

Economic Evaluation of Electric Taxis in Megacities – Example of Singapore

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This research makes a contribution to the question of the cost effectiveness of battery electric taxis (e-taxis) compared to conventional taxis with internal combustion engine. The assessment is based on the total cost of ownership, and it combines technical, economic, regulatory as well as behavioural data from taxi drivers and passengers. The results indicate that e-taxis can be advantageous compared to conventional taxis, as they allow the drivers to earn higher profits, which is considered a key element for the success of e-taxis. However, some key parameters such as the vehicle battery life time need to be further investigated. In addition, the high purchase price of e-taxis may impact the fare structure and leasing rates of e-taxis which can be an obstacle for their acceptance by both drivers and passengers.

Keywords: BEV (battery-electric vehicle), HEV (hybrid-electric vehicle), cost, business model, taxi

1 Introduction

Taxis seem to be a reasonable starting point to assess the viability of environmentally friendly battery electric vehicles (BEVs). Taxis travel high annual mileages, and large fleets of them form a part of the transportation system of many metropolitan areas around the world [e.g. 1,2], including Singapore where currently about 28,300 taxis are operating [3]. This means that substituting conventional taxis by battery electric taxis (e-taxis) can have a significant leverage effect in terms of emission reduction. Especially in Singapore, using a high number of locally emission-free e-taxis can make an impact, because such vehicles can support the target to further enhance its image as a green and sustainable city, where about 95% of the fuel mix for energy generation consists of natural gas [4,5]. Focussing on taxis also supports the aim of the Singaporean government to discourage their citizens of using private vehicles instead of public transport which taxis are considered a part of.

In this work, we present results about the viability of BEVs used as taxis in the urban environment of Singapore. The assessment is made primarily from the point of view of the cost effectiveness of e-taxis, and it is based on a set of technical and vehicle-related data, economic and regulatory data as well as behavioural data from taxi drivers and passengers, which are combined in an overall model.

The economic perspective was chosen because electric vehicles generally have a different cost structure compared to conventional vehicles. Their acquisition costs are usually higher, whereas they are relatively cheap to operate. This raises the general question whether BEVs are more suitable to be used as taxis, in particular regarding the fact that taxis accumulate a high mileage over their lifetime. Comparatively low operating costs could lead to cost savings, even if upfront costs are higher. However, pure economic considerations may be too short-sighted, so that data from taxi users has been included in order to make this assessment more comprehensive.

The paper is structured as follows. Section 2 contains a short description of the data that is used in the assessment. It is divided into data from the two main user groups of taxis, namely taxi drivers and passengers. Section 3 gives an overview about the calculation model used for the assessment. The main findings are summarised in section 4, focussing on the taxi drivers' potential profit when using e-taxis instead of conventional taxis. The results are discussed in section 5. Section 6 concludes the paper.

2 Data basis

The data used in this work originates from different sources. General data to calculate the total cost of e-taxis and conventional taxis was drawn mainly from scientific literature as well as data sources from within Singapore (e.g. fuel prices, vehicle tax structure, vehicle component prices including battery prices), whereof some important data has been summarised in [6]. More specific taxi-related data was collected by tracking taxis with GPS data loggers (e.g. annual mileage of taxis, taxi drivers' revenue), which involved the collaboration with a Singaporean taxi operator. Regarding the taxi drivers' points of view, local taxi drivers were surveyed in personal interviews in order to learn about their acceptance of e-taxis. Finally, an online survey among people using taxis in Singapore provided insights into the taxi passengers' opinion.

In the following paragraphs we give a brief overview about this data. We focus on the description of data from the two main user groups of taxis, namely taxi drivers and taxi passengers. In particular, the GPS-based data about the travel behaviour of taxis, which provide information about the driver's behaviour, is considered important for the assessment. A more comprehensive description about this data and respective data collection methods can be found in [7,8].

