Data Analysis of Public Charging Infrastructure and User Behaviour in Denmark

Emil Hu
Dept. of Electrical and Computer Engineering
Aarhus University
Arhus, Denmark
201907692@post.au.dk

***Abstract*—As the adoption of electric vehicles (EVs) accelerates in response to the global climate crisis, the public charging infrastructure becomes increasingly crucial. This study examines the charging behavior of EV users and the capacity of public charging facilities in Copenhagen, Denmark, with the goal of forecasting future demand and utilization of the public charging infrastructure. This analysis revealed a predominance of short charging sessions during midday and the influence of fast charging availability on user behavior. Additionally, the study showcases disparities in pricing schemes across different charging station owners, ranging from using base rates to location-dependent pricing. These insights provide valuable insight into the landscape of public charging infrastructure and provide a foundation for the development of a forecasting model.**

***Index Terms*—electric vehicles, charging stations, charging behaviour, charging infrastructure**

I. Introduction

As the world seeks sustainable solutions to combat climate change, the transition from fossil-fueled vehicles to electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) emerges as a fundamental factor in the fight against carbon emissions. In Denmark, the transport sector accounts for nearly a third of the total energy consumption. Consequently, the Danish government has issued a goal of reaching 1 million EVs and PHEVs in 2030. As of 2020, the number of EVs and PHEVs amounted to 62.000, which represented 2% of the total population of cars in Denmark [1], [2]. However, recent figures show a clear upward trend in the number of EVs and PHEVs, with the population of EVs increasing by 69% to 112.700 cars in 2022. Similarly, the population of PHEVs rose by 35% in the same period [3]. As the number of EVs and PHEVs inevitably increases, the requirements for the public charging infrastructure will also need to expand and evolve. Thus, ensuring accessible and efficient public charging becomes vital to support this increasing demand.

In response to this growing need, this paper conducts a data analysis of the public charging infrastructure of Denmark, which includes inspecting the current capacity and user utilization. Understanding the current state of the public charging infrastructure, the usage patterns, and potential stress points is crucial for anticipating future demands. Besides providing a picture of today's infrastructure, this data analysis shall also serve as the foundation for predictive models aiming to accurately project the increasing demand and utilization of the public charging infrastructure.

The rest of this paper is organized as follows: Section II gives an overview of existing research on user behavior patterns and its impact on public charging infrastructure as well as other data analysis methods previously employed. Section III presents the dataset, while Section IV describes the preprocessing steps undertaken to prepare the data for analysis. Section V showcases the findings of the data analysis, highlighting key observations and patterns, and Section VI discusses these findings in greater depth. Lastly, VII will provide some concluding remarks on the obtained results as well as potential possibilities for future research.

II. Related Studies

In the past decade, several studies have conducted data analysis on the public charging infrastructure across cities around the world. These investigations focused on various topics, including user preferences, usage patterns, and the charging stations' energy consumption, which all contribute to the understanding of the EV charging domain. van den Hoed et. al. (2013) analyzed the usage patterns of public charging stations in Amsterdam and found that a fast increase in the amount of charging stations leads to a relatively high average capacity utilization of the charging infrastructure, suggesting that implementing charging stations may be the solution to the dilemma of developing infrastructure versus waiting for EVs to circulate in the traffic. This dilemma is also known as the "chicken and egg" problem. However, the study only focused on the four main districts of Amsterdam and disregarded districts with limited public charging infrastructure [4].

Similar studies have been conducted by Almaghrebi et. al (2019) and Jiang et. al. (2016), which analyzed 17,675 charging events in Nebraska and 19,000 charging events at the University of California, respectively. The findings from Almaghrebi et. al. showed a peak in demand for public parking at 1 pm, which coincided with lunchtime. Furthermore, the study highlighted that only 23% of the total connection duration at public charging stations was used for actual charging, with the remaining 77% for parking. An indication that increasing the number of charging stations in an area might not adequately meet the charging demands [5]. Likewise, the study by Jiang et. al. found that 90% of charging events transferred less than 12 kWh of energy, where the majority of EV users (67%) connected their vehicles for less than 4 hours, and 87% for less than 7 hours. This indicates that most EV charging sessions are relatively short, suggesting a need for more efficient charging solutions that can deliver faster charging. The study also observed that the peak energy demand from EV charging occurred between 7-10 am, aligning with the morning work commute. This pattern suggests that workplace and public parking areas could be key locations for deploying additional charging stations [6]. The findings from these studies highlight the importance of understanding EV charging patterns in order to optimize the grid's performance and the deployment of charging stations.

