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## **Innovative practice of EV-carsharing in China for urban E-mobility**

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### **Abstract**

EV-Carsharing (called as 'EV-Timesharing' in China) has been rapidly developing with the 2<sup>nd</sup> round National EV promotion and application project in 88 Chinese EV pilot cities authorized by Central Governments from 2013. While EV-Carsharing has been launching in more than 10 cities by end of 2014, Central Governments will select 4 as demonstration cities from 2015 and give special support to help them integrate EV-Carsharing into urban E-mobility more successfully. Recognizing importance and benefit for energy conservation, emission and traffic congestion reduction from EV-Carsharing, encouraged by Central Governments and pilot cities, more and more cities are preparing for EV-Carsharing to develop local EV industry and expand usage for urban E-mobility.

This report is based on deep understanding of Chinese EV Pilot City as the biggest background for EV-Carsharing's boom in China in past 2 years. Through conducting comparative studies, field investigation, survey, expert interview, data collection and analysis, this report comprehensively summarizes latest status of EV-Carsharing in China and some typical practice in different cities and highlights successful experience as well as barriers on key dimensions for EV-Carsharing, including application of telematics on EVs, Governments' policy and administration, business and operating models, safety and security system and consumers' education. Suggestions and guidelines will also be provided with recommendations on operating successful EV-Carsharing for urban E-mobility and better low carbon society for both China and other areas.

*Keywords: EV-carsharing, Pilot Cities, Business and operating models, urban E-mobility*

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### **1 Introduction**

With continuous development of EV promotion and application in all fields of urban mobility, EV applied in carsharing has become increasingly widespread. Positively affected by

early well-known and successful cases worldwide, such as Car2go in Germany and Autolib' in Paris, Chinese EV-Carsharing has been blooming since 2013 encouraged by fast development of Chinese EV pilot cities and strong demand for sustainable urban mobility.

## 1.1 Background

The first EV-Carsharing project in China was 'Chefenxiang', which kicked off in 2011 and was operated by Hangzhou EVnet Intelligent Technology Co., Ltd. The company learned from experience of American Zipcar Carsharing model to carry out carsharing service of Internal Combustion Engine Vehicle (ICEV) and also conducted testing business operation of 2 EVs (vehicle model: BYDF3) using operating experience of Car2go and Autolib' EV Carsharing for reference. Followed this earliest Chinese EV-Carsharing in Hangzhou, with substantial increase of Chinese EV production and sales in the past two years as well as the 2<sup>nd</sup> round of Chinese NEV pilot city development as the most important background, EV Carsharing rapidly expands in these cities. By January 2015, at least 15 cities had begun commercial operation or entered test preparation phase while more and more cities had proposed development plan.

## 1.2 Main power for fast development of Chinese EV-Carsharing

The biggest driven power and base for boom of EV-Carsharing comes from National EV strategy and EV Pilot City project in China.

In 2012, Chinese State Council published 'Energy saving and new energy vehicle development plan (2012 - 2020),' making a strategic plan on national level that cumulative production and sales of New Energy Vehicles (NEV), including Electric Vehicles (EV) and Plug-in Hybrid Electric Vehicles (PHEV) and Fuel Cell Electric Vehicles (FEV), should reach 500,000 by 2015 and more than 5,000,000 by 2020.

To assure the national EV strategy, the Four Chinese National Ministries (Ministry of Science and Technology, Ministry of industry and information technology, the Ministry of Finance, National Development and Reform Commission) led and conducted the 2<sup>nd</sup> round national project named EV Pilot City to facilitate EV usage in urban mobility from 2013 based on the closed 3 years' 1<sup>st</sup> round project from 2009-2012. 88 cities including 30 single cities and 58 cities grouped in 9 city clusters in 9 provinces were selected as EV Pilot Cities and should promote and apply at least 5,000 EVs or 10,000 EVs for each city or city cluster in their urban mobility during 2013-2015. All 88 cities should promise to promote at least total 336,000 EVs in the 3 years.

