Management System Design Using Smart-Grids in Manaus

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Abstract

With the large increase in population among the capitals of the Brazilian states Manaus is a city with great energy potential being in the national interconnected system (SIN), reconciling the expansion of its generation capacity fits the scope provided for in the Ten Year Plan for Expansion of Electricity that The objective is for the energy sector planning, with benefits in terms of increased reliability, reduction of production costs and reduction of environmental impacts, already in the plan through distributed generation, which aims to fit micro generation of as a way to increase supply capacity the plan that provides targets for the country to comply with the COP24 Plan of Countries with the largest amount of clean energy to reduce the environmental impacts caused by the warming of the atmosphere caused by emission of pollutant gases such as the case of CO_2, thinking about how to improve the use of energy juice generated in its capital and partially supplied by the national system, this work has the purpose of collecting data pertinent to the consumption in order to create a possible projection of the increase and influence of renewable energies in Manaus City through the Smart Grid system as an insertion model the diversification of the capital's generation park.

Keywords: Intelligent Electric Networks; Renewable energy; Energy Expansion;

1. Introduction

Electricity has been declared as an essential consumption good for socioeconomic and cultural development, as it has a great influence on the accessibility of goods and services, as well as its use for income generation in certain regions, which have, for example, manufacturing culminating in the

generation of direct and indirect jobs.

The growing demand for the expansion and operation of the Brazilian Electricity System (SEB) to be carried out more efficiently and less costly, in order to accommodate uninterrupted supply-side options to meet the requirements of an increasingly dynamic market. Seeking standards of quality and reliability makes the planning process of the power sector gaining primary importance in determining system configuration and performance [1].

Nowadays it is unthinkable to live without electricity, since in the world, daily, new technologies are emerging to improve our quality of life and most of them are related to the use of electricity. Thus, one of the current models, aimed at reducing the wear of the resource is based on photovoltaic solar energy, which converts solar radiation directly into electricity through photovoltaic modules (PV), not emitting greenhouse gases, being an environmentally friendly energy [2].

The resources used in the various types of technologies, not only in photovoltaic solar energy, have great energy potential, but most of these resources are intermittent, and since Brazil is a large country, region by region is considered. Although applications based on different types of materials have been developed, crystalline silicon dominates the world market for manufacturing and marketing [3].

In this context, considering new sources for Brazil, an emerging economy country, is extremely important, especially in terms of energy security. Since the country is located in an intertropical region that has a considerable vertical incidence of sunlight - which favors the increase of radiation rates in almost the entire country - it is reasonable to discuss the potential of using solar photovoltaic energy and its nuances within the Brazilian reality. [4]

Deploying demand-sensitive loads and distributed energy resources in the distribution system is the initial step towards making the grid more sustainable. Thus, based on the premise of Distributed Emery Generation, there is greater control through reduced demand that allows the utility to utilize current network capacity as much as possible and therefore to postpone capacity expansion projects that are normally associated with the environment. [5]

In the electricity sector, the evolution of the matrix in its various sources is configured in continuous growth, due to some characteristics such as: low loss rate during conversions, ease of transport and direct conversion to other types of energy, such as thermal, chemical, luminous, mechanical, among others, plus the emerging demand for electricity due to the lifestyle of modern society [6].

According to [7], photovoltaic (PV) energy has grown substantially in recent years while achieving considerable cost reductions, thus increasing the challenge of establishing integrated energy matrix models combining different energy sources and envisaging the fact that solar energy is a dominant model in the long run.

According to [1] in the future, the Energy Sector will go through a period of profound transformations, which will require relevant action by the Ministry of Mines and Energy in at least two major dimensions. On the one hand, the process of correcting the distortions of the past must be completed, with a view to restoring the vitality of this strategic sector to the national economy, as well as to the welfare of all Brazilians. On the other hand, the energy sector will have to be planned for the future, making it able to incorporate new technologies and thus be competitive in new market configurations.