2.1 Interviews with taxi drivers

Taxi drivers are considered the main users of e-taxis. Most of them use their taxis as a main source of income, which means that they spend a significant amount of time in the taxi every day. In order to learn about their taxi usage behaviour and to collect input data for the cost assessment of e-taxis, we conducted structured personal interviews with 78 local taxi drivers. A key part of the interviews aimed at learning about the drivers' acceptance of (future) e-taxis with particular characteristics that are likely to be different from the characteristics of the vehicle they were driving at the time of the interviews. These characteristic are:

The driving range: It is defined as the maximum range that an e-taxi can cover on a single charge, and thus the distance a taxi driver can drive before having to make a stop to recharge the battery. Currently, BEVs usually have a lower range compared to internal combustion engine vehicles (ICEVs). Larger batteries may be possible, but they are costly [6,9] and lead to increased vehicle weight and poorer energy efficiency.

The charging time: The average daily charging time which is needed to cover a given distance with a BEV is longer than it takes to fill the tank of an ICEV. The time mainly depends on the charging power and total battery capacity, and it can range from a few minutes to several hours [10].

The flag down fare: This is the fare that a passenger has to pay for the first kilometre or less of a taxi trip [11,12]. In Singapore, the developments of the last years indicate that when older taxis are replaced by newer ones, the new taxis usually have a higher flag-down fare compared to older models. For example, the flag-down fare of a Chevrolet Epica which is operated by the taxi operator SMRT Taxis Pte Ltd is currently 3.60 SGD, whereas a newer Toyota Prius costs 3.90 SGD¹ [12]. Hence, it can be assumed that e-taxis will have a higher flag-down fare, too.

The daily rental fee and fuel costs: This fee is a daily leasing rate at which a taxi driver leases a taxi from a taxi operator. In Singapore, like in many other cities, taxi drivers are self-employed [14-18]. They pay a daily rental fee to a taxi operator which allows them to use a taxi and keep almost all revenues² from taxi

¹ 1.00 SGD equals about 0.70 USD [13]

² Passengers have the option to book taxi trips for a booking fee of between 2.30 SGD and 3.30 SGD [12]. If a driver picks up a passenger who has made a booking, the driver has to pay a small percentage of this booking fee to a booking platform provider.

trips. Drivers have to pay for fuel on their own. All other costs for operating the vehicle, including service and maintenance costs, are taken over by the taxi operator and reflected in the daily rental fee. As the acquisition costs of BEVs are still relatively high today due to the expensive battery technology [9], it is assumed that the daily rental fee will also be increased in order to enable the taxi operator to cover the electric vehicle purchase costs. In return, the higher flag-down fares and lower electricity costs compared to fuel costs could help taxi drivers to compensate for their higher expenses caused by the increased rental fee.

The results from the interviews [7] indicate that many taxi drivers have difficulties imagining a scenario in which they use a vehicle with different characteristics compared to their current taxi. For example, this is reflected in their answers about the lowest range on a full charge that they can accept for an e-taxi: most drivers indicated 250 km as the minimum acceptable range, mentioning that they prefer not to recharge during their shift. Hence, losing time for charging an e-taxi during a full day is considered inconvenient, although the tracking data reveals that most taxis are stationary for several hours a day (see section 2.2), which would be enough time to recharge the battery. In addition, drivers are also very sensitive to increased leasing rates, even if lower energy costs can compensate these additional daily expenses. However, higher flag-down fares that would increase the drivers' income are generally not preferred either, because this may deter passengers and make them choose other cheaper taxis instead. Thus, an introduction of e-taxi which leads to such changes of major parameters is generally rated negatively by the taxi drivers, even if there is no clear financial disadvantage for them.