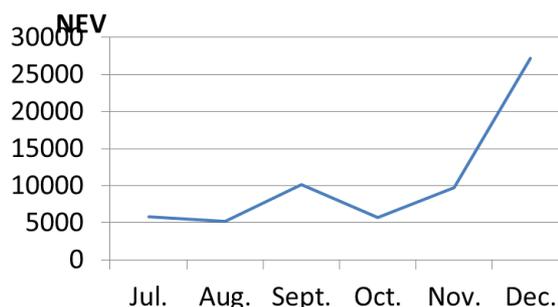


Figure 1: NEV production trend in 2014 from July to December in China

Chinese central governments and cities have adopted many policies to encourage NEV application, especially a large number of policies have been introduced densely to form effect superposition since the second half of 2014, and Chinese NEV production and sales have increased rapidly as shown in Figure 1. National annual production and sales of NEV in 2014 are respectively 78,499 and 74,763 vehicles, which are respectively at 3.5 and 3.2 times year-on-year growth. But due to various obstacles of NEV application, by the end of November 2014, the average task completion rate of the 88 pilot cities in NEV promotion and application is lower than 12%. [1]

EV applications in Chinese cities are mainly E-buses and E-taxis in public fields as well as private purchase of EV for personal and family transport. Due to limited number of buses in public transport in each city, each EV pilot city focuses on EV-Passenger cars to achieve demonstration mission. Because extended range of most current local Chinese EVs is less than 150 km, EV-Passenger cars are not suitable for taxis which need long traveling distances sometimes with uncertain routes or locations in most Chinese cities. In private EV usage field, although there are governments' subsidies and purchase tax-free policy, etc., current EV prices are still higher than the same type of traditional ICEV. Because most urban residents do not have dedicated parking spaces to install private charging poles while public charging stations are not suitable for family EVs to charge, it's hard to promote EV private purchase in the pilot cities. Similar to public bicycle sharing, EV-Carsharing generally requires a lot of outlets in a city and is easy to lay out charging poles centralized. By developing EV-Carsharing, large quantities of EVs will be purchased or rent by one or more operating companies so that promotion and application scale of a city can rapidly expand. In this context, a growing number of EV pilot cities' governments

take developing EV Carsharing as the best way and means to rapidly promote and apply EV for completing demonstration missions.

In addition, important factors in accelerating development of EV-Carsharing in China include:

- City's needs of congestion governance and developing sustainable low-carbon E-mobility. This will be analyzed more detailed in 1.3.
- City's needs of energy saving and emission reduction and controlling environmental pollution
- Reform of official vehicles of central government agencies and city governments, public institutions from the beginning of 2013, has forced a large number of needs for civil servants to rent cars, especially EVs, to travel to work. EV-Carsharing meets the convenience, security, confidentiality requirements well due to its self-driving and intelligent rent process.
- Vehicle networking, mobile Internet, big data, cloud services and other technologies and business applications are evolving, smart phone applications are popular, O2O mode continues to achieve commercial success, and intelligent vehicle management and scheduling tools as well as multiple flexible payment methods, laid a good foundation for the application of EV-Carsharing.
- The continued success and expanding demonstration effect of international Car2go and Autolib' and domestic leading EV-Carsharing projects.
- With the continued support of various policies and forces of central government, local government and various corporate, including OEM, Internet companies, insurance and car rental companies, the pace of EV-Carsharing entering the capital market is accelerated.

Ordinary consumers' feeling and understanding of sharing economy caused by the Internet and mobile Internet era are deepening that introduce a rapid improvement of their awareness, understanding and acceptance of EV-Carsharing.

### **1.3 Role of EV-Carsharing to sustainable urban mobility**

EV-Carsharing is a kind of organic integration of EV, low carbon vehicle compared with traditional ICEV, and carsharing, low carbon travel mode compared with driving private car.

- Although the result of quantitative research on the amount that a car-sharing vehicle can substitute for private cars is different, the basic consensus is: it contributes to reduce the amount of private cars' ownership or trip mileage, promotes the transition that people travel by private cars to public transport and non-motorized transport, decreases urban traffic flow and occupancy for parking space and reduces greenhouse gas emissions. It has a far-reaching meaning on low carbon , sustainable urban mobility and environmental improvement.
- Similar to public bicycle system, EV-Carsharing can set up stations in major public transport hub so as to form important complement and seamless connection to public transport .This will resolve the 'last 1 kilometer' problem of consumer and raise the use of public transport.
- Transform people's ideas on car ownership from 'owning car' to 'sharing car', change the habits people travel, reduce occupation of roads and public parking spaces due to the private cars' inefficient travel, improve the combined travel mode of using public transport and using car sharing in short-distance transshipment, significantly reduce urban traffic congestion, reduce energy consumption and emissions so as to make urban transport more optimized and low-carbon.
- EV-Carsharing can ease the demand contradiction caused by cities' restriction on purchase and travel of vehicles. Chinese urban traffic congestion is a serious problem. According to statistics, traffic congestion leads to an annual loss of 105.6 billion yuan in Beijing, equivalent to 7.5% of Beijing's GDP. The average annual economic loss of per vehicle is up to 21,957 yuan and the delay in time is 66 minutes per person per day. [2]

