



## Development of Energy Efficiency Activities at El Bosque University to Contribute to Climate Change

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**Abstract.** This article demonstrate that the increase reached by the University El Bosque promoted by the UIgreenmetric focuses on the Energy and Climate Change approach is important for the organization. The results on calculating the carbon footprint are important for the community of the Forest for having Environmental responsibility, Awareness of the university community, cost savings and Institutional image. By doing that The educational institution installed 1,227 panels solar which contribute to reduce 79.2 tons of CO<sub>2</sub> per year, whose function generates a percentage change of 20.11% in the facilities located in Usaquen. The bicycle parking system increased the use of the bicycle as transportation within the community university in more than 100%. Well, before the installation of the new bicycle parking spaces, the bicycle rotation at the University estimated a t 200 bicycles a day, while currently, the average daily turnover of bicycles is estimated at 528. In the first room, the elevators have a system of LED lights, which make the energy consumption related to Cabin lighting is greatly dimmed. They also provide greater durability luminaires and great savings on the bill electrical.

**Keyword:**

Climate Change, Carbon Footprint, Savings, Luminaires

### 1. Introduction

At present, the increase in the temperature of the climate system is unequivocal and human influence on the system is a determining factor. Anthropogenic activities generate an evident degradation of the environment, which is manifested in the pollution of the oceans, water scarcity, reduction in the biodiversity of flora and fauna, increased deforestation, desertification, global warming and climate change.

The latter is the concept that refers to the significant and lasting changes in the earth's

climate as a result of the increase in global average temperature caused by the emission of greenhouse gases (GHG) into the atmosphere. These gases, mainly carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), are generated and released by human activities, where approximately 70% of greenhouse gas emissions come from the energy industry.

According to reports made by the Intergovernmental Panel on Climate Change (IPCC), anthropogenic emissions of greenhouse gases have increased since the pre-industrial era, largely as a result of economic and population growth, and consequently to atmospheric concentrations of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) have reached levels not comparable to those reached over the last 800,000 years. [1]

In addition, according to the National Inventory of Greenhouse Gases, developed in the third national communication on climate change by the Institute of Hydrology, Meteorology and Environmental Studies - IDEAM, in Colombia the energy sector generates significant emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, as a result of the burning of fossil fuels in the extraction and production of oil and natural gas for the country's supply.

Climate change has a number of negative impacts on the planet, including sea level rise, ocean acidification, loss of biodiversity and increased weather events such as storms, droughts and floods, with severe consequences for human health, food security and the global economy.

For this reason, it is imperative to develop measures to reduce greenhouse gas emissions and adapt to the climate changes that are already occurring. This includes the transition to renewable energy sources, the protection and restoration of ecosystems, and the adoption of more sustainable agricultural and land-use practices.

## 2. Points of Results and Discussions

### 2.1. Calculate the carbon footprint according to the methodology of the NTC- ISO 14064:2020 standard at Universidad el Bosque, Sede Usaquén, in order to establish plans to reduce CO<sub>2</sub> emissions

After defining the organizational boundary for the evaluation of greenhouse gas (GHG) emissions, as established in the ISO 14064-1:2020 standard, the direct and indirect emissions applicable to the different processes at the study site were identified, based on the applicable categories.

The quantification of emissions is based on equation 1, which is based on the emission factors of each of the activities present in the institution.

Equation 1. General Equation Carbon Footprint

$$GHG \text{ emissions} = (\text{Activity Data}) \times (\text{Emission Factor})$$

Table 1. Emission factors

Concept	Emission Factor
Natural Gas Consumption	1.86 kg CO <sub>2</sub> / kg
Energy Consumption	0,2 kg CO <sub>2</sub> / kWh
Coolant consumption	1,774 kg CO <sub>2</sub> / kg
Gasoline	7,6181 kg CO <sub>2</sub> / gal

Concept	Emission Factor
Diesel	10,149 kg CO <sub>2</sub> / gal
Solid Waste (Controlled Dump)	12.83 kg CO <sub>2</sub> / kg
Organic Waste	0.365 kg CO <sub>2</sub> / kg
Hazardous Waste (Biosanitary)	0.0502 kg CO <sub>2</sub> / kg
Paper + Cardboard	0.55 kg CO <sub>2</sub> / kg
Glass	0.04 kg CO <sub>2</sub> / kg
PET	2.538 kg CO <sub>2</sub> / kg
Plastic	0.035 kg CO <sub>2</sub> / kg

