



A review on the Central America electrical energy scenario



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ABSTRACT

Since the mid 1990s, after the pacification of Central America, the region has experienced a sustained economic growth. Additionally, the Central American governments have been able to increase the population's access to electricity, e.g. the percentage of Central American population with access to electricity in 1995 and 2010 was 59% and 86%, respectively. The aforementioned reasons and the need to reduce electricity costs in order to remain competitive in a global economy have produced a transformation of the power scenario in Central America.

The present paper presents a review about the power generation scenario of Central America within the framework of the new Regional Interconnected Electric System. It also briefly analyzes the trends of the power generation profile with a special emphasis on the renewable energy sources. As it can be inferred from the analysis presented in this paper, the Central American power scenario will mainly be shaped by the participation of the private sector and the development of the recently created regional electricity market. Additionally, it is clear the willingness of all the Central American countries to move away from oil-fired power generation. The lack of up-front capital needed to develop large renewable energy projects (mainly hydropower) can favor the development of gas-fired and/or coal-fired power stations. Nevertheless, the regional electricity market may favor the viability of large power generation projects.

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1. Introduction

The need for investments to meet the increasing energy demand and, in some cases, the debt crisis, has led to a process of deregulation and privatization of the electricity market almost everywhere.

The electric energy scenario has also changed due to the evolution that non-traditional power generation technologies have had in recent years. For instance, wind and solar power generation have become more attractive not only because both technologies have experienced a steady decrease on their costs but also because they represent a highly scalable energy solution. Scalability is a highly desirable characteristic – especially in developing countries – because it allows to test a new technology at a relatively low cost. Consequently, it seems reasonable to envisage a future electricity market in which several low to mid distributed power generation units deliver energy to the utility grid.

Small countries can be especially affected by the transformation of the electric energy scenario. Take for instance the case of El Salvador, a Central American country of only 21 000 km², in which the privatization of its electricity market has led to a sudden rise in prices for the consumers and eventually forced the government intervention [1]. According to [1] the aforementioned situation was mainly due to the small size of the Salvadorian market which failed to attract enough private companies and to create a healthy competitive environment.

In this regard, integration of energy markets across boundaries seems to be not only a viable but also a necessary option for small developing countries. The rationale behind the integration of energy markets is not only related to the potential financial savings that might be achievable but also to the need to cope with the intrinsic variability of the new renewable energy technology (e.g. solar and wind) that is gaining importance in the power grid, i.e., larger power grids can profit more efficiently the diversity and complementary properties of renewable energy sources.

Central America has been dealing with the integration of their local energy markets since the 1970s [2]. In 1996 the Central American presidents signed an Electricity Market Framework Treaty that, along with subsequent regulations, set the legal framework for energy transactions between the Central American countries. At that time, the existing regional electrical interconnection infrastructure was weak and unable to operate above 50 MW. Consequently, the main priority of the aforementioned agreement was to construct the required infrastructure for the efficient interconnections of the local power grids. The construction of the dedicated transmission line started in 2006 and has been finished in 2013. It is expected that the regional market will be activated with the finalization of a dedicated power grid infrastructure with much larger power capacity [3].

The Central American energy scenario has been previously analyzed and described in not many published international scientific papers. Most of the works have focused their attention on the relationship between energy consumption and economic development, such as the studies mentioned in [4]. In this regard, the latest study performed on this matter, i.e. [4], concludes “*that energy consumption in Central America plays an important role in the growth process both directly and indirectly as a complement to*

labor and capital”. Other studies deal mainly with the regional cooperation efforts both to create an integrated energy market and to lower CO₂ emissions [1,5]. For instance, the study performed by Hosier et al. in [5] concludes stating that the “*integration of the Central American region can result in considerable benefits in all aspects of the energy sector, particularly in the power subsector*”. In [6], Flores et al. present a diagnosis of the Honduran energy economy. The authors also analyze policies and investment needed to improve the Honduran energy market. In the aforementioned work, the authors also highlight the unexploited potential of natural resources available in the Central American region for producing clean energy.

This document presents a review about the power generation scenario of Central America within the framework of the upcoming regional interconnected electric system. It also briefly analyzes the trends of the power generation profile. It should be pointed out that similar reviews of countries’ energy scenarios have been presented in [7–10] for the cases of Indonesia, Iran, Malaysia, and Pakistan, respectively.

2. Central America: geography and demographics

Central America is the region of the Americas that lies between North America (Canada, United States and Mexico) and South America. Geographically speaking, seven countries constitute this isthmus, namely, Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. All of them except for Belize share a common language, culture and infrastructure. For instance, the Pan-American Highway connects the six countries and represents the main trade route between them. Also, a recently completed Central American Electrical Interconnection System connects the power grids of the six countries, allowing also the trade of energy between them.

Moreover, since the mid 1990s there have been a consensus among Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama, to create common institutions and discussion groups to coordinate the actions of the countries in terms of power policy, energy investments and electrical tariffs. For instance, the Central American Electrification Council is a regional organization, created in 1979 and formed by the institutions in charge of planning the power expansion of the aforementioned countries, that have had a central role in the consolidation of the regional electricity market.

Belize has not actively become part of the regional institutions or the regional integration process in Central America. This might be due to cultural and language differences and the territorial disputes between Guatemala and Belize.¹ Additionally, in terms of regional integration Belize has been closer to the Caribbean islands; it has been a member of the Caribbean Community (CARICOM) almost since its creation (1974). In this regard, the situation of Belize with respect to Central America is similar to that of Guyana and Suriname, also members of CARICOM, with respect to South America. Moreover, the energy interaction between

¹ The territory of Belize has been claimed in whole or in part by Guatemala since 1940.

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