

Список использованных источников

1. Официальный сайт ПАО «Т Плюс» // Теплоснабжение: [Электронный ресурс] – URL: <http://www.tplusgroup.ru> (Дата обращения: 30.10.2018).
2. Федеральная служба государственной статистики: [Электронный ресурс] – URL: <http://www.gks.ru> (Дата обращения: 30.10.2018).
3. Министерство Энергетики Российской Федерации: [Электронный ресурс] – URL: <https://minenergo.gov.ru> (Дата обращения: 30.10.2018).

DEVELOPMENT OF WIND ENERGY IN BOYACÁ, COLOMBIA

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Colombia seeks to conserve natural resources, applying an environmental policy in principle of sustainable human development. The state seeks that the community, the private sector and NGOs, aim to protect, conserve and recover.

The country's ecosystem has been highly affected by the exploitation and consumption of conventional energy, which is why it is expected that by 2030 at least Colombia will consume 30% of non-conventional clean or renewable energies and 70% of traditional sources (hydroelectric and thermal), focusing on alternative sources such as the wind resource, and seeking a sustainable regional economic development.

The year 2017 was another record-breaking one for renewable energy, characterized by the largest ever increase in renewable power capacity, falling costs, increases in investment and advances in enabling technologies.[1]

Wind power is providing a significant share of electricity in a growing number of countries. In 2017, wind energy covered an estimated 11.6% of EU annual electricity consumption and equal or higher shares in at least 8 EU member

states, including Denmark, which met 43.4% of its annual electricity consumption with wind power. [2]

As a source of renewable energy, the wind is safe, environmentally clean and long-term economic and profitable. Wind technology has had the most growth in recent times.

The speed, direction of the wind, its variability and density, although to a lesser degree, are components that determine the available energy.

The wind speed is the relation between the distance traveled by the air and the time it takes to travel it. The "instantaneous velocity" or the "velocity" more briefly corresponds to the case of an infinitely small time interval.

The "average speed" is related to the case in which the time interval is finite. The density is defined as the mass per unit volume of atmospheric gases. The persistence of wind speed is the percentage value of the predominant direction of the wind. When low values are presented, it is considered that the wind tends to be variable. [3]

Wind is air in motion, an indirect form of solar energy, since it is caused by differences in temperature, so wind turbines are used to convert kinetic energy into mechanical energy.

Aerodynamic designs in wind turbines, allow the use of wind converting kinetic energy into mechanical, to capture the largest amount of energy from this resource.

The installed capacity in Colombia in 2017 was 167,778 MW, and it is dominated by the generation of hydroelectric energy, followed by gas and coal thermal power plants. A percentage lower than 10, belongs to the generation of energy through various technologies (Liquids, gas, biomass and wind, which has only a percentage of 0.11%). In the department of Boyacá, 75% of the total capacity is concentrated in hydroelectric generation and the remaining 25% in thermal generation using coal and gas. [4]

There is a dependency on hydroelectric generation, both in the country as in the department of Boyacá; a dependency that is often affected by natural

phenomena, due to the variability of rainfall and the increased risk of droughts, and although the department has abundance in coal, the construction of thermoelectric plants would increase environmental problems. Which is why the state seeks to implement alternative generation sources that are not considered vulnerable due to the conditions of rain or that do not produce large amount of carbon emissions.

Recent studies indicate that the department of Boyacá has a favorable condition in renewable energy resources, the climatic conditions allow to visualize a potential for the generation of wind energy, with wind speeds equal to or higher than 5 m / s in several months of the year. For purposes of wind energy studies, the mentioned speeds provide a good alternative, according to the Atlas of wind and wind energy of Colombia, in the municipality of Samacá. They were identified throughout the year between 8:00 and 17: 00 speeds of 5m / s, however towards the middle of the year they can reach average intensities close to 7 m / s from 5:00 to 17:00. [5]

Opportunities for wind development have been identified through the planning of wind farms with 2.5 MW nominal wind turbines, in the municipality of Samacá, in Boyacá, Colombia. The main activities of the municipality are agriculture, livestock, mining.

The use of the wind resource will allow expanding the energy supply of the department and partially or totally displace the thermal generation in the long term, resulting in a sustainable regional economic development, by reducing generation costs, environmental benefit by reducing gas emissions, greenhouse effect, and security in the energy supply for the department.

Unlike other departments, Boyacá has transmission lines of the National Interconnected System (SIN), so for the state it represents a good option for the implementation of complementary generation projects.

Wind energy has important environmental and socioeconomic advantages, but like any other electricity generation system, this energy source generates negative impacts on the environment. However, the implementation of this type of

generation allows the reduction of CO2 emissions, since each wind kWh generated in Boyacá could replace a kWh produced with coal.

It is also considered the possibility of managing the benefit of the sale of reductions of Certified Emissions (CERs), with the Kyoto Protocol or another similar initiative, which would increase the annual income for this concept for the project.

References:

1. Official website of Renewable energy policy network for the 21st Century. [Electronic resource in English language] URL: http://www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_final_.pdf (accessed 17/11/2018).
2. Official website of Renewable energy policy network for the 21st Century. [Electronic resource in English language] URL: http://www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_final_.pdf (accessed 17/11/2018).
3. Official statistic site of the wind in Colombia. URL: [Electronic resource in Spanish language]. <http://atlas.ideam.gov.co/basefiles/TEXTTO---Velocidad-del-Viento.pdf> (accessed 17/11/2018).
4. Official site company specialized in the management of real-time systems. [Electronic resource in Spanish language]. URL: <https://www.xm.com.co/Paginas/detalle-noticias.aspx?identificador=1693> (accessed 17/11/2018).
5. Official statistic site of the wind in Colombia. [Electronic resource in Spanish language]. URL: <http://atlas.ideam.gov.co/basefiles/TEXTTO---Velocidad-del-Viento.pdf> (accessed 17/11/2018).