

THE CASE FOR ELECTRIFICATION OF TAXIS & RIDE-HAILING

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INTRODUCTION

The world today is eager for more green solutions to tackle climate change. In the transport sector, several taxi and ride-hailing companies have chosen the path of electrification to reduce their carbon footprint. Electrification of the sector is important as these vehicles have the highest energy and greenhouse gas (GHG) emission impacts per passenger kilometre of all urban mobility¹, and are among the vehicles that register the highest lifetime mileage. The sector and its users would greatly benefit from a rapid transition to zero tailpipe emission vehicles and notably to 100% electric vehicles (or BEV for Battery Electric Vehicles).

Prioritising the electrification of fleets would secure the biggest and fastest impact: In Europe alone, it is estimated that fleets² represent only 20% of the European car park of light and heavy duty vehicles but account for 50% of the carbon dioxide emissions of that same car park³. Their contribution could skyrocket as the number of vehicles grows, unless a fast transition to zero tailpipe emissions is ensured.

This Knowledge Brief shines a light on the electrification of the taxi and ride-hailing sector, provides best practices from the frontrunners and evaluates what still needs to be done to support the transition.



1 ITF, 2020. *Good to go? Assessing the environmental performance of new mobility.* • 2 Vehicles operated by a single organisation or under the same ownership such as corporate fleets, taxi and ride-hailing. • 3 Transport & Environment, 2021. *Why the EU needs a ZEV Fleets Regulation & how to do it.*

WHERE IS ELECTRIFICATION HAPPENING?

The first taxicab company in New York City, USA, was the Samuel's Electric Carriage and Wagon Company, which began running 12 electric hansom cabs in July 1897. Reformed into the Electric Vehicle Company, by early 1900s it was running up to 1,000 electric taxicabs (with swappable batteries) before going bankrupt in 1907, marking a halt to electric cabs.

Now, more than a century later, electric taxis are used in a few cities worldwide, from Hong Kong, Macao and Shenzhen (China) to London (UK), passing through Nairobi (Kenya), Columbus and New York City (US). China seems to be at the forefront with Shenzhen operating almost 100% of its taxi fleet electrically.

In 2019 and 2020, there were more cases with trials in Kigali, Rwanda, new leasing schemes in India, by India's Energy Efficiency Services⁴, and new services in Montreal, Canada, with the new electric taxi service, Téo⁵. In 2020 and 2021, the need to improve air quality has become increasingly apparent as a result of the COVID-19 pandemic and climate change policy goals have further pushed the need to accelerate electrification. We are seeing electric vehicles sales increasing and some prominent ride-hailing companies have committed to go electric in the years to come.



However, electric taxis remain very much marginal even counting the electrification of other means of transport, especially private cars: Norway's capital, Oslo, has the highest number of electric cars per capita in the world⁶ and yet, in 2019 it was estimated that 2% of the taxi fleet were fully electric⁷.

In cities, such as London or Montreal, there is clearly a demand for cleaner solutions from customers who wish to book electric taxis, but also from companies wishing to satisfy their corporate responsibility.

REACHING SUSTAINABILITY GOALS AT SCHIPHOL AIRPORT

Since 2014, Schiphol airport in the Netherlands boasts around 700 electric powered taxis, the largest fleet of any airport in the world. This comes as a result of its policy to become more environmentally friendly. Iconic symbols such as taxis converted to cleaner technologies promote operators' brands and attractiveness of cities and regions.



On the private operator side, there is also a wish to switch to electric, more efficient, and smart vehicles but the transition is complex because it implies costs, timely conversion of infrastructure from diesel to electric, and a big leap into the unknown which has to be dealt at all levels, including the drivers.

4 They are responsible for managing procurement programmes for government vehicles. • 5 REN21, 2021. *Renewables in Cities Global Status Report*. • 6 Breathelife2030, 2020. Oslo achieves highest number of electric cars per capita in the world! • 7 UITP, 2020. *Global Taxi Benchmarking Study 2019*. Statistics Brief.

WHY IS ELECTRIFICATION SLOW TO DEVELOP?

Despite the increasing offer in the electric vehicle (EV) market as well as better and cheaper batteries, battery electric vehicles (BEV), **are still more expensive than gasoline vehicles at the acquisition.** In some markets more than others, original equipment manufacturers (OEMs) have not yet properly addressed the sector's needs by providing more tailored vehicles. **The lack of funding for companies converting their assets from fossil fuel** into electric (e.g. fleets, maintenance facilities, re-skilling of staff and drivers) is also crucially slowing down the transition. Sometimes also regulation can help or impede business models that can support the transition.

However, the TCO has been decreasing and decreases even more with **the access to slow chargers** (the lowest charging costs possible) and **vehicles fit for the usage** with a range that is adapted to cover the average daily mileage, thus reducing the need for the driver to stop to charge. And if they have to stop, fast chargers in the right locations will help.