2.2 Taxi Tracking

In order to get detailed information about the mobility patterns of taxis in Singapore, GPS loggers have been installed in 50 taxis to track their location and speed with a high recording frequency over a period of six months. Furthermore, this data was synchronised with the taxis' operation status (e.g. *hired*, *for hire*, *on call*, ...) and the revenue which was generated after each *hired* trip. Due to the requirement of installing additional GPS loggers in the vehicles, this data set covers only a relatively small number of taxis.

To overcome this restriction we used another data set that is based on low frequency GPS data and covers a whole fleet of 2,973 taxis over a period of one month. Due to the lower recording frequency, mileage, standstill durations and revenues were estimated. A comparison between the two data sets revealed that the estimation error of these values is between 5.1% and 10.0%. Because of these relatively small deviations and the better representativeness almost all results presented in this paper were derived from the low frequency data set.

A detailed description of these data sets can be found in [8]. The following statistics were derived from these data sets and used for further calculations:

Daily mileage: Average mileage per day including trips of any status.

Operating time: Average duration per day when the taxi was active, i.e. executing trips of any status (the stationary time which can be used for charging is 24 hours minus the operating time).

Share of standstill periods: Standstill periods are periods between trips when the taxi was not active. We classified these periods into two categories: *break* and *shift change*. Thereby, *shift changes* are typically long standstill periods of several hours when the taxi is parked at the end of a shift until the same or another driver picks it up to start a new shift. In contrast, *breaks* are short interruptions of shifts when drivers are having a rest or a meal. This distinction is important in the context of analysing the potential of e-taxis since during *shift changes* private charging station with a low charging power would be sufficient, whereas during *breaks* public charging stations with a high charging power would be required to minimise the drivers' loss of time caused by recharging. The share of standstill periods indicates the ratio of all shift change / break durations to the total standstill period duration.

Hired trips per day: Average number of *hired* trips per day.

Daily revenue: Average revenue per day (sum of all daily trip fares collected by the drivers).

Distribution of hired trips: The fare system in Singapore contains a peak hour surcharge of 25% (6:00 am to 9:30 am on Monday to Friday and 6:00 pm to 12:00 am on every day) and a midnight surcharge of 50% (12:00 am to 5:59 am) that is added to standard fare [11,12]. In order to estimate e-taxis' revenues we extracted the percentages of *hired* trips within and outside (off-peak) these surcharge time periods.

Annual days off: Extrapolated number of days per year on that the taxi did not execute any *hired* trips.

The extracted values for each of these statistics are shown in **Table 1**.

Table 1: statistics extracted from tracking data

Daily mileage	365 km
Operating time	12.7 h
Share of standstill periods	Shift change: 84%; Break: 16%
Hired trips per day	21.2
Daily revenue	317.44 SGD
Distribution of hired trips	Off-peak: 46.0%, peak: 42.5%, midnight: 10.6%
Annual days off	10.1

2.3 Taxi passengers

Taxi passengers are considered the second main user group of taxis. Data from taxi passengers was collected via an online survey [7]. In order to evaluate a potentially increased flag-down fare for e-taxis compared to conventional taxis from the passengers' point of view, a part of the survey was designated to test their acceptance of different flag-down fare options which are higher than the currently highest flag-down fare for standard taxis in Singapore of 3.90 SGD. The proposed flag-down fares ranged between 4.00 SGD and 4.40 SGD. This would result in a single taxi trip being a maximum of 0.50 to 0.75 SGD³ more expensive than a trip in existing taxis.

Passengers were found to be indifferent to take or not take an e-taxi only for a flag-down fare of 4.00 SGD, and they would rather reject an e-taxi with a flag-down fare of more than that. Thus, similar to the taxi drivers, monetary considerations are a critical point. However, benefits of e-taxis also play a role. For example, the passengers' intention to use e-taxis correlates with their attitude towards the potential of BEVs to reduce urban air pollution. A more detailed description of the taxi passenger data can be found in [7].