More geographically related to this study, Anders Fjeldbo Jensen et. al. has conducted extensive research with a focus on factors influencing the adoption of EVs in Denmark. In 2020, Jensen et. al. investigated the actual route choice behavior of drivers from 107 Danish households. These households participated in a large-scale experiment involving both EVs and Internal Combustion Engine Vehicles (ICEVs). The study revealed a higher sensitivity to travel time and trip length when participants were driving EVs, where EVs were primarily used for shorter trips. This pattern might be associated with the perception of lower energy consumption in BEVs compared to ICEVs. However, the study also notes that EVs driving range has improved significantly in recent years, and thus drivers may not need to adapt their route choice preferences when driving EVs to such a degree as found in this study [7]. In a more recent study from 2022, Jensen et al. conducted qualitative and quantitative assessments to understand EV user preferences. This study involved interviews with 11 EV users and statistical analysis of data collected through Stated Choice (SC) experiments and discrete choice modeling. Key findings from this study highlighted the importance of cost and convenience in their charging decisions e.g. interoperability across different charging providers. Interestingly, users were also willing to drive detours to access charging stations with fast charging [8]. These insights are crucial for understanding user behavior and preferences, which can aid the development and optimization of public charging infrastructure in Denmark in a different manner compared to the above-mentioned studies, which mainly focused on utilization patterns and energy consumption of public charging stations.

In summary, while data analysis of public charging stations has been conducted across various cities, this approach has not been extensively applied in Denmark, where the current research has focused on inspecting user preferences and user behavior for EVs compared to fossil-fueled vehicles. This study seeks to address this gap by performing data analysis on the public charging infrastructure in Denmark to provide a comprehensive understanding of the state of the EV charging infrastructure.

Property	Description
slug	Unique identifier for associated charging station.
location	Geographic coordinates of the charging station
locationAddress	Address of the charging station
owner	Company that owns the charging station
minimum capacity (kW)	Lowest power output the charging station can provide
maximum capacity (kW)	Highest power output the charging station can provide
plug	Type of plug (marked by ”1”)

TABLE I: Description of relevant properties in JSON files

III. Dataset

The dataset used for this study was provided by Norlys A/S, which gathered the data from ChargeFinder [9]. The dataset consists of multiple JavaScript Object Notation (JSON) files as well as a parquet (parq) file. The following sections will describe both types of data in greater detail.

A. JSON Files

The JSON files contain metadata for 598 charging stations in Denmark. These charging stations are categorized into seven different regions, which are the following:

- Bornholm
- Fyn
- Nordjylland
- Nordsjaelland
- Soenderjylland
- Storkoebenhavn
- Sydsjaelland

An example of one data entry can be seen in Fig. 1. As seen, a single entry consists of various properties. However, not every property was deemed relevant or contained sufficient data for this analysis and was therefore disregarded. Tab. I provides a description of all the relevant properties. As seen in the table, the 'slug' property is used to identify a charging station. Each charging station may consist of one or more charging points. Thus, the term ”charging station” will refer to the group of charging points, whereas a ”charging point” will refer to a single power outlet within a charging station. The 'slug' property also acts as the bridge between the Parq file and the JSON files as both files contain this identifier. Additionally, another aspect is the minimum and maximum power capacity of the charging station. As stated in the table, the maximum capacity indicates the highest power output that the charging station can deliver, which is typically utilized until a certain number of charging points are in use. Once this limit is reached, the charging rate for additional vehicles is determined by the minimum capacity.