2. Material and Method

2.1 Kind of study

Exploratory research aims to bring a greater understanding of the object of research, which aims to discover, find, elucidate phenomena or explain those that were not accepted despite being evident. Exploration currently represents an important competitive differential in terms of competition [8].

2.2 Study area

The selected area is the city of Manaus / AM, as well as development information was used, pertinent to its implementation history, with the national system as well as its use over time. Thus, the use of the collected data demonstrates the type of information needed for growth projection and implementation of the Smart Grid system in the region, so that a projection can be made.

2.3 Data collect

Data collection was based on content analysis of documents, articles and data conditioned and registered by public agencies, freely accessed objects characterized as primary sources (documents that will still be analyzed to create information) or secondary sources (information that have already been elaborated).

2.4 Collection instruments

According to data presented by [9] points out that the estimated population in the city of Manaus, AM is approximately 2,182,763 people a significant increase compared to the previous common sense with a population density 158,06 "hab /" 〖"km" 〗 ^ "2".

According to [10], the installed capacity of electricity generation in the state of Amazonas was 2,315 MW, of which 275 MW correspond to generation by Hydroelectric and 2,040 MW by Thermoelectric, during 2016, the total residential consumption of electricity in the state of Amazonas was 2,125 GWh, which shows residential consumption is higher than the country's average, which can be explained by the climatic characteristics of the Amazon region, however, its lower consumption of electricity per capita reflects the lower industrial development. of the region as a whole.

3. Results and Discussion

[11] was experimentally connected to the National Interconnected System (SIN) on 07/09/2013, but was confirmed the conclusion of its interconnection works on 05/05/2015 thus causing the unbundling of the generation, transmission and energy distribution by starting a new process of services and new contracts of amounts of gas plants.

The power plant system in Manaus consists of an energy complex based on thermoelectric power plants (UTE), hydroelectric power plant (HPP) and independent producers (PIEs), consisting of UTEs, with energy supply services contracted to supply certain demands (table 1).

Table 1: Manaus Generation Capacity

Generation	Capacity (MW)
UTE - Aparecida	172
UTE - Maúa	436,5
UTE - Cidade Nova	15,4
UTE - São Jose	36,4
UTE - Flores	69
UHE - Balbina	250
UTE - Electron	120
UTE - Breitener Tambaqui	60
UTE - Breitener Jaraqui	60
UTE - Manauara	60
UTE - Rio Amazonas	65
UTE - Gera	60
Total	1404,3

Source: Amazonas Energia Management Report (2017).

As observed, most of the energy supply systems are generated largely by thermoelectric plants, where part of the TPPs are supplied by natural gas from contracting amounts from companies from municipalities such as Coari, AM, Figure 1.

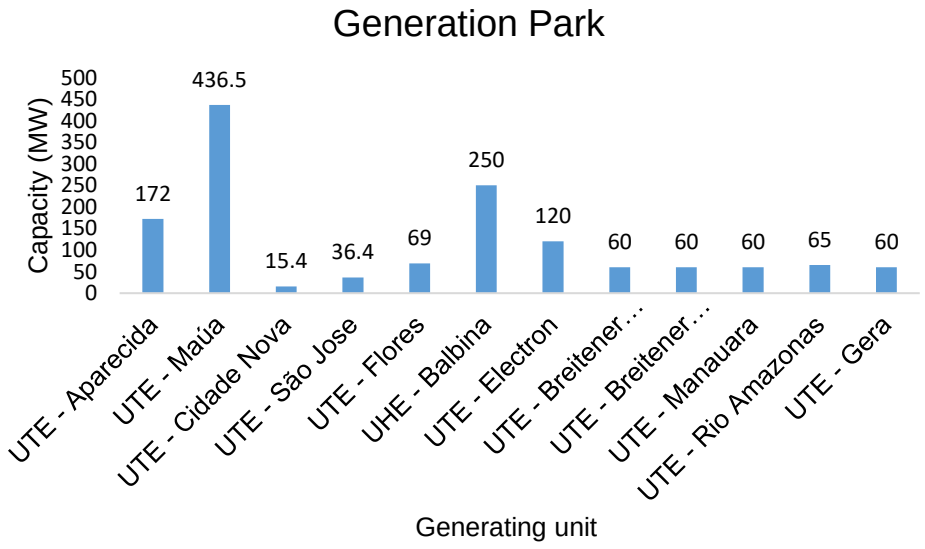

Fig. 1: Generation Park
Source: Amazonas Energia Management Report (2017)

