficult

What most of Brazilians do not know is that one of the reasons for lack of rain is the deforestation. Its impact on watershed areas is significant. The forest plays an essential role in preventing dry because replenishes groundwater and prevents soil erosion and silting of rivers. The hydric crisis is also an environmental crisis. As we could see this year, and Marina Silva pointed it⁴ in her blog, we are in the middle of a crisis, and the 5th of June, international environment day, was not even remembered. Environment is not a main theme in Brazil, mostly because it just generate theme for the press when the situation is already chaotic. It was like this with the hydric and the energy crisis. The press only put this in first page, when the situation was so bad that the government could not mask it anymore. Besides that, politics motivate the management of state-owned enterprises as well as the institutions responsible for correct operation of the energy sector. Therefore, a change in its governance is essential to untie its management of short-term political goals. Even when dealing with companies controlled by the government, the managers of joint stock companies must ensure that they can fulfil the social function for which they were created, in the case of the energy sector, this means the expansion of energy supply. Due to the increase of the price of energy bills caused by this mismanagement of the electric sector in the past few years⁵, the population is aware that we need to use energy in a conscious way. This can be the best moment to discuss new policies and to put in evidence new campaigns.

3. One possible solution: Smart Grid

According to IBM, the distribution process dissipates 14.7% of the total energy produced in Brazil⁶. In addition, and mainly this year with the high price of energy, is quite common the energy theft through illegal connections. The Smart Grid technology is the future of disruptive innovation in energy distribution⁷. Consists in dividing areas of energy distribution in grids and installing sensors (smart meters) in all levels of distribution. It can be widely used, more precisely, in the consumption measurements and additional functions such as identifying failures in the distance. The sensors deliver information about generation and the need of energy. Therefore, the energy grid can react in a flexible and smart way. The smart grid technology enables demand side response systems to perform with accuracy. With this technology we can be aware of load requirements and the ability we need to meet those requirements because it is possible to know precisely when to shift loads to balance and therefore we can ensure optimal use of your energy sources. The Smart Grid requires an innovative technology that can attend the demand of smart systems. The national industry has already shown interest in developing new products for smart grids. There are initiatives and investments in Smart Grid in Brazil, through pilot projects financed with resources of ANEEL program, but the first pilot projects are in their initial stages. We have already one pilot of a "smart city". It is Barueri, a small city 30 km far from Sao Paulo. There, the AES Eletropaulo company installed the smart meters and expects to have a full smart network until 2017. The major focus in the beginning of the project is to install smart meters for low-income customers. At this stage, they will benefit 2.100 families that now have illegal connections and live in communities. The aim is to bring safe energy to this population and give them the opportunity to have the standards of a new electricity distribution model.

⁴ <http://marinasilva.org.br/dia-de-realizar-sonhos/> Silva, Marina. Retrieved 6th, June 2015.

⁵ Setor Elétrico: da MP 579 ao pacote financeiro. Costellini, Clara. Hollanda, Lavinia. 31st, May 2014.

⁶ Energy and Utilities, IBM Global Residential/Small Business Consumer Survey, 2007.

⁷ <http://www.tecmundo.com.br/3008-smart-grid-a-rede-eletrica-inteligente.htm> retrieved 12th June, 2015.

4. A possible innovation with Smart Grid and neural network

Imagine the house of the future. Imagine having information about how much energy you spend in your house, every day, every hour, instantly. Imagine its value converted to your country's currency. This is possible and most of all, useful. The neural network⁸ is a supervised learning system. Given a massive data set, it has the ability of recognize patterns or approximate a non-linear function. A program can then tell the network how to behave in response to an external stimulus or can initiate the activity on its own. For example, given a database on the various types of shower available in the market, they can be tested in use at the same time with other equipment in the house. The energy peak follows a pattern when the shower is switched on and then off, this would be the input database for the neural network. The system will then recognize this pattern when used in a common house and determinate whether the person is taking a longer bath and therefore consuming more energy. It would be possible to the user to receive this information via smart phone therefore we can promote e conscious consumption of energy. The main goal is to plan the consumption. In addition, with neural network technology, it is possible to prevent to consume energy at a peak (higher price). With a data base of peak times and the smart meter that shows real time energy consumption in the house, the user can be aware of the best time to use each equipment and also the best time to take a shower, wash clothes, and so on. This is particularly important during episodes of peak demand, those times of greatest need for electricity during a particular period. Imagine that it is a blisteringly hot summer afternoon. With countless commercial and residential air conditioners cycling up to maximum, the demand of energy is higher, to its "peak." At these moments, in Brazil, not only hydroelectric power stations are working, but also the thermal ones. The thermic energy is more expensive, and lately in Brazil, the thermal power stations programmed to work only and peak periods are now working full time. This explains why the electric bills are now higher than before. This also explains why the consumers have to avoid using electricity during the peak period. The Smart Grid technology, associated with a neural network will give us the ability to anticipate peak periods, and warn the users about them. It connects consumers to the grid in a way that is beneficial to both, because there is a lot that consumers can do to help the grid. In the case mentioned above, as the consumer is aware of the peak period, he will immediately turn off some equipment or stop some process to pull the energy consumption down. It is possible to say that with the Smart Grid, the risk of black out will drop significantly.

5. Conclusion

The current electric power delivery system in Brazil is almost entirely a mechanical system, with only limited use of sensors, minimal electronic communication and almost no electronic control. The smart grid is an innovation that has the potential to revolutionize the transmission, distribution and conservation of energy. Smart grid enables and facilitates the participation of the energy consumer in the energy market, through an innovative interaction with the electric distribution companies. In this context, we need to consider the aspects of planning, operation expansion and the fare structure. Given Brazilian population growth and the exponential increase in the number of power-hungry digital components in our digital economy, the government must invest in additional infrastructure, whether smart or not. Today we have to face a crisis scenario. It represents the worst-case scenario in all studies through times and therefore, there was no investment to avoid this situation. The Smart Grid holds the potential to be the most affordable alternative to control the current situation by building less and saving more energy. It will clearly require investments that are not typical for utilities, but the overall benefits of such efforts will outweigh the costs. However, this kind of transformation must come along with a transformation in Brazilian culture and politics. Strengthen the tripod: planning,

⁸ Bishop, Christopher. Neural Networks for Pattern Recognition. Birmingham, UK. 1995

management and regulation, reducing the excessive intervention of the government in the electric sector in the short term. We also have to transform the culture, propagating and perpetuating the idea of sustainability. Thinking about what are we going to leave for the next generations has to be intrinsic to the citizens. Taking care of our country's abundance of different kinds of energy resources, most of them, clean energy.