2.4 Vehicle specifications

In addition to the key behavioural or usage-related data from taxi passengers and drivers, technical, economic and regulatory data had to be collected from various sources. The most important values for this assessment are summarised in **Table 2**, which contains figures for the conventional taxi as well as a generic BEV (e-taxi). The conventional taxi is a Toyota Prius hybrid petrol electric vehicle (HEV), a taxi which is commonly seen in Singapore today and which is currently replacing more and more older taxi models. The Toyota Prius was chosen as a point of reference for e-taxis as our analysis showed as well that its total cost of ownership (TCO) is usually lower than the one of current diesel taxis. The parameters for this e-taxi are set in a way that there is a break-even of the TCO after four years, which is half of the typical eight-years usage period of taxis in Singapore [19]. The reason for choosing a generic e-taxi is that currently, BEVs are not available for general purchase in Singapore, so that the purchase price of the e-taxi has to be estimated based on similar vehicles. For this analysis, we did this by estimating the costs for a traction battery and electric drivetrain and comparing them with the costs of a conventional drivetrain in a reference ICEVs. The e-taxi used for this analysis has properties similar to a BEV named 'EVA' [10], which was specifically designed for use in Singapore.

³ The difference depends on time of the day when a taxi trip takes place (see peak hour and midnight surcharges described above).

Table 2: model specifications, main taxi vehicle characteristics and resulting TCO values [4,6,10,19-22]

	Toyota Prius HEV	E-taxi
Annual mileage	129,531 km	
Main vehicle specifications		
Vehicle price including applicable vehicle taxes (beginning of 2020)	108,240 SGD	130,698 SGD
Vehicle end-of-life value (end of 2027)	1,000 SGD	1,000 SGD
Fuel consumption *	5.3 l/100km	18.3 kWh/100km
Petrol/electricity price **	1.96 SGD/l	0.26 SGD/kWh
Li-ion battery price **		336 SGD/kWh
Li-ion battery capacity ***		50 kWh

Values in the table are taken from the sources provided and from own data collection described in this paper, or are calculations based on that.

* Fuel consumptions are derived from the statements of the taxi drivers interviewed (Toyota Prius) and from own simulations (e-taxi).

** Values are plausible projections for 2020 based on current prices and historic price trends; the model assumes a further price drop for battery prices and continuous price increase for fuel/electricity costs after 2020 to 296 SGD/kWh in 2027.

*** Battery capacity installed in the vehicle. The usable capacity is lower and depends on the charging pattern and other battery parameters.

3 Model description

The basis for the economic assessment consists of a TCO model for BEVs and ICEVs. The TCO concept has been used in various fields of applications. For example, it has been widely applied as a tool to support strategic cost management [23]. In the context of the automobile industry, TCO can be described as “the cost of owning a vehicle from the purchase, through its maintenance, and finally its sale as a used car” [24]. Different examples where this concept has been applied can be found in [9,25-27].

For this work, we set up a TCO model following the examples mentioned above and adapted it to the particular case of taxis in Singapore in order to take into account the special usage pattern and tax structure of taxis. As the TCO can only be used to assess the cost effectiveness of e-taxis from a purely cost and technical point of view (vehicle purchase costs, vehicle operating costs, vehicle end-of-life value), an extension was added in order to integrate the data from taxi users (drivers and passengers) into the assessment. This extension focuses on the taxi driver as the main taxi user, and it is designed to compare his or her earnings driving conventional taxis or e-taxis, depending on a set of parameters. **Table 3** gives and overview of the main parameters used in the model.