With the right policy framework and incentives, experts recognise that the economics can be reversed to make EVs less expensive due to lower operational costs compared to Internal Combustion Engine (ICE) vehicles. But, only effective discussions between the sector and drivers will ensure the best results.

“ *Operations with electric vehicles are far cheaper than gasoline ones, but you wouldn't know if you hadn't tried!* ”

Chris Liang, Shenzhen Bus Group

Experts agree that, together with higher acquisition costs, a key bottleneck is the **provision of the right charging infrastructure** fit for the variety of needs of taxis and ride-hailing drivers, such as:

- **Fast charging hubs** to top up the battery between shifts, as there are often more drivers for a taxi, and during the day at major destinations, such as airports and city centre. However, this charging is more expensive.
- **Slow charging near drivers' residences** to lower costs and avoid “range anxiety” (stress of starting the day on low battery without knowing where to top up). This charging is cheaper.

- **More facilities around the charger**, such as toilets and bars for drivers⁸.

In addition, the provision of such charging infrastructure which must accompany the acceleration of the transition towards EVs also brings challenges:

- High quantity required in a short time⁹.
- Quality needed for adequation to needs, hardware and software interoperability.
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- Potential conflicting use of charging stations with private car users.
- Clear goals and leadership with regulations, measures and incentives from different levels of government are necessary.

THE IMPORTANCE OF ALIGNED PUBLIC MEASURES IN MONTREAL

In Quebec, there are aligned public measures from different government levels to support the acquisition of BEVs as well as the provision of charging infrastructure. An e-taxi buyer would receive up to \$16,400, combining both the incentive of the federal government and the provincial government. This is very much welcome as today's schemes generally are not based on the priority of incentivising BEV kilometres rather than BEV ownership, which is what matters for reducing emissions.

The city of Montreal has a strategy for the provision of charging points, making use of public subsidies from other government levels, while companies can also apply to subsidies to install charging points on private land. Finally, the controlled price of the public charging points has a regulation effect on the overall market of charging point fees.



● 8 Uber, 2020. *Spark! Partnering to electrify Europe.* ● 9 According to Transport & Environment, across the European Union there will be a need for three million public charge points by 2030. This is a huge increase when set against the 185,000 that were in place by the end of 2019. If this is estimated for all road vehicles, for the needs of taxis & ride-hailing, the charging provision is far small but at the scale of a city it can still represent a consequent effort.

WHAT CAN WE LEARN FROM THE FRONTRUNNERS?

When we talk about taxi and ride-hailing we need to acknowledge the variety of possible configurations with variable characteristics of their business models such as ownership of vehicles, facilities, e.g. for maintenance and/or charging, as well as the interface with the client. Therefore, **lessons learnt must be adjusted to the local conditions and regulations.**

E-CHARGING INFRASTRUCTURE: PUBLIC INVOLVEMENT, PRIVATE INITIATIVE AND PARTNERSHIPS WITHIN AN EV ECOSYSTEM

It is well known that local governments are key stakeholders in the development of electric charging infrastructure, as they can publicly procure, award concessions or grant government support for the construction and operation of recharging points in their territories. Even in the scenario of the infrastructure development being left to the market, their involvement is crucial to maintain network stability, create incentives (not necessarily financial, but more related to access to public space, such as road, parking, city centre) and manage the public space as well as private space through permitting procedures. Therefore, it is important that **local governments develop long-term mobility strategies including an electrification and infrastructure strategy** to identify needs and fix targets that can also create a stable investment climate.

Cooperation between different government levels as well as neighbouring cities, regions and states is important to align policy measures between authorities, increase coherence between strategies across different policy domains (energy, mobility, housing, etc.) and ultimately reinforce and leverage impact. In China, for example, it is recognised that important and comprehensive subsidies for manufacturers, operators and charging operators have pushed the massive transition towards electrification of the transport sector. In Europe, partnerships, not only with distribution system operators but also mobility players, are strategic to deliver the maximum impact. The goals of such partnerships should be follows:



On the one hand, authorities and concerned stakeholders should aim to provide sufficient availability and capacity for drivers to recharge at their convenience by:

- **Defining the required amount of recharging points**, taking into account the expected demand, developments in battery and charging technology as well as new services e.g. autonomous vehicles.
- **Identifying the best locations**, based on drivers' needs and data to avoid the classic mismatch between the needed locations close to high-mileage drivers' houses and the actual locations clustered in wealthy areas.
- **Identifying appropriate power levels**, where drivers' preferences are for both slow and fast charging but for different time and space (e.g. slow charging for overnight cheaper charging near their residence).