Many cities in China have implemented restriction on purchase and travel of vehicles to deal with traffic congestion. On December 29, 2014, Shenzhen became the eighth city which implements restriction on purchase of cars after Beijing, Shanghai, Guangzhou, Guiyang, Shijiazhuang, Tianjin and Hangzhou. In addition, Chengdu, Shijiazhuang, Chongqing, Qingdao, Wuhan, etc. are ready to do the same.

Cities like Beijing, Tianjin, Chengdu, Hangzhou, etc. implement long-term restriction on the travel of vehicles according to tail number. Some cities

will temporarily do the same due to serious haze or large-scale events.

EVs, which especially applied in EV-Carsharing business operations, are not affected by the restriction on the purchase of vehicles. They play an important role in meeting the demand of travel from residents and relieve traffic congestion contradiction in cities which have implemented restriction on the purchase and travel of vehicles.

- Improve smart transportation: By means of Internet of Vehicles, mobile Internet and Internet technology, intelligent multiple terminal interconnection will be realized among cars, charging poles, parking spaces, people as well as operating companies even the entire city traffic monitoring system. If EV-Carsharing realizes self-service and smart car rental, car rental process, battery status, driving process, security, charging poles' performance are monitored and aspects of billing payment and settlement are intelligentized, it will improve the level of smart urban mobility.
- Providing test driving to people without drive license will help improve safe driving level of urban residents.
- Providing test riding and test driving opportunities help people better understand and ready to buy EV.

In addition, to individual or corporate users, EV-Carsharing is a more economical way to travel.

## 2 Chinese EV-Carsharing and characteristics

Compared with international EV-Carsharing cases, such as Car2go and Autolib', Chinese EV-Carsharing has its unique characteristics because the precondition, history and development models are quite different.

### 2.1 Why EV-Carsharing was called as 'EV-Time Sharing' in China

Chinese EV-Carsharing is a kind of carsharing with the flowing characteristics.

- Drive by renters, no driver provided. This distinguishes it from Taxi or Uber car rental.
- EVs used for business are all purchased by operating companies or obtained from OEMs or car rental companies with legal rights to operate. No private cars are used for business. This distinguishes it from P2P carsharing which use private cars and is prohibited in most cities as illegal operation.

- Rental time is shorter than traditional car rental like Avis and Hertz. Each rent can be short as 10 minutes and most of its charge is calculated by minutes but rather days.
- Better for short distance in a city, such as 2-50kms one trip rather than long distance or intercity trip.
- Membership system: need to register to become a member, a one-time authentication.
- Intelligent full self-service, all stations unguarded.

EV-Carsharing was called as 'EV-Timesharing' officially in China from 2013. The main reason is that car rental developed rapidly from 2012, the word Carsharing was used with fuzzy boundaries among different car rental model, including some illegal carsharing business, such as P2P car rental. As stated above, EV-Carsharing mentioned in this report does not allow any private EVs used for rental business and is supported by Chinese Central Governments and cities officially. Based on the clear statement above, this report will still use EV-Carsharing to refer the current name 'Chinese EV-Timesharing'.

### 2.2 Business types and consumer groups

- Currently Chinese EV-Carsharing service objects are mainly the crowd around large high-tech enterprise campuses, universities and business centers. Members are mainly under-40-year smart phone users. Demand for travel is mainly for daily work and life travel instead of walking within the city. The most common rent distance is 5-10km one way and lease time is 30-60 minutes.
- Most current EV-Carsharing is still fixed station type. Customers are required to pick up and return EVs at the same station. But most carsharing companies are planning to launch one-way service that allows customer to return EVs to the other stations. There are 3-5 EVs in one station average.
- Network cooperation model: operating companies conduct physical division and layout of user modules based on user groups. Network settings are generally distributed in: government agencies, large universities, research institutions, large enterprises, factories, large-scale industrial parks, large residential communities, hotels, shopping malls, office buildings, parks, airports, railway stations, bus hub stations, etc.

