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Evaluation of Peruvian Territorial Spaces for the Creation of Wind Power Plants According to the AHP Matrix Analysis

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***Abstract*—The paper presents an analysis of the evaluation of territorial spaces in the province of Junín, Peru, for the implementation of wind power plants using the AHP (Analytical Hierarchical Process) matrix analysis method. Several evaluation criteria are used, such as average wind speed, altitude, roughness length, slope, administrative boundaries, urban areas, power lines and substations, hydrographic units, and environmental and archaeological zones. The results obtained show the percentage weightings for each province of Junín in relation to the different evaluation criteria. According to the AHP analysis, it is determined that the most optimal province for the implementation of a wind farm in Junín is the province of Yauli, followed closely by the province of Chupaca. These provinces meet the selection criteria and present similarities with current wind farm locations.**

Keywords—Evaluation, Territorial spaces, Wind energy, matrices, criteria.

INTRODUCTION

The great need in the management of renewable energy facilities within the scope of planning, design, operation, in order to produce sustainable energy alternatives without carbon emissions [1], such as solar, wind, hydroelectric, among many others, which allow the reduction in technical, economic and environmental aspects [2], hence the need to innovate in new processes that can optimize the planning, design and operation; that allow technologically innovate processes for the mitigation of greenhouse gases [3].

According to IRENA (International Renewable Energy Agency), it is estimated that by 2050, 90% of the world energy used should come from the development of renewable energies [4], which is why countries worldwide generate large investments in the field of renewable energies, with new and different innovations that support the electricity markets. Globally, the largest investors in implementing new contributions in the reduction of gases are China, Japan, Spain, Russia and the United States, since these have been presenting important changes in the self-sustainable electricity sector [5] [6], thus providing multiple benefits, which allow the reduction of greenhouse gases in different sectors of each world government, also generate global impacts within the socioeconomic field, such as energy access to the poorest sectors generating health welfare, this access to energy sources allows the development of innovation and education worldwide [7].

In Peru, electrification is of vital importance for economic growth, considering that Peru has many rural areas without access to electricity service or even with poor quality service, which generates a high cost of living [8]. Therefore, the implementation of strategies allows the use of energy in a fundamental way for national energy development [9], currently in Peru only about 5% of electricity generation comes from renewable energy, with a high rate of pollution [10], according to the ONU, which mentions that there is a high rate of increase in the growth of greenhouse gases [11].

One of the most widely used energies worldwide is wind energy, which is directly responsible for harnessing the energy generated by the wind through the use of wind turbines, which transform wind energy (kinetic energy) into electrical energy [12]. Therefore, the location of these wind farms is of vital importance within the implementation management, which will essentially depend on the location, size, number of wind turbines, among others, which will define the amount of wind energy generated [13].

With this we present the following research, which will evaluate the most optimal site to implement a wind farm according to data in GIS format [14], using AHP multicriteria analysis [15], in which basic criteria will be analyzed for the determination of optimal areas with each province of the Junín department, in order to evaluate the most effective place for the implementation of the wind farm, according to selection criteria.

MATERIALS AND METHODS

The research works with the AHP multicriteria análisis [15] the selection of an effective area for implementation of a wind farm, therefore the analysis of the 9 provinces of the department of Junin is performed, using data in GIS format that was granted by the "WIND ATLAS OF PERU" which was conducted by the Ministry of Energy and Mines of Peru (MINEM) [16]. The GIS analysis was taken into account as a suitable consideration for the evaluation of the department of Junín; the data provided by MINEM demonstrates its validity when identifying the zones according to the AHP multi-criteria decision-making method.