B. Parq File

The Parq file contains time-series data gathered from every observed charging station, spanning a duration of one month.

```
   {
    "slug": "ym6rkk",
    "title": "Foetex Broenderslev",
    "location": {
        "latitude": 57.265867,
        "longitude": 9.948698
    },
    "contact": "",
    "locationAddress": {
        "city": "Broenderslev",
        "country": "Denmark",
        "countryCode": "DK",
        "county": "",
        "street": "Oestergade 43",
        "full": "Oestergade 43, Broenderslev,
    Denmark",
        "zip": "9700"
    },
    "ownerId": "",
    "owner": "Clever",
    "freeCharging": 0,
    "freeParking": 0,
    "authCard": 1,
    "minCapacity": 300,
    "maxCapacity": 300,
    "plugType1": 0,
    "plugType2": 0,
    "plugType3": 0,
    "plugTesla": 0,
    "plugCCS": 2,
    "plugChademo": 0,
    "status": 9
},
```


Fig. 1: Example entry in `nordjylland.json`


```
qzg9gj,"[{'id': 3168031, 'status': 2, 'info': '
    Available since:\n> 2 days', 'free': 0}, {'id':
    3168032, 'status': 2, 'info': 'Available since:\
    n> 24 hours', 'free': 0}]",2023-08-25
    20:00:17.783099,20.0

mwrmwy,"[{'id': 431596, 'status': 2, 'price': '2,83\
    xa0DKK/kWh', 'free': 0, 'tariffs': [{'name': '
    Monta', 'shortDescription': 'Dynamic price', '
    currency': 'DKK', 'planId': 'pl2j599', 'costKwh
    ': 2.83, 'costMin': None, 'costSession': None
    }]}",2023-09-09 19:31:07.049824,19.0
```


Fig. 2: Data samples from the parq file. Upper data sample showcasing 'info' data for two charging points from owner Drivee. Lower data sample showcasing 'price' data for one charging point from owner Monta.

The first timestamp is sampled at 13:33:13 on August 10, 2023, while the final timestamp is sampled at 12:01:17 on September 11, 2023. The file consists of 925150 data points spread between 23 different owners and has been sampled at 15-minute intervals. The data has the format:

$$[\texttt{Slug}, \texttt{Stander}, \texttt{Timestamp}]$$

The values in the 'slug' column are the IDs of the charging stations, which correspond to the same unique identifiers present in the JSON file. The 'timestamp' column describes the exact time and date the data is sampled, while the 'stander' column contains a list of information about the charging points located at the station. This includes an ID of the charging point and its status. The status is described by a status code that can be one of the following numbers:

- **Status: 0** = Unknown
- **Status: 2** = Available
- **Status: 3** = Occupied
- **Status: 5** = Unavailable

For this study, only the status codes are the values 2 and 3 have been taken into account. Furthermore, the charging points either have an 'info' attribute or a 'price' attribute. The 'info' attribute describes the duration a charging point has been either occupied, available, charging, or unavailable. Meanwhile, the 'price' attribute contains information about the current charging price. The 'price' attribute is often accompanied by a 'tariffs' attribute. The tariffs indicate varying charging prices at the station i.e. drop-in prices and membership prices. An example of each type of data sample is showcased in Fig. 2.

IV. Data Preprocessing and Cleaning

In order to conduct the data analysis effectively, preprocessing and cleaning of the data was necessary as the raw dataset contained inconsistencies, missing values, and noise, which needed to be addressed before proceeding with the actual analysis.

Upon inspecting the JSON files, several inconsistencies were found, particularly in how the data aligned with the geographic regions indicated by the file names. For instance, the data from Bornholm did not contain information about charging stations in Bornholm. Instead, the file consisted of charging stations located in central Copenhagen. Thus, `Bornholm.json` was disregarded in its entirety. Redundant data also occurred in the form of charging stations located near regional borders, which were included in both JSON files. Furthermore, charging stations in neighboring countries (Germany and Sweden) also appeared in the files. Since the scope of this data analysis is in Denmark, these charging stations were also disregarded. More general inconsistencies were apparent across the different JSON files. While some files presented charging station data as shown in Fig. 1, others included additional properties like 'access', 'description', and 'reservation', leading to a lack of uniformity in the dataset. However, all JSON files included the relevant properties presented in Tab. I. Therefore, these inconsistencies were neglected.

