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To cite this article: Qihang Zhang 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **295** 052048

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# Analysis of "Shenzhen Model" for New Energy Vehicle Promotion in Public Transportation

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**Abstract.** As one of the pilot cities promoting new energy vehicles in China, Shenzhen has achieved the rapid development of new energy vehicles, especially in the field of public transportation. At present, buses and taxis have basically achieved full electrification, offering successful promotion model and experiences for other cities. This paper studies the "Shenzhen model", which successfully promoted new energy vehicles in Shenzhen. This paper analyses the measures taken by Shenzhen in the field of public transportation, and summarizes the experience in forming the model. In addition, given that there are still some obstacles in promoting new energy vehicles and the subsidy is prone to be reduced, suggestions on policy implements are also made in this paper to make Shenzhen's new energy vehicles industry achieve sustainable development.

## 1. Introduction

Since the implementation of the "Thousands of Vehicles, Tens of Cities" program in China in 2009, all pilot cities have actively explored new energy vehicle promotion methods. Considering the local economic development and the characteristics of the local automobile industry, the Shenzhen local government coordinates new energy vehicle production companies, power supply companies, charging facilities operators, financial institutions and other parties, starting from the public transportation sector, forming the "Shenzhen Model" in the public transportation field. Up to now, the "Shenzhen Model" has achieved remarkable achievements. At the end of 2017, Shenzhen had promoted 16,359 electric buses, excepting the 634 fuel buses serving as emergency transportation capacity, thus the city's franchised buses have all become electric buses. Among the metropolises in China and even in the world, Shenzhen is the first one to achieve full electrification in public transportation field. In addition, by the end of January 1st, 2019, the proportion of electric taxis reached 99.06%, which means that taxis in Shenzhen almost achieved fully electrification.

This paper takes a deep research into the measures Shenzhen has taken to promote electric buses and taxis, analysing the successful experience of the "Shenzhen Model", and proposing recommendations for further improvement in the background of subsidy reduction.

This paper is organized as follows. Section 2 analyses the methods of Shenzhen in the promotion of electric buses. Section 3 analyses the methods of Shenzhen in the promotion of electric taxis. Section 4 concludes the advantages of the "Shenzhen Model" and proposes recommendations.



**2. Analysis of the promotion model in bus field**

In the bus field, the Shenzhen Government endows the franchise rights to the charging facility operators, thus enabling them to step into the industrial chain of new energy vehicles, and forming the “Shenzhen model” characterized by “financial leasing, separation of vehicles and battery, and integration of charging and maintaining”.

In 2010, the Shenzhen government and Potevio Ltd. (hereinafter referred to as Potevio) signed a strategic cooperation framework agreement, and the two parties agreed to jointly accelerate the promotion of electric buses in Shenzhen. According to the agreement, Shenzhen Lineng (a wholly-owned subsidiary of Potevio New Energy Co., Ltd.), which is owned by Potevio, has obtained the construction right and franchise of the new energy charging facilities in Shenzhen, and has become a new energy vehicle charging facility operator. With the support of the central finance and local finance, the bus companies, Potevio, financial leasing companies and electric buses production companies cooperate to achieve the operation of electric buses, forming a “financial leasing, separation of vehicles and battery, and integration of charging and maintaining ”model.

(1) Financial leasing. The bus company, Shenzhen Lineng, financial leasing company and electric bus production companies sign electric bus purchase and sale contracts. The financial leasing company pays the bus (without battery) purchase price (after deducting the central and local subsidies) to the electric bus production companies and leases the buses to the bus company, and Shenzhen Lineng provides guarantee to the financial leasing company. After the bus company obtains the vehicle, it pays the lease fee in 8 years according to the lease contract, which covers the principal and interest the financial company has paid.

(2) Separation of vehicles and battery. The vehicle and battery are separated in the purchase, the vehicle is purchased by the financial leasing company deducting the price of battery, and the battery is purchased by the charging facility operator Shenzhen Lineng who receives financial subsidies from both the central government and the Shenzhen municipality.