With the increase in consumption over the years, it was possible to find data regarding the average consumption of the capital, the information indicates that after the insertion of Manaus to the SIN and that the current moment of the country there was a decrease in the use and generation of energy. thermoelectric plants, but the increase in energy demand was supplied by the source of the national system, where the Manaus industrial park, despite a financial crisis, had its consumption significantly increased, follows graph

with the annual average energy consumption of the Capital Figure 2

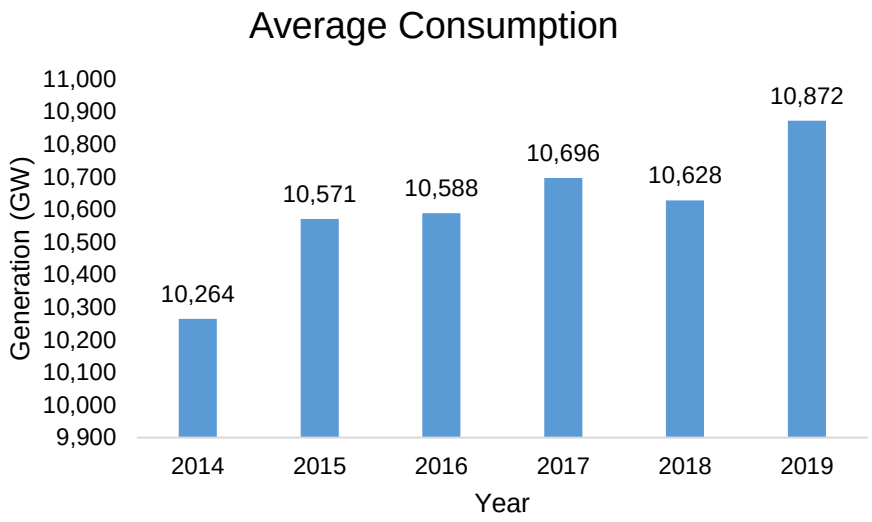

Fig. 2: Average Annual Consumption
Source: Amazonas Energia Management Report (2017)

The energy required in this scenario in recent years has not increased, contrary to annual averages, it has decreased over time, with the creation of new tariff policies by utilities as a way to encourage energy rationing by of demand with the creation of the so-called off-peak consumption uses, its use had a decrease in the generation required to meet the utilization demand Figure 3.

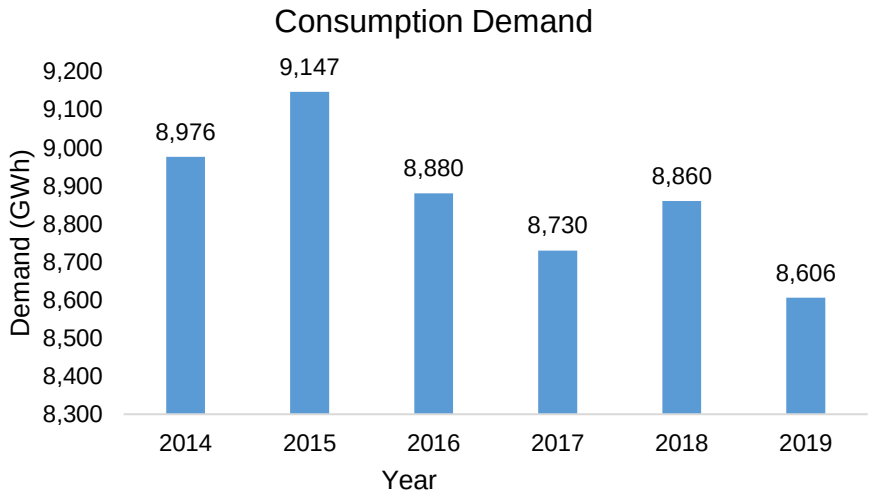

Fig. 3: Consumption Demand
Source: Amazonas Energia Management Report (2017)

