



# LOCOMOTION

Low-carbon society:  
an enhanced modelling tool for the transition to sustainability

# Global transportation decarbonization pathways considering lifestyle change and mineral availabilities



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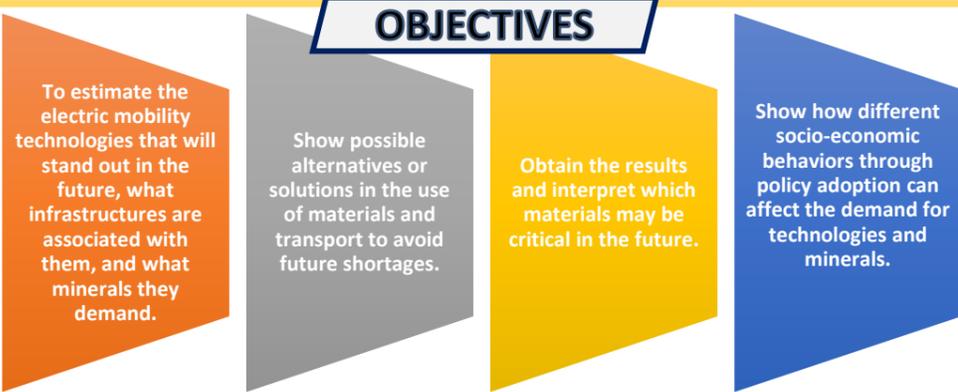
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## INTRODUCTION

The global increase in greenhouse gas (GHG) emissions and the depletion of good quality oil reserves are two of the greatest challenges facing humanity today. Globally and throughout 2019, the transport sector emitted 20% of all GHG emissions. This has caused various institutions to promote cleaner and more efficient mobility systems than those currently in place, including electric mobility. But, electric mobility, a priori more respectful of the environment, has associated the problem that some of the materials that are present in this technology, are critical elements, it may present problems of exhaustion in the near future.

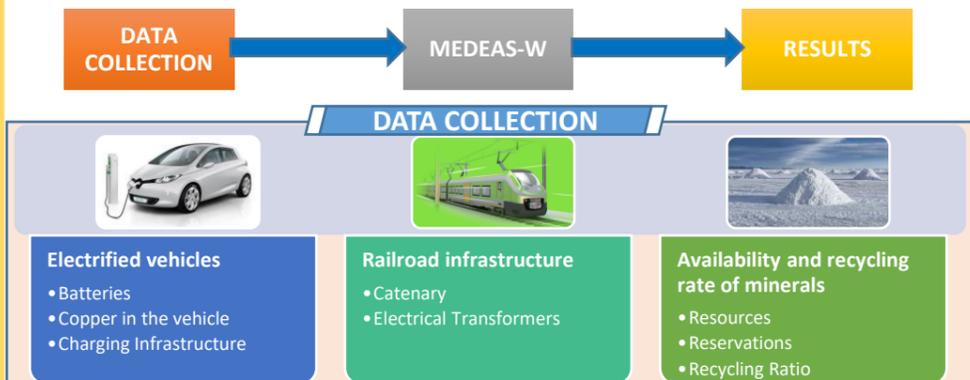


## OBJECTIVES



## METHODOLOGY

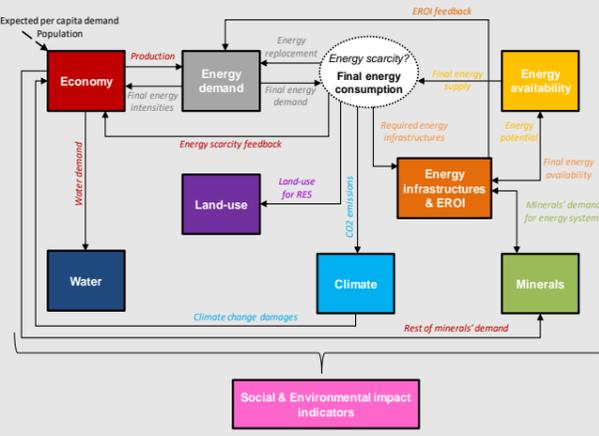
An exhaustive bibliographic review has been carried out in order to obtain the most precise information about the technologies used in electrified transport, which materials are demanded and in what quantity, to later use the system dynamics model MEDEAS-World in order to know the viability of the use of these minerals or if their world reserves could be finished prematurely.