(3) Integration of charging and maintaining. According to the agreement, apart from being responsible for purchasing the battery, the charging facility operator is also responsible for the investment, construction and operation of the electric bus charging facilities, and responsible for the charging cost, the maintenance costs of batteries and charging facilities. In order to obtain the above services, the bus company needs to pay the maintenance service fee to the charging facility operator. The service fee is equal to the fuel cost of the fuel bus deduct the electricity fee of electric bus which drives the same mileage.

In this model, the obligations of each party are illustrated in Figure 1:

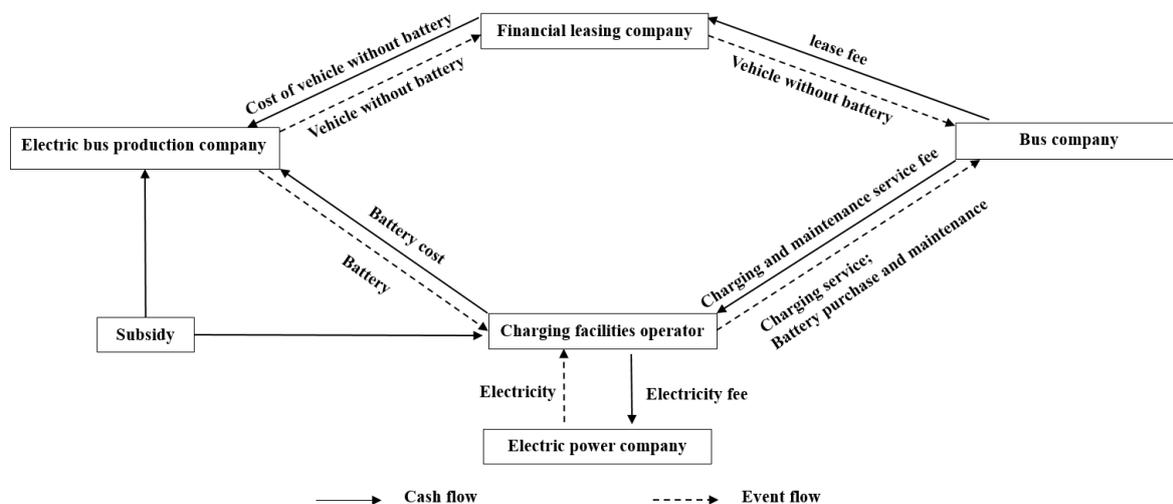


Figure 1. The business model of promoting electric bus in Shenzhen

Even with the central and local subsidy, the purchase cost of electric bus is still much higher than that of fuel bus. By adopting the model above, the problem that the cost of the electric vehicle is high is alleviated, the responsible party for battery and the after-sales service is clearer, and the construction of charging infrastructure is promoted, which are the three major electric vehicles promotion obstacles. In the meantime, this model effectively alleviates the cash flow pressure and financial burden of the bus companies.

### 3. Analysis of the promotion model in taxi field

The realization of taxi electrification in Shenzhen depends on the cooperation of electric taxi production company, taxi company and financial institutions. In 2010, Shenzhen Bus Group and BYD Company Limited. (hereinafter referred to as BYD) jointly established the first electric taxi company in China, named Shenzhen Pengcheng Electric Taxi Co., Ltd. (hereinafter referred to as Pengcheng Electric). Pengcheng Electric has experienced the demonstration operation phase and the market operation phase. From the establishment of the company to the 26th Shenzhen Universiade in 2011, it is in demonstration operation stage. During this phase, 50 electric taxis were put into operation in total. After the Universiade, the number of charging facilities in Shenzhen has been increasing. The number of electric taxis in the company has increased, Pengcheng Electric also entered the stage of market operation.

When Pengcheng Electric purchases a taxi, it adopts the “zero-yuan car purchase + zero cost + zero emission” program provided by BYD. Pengcheng Electric does not have to pay the whole purchase cost at one time, there is zero down payment and installment payment. The China Development Bank provides financial support amount to 10 billion yuan for the program. BYD provides 4 years or 100,000 kilometers warranty for electric taxis, and the key components (power battery pack, motor, Drive motor controller, power battery manager) are provided 5 years or 100,000 kilometers warranty, which greatly eases the concerns of taxi companies and drivers about the service life of electric taxis.