Using the annual averages data, it is possible to create a projection of consumption and thus we have in view that with the increased use of energy, it is necessary to diversify the generation park, together with the insertion of renewable energies. Figure 4.

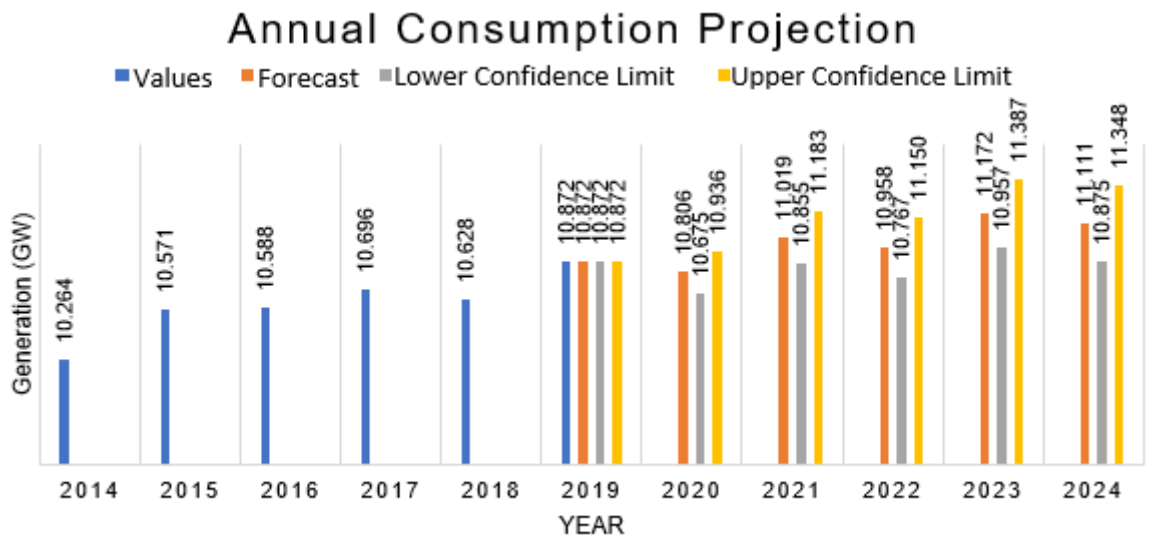

Fig. 4: Annual Consumption Projection
Source: Personal Collection

In recent years, it has been noted that the traditional power generation and transmission system has become inefficient and outdated to meet all demand. However, with the growth of research on the concept of smart grids, new technologies are emerging. to build aspects of a grid that can guarantee sustainability, reliability, availability through automation and control of the power grid thus allowing the optimization of the generation, transmission and distribution system as a way to improve system efficiency [12].
With the advancement of technology, there is a significant improvement in the efficiency of end-use equipment, as well as the methods of implementation of generation, transmission and distribution of electricity, seeking a better use of supply and consumption resources through real-time control. of the system, being one of the ways to maximize the efficiency of the grid, in order to avoid waste [13].

4. Conclusion

With the increased use of electricity as a consumption good we have to make better use and rational use, the implementation and connection of Manaus to the SIN concerns the better flow of energy systems with each other, which can be made better use of resources allocated to the capital to serve not only the capital, but to serve other regions when it is suffering due to the seasonality of its regions, thus using the concept of Smart Grid in the proposed National System that improves the management of this resource, it is also obtained quality as a purpose for the customer, in this case the consumer.

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