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ANALYSIS OF THE MATERIAL REQUIREMENTS OF GLOBAL ELECTRICAL MOBILITY

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ABSTRACT:

Today, we are witnesses to the early days of a change in mobility technology as oil reserves decline and society's environmental awareness increases. Electric technologies are intended to replace those based on hydrocarbons as they have been initially conceived as more environmentally friendly and energy efficient. However, the problem of the future availability of the materials required for this change has arisen. A large demand for this type of mobility could contribute to the depletion of these resources, leading to major problems for the manufacture of vehicles and all other technologies that use these materials if we do not find alternatives that allow us not to deplete these natural resources. These alternatives may involve not only a change in the materials used in electric vehicles but also the use of different modes of transport.

The MEDEAS system dynamics simulation model will be used to help us estimate which materials related to the transition in the transport sector might be most critical in the future globally. Once the simulations of different scenarios have been run, we observe that aluminum, copper, cobalt, lithium, manganese and nickel have such a high demand that it would practically exhaust the reserves in several scenarios, so we will propose alternative measures to try to avoid their exhaustion due to the use of this type of mobility.

Keywords: *Transport modes, mineral resources, system dynamics, lithium-ion batteries.*

1.- INTRODUCTION

The global increase in greenhouse gas (GHG) emissions and the depletion of good quality oil reserves are two of the biggest challenges facing humanity at the moment. The transport sector, which symbolizes modern social and economic relations like no other, is centrally affected by these two problems.

Globally and throughout 2014, the transport sector emitted 20% of all GHG emissions [1]. These emissions are unevenly distributed among the different countries, highlighting those with the highest GDP [2]. Within the European Union (EU-28), transport is the only one that increased its GHG emissions, compared to 1990 those of 2017 were 28% higher, resulting in 27% of total EU-28 emissions [3].

This has led to cleaner and more efficient mobility systems than current ones being promoted from various institutions, including electric mobility. However, electrical mobility, a priori more environmentally friendly, has the associated problem that some of the materials present in several of the elements of this technology, such as electric motors and batteries, are critical elements [4], that is, can present problems of exhaustion in the near future [5], [6].

Several authors have pioneered attempts to draw attention to the problem of the depletion of mineral resources needed in the different technologies used to reduce GHG emissions and the use of fossil fuels in modern societies, such as photovoltaic technology or electric vehicles. A.Valero et al [5] estimated the mineral requirements of various technologies, such as electric vehicles, until 2050 using an extrapolation of current trends; Junne et al [7] manages to estimate the demand for minerals considering various types of batteries and technologies through a static analysis using exogenous scenarios; K.Tokimatsu et al [8] uses a model that integrates energy, materials and a simplified climate model to evaluate and estimate the mineral requirements of various technologies in 2 scenarios based on the 2ºC limit in the year 2100; A. García Olivares et al [9] estimates the mineral requirements of various technologies by deepening the elements used in the field of electrified transport, with an extrapolation of current trends that, assume linear demands of minerals. These authors conclude that a large number of materials, such as