



## Spatial assessment of the potential of renewable energy: The case of Ecuador



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### ARTICLE INFO

JEL:  
O13  
Q28  
R32  
Q42

**Keywords:**

Renewable-energy  
GIS  
Ecuador  
Multi-criteria analysis

### ABSTRACT

Although renewable energy represents a large share of the electric energy generation sources in Latin America, non-conventional sources such as solar or wind energies have not represented a big share of their electric energy systems. The first step to promote the use of these sources in the region is identifying the potential of each energy source, task that can be estimated with the use of spatial tools such as Geographic Information Systems (GIS). This study has reviewed a large list of GIS publications to select a methodology to identify suitable areas for the development of non-conventional renewable energy projects (REP), in order to estimate the maximum energy these technologies could contribute to a national electric energy system, and its applied to the Republic of Ecuador. By using GIS, it is sought to identify the sites where potential renewable energy plants could be located, and initially recommends geographic locations for the installation of measuring towers of solar and wind resources, in order to obtain more detailed information on their behavior. As a result, the areas with higher potential for the development of REP have been identified, and classified in spatial layers according its technology and location. These results show that solar PV is the technology with most suitable areas in the country and demonstrate particularly large potential in two regions: the Andes cordillera and Insular region, especially in the provinces of Loja, Pichincha and the Galapagos islands.

### 1. Introduction

Whilst Non-Conventional Renewable Energy (NCRE) sources are increasing its share in most energy systems worldwide, the participation of these technologies in the majority of developing countries has not shown greater increase of installed capacity, and energy generated, during the last decade [1]. Besides Hydropower and biofuels, renewable energy has not played a significant role in the energy sector in the Latin-American region, although this trend has started to change thanks to the construction of some renewable energy projects, and public policies encouraging the development of clean energy generation projects [2]. If the goal of reducing greenhouse gas emissions is to be achieved, it is necessary to keep track to the growing economies of developing regions, which are projected to increase in energy demand and production.

Nowadays some countries in Latin America have achieved (or are close to) a complete renewable energy electricity grid, using a mix between hydropower and other NCRE. Examples of this are Costa Rica, Paraguay and Uruguay, which now satisfies more than 90% of their

electric power demands using hydro, wind, or a mix of both [3]. Since 2016, Ecuador is trying to join these countries with an almost sustainable electric grid thanks to the construction of eight hydro power plants summing an installed capacity of 2.76 GWp and some minor capacity of NCRE [4]. As it can be seen in Fig. 1, Ecuador is a country filled with natural resources, and for decades has been able to use them to produce electricity. Despite the government has encouraged the expansion of renewable energy technologies in the country, through the issuance of various regulations that promote their participation [5–8], the share of NCRE power plants in the national energy balance was still below one percent in 2016. However, the few NCRE power plants that have been commissioned in the country have proven to be highly effective. One example of this is the Villonaco wind farm, which in 2014 showed a capacity factor of 53%, which is considerably high compared to the average capacity factor for this type of plants. Solar Photovoltaic plants have also shown high efficiencies, thanks to the privileged position of the country regarding the sun. Because of the high effectiveness of the projects mentioned, it is of great importance to promote the use of these technologies in the region.

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