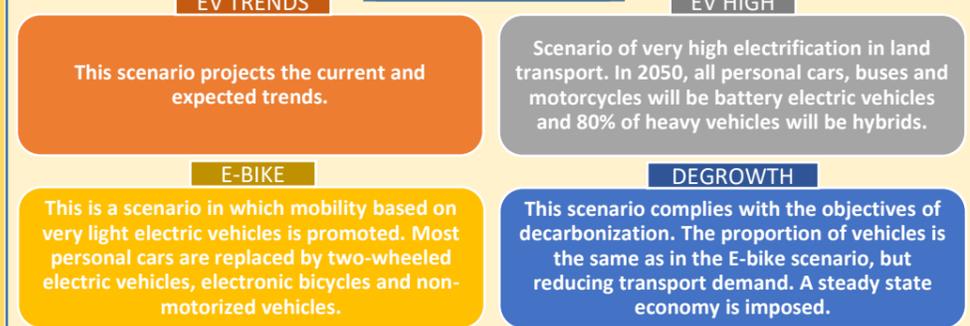
These data have been entered into the MEDEAS-World database and the modeling structures have been modified to dynamically compute the associated mineral requirements, so that, together with various policies or scenarios [2] that we will establish in order to mimic the various physical, political regulations, we can obtain the temporal evolution of the demand for mineral resources.

## MODEL: MEDEAS-W

The open source dynamic systems model MEDEAS-World [1], allows to consider the feedbacks between the different economic and energy sectors. MEDEAS has been developed with the objective of informing decision making to achieve the transition to sustainable energy systems, focusing on biophysical, economic, social and technological constraints.