Likewise, data inconsistencies in the parq file were found during the inspection, which involved dividing the time-series data according to the distinct owners. The inspection revealed that the data of a number of owners were either absent or erroneous and thus, the data from these owners were disregarded. Additionally, two specific inconsistencies were identified with Sperto and CloudCharge. Only a single station under CloudCharge ownership was observed, leading to its removal. For Sperto, a significant disparity in the sample rate was noted: while most stations recorded about 2000 responses, Sperto's averaged only 700. Consequently, any station with

with tariff/price	with info	Disregarded
Circle K	Allego	Base2Charge
E.on	Clever	Better Energy
Monta	Drivee	CloudCharge
Q8	EVBox B.V	Jysk Energi
Spirii	IONITY	Norlys
Tesla (Open for all EV)	Shell Recharge	OK
Tesla		Shell Recharge DK
		Uno-X
		Sperto

TABLE II: Summary of owners after data cleaning.

fewer than 1500 updates was excluded in order to ensure consistency. As highlighted in Sec. III-B, the ’stander’ column either contained an ’info’ or a ’price’ attribute. Which attribute that is included is dependent on the owner itself, where some disclose the duration of its current state, while others provide information about their pricing and tariffs. Tab. II presents an overview of which owners include what attribute as well as the discarded owners.

After applying these changes to the JSON files and the parq file, the relevant properties from both types of files were unified into a single dataset, allowing for a more streamlined analysis. The final dataset comprised of the following parameters:

$$[\texttt{Slug}, \texttt{Stander}, \texttt{Timestamp}, \texttt{Owner}, \texttt{HourDate},$$
$$\texttt{Day\_of\_week}, \texttt{Longitude}, \texttt{Latitude}]$$

Where ’Hour’, ’Date’, and ’Day_of_week’ are derived directly from the timestamp and represent the hour of the day, date, and day of the week the data was sampled, respectively. After the cleaning steps, the size of the dataset has been decreased to 814427 data samples.

V. Data Analysis

The focus of the data analysis is to uncover user behavior patterns and tendencies for the public charging infrastructure. For this analysis, a particular focus has been on analyzing the data in ’stander’ column. More specifically, the ’info’ attribute and the ’price’ attribute.

A. Area Selection

In order to provide a comprehensive data analysis, the scope of this study was narrowed to specifically examine the charging stations within Copenhagen due to the high density of charging stations in the city, which could provide a more detailed and representative understanding of the usage patterns and user behavior. To determine the exact area of focus, the geocoding tool Nominatim was utilized to accurately define the coordinates of the Copenhagen. Thus, the area of inspection was bounded by the following coordinates:

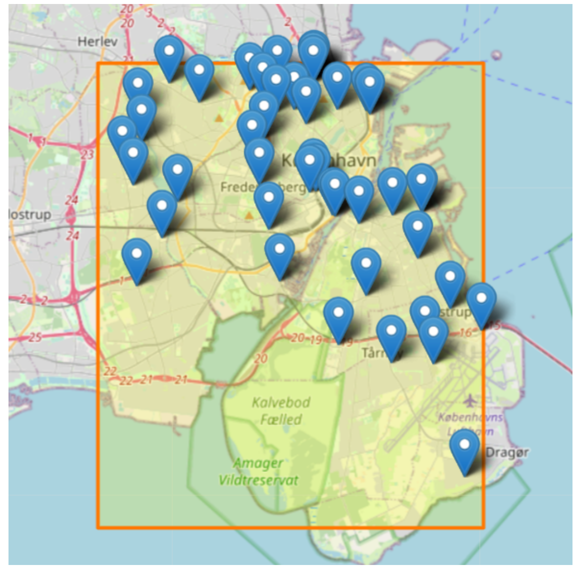


Fig. 3: Charging stations within the Copenhagen bounding box.

$$[12.438°, 55.568°, 12.658°, 55.718°]$$

This area covers approximately 236.822 km^2 and comprises of 37 charging stations divided between 75957 data samples and the following seven owners:

- Allego
- Circle K
- Clever
- E.ON
- Monta
- Q8
- Spirii

Fig. 3 shows all charging stations located in the Copenhagen area as well as the corresponding bounding box.

