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# IN SPAIN, PRIVATE VEHICLES AND GREENHOUSE GAS EMISSIONS ARE A LOSING BATTLE

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## ABSTRACT

*In 2016, the Madrid area, which comprises the capital and neighboring cities, had over 4 million private automobiles, in addition to around a million trucks, motorbikes, and vans. With up to 2.5 million vehicles, the current scenario in Barcelona is comparable. Both nations (and two of Spain's most populated towns) have started to consider severe measures to decrease vehicle exhaust pollution. In reality, certain measures (inadequate and controversial) were previously taken in 2016. It's safe to say that the battle against pollution has started. Are there going to be any winners? And how did they get to this point of no return? This study attempts to depict the development of greenhouse gas emissions in these sample nations, taking into account variables such as urbanization and economic crises.*

**KEYWORDS:** *Green House, Emission, Automobile, Pollution, Economic.*

## 1. INTRODUCTION

Every day, citizens of urban cities breathe an atmosphere in which harmful particle concentrations have risen dramatically and uncontrollably over the twentieth century. Internal combustion engines (ICEs) in automobiles, trucks, ships, trains, and planes primarily burn petroleum-based fossil fuels, contributing significantly to global warming and air pollution. ICE emits a variety of gases and particles that are commonly known as greenhouse gases (GHG). An emitting source that includes many different greenhouse gases is commonly expressed as a single number in order to use a standard unit that expresses the impact of each different particle emissions in terms of the amount of CO2 that would produce the same effects (CO2eqIn comparison to CO2, there are 157 greenhouse gases. Carbon dioxide has a weighting factor of 1, methane has a weighting factor of 25, nitrous oxide has a weighting factor of 298 and sculpture hexafluoride has a weighting factor of 22,800.

Figure 1 depicts the global distribution of direct emissions by economic sectors, revealing that the transportation sector emitted 7.0 GtCO2eq of direct GHG emissions (including non-CO2 gases) in 2010, accounting for roughly 23% of total energy-related CO2 emissions (IPCC 2015). In 2014, greenhouse gas emissions in the EU-28 were down by 22.9 percent compared to 1990 levels, putting the EU-28 on track to meet its 2020 Kyoto Protocol target of reducing GHG emissions by 20% by 2020 and 40% by 2030 compared to 1990 levels [1]. The Kyoto Protocol was the most significant international environmental agreement ever. In fact, the Kyoto Protocol (adopted in Kyoto on December 11th, 1997 and ratified on February

16th, 2005) was a binding agreement that required states to collaborate on a variety of environmental standards aimed at reducing pollution [2]. To meet the Kyoto Protocol's goals, the EU decided that new passenger vehicle emissions should not exceed 120 grams of CO2 per kilometer by 2012 (Directive 93/116/EC). Nonetheless, since major manufacturers' statistics were inadequate, the European parliament replaced voluntary pledges with obligatory obligations in 2005. Later, in 2008, a revised timetable was established to phase in the CO2 emission limit, with percentage levels rising from 2012 to 2015 for the 130 g/km requirement. By 2021, all new vehicles will have a fleet average of 95 grams of CO2 per kilometer. This equates to a fuel usage of 4.1 liters per 100 kilometers for gasoline and 3.6 liters per 100 kilometers for diesel. When compared to the 2007 fleet average of 158.7 g/km, the 2015 and 2021 goals reflect 18 and 40% reductions, respectively [3].

Greenhouse Gas Emissions from Private Vehicles. The author's goal in this research is to examine the current state of Spanish attempts to achieve gradual decarburization, with a focus on two of Spain's most populated cities: Madrid and Barcelona. Greenhouse Gas Emissions and Vehicles

Currently, several kinds of energy sources (or fuels) are utilized to fuel road transport vehicles:

• Gasoline and diesel.

• Ethanol and biodiesel are examples of biofuels.

Liquefied petroleum gas (LPG), natural gas, and electricity are all examples of energy sources (produced from various energy sources).

Carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (Knox), particulate matter (PM), and carbon dioxide (CO2) make up the majority of tailpipe emissions from gasoline and diesel cars. Significant success has been made in decreasing emissions (NOx, CO, HC, and PM) associated with local photochemical air pollution, and it seems that this development will continue in the future (Wallington et al. 2008).

