

Data analysis of charging processes at public charging infrastructure in Germany and Europe

Master's Thesis of Ossama Melaky

Mentoring:

Dr.-Ing. Antonios Tsakarestos
M.Eng. Markus Fischer

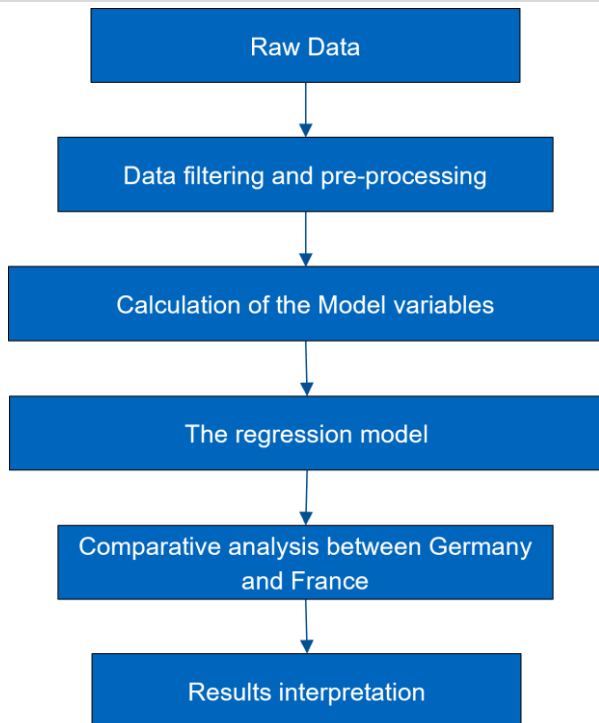


Fig 1: Research structure

DATA ANALYSIS

A multinomial logistic regression model was developed to investigate the cause-effect relationship between the connection time as the dependent variable, and the following variables, prepared from the dataset, as the independent variables:

- The charger power & type.
- The weekdays and time of day.
- The predominant land use.
- The pricing strategies

Also, a comparative analysis was conducted between France and Germany, and it was found that the average connection time in Germany is 6 hours, while in France is only 4 hours..

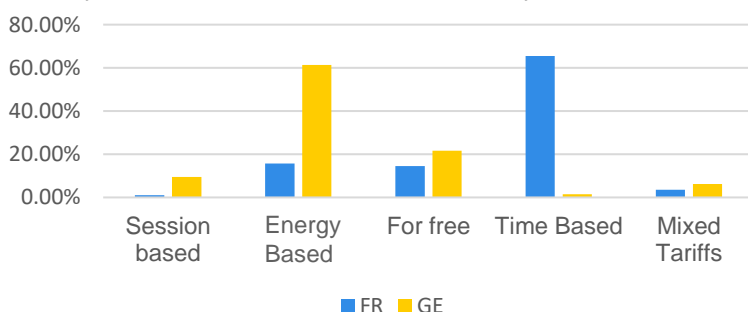


Fig 3: Germany vs France pricing policies



Fig 4: Germany vs France transmitted energy per charger type

INTRODUCTION

The development of electric vehicles is a promising decarbonization plan to reduce the green house gasses emissions and the reliability on the nonrenewable fossil fuel.

Furthermore, The availability of electric vehicles charging infrastructure is a prerequisite for the growth of elective vehicles. The governments, however, have been focusing their efforts on providing the charging infrastructure without knowing if they are being sufficiently used or not. Recent studies have found that users tend to use the charging points as parking, and the actual charging time constitutes on average only 20 % of the total connection time.

This research is explanatory and aims to understand more the user behavior during the charging events, and what influences the charging session connection time, and what is the reason behind the long connection times. The research has reached its goal through analyzing the variables of more than 500,000 charging event occurred in Europe (mainly Germany and France) during the year 2020. The research structure is as per Fig 1.

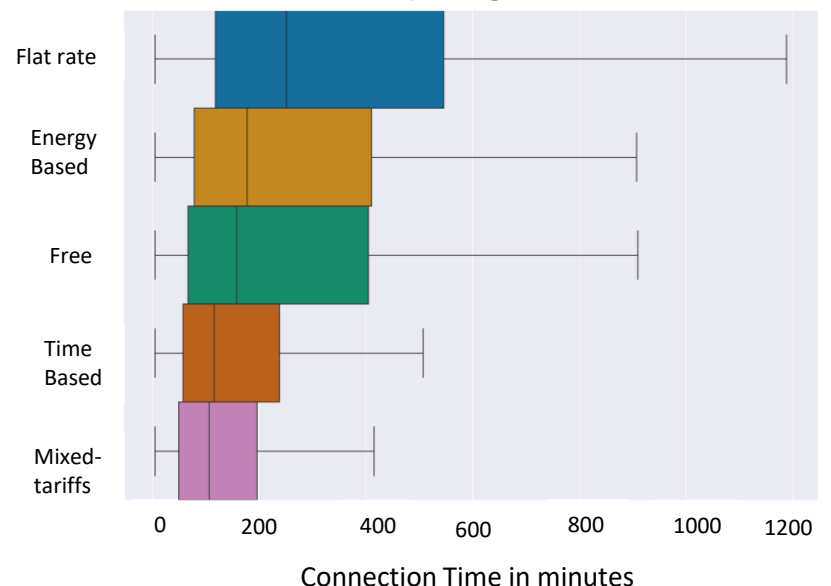


Fig 2: Tariff strategy

RESULTS AND CONCLUSION

The model results showed that the connection time is influenced by the land use, start time, but the strongest relationship was with the charger power and the tariff strategy (Fig 2).

The model results were supported by the difference in behavior between Germany and France, and this difference is only due to applying different pricing strategies in both countries (Fig 3), which shows the strong effect of the pricing strategy on influencing the connection times.

The average transmitted energy per session in France was found to be more than what is being transferred in Germany (Fig 4), this proves that the difference in the session length between France and Germany is only in the parking time not the charging portion of the session.

To conclude, the charging points capacity could be enhanced by only applying more restrictive pricing strategy just as time-based strategies and avoid the flat rate and energy-based policies , as users tend to wait longer when they are not being charged for the time spent on the charger.