B. Info

The ’info’ attribute gives an insight into the operational patterns of the charging stations and their charging points. As previously mentioned, the attribute provides the duration a charging point has been in its current state e.g. available or charging at the given timestamp. Tab. II shows the owners with the ’info’ attribute, however only Clever and Allego were present in Copenhagen, with Clever having 12 charging stations and Allego having a single charging station in the city. Furthermore, there were 37 charging points among these charging stations.

Fig. 4 showcases a histogram of the daily status counts, categorized by the ’Available’ and ’Charging’ states, between the hours 6-23. The number on top of each bar represents the percentage of ’Charging’ statuses out of the total number of statuses recorded at each hour. As seen, there is a higher proportion of ’Charging’ status between the hours 10-15, suggesting a peak in charging activity. This trend

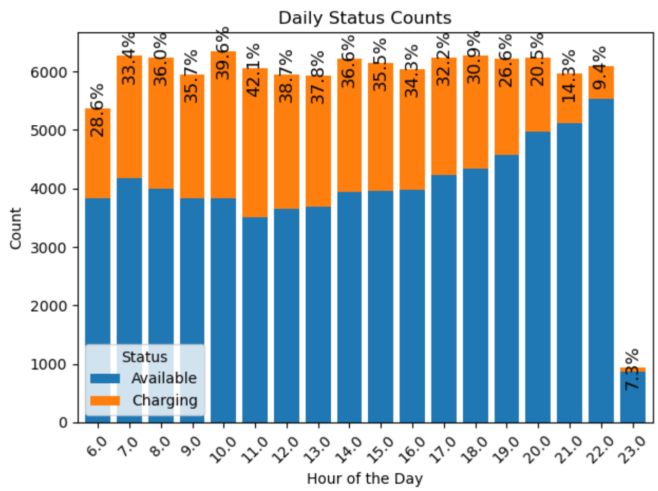


Fig. 4: Daily status count for charging stations in Copenhagen with the 'info' property.

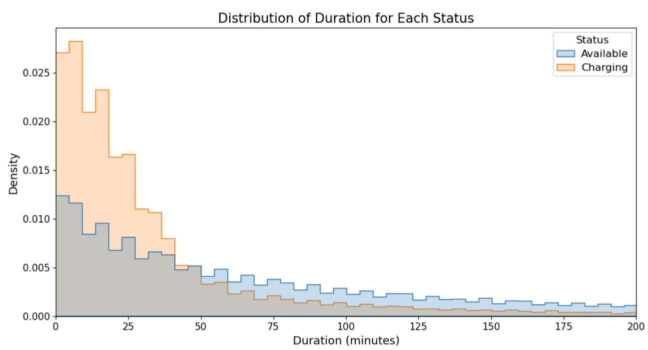


Fig. 5: Distribution of durations for 'Available' and 'Charging' statuses at charging stations in Copenhagen.

declines gradually towards the evening, with 'Available' status becoming more predominant. This pattern could reflect the daily routines of electric vehicle users, where public charging typically occurs during working hours or periods of parking throughout the day, and prefer to charge their EV at home in the evening.

Fig. 5 illustrates the distribution of durations for 'Available' and 'Charging' statuses at the charging stations. Looking at the graph it is apparent that 'Charging' sessions tend to have a shorter duration, with a higher density clustered within the initial time frame. This further suggests that public charging is used for small periods of parking, presumably throughout the midday hours. On the other hand, the 'Available' status shows a more extended duration, indicating that charging points often remain unoccupied for longer periods.

