

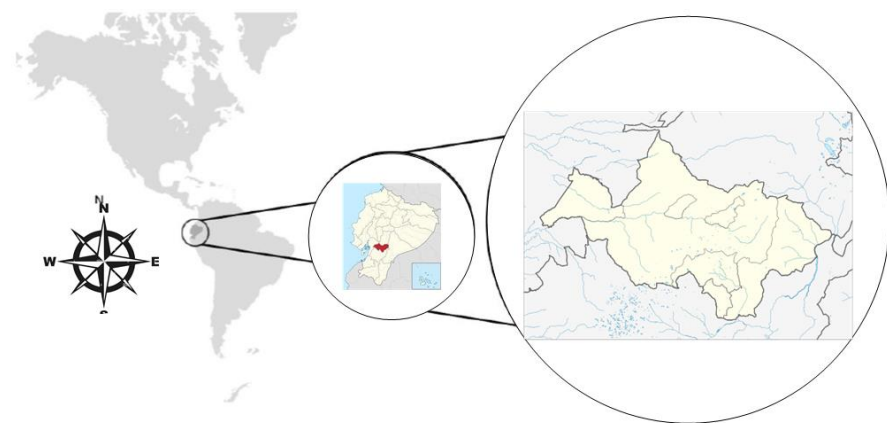


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ABSTRACT

Promoting electric vehicles (EVs) is a solution to reduce environmental pollution caused by traditional mobility solutions like combustion vehicles. However, urgent action is required to allow EV technology to deploy in cities, including identifying optimal locations for charging stations. This study used the Promethee multicriteria method to identify the most feasible location for EV chargers (EVC) in Azogues, Ecuador. The study considered three location alternatives and four criteria with ten subcriteria. The optimal candidate site was established using Visual Promethee, which works with Promethee II. The study found an optimal location for the EVC.

INTRODUCTION

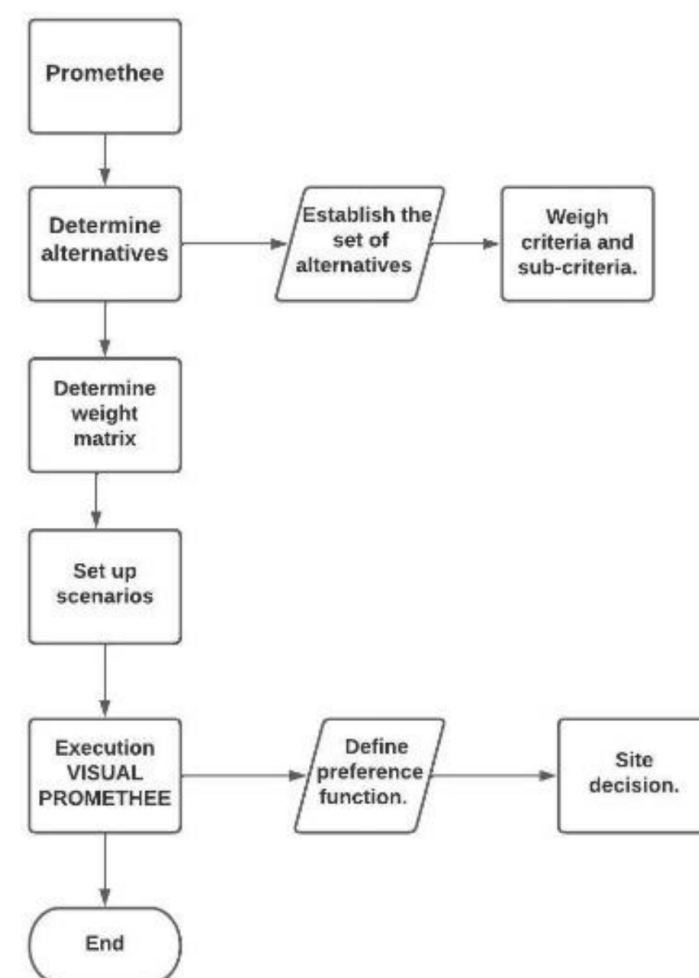


Electric vehicles (EVs) were popular until the early 20th century, but the development of gasoline engines made gasoline more affordable and long-range capabilities possible. Decarbonization of transportation is crucial since it generates almost 14% of global emissions. The increase in EV circulation has made it necessary to introduce EV charging stations (EVCs) in

cities. This paper presents a methodology for establishing the best location for EVCS implementation in Azogues, Ecuador, to comply with the country's law mandating the use of electric means of transport in public services by 2025.

METHODOLOGY

MCMs help decision-makers choose the best alternative based on specific criteria. In the electricity sector, MCMs should be easy to use, widely accepted, and produce easy-to-interpret results. The Promethee method is well-suited for selecting alternatives based on multiple criteria and is popular due to its logical and user-friendly nature. It enables straightforward and direct comparison of alternatives based on a criterion, and decision-makers can easily access effective computer programs. The Promethee method constructs preference functions using numerical differences between pairs of alternatives, and linear preference with an area of indifference is recommended for identifying optimal locations for EVCS. The aggregate preference index is calculated using weights for each criterion and the degree of preference in which one alternative outperforms the other.