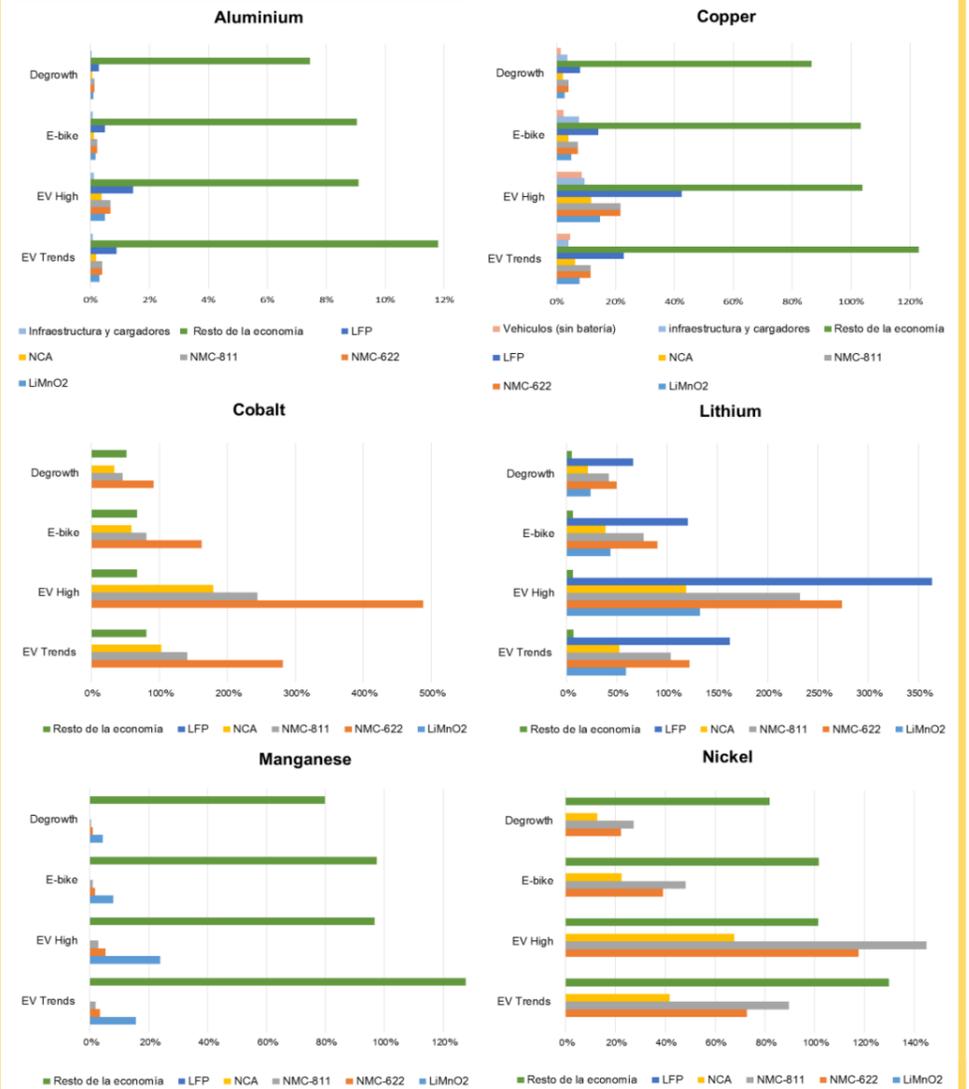


## SCENARIOS



## RESULTS

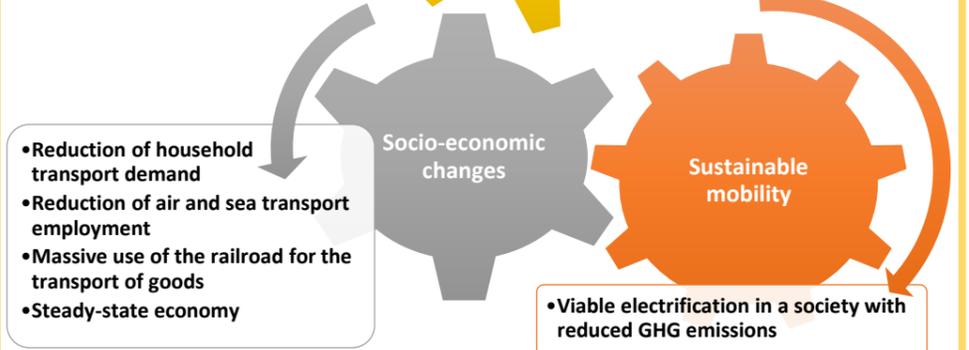
The graphs show the percentage of demand for minerals by the different technologies of transport electrification and in the rest of the economy with respect to their reserves in the different scenarios in 2050:



## CONCLUSIONS

The results show that alternatives must be sought, since electric mobility technology uses a large amount of minerals at the present time. The alternatives that can be taken lie in adopting different socio-economic behavioral changes such as those assumed in the Degrowth scenario [2]. The application of these alternatives in the model together with solutions such as circular economy or massive recycling shows that it is possible to control the expenditure of certain minerals in the field of transport and also reduce emissions.

We can finally reach the conclusion that a change in mobility without changing our habits and customs would not serve to reduce our problems with the environment and our planet, but rather to aggravate them.



REFERENCES:  
[1] I. Capellán-Pérez, I. de Blas, J. Nieto, C. de Castro, L.J. Miguel, Ó. Carpintero, M. Mediavilla, L.F. Lobejón, N. Ferreras-Alonso, P. Rodrigo, F. Frechoso, D. Álvarez-Antelo. MEDEAS: a new modeling framework integrating global biophysical and socioeconomic constraints. doi: 10.1039/C9EE02627D  
[2] I. de Blas, M. Mediavilla, I. Capellán-Pérez, y C. Duce. The limits of transport decarbonization under the current growth paradigm. doi: 10.1016/j.esr.2020.100543.

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