Lastly, Fig. 6 presents the spatial distribution of charging stations with the highest frequency of 'Charging' statuses, where areas with the most intense colors indicate a higher concentration of charging activity. Notably, the central and northeastern regions of the city show significant activity, indicating these are key areas where electric vehicle users often

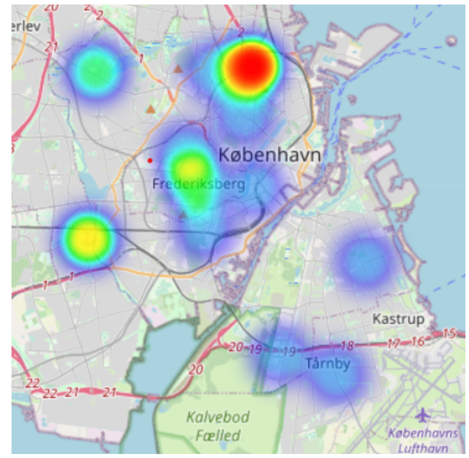


Fig. 6: Heatmap of charging station in Copenhagen with based on the number of 'Charging' statuses.

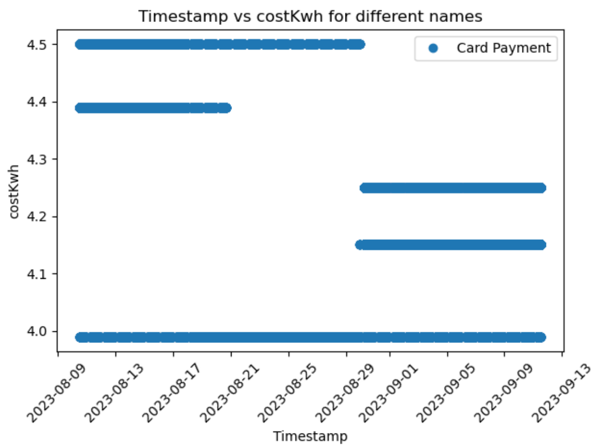
charge their vehicles. Further inspecting the charging stations, most of them are located next to high-traffic infrastructure such as hospitals, supermarkets, and shopping malls. What differentiates the charging stations with high activity is the high number of charging points, where the most trafficked charging station contains 10 fast charging points. On the other hand, the charging stations with a lower activity level only contain between 2-4 charging points. Thus, it is unsurprising that the activity level at these stations is experiencing a lower activity level. However, common to all charging stations in Copenhagen is the inclusion of at least one fast charging point. This high number of fast chargers, combined with the observed trend shown in Fig. 5 indicating that charging sessions are generally shorter and more frequent within certain hours, further supports the need for fast charging points in the public charging infrastructure.

C. *Price Checking*

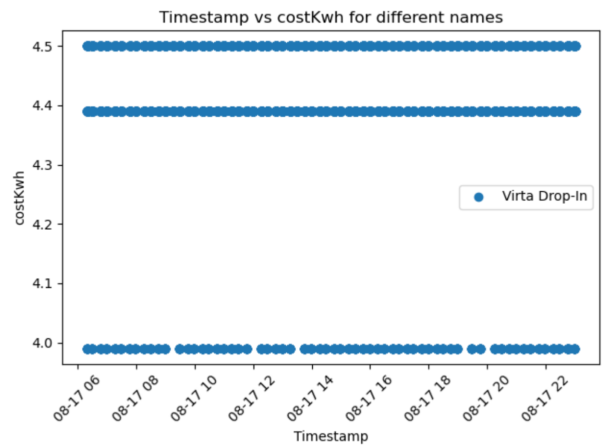
The cost of charging is another variable that could influence user behavior towards public charging. As mentioned, the prices were derived from the 'price' attribute in the dataset. In general, the charging price varies from owner to owner, where some owners set the same charging price across all their charging stations. Other owners determine their charging price based on multiple factors such as:

- Time of day
- General energy price
- Location of the charging station

The owner Q8 is an example of the latter. Q8 uses a location-based pricing strategy, where charging stations on highways and at strategic road network points like bridges are charged the highest rate. Urban charging stations in larger cities like Aarhus and Copenhagen have moderately lower rates, while the charging price for stations not fulfilling any of these criteria are set at a base rate. Fig. 7. shows two examples of the different pricing rates for Q8.



(a) Price over time for 'card payment'.