In terms of Pengcheng Electric, the main costs of it include taxi purchase cost, electricity fee, management fee, labor cost and vehicle maintenance cost. Potevio invests in the construction of charging stations and purchases electricity from China Southern Power Grid. , providing charging service.

In this model, the obligations of each party are illustrated in Figure 2:

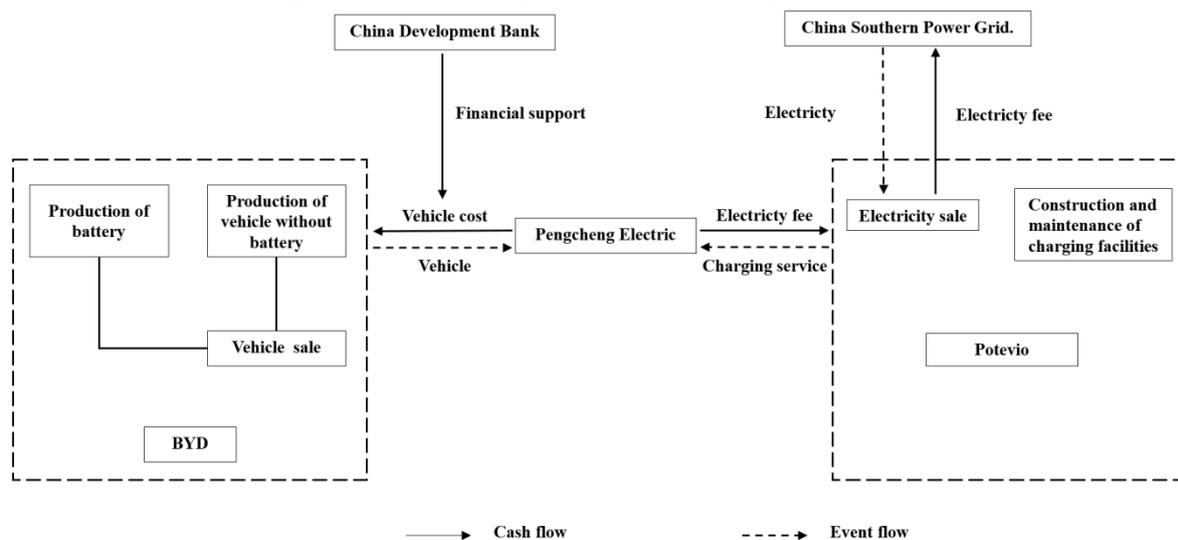


Figure 2. The business model of promoting electric taxi in Shenzhen

This model alleviates the financial pressure of taxi companies who used to have to pay the purchase cost at one time. At the same time, taking into account the cost difference between oil and electricity, when the quantity of electric vehicles reaches a certain level, Pengcheng Electric can achieve

profitability. It is reported that Pengcheng Electric achieved profit of 12 million yuan in 2017. With the continuous expansion of the operation scale, the future economic benefits will be more.

#### 4. Conclusions and policy implications

The “Shenzhen Model” plays an important role in the promotion of electric vehicles in the public transportation sector in Shenzhen. This model combines resources from local government with those from other participants. It not only alleviates the problems of high purchase cost and high capital pressure for electric vehicle buyers, but also solves the problems of battery maintenance and charging facilities construction. At the same time, due to the cooperation mechanism among these parties, the bus companies or taxis companies, charging facility operators, power supply companies, financial institutions can participate in the industrial chain of electric vehicle promotion jointly, sharing risks and responsibilities, and benefiting from the growth of the electric vehicle industry, which gives them motivations to join the promotion. As for the local government, the charging facilities operator is in charge of developing charging infrastructures and providing charging services, thus the local government is saving the costs of investing in charging infrastructures.

The success of “Shenzhen Model” is highly relevant to the unique advantages of Shenzhen to promote electric vehicles. Firstly, Shenzhen is a special economic zone with rapid economic development, and its booming economy makes the Shenzhen municipality well prepared for the financial pressure emerging from electric vehicles deployment. Secondly, enterprises participating in the promoting of electric vehicles are deeply involved in the value chain. They have the ability to provide these services and the courage to bear financial risks, thus they are playing an important role in the promotion activity.

