This presentation aims to discuss the UK’s electric vehicle support infrastructure. Examining forecasted electric vehicle millage growth with the electricity generation impacts it can have. (click)

Firstly, I will discuss about the basic analysis and the trends that I have observed (click)

Skimming through my chosen, Regional Traffic Dataset I have tried to understand (click) the structure of data columns and the data it stores. (click) Having observed no missing or missformated entries it meant minimal clean up was needed to get the dataset read to use. (click)

I have created several graphs trying to summarize the data within the dataset. (click) First, I have grouped the data per vehicle type, visualizing the millage changes through the years. (click) With cars, taxis and Large Goods Vehicles having the largest observed millage growth. (click) Cars and taxis with a 19% increase (click) and Large Goods Vehicles with a 71% increase in millage. (click) For the other vehicle types I have observed minimal differences as the results show constant millage though the course of this recorded time period. (click)

Adding all motor vehicles results to a single column (click) I was able to observe the annual millage changes per region. Through the graph we can identify that the least (click) vehicle millage is being recorded in the North East region and the most (click) in the South East region of the UK, with all regions (click) having mostly same constant increase in millage through the years. (click)

Then combining previous results, (click) I found the millage differences for each region and differentiated them between vehicle types. (click) With South East’s cars and taxis vehicle type having the substantial difference amongst all, probably being the cause of the region’s high millage. (click)

Grouping all regions and vehicle types, (click) I found the annual millage for all motor vehicles combined through all the regions. (click) Seeing over 23% increase in total millage through the years 2000 to 2019. The graph shows some ups and down. (click) Trend factors in the rise of millage could possibly being due to the population increase and the affordability of vehicles. For the dip (click) from 2007 to 2014, it may be due the changes in fuel price as recorded data shows that during that time, prices had spiked. Another cause can also be due to the economic downturn that UK was experiencing at the time. (click)

Moving to Regression, specifically forecasting (click)

There were several good options to choose from in making the best possible estimates for future predictitions. The key point was choosing an appropriate Time Series forecasting model, as simple regression models would not have been enough to create good, extrapolated results. Some of these options where ARIMA, Prophet and LSTM (click)

I had chosen to use ARIMA or Autoregressive Integrated Moving Average (click) It is one of the most widely used approaches to time series forecasting (click) It does not require a set of predictor variables (click) uses its history as an explanatory variable and it is a univariate model which in our case have. (click)

Using seasonal decomposition (click) I was able to observe the Trends (click) and residuals of the datasets millage growth (click)

Then using the model to forecast results for the next 30 years I got this (click) A mean forecast prediction represented by the blue line, with the grey area showing the 95% confidence interval (click)

Then I have performed further research trying to identify the impact electric vehicles can have from this millage growth (click)

The UK has been following the Plan of Shifting to Zero Emission Vehicles, (click) as shown by the figure, one Scenario projects that the UK’s vehicle fleet will switch be mostly electric. (click) Possible Factors for these changes could be (click) Established government policies, targets and grants. (click) Availability and affordability of electric vehicle models or even (click) due to number of charging ports increasing making having an electric vehicle more accessible (click)

Using this fleet percentage changes, we can identify how much of the forecasted total millage will be electric. (click)

Then, by this estimate of electric millage driven, we can use the average energy consumption measurement between multiple electric vehicles of 306-watt hour per mile to find an estimate in Tera Watt hours per year on the electricity demands of electric vehicles.

We can identify the UK’s electricity margin by observing the Supply (click) and Demand (click) for electricity. How much electricity they generate, how much its people use and how the additional power needed for the electric vehicles can have an impact in the country’s electricity demand. (click)

Throughout the recorded years the country always had a 5 tera watt hour surplus in the Supply of electricity. By using the predicted power generation required we can find (click) how much additional power they would need for this increase in demand. With my forecasts I have found that they would require additional electricity from the year 2022 and they will need over 140 Tera watt hour of additional power for the year 2050. (click) Comparing my findings with independent estimates we can see that the trends are similar, but they are predicting shorter demand throughout the years (click)

Finally, making recommendations of how they can meet this electricity demand (click)

Using estimates from the Department for business, energy and strategy (BEIS) we can see how the prices in power for each technology are predicted to change over the next 20 years. (click)

Calculating the additional power demand for the Year 2040 for each region and using the predicted prices of BEIS for Solar Power we can find how much it would cost for each region to meet the additional demand when using 100% Solar energy. This tends to be from 100 to 600 million pounds for each region (click)

Different technologies are suitable for different regions (click) As you can also observe by the Map of the UK, the geographical location of each region means different technologies can be more suitable (click) London for example cannot have wind and solar farms to generate electricity as they require a huge amount of land. (click) And for seaside regions, Offshore wind can be a very suitable technology to use (click)

Accounting for the time of day charging issues (click) , the power Grid should be able to handle peaks in demand, (click) as observed, the largest peaks of charging demands are at around 10 o’clock at night. (click) Because the grid does not have enough storage capacity, (click) having constant energy sources will be key in meeting demand in high peaks.

Some comments on my recommendation are, (click) as renewables are cheaper in producing electricity, having more would be best (click) Each region should take advantage of their geographical positioning when choosing on power generating technologies. (click) Although we want to minimize costs, more expensive technologies can be used to cover high peak demands (click) Lastly, especially for the UK, regions cannot be dependent only on natural renewable sources are the weather can be very unreliable causing shortage in supply issues. (click)

Finally, my recommendation on the Amount and technologies used for the additional energy requirements are (click) 35% offshore wind, (click) 25% onshore wind, (click) 25% fgdgfg and 15% Solar (click) Amounts can vary slightly for each region, but these should be optimal to meet demand at the lowest costs. (click) Finally a figure that shows the costs of my recommendation for the year 2040 per region. (click)

That is all, Goodbye.