Table 3: main parameters used in TCO model and in the taxi model extension

Phases of vehicle ownership	TCO model		Taxi model extension	
	Technical / usage-related	Economic / regulatory	Technical / usage-related	Economic / regulatory
Purchase	- Engine power - Battery capacity	- Vehicle open market value - Vehicle purchase taxes and subsidies - Battery pack prices		
Operation	- Fuel consumption - Annual mileage - Charging strategy (fast/slow)	- Vehicle operating taxes - Fossil fuel / electricity prices - Maintenance costs - Insurance costs - Parking costs - Charging infrastructure costs	- Daily mileage - Operating / standstill times - Driving strategy (peak/off-peak/night) - Charging strategy (fast/slow)	- Taxi leasing rates (drivers) - Flag-down fares (passengers)
End-of-Life	- Vehicle lifetime - Battery lifetime	- Vehicle end-of-life value		

The assessment builds upon the fact that the TCO of taxis is split between the taxi driver, who pays for fuel and parking costs, and the taxi operator who takes over the remaining part of the costs. However, the operator's part of the TCO is handed on to the driver in form of the daily rental fee. Eventually, all costs are covered by the taxi passengers who pay the trip fares to the drivers. **Figure 1** contains an overview of this taxi system.

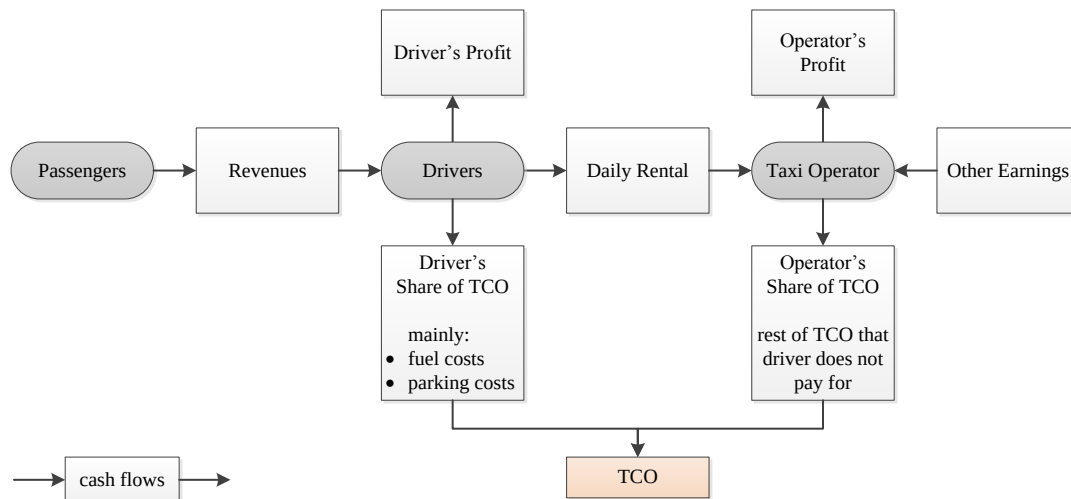


Figure 1: Taxi cost system

Table 4 lists the main model specifications used in this work. The purchase date of 2020 was chosen as there is currently no fully developed charging infrastructure in place to allow taxi drivers to charge e-taxis at convenient locations. In addition, regulatory structures to register vehicles in Singapore are tailored to ICEVs, and an adaption may be required in the future to facilitate the registration of a larger number of BEVs.

Table 4: Model specifications

Purchase date	2020
Taxi usage period	8 years
Annual discount rate	3%

4 Results

This section deals with the main findings about the cost effectiveness of e-taxi in Singapore. The results are presented in two steps. In the first step, the TCO of conventional and e-taxi in Singapore is compared. The results from this comparison are then used as a basis for the second step in which a comparison of the taxis regarding the driver's profit (see **Figure 1**) is presented. The profit can be considered as a key element of a successful introduction of e-taxi taking into consideration the acceptance of e-taxi by taxi drivers.

4.1 TCO of taxis

The TCO results are presented in **Figure 2**. Starting from the purchase price in 2020, the costs accumulate over the eight-year lifetime of the taxis until the end of 2027. Both graphs show some discontinuities which represent the fact that traction batteries need to be replaced at defined time intervals. The steps are higher for the e-taxi as its battery is larger and hence more expensive than the small battery of the Toyota Prius HEV. Both graphs also drop towards the end of the usage period indicating the end-of life value of the vehicles as well as some vehicle tax returns which are usually applicable in Singapore. Both curves intersect at the beginning of the year 2024 (or end of 2023), which represents the break-even point after four years of operation of the taxis.