For more details, please visit:



ALTERNATIVES, CRITERIA AND SUB - CRITERIO

The Promethee method is used to determine the optimal place to implement electric vehicle charging stations in the urban area in Azogues city. For the selection of candidate sites, based on the vehicular flows, five candidate sites are established. Table 1, details a summary of the vehicular flows data in concordance with the account of traffic conducted by staff of the Directorate of Mobility of the Municipality of the city of Azogues.

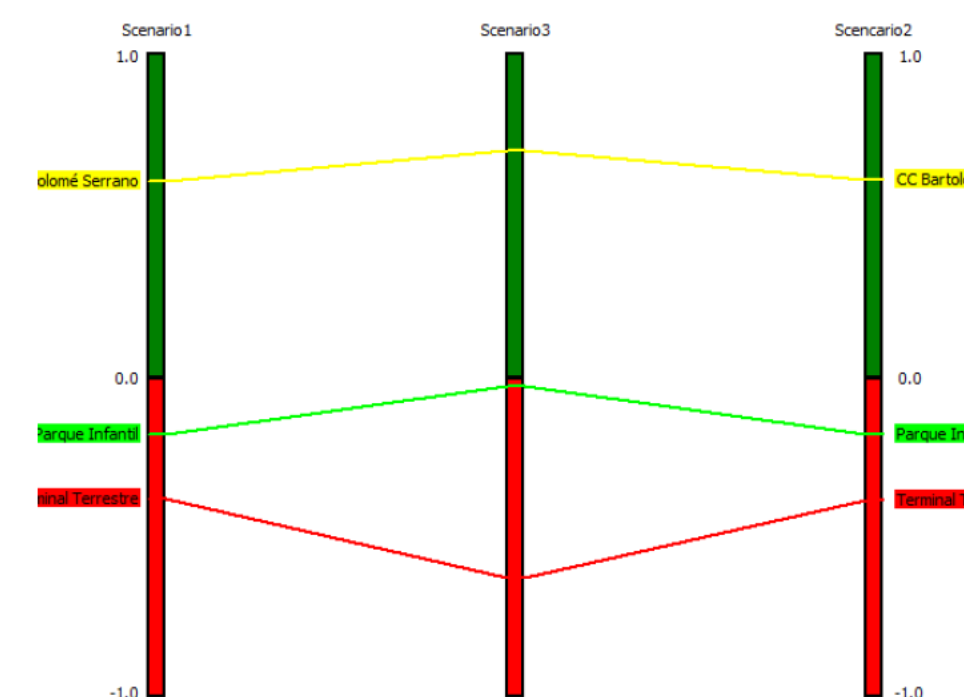
Criteria and sub-criteria have been identified through an extensive literature review and consideration of various factors:

Three scenarios are presented, each using a different weighting method. The first scenario uses equal weighting, the second involves surveying experts to determine importance, and the third uses the critical weighting model to determine information transmission of each criterion.

Candidate sites	Total number of vehicle flux.
Terminal terrestre	2960
P. Infantil "Marco Romero"	2231
C.C Bartolomé Serrano	2736
Municipio de Azogues	2333
Bosque Azul	1928

Criterion	Sub criterion	Terminal Terrestre	Parque Infantil	C.C. Bartolomé Serrano
Economic Factors	C11 (USD)	187.086	124.724	93.543
	C12 (USD/AÑO)	124.495,5	102.997	77.247,75
	C13 (USD)	620,88	595,92	171,6
Technical Factors	C21 (m)	59,7	57,3	16,5
	C22 (%)	42,56	12,49	9,98
Social Factors	C31	0,86	0,88	0,6
	C32	0,87	0,82	0,73
Environment Factors	C41 (NOx/km)	484,7	402,2	493,02
	C42	0,52	0,51	0,62
	C43 (dB)	69,74	63,82	65,71

RESULTS AND CONCLUSION



In this study, the Promethee multi-criteria method was used to determine the best location for an electric vehicle charging station (EVCS) in Azogues based on various decision criteria, including economics, technical, social, and environmental factors. Three scenarios were analyzed with different weights given to each criterion, and Visual Promethee was used to analyze the results. Despite the different weights used in the scenarios, the hierarchical order of the candidate sites remained the same.

The Bartolome Serrano shopping center was found to be the best location for the EVCS, based on its greater weight of influence in the technical, economic, and environmental sub-criteria, and its inclination towards the social sub-criteria. The technical and economic sub-criteria were found to be more important than other sub-criteria, according to the Visual Promethee analysis. This study goes beyond previous research in the area by considering multiple criteria and using a different analysis method to determine the optimal EVCS location