MUTUALISING CHARGING INFRASTRUCTURE FOR DIFFERENT VEHICLES

Making charging infrastructure available for all types of electric vehicles, such as e-buses, e-taxis and e-bikes, could be much more cost-effective than standalone infrastructures. However, this should be done without endangering the provision of operators. In Montreal, for example, taxi drivers would have priority to charge at Mobility Hubs created by the city.



An effective partnership with operators and drivers is highly beneficial and recommended.

On the other hand, authorities and concerned stakeholders should also aim to reduce overall deployment costs and nuisance by:

- **Making best use of existing infrastructure** to limit costs, e.g. by making the most of the local grid capacity, and limiting use of public space especially in cities to reduce land issues, e.g. by agreement with private land owners or parking facilities.
- **Maximising the usage rate** of the recharging infrastructure to reduce the need for additional recharging infrastructure, e.g. by location and effective EV parking policy, including stations reserved to drivers for fast charging, and to maximise the return on investment of the infrastructure provider.
- **Fostering hardware and software interoperability** that can limit the use of public space, avoid technical operator lock-in and give drivers access to an increased amount of recharging points through a single subscription
- **Reducing nuisance** during works and during deployment and addressing the objections coming from other stakeholders and the wider public¹⁰.

PARTNERING WITH OTHER CHARGING STATION OPERATORS IN SHENZHEN

Drivers prefer to access convenient charging points when needed without having to go to one of their taxi stations. Pengcheng Electric Taxi (a subsidiary of Shenzhen Bus Group) started to negotiate for taxi drivers to access privately-owned charging stations, e.g. in shopping and business centres. Drivers would then benefit from a lower fee, on top of the electricity price, to get a similar rate to the one they would have in the company's stations. As a result, the company agreed on having external drivers using its own stations, at the same rate applied to its own drivers, which led to a higher return rate for the operator. This can be also a first step in the direction of a business model as charging station operator.



PRIVATE INITIATIVE TO BUILD CHARGING STATIONS AND FACILITIES FOR PENGCHENG ELECTRIC TAXI

Pengcheng Electric Taxi is a subsidiary fully owned by Shenzhen Bus Group (SZGB). With an experience of more than 10 years in electrification of their fleets, the Shenzhen Bus Group and Pengcheng Electric Taxi have built and continuously improved their own charging stations, categorised into three types, according to location and services available for drivers and passengers:

DEPOT C - CENTRAL AREAS INCLUDING SERVICES FOR GENERAL PUBLIC

- Dining services, convenient stores, fitness centres
- Proper directional and functional signages and road markings
- Power supply and distribution facilities
- Firefighting facilities and other infrastructure

DEPOT A - OUTER CITY

- Vehicle charging
- Maintenance facilities
- Drivers resting areas
- Toilet facilities for drivers
- Dispatching office

DEPOT B - OUTER CITY + HUB / INTERCHANGE

- Car washing
- Changing room

¹⁰ For more information: Sustainable Transport Forum, 2020. *Recommendations for public authorities on: procuring, awarding concessions, licences and/ or granting support for electric recharging infrastructure for passenger cars and vans.*

OPERATORS BETWEEN NEW PROCEDURES AND OPPORTUNITIES

In the transition to electrification, there is a clear need for taxi companies to plan and adapt, according to the characteristics of their business models. This adaptations included the internal processes and standards, e.g. repair and maintenance, safety and security, human resources reskills of staff and drivers, in a **comprehensive change management process**.

Big operators need to pay special attention to the impact of their electricity consumption over the grid and the nearby residential and industrial areas. It is important to choose the location of facilities with access to high voltage electricity, e.g. near train stations, but also to improve energy usage with peak shaving measures by spreading out electricity demand over the day.

Finally, good operators will develop opportunities, such as:

- The **integration of supporting systems**, so to monitor and better train drivers for increased efficiency.
- **Big data analysis** allowing to better understand the passenger demand and therefore improve operations and efficiency.
- **Better service for passengers**, communication and branding to differentiate their services.
- **Diversification of revenue streams** through monetisation of collected data, commercial use of stations and facilities etc.

BEYOND CHARGING INFRASTRUCTURE AND TECHNOLOGY FOR SOUND BUSINESS MODELS

Nowadays, electric cars are reliable and improving their performance, but they are still lacking a comprehensive interoperable infrastructure for their recharge. A robust supply chain, including the availability of spare parts, and the existence of a second-hand BEV market would offer cheaper and easier to access. All of these elements are very important for sustainable business models of taxi and ride-hailing services, where technological developments, enabled also by electrification, offers new possibilities to be further explored and tested. As with the Electric Vehicle Company in early 1900s, it is important not to misinterpret the failure of a business model with the failure of a technology and to work on the elements that can make the business model sustainable.