Table 5 contains a breakdown of the TCO for both taxis into the driver's and the operator's shares (see **Figure 1**). The cost values reveal that the operator's share is higher for the e-taxi than for the conventional taxi, which is caused by the high upfront costs of BEVs. In contrast, the driver's share is lower. This is mainly due to the electricity costs for the e-taxi which are paid by the driver and which are lower than fuel costs for the conventional taxi.

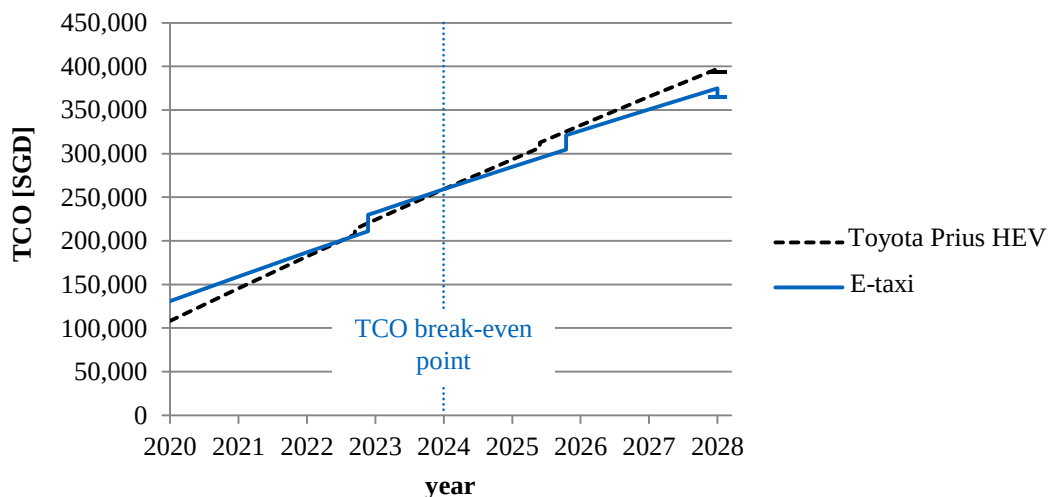


Figure 2: TCO of Toyota Prius HEV taxi and e-taxi in Singapore

Table 5: breakdown of TCO into driver's and operator's share (rounded values)

	Toyota Prius HEV	E-taxi
TCO (break even after four years of operation)	393,574 SGD	365,299 SGD
operator's share	283,627 SGD	307,247 SGD
driver's share	109,947 SGD	58,051 SGD

4.2 Driver's potential profit

Based on these TCO results, we estimated potential profits for taxi drivers using either of the taxis, based on the taxi system presented in **Figure 1**. Data for this estimation is mainly drawn from the tacking data (section 2.2). Data from the driver interviews and the passenger survey are used to narrow the set of

plausible data values, for example regarding flag-down fares and rental fees, which helps to make statements about the practicability of the results.

Figure 3 shows the overall results. The graphs represent a driver's average working day from a monetary point of view. At the beginning of each day, he or she pays the daily rental fee for the taxi. For the Toyota Prius, the current average rental fee of the drivers that were interviewed is 132.60 SGD per day. The rental fee for an e-taxi has to be 142.64 SGD so that the taxi operator makes the same average annual profit for each taxi. It is higher than the Toyota Prius rental fee because the operator's share of the TCO is higher for the e-taxi. Once the driver starts driving, he or she collects the trip fares from the passengers, which sum up to a total amount of takings at the end of each day. In addition, the drivers need to refuel the taxi for the mileage driven on that day, which costs about 0.10 SGD/km for the Toyota Prius according to our calculation. This value is in line with the drivers' own statements from the interviews. E-taxi drivers only pay about half this amount for electricity. Finally, the drivers' daily profit (earnings) is calculated by deducting the daily rental fee and driver's share of the TCO from the total takings. In the present case, this results in 142.11 SGD for the Toyota Prius and 152.63 SGD for the e-taxi, which would be a 7.4% salary increase for drivers who switch to an e-taxi.

