INVESTIGATING ELECTRIC VEHICLE CHARGER LOCATIONS IN LONDON

IBM DATA SCIENCE PROJECT

INTRODUCTION

Electric Vehicles, (EVs) are seen as an environmentally friendly alternative to petrol vehicles. Electric vehicles (plug in) do not require fossil fuels, leading to reduced total fuel consumption, and do not emit greenhouse gas emissions. As the United Kingdom strives to meet its net zero carbon target and reduce its dependence on fossil fuels the electrification of transport is becoming increasingly important. There has been, in recent years, a rapid growth in the amount of EVs in both residential and public transport. EVs require supportive infrastructure in the form of charging stations. Residential charging stations refer to chargers located on an owner's private property that is used by the owner alone. Public chargers are available in public areas like sidewalks or public parking garages. These public chargers are the equivalent of petrol fuelling stations and will be required to recharge EVs during normal daily activities especially for commuters or public transport who may require re-charging as the day progresses. There are two broad types of chargers; rapid chargers and regular or slow chargers. As the name implies rapid chargers may charge vehicles in minutes to hours while regular chargers may require a few hours to possibly overnight charging. Ensuring the optimal type, location and number of chargers installed in extremely important especially in a densely populated city like London. As its workday population is significantly high during the day rapid chargers may need to be located in areas with more public parking. While regular chargers may be more suited to more residential areas. This project will therefore seek to investigate the locations of these chargers in London boroughs to determine how they are currently distributed and if there are areas for improvement. The problem statement can be phrased as:

Are the locations of different types of chargers suitable for the characteristics of those locations in London boroughs?

In order to investigate this question location data from foursquare and publicly available data that describe London boroughs will be combined. Clustering will be used to identify similar areas and the defining features will be used to attempt to describe if these groups have good charger concentrations or not. This analysis will be helpful to government planners in identifying areas that may need more of a certain type of chargers. It can also help potential EV owners (residents or commuters) identify how the borough they live or work in may be suited to their charging habits.

DATA

Data required to investigate the problem statement will be sourced from publicly available resources and from Foursquare. Data required to investigate the problem statement include:

1. Location Data will be used to determine the characteristics of each borough. Of particular interest will be the amount of parking facilities and residential buildings. This data will be obtained from Foursquare Venues data. API calls will be used to query the data for parking and residential buildings withing a few kilometres from each borough's GPS location.

Borough	Venue
Barnet	Corsini Residence
Barnet	Residence One
Barnet	Livingston Road Residence
Barnet	NRV Residents' Gym
Bexley	Commonwealth Way Flowers Estate Residence

	Borough	Venue
0	Barking and Dagenham	Car Parking
1	Barking and Dagenham	Chadwell Heath Station Parking
2	Barking and Dagenham	Liberty Parking
3	Barking and Dagenham	Tesco DC Parking
4	Barking and Dagenham	Car Parking In Clements Road

2. A list of London Boroughs along with its GPS co-ordinates, population estimates and area. This data are available at https://en.wikipedia.org/wiki/List_of_London_boroughs and will be read into a python dataframe.

Borough	Inner	Status	Local authority	Political control	Headquarters	Area (sq mi)	Population (2013 est)[1]	Co-ordinates	Nr. in map
Barking and Dagenham [note 1]	NaN	NaN	Barking and Dagenham London Borough Council	Labour	Town Hall, 1 Town Square	13.93	194352	51°33′39″N 0°09′21″E / 51.5607°N 0.1557°E	25
Barnet	NaN	NaN	Barnet London Borough Council	Conservative	Barnet House, 2 Bristol Avenue, Colindale	33.49	369088	51°37′31″N 0°09′06″W / 51.6252°N 0.1517°W	31
Bexley	NaN	NaN	Bexley London Borough Council	Conservative	Civic Offices, 2 Watling Street	23.38	236687	51°27′18″N 0°09′02″E / 51.4549°N 0.1505°E	23
Brent	NaN	NaN	Brent London Borough Council	Labour	Brent Civic Centre, Engineers Way	16.70	317264	51°33′32″N 0°16′54″W / 51.5588°N 0.2817°W	12
Bromley	NaN	NaN	Bromley London Borough Council	Conservative	Civic Centre, Stockwell Close	57.97	317899	51°24′14″N 0°01′11″E / 51.4039°N 0.0198°E	20

3. A table of number / types of EV chargers per London borough which can be found from the UK government publicly available data at http://maps.dft.gov.uk/ev-charging-map/ev-charging.html . Note this table lists number of chargers per 100000 people in each borough in the UK. This data will be read into a dataframe and the London Data will be used.

	ONS code	Local Authority	Total public charging devices	Total public rapid charging devices	Charging devices per 100,000 population
0	K02000001	UNITED KINGDOM	17947	3107	27
1	E06000047	County Durham	102	14	19
2	E06000005	Darlington	28	2	26
3	E06000001	Hartlepool	6	1	6
4	E06000002	Middlesbrough	29	6	21

4. The work day population of London per borough will give an indication of the number of commuters or the actual daily population present in London each day. It is therefore more representative of the potential demand for public chargers. This can be found Greater London Authority's London Datastore located at https://data.london.gov.uk/dataset/daytime-population-borough?resource=7c9b10fb-f8c9-45bb-8844-d5e5cd7f6dca. This data will be read into a dataframe and the appropriate columns (Work day population without tourists) will be used.

	Code	Boroughs	nan	Workday Population (excludes tourists)	In work (employee)	In work (self-employed)	Not in work
	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	E09000001	City of London	553103	431384	330622	95692	2427
2	E09000002	Barking and Dagenham	178326	164584	41039	8446	61136
3	E09000003	Barnet	356003	331094	101609	41075	108067
4	E09000004	Bexley	211551	194807	56038	12394	71273

5. Another important metric will be the job density per borough which may give some insights into which areas may be more commercial or which areas contain more workers that require rapid charging. This can be found Greater London Authority's London Datastore located at https://data.london.gov.uk/dataset/jobs-and-job-density-borough?resource=116a2961-6c12-4960-ab3a-945c7448a989.

Borough	Job Density
City of London	110.11
Barking and Dagenham	0.49
Barnet	0.67
Bexley	0.56
Brent	0.71