The advent of new technology such as catalytic converters, which oxidize pollutants such as CO to CO2, has decreased emissions from gasoline vehicles [4]. CO, HC, and NOx emissions are considerably lower in a petrol catalyst vehicle than in a non-catalyst vehicle, but CO2 emissions are greater owing to carbon monoxide oxidation to carbon dioxide. Despite these advancements, petrol vehicles with catalysts still generate more CO and HC than diesel cars, despite NOx emissions being much lower. Diesel vehicles emit more particulate matter, probably the most distinctive of diesel emissions, which is responsible for the black smoke associated with diesel vehicles, as compared to petrol automobiles with a catalyst.

Because they are made from renewable resources, ethanol and biodiesel are called green fuels. The majority of biofuels used in cars today are additions to gasoline and diesel. The usage of these combustibles helps to reduce the amount of Catalyst Scheme Liquefied Petroleum Gas (LPG) is a propane-butane combination. It is a less polluting alternative to gasoline and is extensively utilized every day in taxis, buses, and trucks, resulting in significant reductions in consumption and emissions. It does not rule out the possibility that LPG emits greenhouse gase. Table shows the differences in emissions between LPG, gasoline, and diesel automobiles [5].

Natural Gas Vehicles (NGVs) are a climate-friendly alternative to gasoline and diesel vehicles that utilize compressed natural gas (CNG) or liquefied natural gas (LNG) as a cleaner fuel. The Energy Policy Act of 1992 classifies CNG and LNG as alternative fuels. Natural gas fuels about 150,000 cars in the United States and over 15.2 million vehicles globally (Alternative Data Center 2017). It's essential to note that natural gas cars are not the same as LPG vehicles, which use a different fuel mix. Natural gas cars decrease CO2 emissions by 20–30%, CO by 70–90%, and NOx emissions by 75–95%. (Thigpen Energy

2017). Finally, during the past ten years, the notion of "electric car" has expanded to include battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), extended range electric vehicles (EREVs), and fuel cell electric vehicles (FCEVs) (FCEV). In this sense, hybrid power trains have an internal combustion engine (ICE) and emit greenhouse gases. So the only electric cars that do not produce GHG directly are battery electric vehicles and hydrogen-fueled vehicles (market penetration statistics for FCEVs are still extremely low). In terms of battery electric cars as replacements for conventional internal combustion vehicles, the decrease of greenhouse gas emissions from the gradual adoption of private electric vehicles will be largely determined by variables such as the power generating mix (Alvarez et al. 2015). Although BEVs do not burn fossil fuels and therefore do not emit tailpipe emissions when driving, the energy required to charge the batteries does produce global warming [6].

## 2. DISCUSSION

In 2015, electricity generation in Spain rose by 0.4 percent over 2014 (Instituto National de Estadistica 2016). However, each power source does not provide the same amount of GWh, and the percentages have varied from 2014 to 2015. The distribution of electricity production in Spain is as follows. Nuclear and carbon-based power production are the most often utilized technologies. Considering the environmental and dangerous implications of this technology, is this a bad point or not? Nuclear power is 1.80% less common in 2014 than it was in 2013, although it is still the most common power source, along with carbon, which is 21.90 percent more common. This rise in carbon-based energy generation adds directly to CO2 emissions, resulting in roughly 50 million tones. The total CO2 produced by electricity production was almost 75 million tones in 2015, and the usage of renewable energy sources fell by 44.30 percent between the end of 2014 and the end of 2015; this is concerning given the need to expand these power sources (hydraulic, wind, solar, and renewable thermal).

This is extremely terrible news, and it emphasizes the need for change by identifying alternative energy sources that produce less pollution. Because this is such a critical problem for the planet's health, steps have been put in place to achieve complete decarburizations of all European nations by 2050, which would result in an 80 percent reduction in greenhouse gas emissions (Regulation (EU) No 566/2011). Measurements will be helpful, but without complete commitment, it will be impossible to meet goals such as increasing the use of renewable energy sources to 55 percent of total final energy consumption, reducing nuclear energy usage, and improving the country's and Europe's energy efficiency.