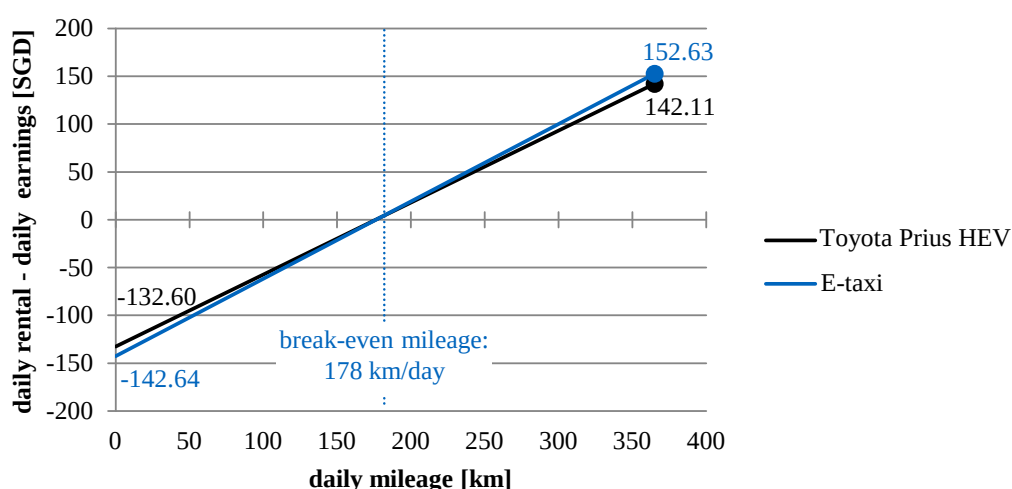


Figure 3: expenses-revenue profile of an average taxi driver with different types of taxis

For these results, the flag-down fare of the e-taxi was set equal to the one of the Toyota Prius (3.90 SGD [12]) following the low acceptance of slightly higher flag-down fares by both drivers and passengers. The average daily mileage of a Toyota Prius taxi, which is taken as a reference for the comparison, is about 365 km according to the tracking data (**Table 1**). This mileage can be covered by a single driver or more than one driver, because drivers have the option to share the daily rental fee with *relief* drivers in order to save money and to increase their personal income.

In addition, it is worth mentioning that e-taxi drivers may have to work longer hours in order to reach the same mileage or number of daily trips. This depends on the individual pattern of a driver to have breaks during which the battery of an e-taxi can be recharged. It is assumed that the charging behaviour of the drivers allows them to recharge their e-taxis for 365 km within their daily standstill periods. This requires a well-developed charging infrastructure, including suitable charging facilities.

5 Discussion

The e-taxi turns out to be competitive compared to the Toyota Prius for the scenario listed in **Table 1** and under the given constraints (TCO break-even point after four years of operation and equal annual profit per vehicle for the taxi operator). This means that although the daily rental fee for the e-taxi is more expensive in order to cover the increased upfront costs of an e-taxi, it is possible for a driver to end up with more earnings at the end of a working day if he or she covers a daily mileage which is greater than the break-even daily mileage (see **Figure 3**).