- EV-Carsharing operating companies will generally also operate ICEVs and number of ICEVs is more than EVs, similar to Car2go. EV used is generally pure EV, and PHEV will basically not be used, mainly because it is more complex to monitor and control both of its electric quantity and fuel capacity.
- Business model mostly used is O2O (Online to Offline), and in order to improve the efficiency of EV use and increase revenue, most operating companies will take a modes combining short-time and long-term lease. For example, during the day time, use mainly short-term lease of time sharing charged according to rental minutes or combining mileage. At night, night package segment long-term lease billing model will be used. Users rent EV from office to home after work and drop the car off at carsharing station when going to work in the next morning.
- Business types include B2G (Business to Government), B2B (Business to Business), and B2C (Business to Customer). With the official use of carsharing business grows steadily, many carsharing companies have launched special programs and charging standards for business travel demand. One operating company will often carry out a business portfolio combined with B2G, B2B or B2C at the same time.

### 2.3 EV Car-sharing process

Although business models of Chinese EV-Carsharing operating companies vary, basic rent process is similar, including registration to be a member, reservation, pick-up and usage, return of EV and payment.

Registration process can be accomplished via smartphone APP or website. ID card and driver's license must be uploaded to verify identity, while some operating companies also require fingerprint verification.

Reserve and pick-up an EV can be finished via smartphone APP by LBS.

EV can be unlocked via a membership card or smartphone while some companies provide a function to unlock EV via ID card or Bank card.

Customers can pay via online payment.

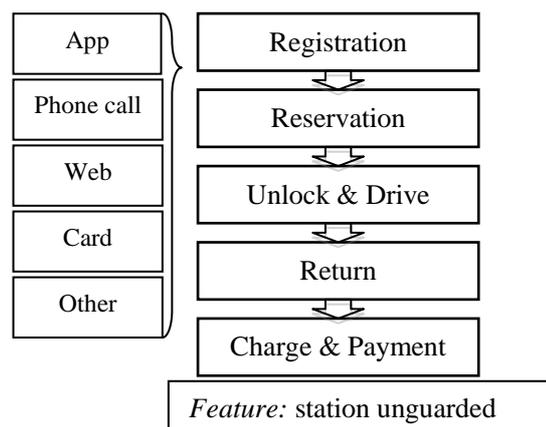


Figure 2: General process of EV-Carsharing

### 2.4 Business moduels

Mainly including: EV model selection, purchase or obtain EVs from partners, network construction combined charging poles with parking space for charging, pick-up and returning EV, customers' mobile terminals, on board equipment and terminals, monitoring and dispatching platform, call-center, repair and maintenance, insurance, finance, charge and payment, emergency rescue, etc.

## 3 Latest development of EV-Carsharing in China

EV-Carsharing has been encouraged by national and local governments' increasing support together with showing a very quick development. Various enterprises have poured into EV-Carsharing business while more EV models are available for carsharing usage and technology of software and hardware as business models developed rapidly.

### 3.1 National - Level encourage on EV-Carsharing

2014, EV-Timesharing was indicated to support for the first time in the highest national level official documents.

On July 14, 2014, General office of the State Council release documents 'Guidance on speeding up the popularization and application of the new energy vehicle', encouraging development of legal EV-carsharing and internet enterprises to participate in the new energy automotive technology research and operation service.

The National Science and Technology Plan in high-tech field was set in 2014 for the first time to support 'research on key technology and integrated demonstration' for EV-Timesharing

In June, 2014, 10 Chinese cities applied for the Special Science and Technology Project on EV-Timesharing established by the Ministry of Science and Technology. Among the 10 cities, 4 cities' plan was approved and authorized to carry out the demonstration projects as EV-Timesharing pilot cities. Each city will get a financial support around RMB 30,000,000-50,000,000 to development EV-Timesharing from 2015 to 2017.

Chinese Ministry of Transport included carsharing into its annual workshop for the first time. On this workshop in June 2014, Chinese Ministry of Transport invited Senator for Environment, Construction and Transport in Bremen, Germany to present on advanced experience of Carsharing to train 250 transport officers at provincial level and local level. This kind of training is helpful for more professional support from local governments on EV-Carsharing.