(b) Price over time for 'Virta Drop-in'.

Fig. 7: Examples of different charging pricing for Q8 stations

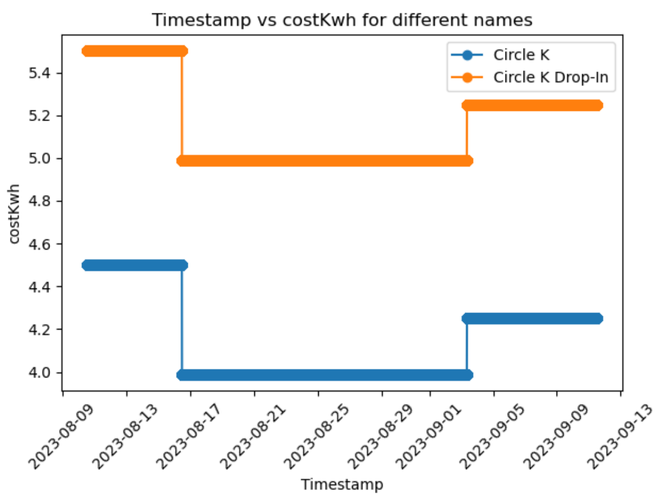


Fig. 8: Charging price over time for Circle K

As seen, the charging price per kWh for 'card payment' dynamically changes, whereas the price rates for 'Virta Drop-in' remain the same. Circle K is an example of an owner, which maintains a standard price per kWh across all their stations. Circle K only uses different rates for subscription-based users or drop-in customers. An example of the pricing rates for Circle K is illustrated in Fig. 8.

VI. Discussion

The analysis conducted has revealed key patterns in user behavior at public charging stations, more specifically in the city of Copenhagen. While the findings presented in Sec. V provide an insight into the landscape of EV public charging in Denmark, the data quality of the dataset must also be acknowledged. The limitation posed by the dataset quality could potentially affect the accuracy of our insights and thus the conclusions drawn from this study should be considered with an understanding of these constraints. Generally, the dataset only consists of one month of data, which is sufficient for determining longer-term trends and seasonal variations in the charging behavior. Additionally, there is a lack of consistency in the data, where it has been necessary to discard many of the owners due to erroneous data. The data for the remaining owners vary in the information that they provide i.e. 'price' or 'info'. These factors further narrow the scope of this dataset, potentially creating a bias towards the remaining subset of owners and making it difficult to make comparisons between the different owners. There is also a gap in the data samples between 23:00 and 06:00. While this time interval is typically off-peak and most users are assumed to charge their EV at home, it is still relevant for understanding the charging station usage. Moreover, the dataset lacks detailed information on crucial aspects such as the the precise duration of the charging sessions and accurate energy consumption for each charging station, which also provides valuable insights into the user behavior as well as the capacity of the power grid. Lastly, the expectation of data sampling at consistent 15-minute intervals was not met, introducing further uncertainty into the analysis due to the irregularity of data entries.

These limitations also become apparent in the analysis of the 'info' data. As mentioned, it has been observed that charging session durations tend to be brief, with higher activity in the morning and afternoon, suggesting an alignment with the daily routines of EV users. The spatial analysis, visualized through a heatmap, indicated that the highest frequency of 'Charging' statuses occurs at charging stations with a high number of fast charging points. However, it must be noted that not all the surrounding charging stations were considered in the analysis, since only owners with 'info' property were taken into account, leaving out data from multiple other owners. Thus, if the charging stations with high activity are the only options available in a given area, naturally, they will experience more traffic compared to areas where multiple charging stations exist. Additionally, the 15-minute sampling interval means that there could be shorter charging sessions occurring between these intervals that may not have been captured. Therefore, the actual usage could be higher. Another consideration is the composition of the charging stations themselves. Some charging stations consist of a mix of standard and fast chargers. However, the data does not show which type of charger has been used and therefore it is not certain that the fast charging points drive up the charging traffic. Nevertheless, considering the observed charging durations as well as the surveys conducted by Jensen et al. described in Sec. II, it is reasonable to assume that the availability of quick charging points is a significant factor for the public charging traffic.