TÉO TAXI BUSINESS MODEL IN MONTREAL

Téo taxis started as a pilot project in November 2015, but stopped for financial difficulties after three years of very successful service. The company had a high number of rides per vehicle, high revenue per vehicle and a top class corporate offer. To maintain the strong brand, the service was relaunched in 2020 with the nickname Téo 2.0, thanks to the following adjustments to the business models:

TÉO	TÉO 2.0
Driver as employee	Driver as self-employed, sharing risks
Maintenance costs: Expensive because the spare parts distribution is not mastered (long times)	Dedicated systems and resources for fleet management
Low vehicle autonomy not meeting needs	Better vehicle autonomy
Recharge management problems	Recharge management solutions, also partnering with the city
100% financial risk for technological development (in-house app for the driver)	Partnership with technology provider

Finally, a **more stable overall framework for taxi and ride-hailing** with fairer conditions for drivers at its centre could also contribute to the electrification, aligning stability of investment and better revenues.

“ *When Henry Ford developed the first cars, they were not reliable and there were no gas stations, but he was very devoted to improving their performance, reducing their cost, and negotiating with oil companies to build the gas station infrastructure and to establish the maintenance service network¹¹.* ”

¹¹ Chan, 2013. *The rise & fall of electric vehicles in 1828–1930: lessons learned*. Proceedings of the IEEE, vol.101, No.1.

HOW TO SUPPORT ELECTRIFICATION?

Looking back on the first wave of EVs, we would see that *“the philosophy of the availability of good product, good infrastructure, and good business model to achieve affordable cost, convenience of use, and energy savings remains valid”*¹².

To summarise, there are **key success factors** for the electrification of taxis and ride-hailing implementation:

- All government levels involvement
 - Regulations
 - Subsidies: To reduce the upfront purchase costs, especially for lower income drivers, and to create the right charging infrastructure
 - Incentives: Financial policy measures that can encourage greater BEV use, such as privileged access to city centres and areas of high demand
 - Funds for companies converting their assets from fossil fuel into electric, e.g. fleets, maintenance facilities, reskilling of staff and drivers.
- Low costs for electricity
- Thriving entrepreneurial and innovative community
- Strategic public and private partnerships
- Trained drivers and staff
- Public awareness and demand for electric vehicles
- EV availability and autonomy



To support taxi companies in their transition to electric vehicles, [UITP has released a dedicated toolkit for its members](#) that provides more detailed guidelines based on international practises as well as the lessons learnt from the first 100% e-taxi operator, the Pengcheng Electric Taxi.

WILL ELECTRIFICATION BE ENOUGH?

Experts agree that **electrification is not the silver bullet**, if there's any, to fight the climate crisis or even to fix externalities such as congestion and crashes.

When talking about taxi and ride-hailing service, we need to consider, on one side, the vehicles and the operations as they are today and, on the other side, the evolutions of governance and the wider mobility ecosystems against

the objective of a massive modal shift towards more sustainable mobility patterns (walking, cycling, shared and public transport).

POTENTIAL FOR REDUCTION OF KILOMETRES TRAVELLED

When we look at the operations of taxi and ride-hailing, their kilometre travelled are the result of travel with passengers and deadheading.

Deadheading refers to different bits of travel that are made without a passenger but are required by current operations (commuting from the driver residence, trip to go pick up a client etc.).

As little data is available to calculate the amount of km travelled as deadheading, International Transport Forum (ITF) mentions studies with quantitative estimates of deadheading in the United States that indicate a range of 42% to 81% of deadheading travel. There is clearly potential to reduce deadheading kilometres and improve operations efficiency.



SHIFT AND COMBINE MORE SUSTAINABLE SERVICES

In order to multiply the effect on air quality, urban mobility quality and citizen's health, cities and regions need to move beyond clean fleet renewal for taxis and ride-hailing towards more liveable cities. This can be achieved thanks to policies that encourage pooled rides and complementarity with mass public transport and **ultimately foster the modal shift from private cars to walking, cycling and multimodal public transport**. Taxis and ride-hailing have their space in this integrated multimodal future.

CONCLUSION

The decarbonisation of the taxi & ride-hailing sector is key to reduce CO2 emissions. It can be achieved through a combination of measures aimed at reducing kilometre travelled, increasing the occupation rate of vehicles, enhancing the complementarity with mass public transport, fostering the modal shift from private cars to more sustainable options as well as reducing the carbon intensity of the vehicle's fuel, with electrification for example.

A dedicated toolkit is available for UITP members on MyLibrary to support them in their transition to electric taxis.



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This Knowledge Brief was prepared by the Taxi & Ride-Hailing Committee. For more information, you can contact Lidia Signor, Committee Manager, at lidia.signor@uitp.org

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