### **3.2 Local cities accelerate development of EV-Carsharing**

Besides cities which launched EV-Carsharing already, such as Beijing, Shanghai, Hangzhou, Shenzhen, more and more cities have been preparing or planning to develop EV-Carsharing, including Chengdu, Qingdao, Changsha, Wuhan, Jinhua, Hefei, Tianjin, Yancheng, Changzhou, etc. Xiamen and other 8 cities in Fujian province are under the way to operate EV-Carsharing as a group taking unified action. Same EVs, operating technology and platform, business model, service price will be adopted in the 9 cities in Fujian.

On January 8, 2015, Chongqing became the first city in Asia to launch Car2Go. Chongqing City signed a contract with Daimler to introduce Car2Go's Carsharing in China. 600 gasoline Smartfor2 will be operated in Chongqing in 2015 first before EV- Smartfor2 used for Carsharing service.

Beijing Municipal Science and Technology Commission listed EV-Carsharing as key projects in 2015 and offer 1,500 licenses for EV-Carsharing business while car rental license is controlled very strictly.

### **3.3 Academic research is strengthening**

Automotive studies in Tongji University set a team and EV-Carsharing lab to research commercial application and impact on urban mobility of car networking technology when

taking the lead in the implementation of '2011 National-level Project of Collaborative Innovation Center' for Intelligent New Energy Vehicle. The lab will conduct special research on business models, operating models and consumers' preference, etc. on EV-Carsharing.

### **3.4 Various type of enterprises are actively involved in EV-Carsharing**

Most of operating companies of EV-Carsharing in China currently are IT or Internet enterprise. They started EV-Carsharing business based on their strong development ability on system and multiple-terminals. From 2014, various enterprises are aggressively involved in. Several major EV makers, such as SAICMOTOR, Beijing Electric Vehicle Co. Ltd., and Chongqing Changan New Energy Automobile Co. Ltd., etc., all announced their plan to establish EV-Carsharing company and start business operation using their own EV productions. Some domestic traditional car rental giant, such as 'Yihai Auto Rental', ordered more than 1,000 EVs to prepare Carsharing business. Some lithium

battery enterprises, like the listing corporation, Shenzhen xingwangda has been finishing test process for EV-Carsharing cooperated with a car networking technology enterprise. In Wuhan, EV-Carsharing will be started by a specially established company, Wuhan Electric Vehicle Demonstration Operation Co. Ltd. In Chongqing, a logistics enterprise took the lead of EV-Car sharing service for EMS industry

Founded in May, 2013 in Beijing, Yiduo company, now renamed the 'one point car rental', is one of the earliest and leading carsharing companies in China who developed a set of carsharing solution including most advanced RFID multi-card recognition and accurate mileage monitoring technology domestically. By end of 2014, its business had been extended to 10 cities with more than 800 station and 15,000 ICEVs serving 200,000 registered members. This leading ICEV-Carsharing company will also enter EV-Carsharing market via cooperating with the Wuhan company. Stgcon New EnergyTechnology Co. Ltd is a provider of EV Charging station construction and service who built the first intelligent photovoltaic charging station in Beijing core shopping district. It signed a strategic cooperation agreement with an EV maker in January 2015 to launch EV-Carsharing deploying its charging network.

## 4 Best practice cases of Chinese EV-Carsharing

Some typical cases of Chinese EV-Carsharing representing different operating or business models for different service objects under different preconditions deserves attention and study for the whole industry.

### 4.1 GREENGO EV-Carsharing for official trip

An EV-Carsharing station of GREENGO, which located besides the office building of Ministry of Science & Technology, kicked off service for Central Governments' official trip on Dec. 18<sup>th</sup>, 2014. GREENGO is well known as EV-Carsharing rental for official trip usage, operated by a NEV rental company. In order to respond the call on reform of official car use system and term of eco and efficacy, Ministry of Science & Technology took the lead and adopted GREENGO. EV-Carsharing station was set up and equipped with 10 EV cars. It is the first live case in China on EV-Carsharing usage for official trip. GREENGO will continuously dedicate its service for official usage as a B2G brand. GREENGO is operated by Beijing HengYu NEV Rental Co., Ltd., established as a joint venture in June, 2014 which was 60% owned by Beijing New Energy Co., while 40% by Foxconn. The main business of HengYu is EV car rental service. Currently, the company has set up 50 rental stations in Beijing, and will put 1,500 EVs in use. [3]



Figure 3: Ministry of Science and Technology adopted GREENGO EV-Carsharing for official trip, Dec. 2014

Furthermore, as one of the Four Chinese National Ministries that lead and guide the project of Chinese EV Pilot City, Ministry of Science & Technology not only adopts GREENGO service for official trip but also encourage officers to purchase and pay it for private use.