**Source.** Own elaboration.

Thanks to the data provided and through the quantitative process, the following values were obtained as a result:

Table 2. Carbon footprint results

Concept	Annual consumption	Total emissions (Ton CO <sub>2</sub> eq)
Fuel consumption by power plants	240 gallons	2.43 Ton CO <sub>2</sub> eq
Coolant consumption	136 kilograms	241,26 Ton CO <sub>2</sub> eq
Natural gas consumption	12603 kilograms	23,441 Ton CO <sub>2</sub> eq
Power consumption	2135286 Kilowatt	427,05 Ton CO <sub>2</sub> eq
Paper consumption	4368 kilograms	11,74 ton CO <sub>2</sub> eq
Organic Waste	7591,5 kilograms	2,77 ton CO <sub>2</sub> eq
Ordinary Waste	8063,5 kilograms	103,45 ton CO <sub>2</sub> eq
Hazardous Waste	8298,9 kilograms	0,416 ton CO <sub>2</sub> eq
Usable waste	14929,5 kilograms	9,15 ton CO <sub>2</sub> eq

**Source.** Own elaboration.

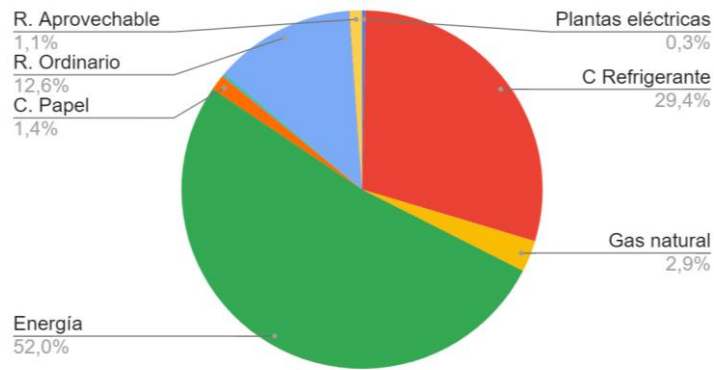


Figure 1. Total emissions (Ton CO2eq)

Source. Own elaboration.

## 2.2. Reduce the university's CO2 emissions through the installation of solar panels and the implementation of energy efficiency measures.

This technology was ideal for generating energy with renewable sources on a small and medium scale and for own use. With the implementation of 1227 solar panels, the environmental impact was reduced by 79.2 tons of CO2 per year. In the long term, it was possible to use this as a strong marketing tool, showing its vocation as an entity committed to the environment.



Figure 2. Installation of solar panels



Figure 3. Installed solar panels

**2.3. Manage a system of LED luminaires in order to reduce energy consumption related to lighting and improve the energy efficiency of the university.**

The LED lighting system is an eco-efficient system because it not only consumes less energy, but also has a lower impact in terms of light pollution. Regarding the monthly energy consumption charges of Universidad El Bosque, a lower consumption was evidenced, since this system lasts up to 50 times longer than any conventional fluorescent light or incandescent bulb.

**2.4. Encourage the use of sustainable means of transportation, such as bicycles, by installing bike racks and other alternatives.**

The implementation of the bike racks within the institution is part of the Universidad El Bosque's "moviéndonos" program, which has been in charge of managing the operation of this space, maintaining monthly reports on bicycle rotation, accidents and requests from the community, responding to these through communication actions. The program has generated a positive impact by promoting the use of bicycles as an alternative and sustainable means of transportation.



Figure 4. Bike racks of the institution

**3. Conclusion or Concluding remarks**

The appropriate management of the different projects is continued, taking into account the promotion of human health care and environmental conservation, through the

planning and development of different projects and programs that promote the mitigation of the different negative impacts generated in the institution.

Carbon foot printing is a useful tool for measuring and understanding the impact of our activities on the environment. By calculating our carbon footprint, we can identify the main sources of greenhouse gas emissions and take measures to reduce our environmental impact.

Thanks to the calculation of the carbon footprint, it is evident that the critical point of emissions of Universidad El Bosque is presented in terms of energy and use of refrigerant liquids. On the other hand, it is concluded that the institution has an integrated management of solid waste, because the values calculated for these categories are those that generate lower emissions.

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