In spite of the above advantages Shenzhen possesses, and the current promotion of electric vehicles in the public transportation sector in Shenzhen having achieved remarkable results, there are still problems such as the dependence on subsidies, insufficient charging facilities, limited driving range and so on. At present, in the background of subsidies reduction, the government needs to find more effective methods, and policies need to focus on demand side incentives, technological innovations, and infrastructure constructions. For the demand side, measures such as charging subsidies and parking fee reductions can be considered. For the technological innovations, the efforts on battery cost reduction and driving mileage increasing need more support. For the infrastructure constructions, social capital should be encouraged to invest in charging facilities. By adopting all these methods, it is hoped that a promising promotion environment can be created and the development of Shenzhen's electric vehicle industry can be accelerated.

#### References

- [1] Christensen, T.B., Wells, P., Cipcigan, L. (2012) Can innovative business models overcome resistance to electric vehicles? Better Place and battery electric cars in Denmark. *Energy Policy*, 48(none): 498-505.
- [2] Lieven, T. (2015) Policy measures to promote electric mobility – A global perspective. *Transportation Research Part A*, 82: 78-93.
- [3] Masiero, G., Ogasavara, M.H., Jussani, A.C., et al. (2016) Electric vehicles in China: BYD strategies and government subsidies. *Rai Revista De Administração E Inovação*, 13(1): 3-11.
- [4] Yang, J., Dong, J., Hu, L. (2018) Design government incentive schemes for promoting electric taxis in China. *Energy Policy*, 115: 1-11.
- [5] He, Y., Zhang, Q., Pang, Y. (2017) The development pattern design of Chinese electric vehicles based on the analysis of the critical price of the life cycle cost. *Energy Policy*, 09: 382-388.
- [6] Langbroek, J.H.M., Franklin, J.P., Susilo, Y.O. (2016) The effect of policy incentives on electric vehicle adoption. *Energy Policy*, 94: 94-103.
- [7] Bjerkan, K.Y., Tom, E., Nørbech, Marianne, E.N., (2016) Incentives for promoting battery electric vehicle (bev) adoption in norway. *Transportation Research Part D Transport and Environment*, 43.

- [8] Lévy, P.Z., Drossinos, Y., Thiel, C. (2017) The effect of fiscal incentives on market penetration of electric vehicles: A pairwise comparison of total cost of ownership. *Energy Policy*, 105: 524-533.
- [9] Lin, B., Wu, W. (2018) Why people want to buy electric vehicle: An empirical study in first-tier cities of China. *Energy Policy*, 112: 233-241.
- [10] Liu, J.H., Meng, Z. (2017) Innovation Model Analysis of New Energy Vehicles: Taking Toyota, Tesla and BYD as an Example. *Procedia Engineering*, 174(Complete): 965-972.
- [11] Zhang, L., Qin, Q. (2018) China's new energy vehicle policies: Evolution, comparison and recommendation. *Transportation Research Part A: Policy and Practice*, 110: 57-72.
- [12] Li, X.Y., Sebastian, C., Maassen, A. (2018) Emerging trends and innovations for electric bus adoption—a comparative case study of contracting and financing of 22 cities in the Americas, Asia-Pacific, and Europe. *Research in Transportation Economics*, Volume 69: 470-481.
- [13] Zhang, X., Liang, Y., Yu, E., et al. (2017) Review of electric vehicle policies in China: Content summary and effect analysis. *Renewable and Sustainable Energy Reviews*, 70: 698-714.
- [14] Wan, Z., Sperling, D., Wang, Y. (2015) China's electric car frustrations. *Transportation Research Part D: Transport and Environment*, 34:116-121.
- [15] Wang, Y., Sperling, D., Tal, G., et al. (2017) China's electric car surge. *Energy Policy*, 102: 486-490.
- [16] Yang, J., Dong, J., Hu, L. (2018) Design government incentive schemes for promoting electric taxis in China. *Energy Policy*, 115:1-11.
- [17] Li, Y., Zhan, C., Jong, M.D., et al. (2015) Business innovation and government regulation for the promotion of electric vehicle use: Lessons from Shenzhen, China. *Journal of Cleaner Production*, 134.