Table 1: Characteristics of usage process Official fleets GREENGO EV-Carsharing

EVs used	E150, BMW ZINORO 1E, BYD
Registration	Phone call, online, on site
Unlock EV	After confirm the rental order, user can get the key by scan the 2D barcode on site.
Charging EV	Charging and discharging automatically: <ul style="list-style-type: none"> <li>• Plug the car key into key box, EV car will start charge automatically</li> <li>• After user select specific pre-ordered EV-car, the car will automatically shut charging switch to ensure personal safety</li> </ul>
Charge and payment	Rental fee of GREENGO is cheaper than traditional car rental service in same rental class. <ul style="list-style-type: none"> <li>• GREENGO EV-Carsharing charges RMB30/hour or RMB159/day, while traditional car rental charges at RMB169/day plus services charge and basic insurance.</li> <li>• Users can pay by Alipay.</li> </ul>
B2G + B2C	<ul style="list-style-type: none"> <li>• Besides providing service for EV-carsharing rental for official trip in the day time, officers can rent an EV from office to home after working hour for a whole night at a price of RMB99/night. For this private rental, officers should pay by themselves and return the EV before next day office hour in the morning.</li> <li>• This combined EV-Carsharing usage mode of official trip and private is more than 2 times efficient than the usage of prior official fleets. It is economic for operating company and is helpful to facilitate EV application.</li> </ul>

### 4.2 Comprehensive business and operating model of EV-Carsharing - Hangzhou 'Chefenxiang'

'Chefenxiang' is a membership-based car rental platform that provides hourly billing car rental

services to its members. It is developed and operated by Hangzhou EVnet Technology Co., Ltd. which is China's first company to develop and operate carsharing system. Currently 'Chefenxiang' mainly operates ICEV sharing by mode with vehicle purchased by themselves, system developed by themselves and fleet operated and managed by themselves. In the future it will cooperate with other car rental companies who provide vehicles and focus on output support on technology, equipment, business models and operation management. Therefore, it can expand fleet size and cities' coverage.

The company began system development in 2010 in Hangzhou and formally launched the system in the end of 2011 through test preparation, becoming the first domestic integrated provider of carsharing technology. [4]

Table 2: Hangzhou 'Chefenxiang' EV-Carsharing Project Characteristics

EVs used	EV: BAIC E150, BYD, BMW ZINORO 1E
Charge & payment	<ul style="list-style-type: none"> <li>RMB 13.7-21/hour (day), RMB 20-24/hour (night), RMB 148-198/day, Phone booking, online booking, on site registration,</li> <li>According to Alipay credit situation, providing free deposit service with maximum amount of RMB 2,000 (promotion within a stated time, as an attempt of promoting way or operating model)</li> </ul>
Business model	<ul style="list-style-type: none"> <li>B2C: began in 2012, operated mainly in Hangzhou, now also in Beijing, Changzhou. There are 80 outlets in Hangzhou. Vehicle: 150 ICEVs and 50 EVs, 92 charging piles; registered members: 20,000; active users: 30%. In addition, in Beijing, Carsharing service for community residents in Diplomatic Residence Compound has also been carried out with more than 700 EVs in operation. It is expected to have 5,000 operated EVs and charging</li> </ul>

	<p>piles by the end of 2015.</p> <ul style="list-style-type: none"> <li>B2G: in the end of 2014, in Beijing, cooperated with Beijing Hengyu New Energy Car Rental Co., Ltd., provide vehicle-mounted and system platform technology, and participate in time sharing lease of official fleets reform of MOST and BMW ZINORO1E EV official fleets of Ministry of Foreign Affairs.</li> </ul>
Operating features	Offline operational services specifications are mature, user experiences are good and consumers can rent a car within 21 seconds, company founders have good experiences such as car insurance and sales, and have detailed regulations in order cancellation fees, damages, liability compensation, 'free compensation within RMB 1,000', etc.; good marketing and promoting model.