Furthermore, the pricing scheme was also delved into as it is a factor that could influence the user charging behavior. Here it was shown that the pricing scheme vary from owner to owner, where some owner employ a base-rate pricing across all stations, whereas other owner determines their charging price dependent on factors such as the charging station location, with higher costs at strategically important sites such as highways and high-traffic locations. Users may prefer base-rate pricing due to its consistency and simplicity. On the other hand, the location-dependent approach offers more flexibility for the owners as it allows the owners to optimize the charging station turnover and potentially increase the revenue. However, it could be beneficial to further inspect which additional factors that could have an influence on the charging prices such as the pricing of competitors, cost of electricity, or peak demand times.

The conducted data analysis presents valuable insights into the public charging landscape of Copenhagen. While the available data is limited, it does provide a foundation for the next step of this study, which is the development of a forecasting model that shall predict the increasing demand and utilization of the public charging infrastructure. However, in order to develop an accurate forecasting model, it is necessary to scrape more data over an extended period of time. This would allow for the inspection of other aspects, such as seasonal trends, weekly trends, and the influence of large events like concerts and sporting events.

VII. Conclusion

The purpose of this data analysis was to provide an examination of the public charging infrastructure behavior and the behaviors of EV users. The data analysis acts as the foundation and is the first step towards the goal of developing a forecasting model that shall accurately predict the increasing demand and utilization of the public charging infrastructure. To narrow down the scope of the data analysis, the city of Copenhagen was selected as the main focus as it contains the highest density of charging stations. The data analysis itself focused particularly on the status and the pricing of the charging stations. The data analysis showed key usage patterns, where charging sessions were mostly brief and peaked during midday hours. Fast charging points also have a significant impact on the public charging activity. Furthermore, the analysis of the price rates revealed a significant variation between the charging station owners, with some offering a base rate across all stations, while others varied their pricing based on the location of the charging station. However, the conclusions drawn must be approached with caution due to the limitations of the dataset. Nonetheless, the data analysis offers insight into EV charging behavior that requires further investigation with more comprehensive data.

References

[1] Energistyrelsen, “Klimastatus og –fremskrivning 2021 (KF21): Transportsektoren: Sektornotat nr. 4A ,” April 24, 2021.

[2] Danmarks Naturfredningsforening, “Elbiler.” [Online]. Available: https://www.dn.dk/vi-arbejder-for/klima/elbiler/

[3] Danmarks Statistik, “NYT: Bestanden af elbiler steg med 69 pct. i 2022,” December 2022. [Online]. Available: https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=40083

[4] R. van den Hoed, J. R. Helmus, R. de Vries, and D. Bardok, “Data analysis on the public charge infrastructure in the city of Amsterdam,” in *2013 World Electric Vehicle Symposium and Exhibition (EVS27)*, Nov. 2013, pp. 1–10.

[5] A. Almaghrebi, S. Shom, F. Al Juheshi, K. James, and M. Alahmad, “Analysis of User Charging Behavior at Public Charging Stations,” in *2019 IEEE Transportation Electrification Conference and Expo (ITEC)*, Jun. 2019, pp. 1–6.

[6] Z. Jiang, H. Tian, M. J. Beshir, R. Sibagatullin, and A. Mazloomzadeh, “Statistical analysis of Electric Vehicles charging, station usage and impact on the grid,” in *2016 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)*, Sep. 2016, pp. 1–5.

[7] A. F. Jensen, T. K. Rasmussen, and C. G. Prato, “A Route Choice Model for Capturing Driver Preferences When Driving Electric and Conventional Vehicles,” *Sustainability*, vol. 12, no. 3, p. 1149, Jan. 2020.

[8] A. A. Visaria, A. F. Jensen, M. Thorhauge, and S. E. Mabit, “User preferences for EV charging, pricing schemes, and charging infrastructure,” *Transportation Research Part A: Policy and Practice*, vol. 165, pp. 120–143, Nov. 2022.

[9] “ChargeFinder - Ladestandere til elbiler.” [Online]. Available: https://chargefinder.com/dk