Emissions of Greenhouse Gases in the Madrid Community 15 Years of Change. In large cities, the huge population moves about a lot on a daily basis, such as to work, social activities, and household chores. As can be observed in places like Madrid, this kind of mobility necessitates the employment of a variety of modes of transportation. The city of Madrid has seen urban expansion in recent years, which is blamed for the majority of lengthy commutes and the increased usage of automobiles. As a result of the increased usage of cars, there are more greenhouse gas emissions much more than anticipated. The Real Decreto (102/2011) established limitations for various greenhouse gases in the atmosphere in order to preserve healthy air quality, which were revised in the Real Decreto (678/2014). The Community of Madrid is the one that represents a large number of municipalities that have exceeded or are approaching the limitations set by the year 2015 [7]. 5th Table Spain's distribution of electric power generating sources

source of energy 15/14 percent total GWh

1.00 Nuclear 56,796

Fuel/gas 56,672 21.90 carbon 3.40 6891

30,217 16.60 Combined cycle

Others include cogeneration. 5.00 27.183

Renewable sources of energy 93,040 44.30 168 93,040 44.30 168 93,040 44.30 168 In the case of PM2.5 particles, the yearly limit set was 25 g/m3, which was not exceeded (Consejera de Medio Ambiente, Administration Local y Ordination de Territorial de la Comunidad de Madrid 2016). The target limit for ozone emissions (O3) is set at 120 g/m3, the information limit is set at 180 g/m3, and the warning level is set at 240 g/m3. Despite the fact that these restrictions have not been breached, they must be maintained.

Nitrogen oxide (NO2) has a temporal restriction of 200 g/m3 and an annual limit of 40 g/m3 to safeguard human health. Even while the emissions did not exceed the time limit, there were occasions when they got dangerously near. Cosalda and Alacalá de Henares surpassed the yearly limit with 46 and 42 g/m3, respectively; while Getafe was on the outskirts (Consejera de Medio Ambiente, Administration Local y Ordination de Territorial de la Comunidad de Madrid 2016). Sulfuric dioxide (SO2) has a temporal restriction of 350 g/m3 and an annual limit of 125 g/m3 for health protection. Despite the absence of SO2, Alcalá de Henares had the highest pollution value (time limit) of 6 g/m3 (Consejera de Medio Ambiente, Administration Local y Ordenación de Territorio de la Comunidad de Madrid 2016) [8].

In the case of carbon monoxide (CO), a maximum 8-hour value of 10 mg/m3 has been set, which was not surpassed. However, in order to meet the 2050 goal, they must be improved. The Municipality of Madrid, the most populated city in the autonomous community of Madrid, released 10,498 kt of CO2eq in 2013, with road traffic accounting for 21% of the total. Clearly, the CO2eq emission levels indicate that the transportation sector contributes a significant portion of overall emissions in Madrid. Simultaneously, it is essential to account for the growing usage of private transportation, which is typically a car per person. It leads to a rise in harmful gases and vehicle density on Madrid's highways and roads, particularly those that serve as direct entry points to the city.

In addition to looking at this research of Madrid, it is also essential to look at a comparable study of Barcelona, Spain's second biggest city. This is a massive urban nucleon, with a population of up to 1,064,555 individuals according to the Barcelona town hall in 2015. According to a study on Barcelona's air quality (Selvas I león 2014), no location inside the city surpassed the limit for CO (8-h), SO2 (time limit), yearly PM2.5 or PM10, although suspended particle levels were near. However, according to annual NO2 media at various locations throughout the city, the limit was exceeded in 2011, 2012, 2013, and 2014 during seasons with heavy traffic (Selvas I León 2014); as a result, a forced air quality improvement plan for Barcelona was implemented, similar to that implemented in Madrid. The desire to decrease polluting gases that contribute to the greenhouse impact prompted this. The Real Decreto 102/2011 and its subsequent modification, the Real Decreto 678/2014, likewise established the permissible limitations inside Barcelona, as mentioned in point 6. According to statistics from the Generalitat de Catalunya in 2015, Catalua has a number of municipalities that have surpassed or are near to exceeding the limitations. PM10 concentrations must not exceed 50 g/m3 on a daily basis. The PM10 limit was surpassed in four locations in 2015, including Vallès-BaixLlobregat, Plana de Vic, and Terres de l'Ebre (Generalitat de Catalunya, Department deTerritori I Sostenibilitat 2016). This is not the case with PM2.5 levels, which were not exceeded (limit 25 g/m3).