Considering the low acceptance of slightly increased flag-down fares by passengers, the flag-down fare for the e-taxi in this analysis was set equal to the one of the Toyota Prius. However, looking at the data from the driver interviews, the acceptance of the increased daily rental fee of about 143 SGD is rather low. This indicates that it may be difficult to launch e-taxis because a proof of concept is not yet available, which shows that increased earnings are possible despite the higher leasing rate. Such a proof may be necessary in order to convince drivers and to get them to hire e-taxis in case they are made available by a taxi operator. Impressions from the driver interviews suggest that they stick a lot to previous experience and various pieces of information, for example from fellow drivers, which influence their decision to hire a particular type of taxi [7].

Moreover, regarding the drivers' answers about the driving range of the e-taxi, it is also unlikely that they will voluntarily go for such an e-taxi without further convincing arguments. In this analysis, the range of the e-taxi is about 200 km on a full charge, which would require a driver to recharge during a shift. This range is determined by the usable battery capacity and the electricity consumption of the vehicle. In reality, however, it is considered unlikely that drivers will always fully deplete the battery before recharging it, so that the average real-life range will be less than 200 km. Looking at the range of alternative BEVs on the market with higher battery capacities and longer ranges, such as the Tesla Model S or the BYD e6 [28,29], it seems possible to find an e-taxi that gets a driver further than 200 km on one charge. However, local driving conditions need to be taken into consideration to determine the range of such a vehicle used as a taxi in Singapore, and purchase costs are likely to increase as well with higher battery capacity so that daily rental rates may be affected and acceptance by the drivers may be lowered again.

Finally, the competitiveness of e-taxis highly depends on a few critical parameters. In particular, this includes the life of the traction battery which determines the number of battery replacements and hence the battery costs during the lifetime of the taxi. The challenge is to estimate this battery life. Firstly, it is not clear how long a battery can be used in a taxi under Singaporean driving conditions. Data used in this model relies on estimations which are based on relevant literature about lithium-ion batteries [30]. For the values presented above, an average battery lifetime of 2000 cycles was assumed, which results in two battery replacements over the entire vehicle lifetime of eight years (see **Figure 2**). Secondly, our analyses indicate that even small changes to the battery life time can render the e-taxi uncompetitive compared to the Toyota Prius, which is caused by the fact that the battery is a very costly vehicle component. And thirdly, the battery life will be strongly influenced by the charging behaviour of an individual driver. For example, a driver who uses fast charging facilities most of the time and often discharges the battery to a relatively low state-of-charge will shorten the battery life compared a driver who mostly uses slow charging facilities and a smaller state-of-charge range [31]. Other important factors which are crucial for this comparison include future price trends of battery packs as well as fuel and electricity price developments. In the particular case of Singapore, governmental regulations targeting vehicle taxation system can also have a decisive impact on the competitiveness of e-taxis.

Hence, it has to be determined whether a BEV can be found that fulfils key conditions including TCO break-even, operator's profit, drivers' desires and other boundary conditions. The assessment should include a comprehensive analysis of all key technical, economic, regulatory and behavioural parameters which will allow to determine a viable framework for e-taxis.

6 Conclusion

In this paper, we presented an approach to assess the economic viability of e-taxis. This approach is based on a TCO concept which was adapted to the comparison of vehicles with different drivetrain technologies. A taxi extension was added to the model in order to assess the business case of electric compared to conventional taxis. Then, taking the example of Singapore, data from different sources was used as an input aiming for a holistic approach: stated preference data from surveys among taxi passengers and drivers, behavioural and economic data from tracking taxi vehicles as well as technical and cost data based on different literature sources.

The results indicate that e-taxis can certainly be economically viable considering their lifetime, from purchase by the taxi operator to resale after eight years of usage. However, some factors such as battery parameters that have an enormous influence on the results need to be further investigated. Changes to some parameters such as range, charging time and taxi fares which directly affect the drivers and passengers are also critical, as they have an influence on how easy it will be to implement an electric taxi system. Hence, it is recommended to do further tests focussing on making drivers (and maybe passengers) more familiar with

the BEVs in order to overcome the initial hurdle of acceptance. Finally, future price trends and governmental regulations will play a crucial role, too.

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