Case Study 2 – Electric Vehicle Support Infrastructure Executive Summary

Exploratory Analysis

The annual average daily flow of traffic on major and minor roads from 2000-2020 was collated and used for this analysis. A major proportion of the total annual miles were covered by cars and taxis, followed by light goods vehicles. While the region 9 had the highest number of miles logged over the last 2 decades, followed by region 5. The annual miles recorded by all motor vehicles have been on an almost constant growth until 2008, then there is a drop in the annual miles and a negligible growth period until 2014. Post-2014, the annual miles recorded grows at an increasing rate, until the pandemic struck in 2020, which results in the annual miles dropping 40% compared to the previous year. As a result, the mileage for 2020 was excluded from the following analyses.

Regression

For the task of forecasting the annual mileage into 2050, an ARIMA (Auto Regressive Integrated Moving Average) model was implemented. This model predicts the future value based on its own lags and its lagged forecast errors. As this model requires stationary data, hence the difference of the annual mileage was used. Based on the autocorrelation plots, the optimal values for the ARIMA were chosen as 1,2 for the Auto Regressive and Moving Average terms.

The model predicts that the annual mileage would increase linearly till 2050 and would be 505 million miles, compared to the 437 million miles in 2019.

Research

In November 2020, the UK government announced a 2-phased approach towards zero vehicular emissions. There will be no sale of new petrol and diesel cars by 2030, and only electric cars will be sold exclusively from 2035. Hence the proportion of electric vehicles is expected to grow exponentially, with estimates of 96.8% of the total annual mileage will be from electric vehicles. On average, an electric vehicle requires 306 Watt-hours per mile, thus the estimated electric energy requirements will be 150 Tera-Watt Hours in 2050. Though at the current moment, there is only a 5 Tera-Watt Hours surplus of electricity in the UK.

Recommendations

Based on the 2040 cost estimates, it is recommended that the 40% of the energy should be produced by offshore wind turbines, and 20% each should be produced by onshore wind turbines, large-scale solar and CCGT+CCS Post Combustion.

References

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