The target limit for ozone emissions (O3) is 120 g/m3, the information limit is 180 g/m3, and the warning level is 240 g/m3 (Real Decreto 102/2011). In 2015, there were 115 hours of information overload (Generalitat de Catalunya, Departament de Territory I Sostenibilitat 2016). This occurred in a variety of locations, including Barcelona, Camp de Tarragona, Plana de Vic, Maresme, Comarcas de Girona, Alt Llobregat, Pirineu Oriental, Prepirineo, and Terres de Ponent. The alert limit was not exceeded despite this. The yearly limit for

protecting human health is 40 g/m3 and the nitrogen oxide (NO2) limit is 200 g/m3 (Real Decreto 102/2011). Sant Adrià del Bess (42 g/m3), Badalona (41 g/m3), Barberà del Vallès (41 g/m3), Martorell (41 g/m3), Mollet del Vallès (46 g/m3), Sabadell (42 g/m3), Sant Andreu de la Barca (43 g/m3), Terrassa (47 g/m3), and other points in It can be observed that the most densely populated regions have the greatest amounts of NO2. Sulfuric dioxide (SO2) has a temporal restriction of 350 g/m3 and an annual limit of 125 g/m3 for health protection (Real Decreto 102/2011). There are no zones inside Barcelona that have surpassed the limit in this instance. Carbon monoxide (CO) is similar to sculpture dioxide in that it did not exceed the permitted levels [9][10].

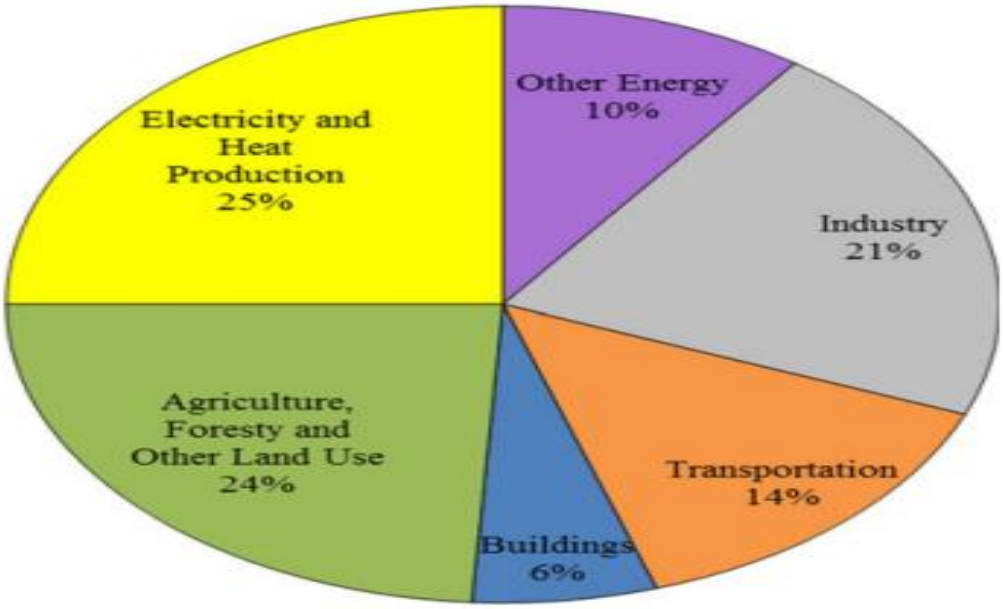


**Figure 1: Global Greenhouse Gas Emissions**

## 3. CONCLUSION

Although the existing transportation system has improved over the last 15 years, it is still insufficient in terms of harmful gas emissions, as shown by this paper. As previously stated (quantities of gaseous pollutants, non-compliance with air quality requirements, transportation system improvement), pollution data is worrisome in that it exceeds the limitations established and fails to identify effective remedies. This pollution is contributing to the rise in greenhouse gas emissions, which is harming the earth. Future pollution and resource shortages will create permanent and irreparable harm if measures are not made to improve the present situation. However, the necessity to avoid environmental penalties for big businesses and nations that hide their real emission levels is too strong, and few people are looking for alternatives. This paper has shown the real issues created by the use of fossil fuels in road transportation, such as the rise in the greenhouse effect and climate degradation. The primary goal is to utilize renewable energy, such as electric cars, motorbikes, or bicycles, which produce no direct pollutants, no noise pollution, and are considerably more efficient than internal combustion engines. The adoption of electric cars will lead to the most significant reductions in pollution in many cities.

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