### 4.3 Eyueche EV-Carsharing

Since 2014, Eyueche has taken business mode that provides governments or companies with technology of EV-sharing platform, in order to help transaction of currently existing fleets from traditional mode to carsharing mode. Eyueche also runs its own EV-Carsharing platform. Car rental service providers can be allied companies with Eyueche, when they include their EV cars into the platform. With the joint venture, car rental and charge of EV will be much more convenient and intelligent, in addition, regional and city EV-Carsharing platform can thus be built up. [5]

Table 3: Cases of business model of 'Eyueche', provider of EV-Carsharing platform technology service

EVs used	E150, BMW ZINORO1E (also Jieda as ICEV) By Jan. 2015, Eyueche has equipped nearly 10 EVs with the EV-Carsharing system to test the platform management and the operating process.
Structure & Service	<ul style="list-style-type: none"> <li>Eyueche EV-Carsharing platform: including pre-order of charging poles, monitoring</li> </ul>

	<p>platform, car rental platform, big data platform</p> <ul style="list-style-type: none"> <li>• Service: including platform building, vehicle system, telecom, platform maintenance, and data service</li> <li>• Income source: including platform service, technology services, management service, data service etc.</li> </ul>
Future plan	<p>In 2015, Eyueche will develop and promote the v1.0 Edition, build up O2O business mode, extend its service to at least 5 cities. In addition, Eyueche will be involved in reform of official fleets.</p> <p>In 2018, Eyueche will update its system to v3.0, extend its service to 300 cities throughout China, set up 50,000 stations, develop 2 billion users. In 2019, Eyueche will make efforts to list itself on the stock market.</p>

	<p>outlets, and need not to return the EV back to the original rent point.</p> <ul style="list-style-type: none"> <li>• provide mobile APP service searching charging poles</li> <li>• For B2B users, offer 24-hour rescue services, operating vehicle insurance, maintenance, operation data collection, vehicle rental hotspot layout and charging infrastructure installation, etc.</li> </ul>
Charge and Payment	<ul style="list-style-type: none"> <li>• Charge by minute, RMB 15 within 30 minutes, RMB 0.5/minute after 30 minutes, RMB 180 max every 24 hours.</li> <li>• Deposit: RMB 1,000</li> <li>• Support mobile banking and Alipay</li> </ul>
Future planning	<p>Mainly operating in Shanghai. By end of 2015, put 500 EVs into operation; by end of 2017, put 5,000 EVs in total into operation, and establish more complete service outlets in Shanghai.</p>

#### 4.4 Shanghai EVCARD

Shanghai EVCARD is a typical case of EV-Carsharing jointly promoted by government, industry, academic institution.

This EV-Carsharing service is operated by Shanghai International Automobile City Operation Service Company, and has functions of undertaking promotion and application task of Shanghai EV pilot city, building Shanghai International EV Demonstration Zone and improving traffic of shanghai, etc. Therefore, it gets strong support from Shanghai Municipal Government and Jiading District where Shanghai International EV Demonstration Zone is located. SAIC and Tongji University cooperate to conduct vehicle-mounted R&D, operational testing, etc.

EVCARD started trial operation at the end of 2013 at Tongji University. By January, 2015, 50 lease hotspots in total have been enabled in Shanghai, including districts such as Jiading, Songjiang, Yangpu and Pudong, etc., and 350 EVs have been put into operation with a membership of more than 3,000.[6]

Table 4: Shanghai EVCARD Project Characteristics

EVs used	SAIC Roewe E50, GM Springo, BMW ZINORO (will increase)
Service	• Rent an EV in any of the 50



Figure 4: Shanghai EVCARD mobile APP

#### 4.5 Other case of EV-Carsharing: ‘E-Micro Public Transportation’ in Hangzhou and Logistical EV-Carsharing in Chongqing

In addition to EV-Carsharing practice mentioned above, there is ‘E-Micro Public Transportation club’ in Hangzhou and Ruikang Logistical EV-Carsharing in Chongqing. Both are in large scale and deeply impacted in China currently. Though the rental process is not as intelligent as other cases, such as Eduo in Beijing, CheFenXiang in Hangzhou or EVCARD in Shanghai, both of them will promote management system and operation model in the near future. [7]

#### 4.5.1 'E-Micro Public Transportation' in Hangzhou

The 'E-Micro Public Transportation' in Hangzhou is dedicated to make car rental process as economic and convenient as bicycle rental. As a revolutionary way of transportation, it is considered as an important supplement to the public transit system, so it is named as 'E-Micro Transportation'. Since July 2013, nearly 10,000 EVs have been put into service in Hangzhou. And 4 integrated rental position and 17 stops were set up. Furthermore, it extends the service to other cities, such as Chengdu, Changsha, Shanghai, etc.



Figure 5: EV-Carsharing in Hangzhou, 'E-Micro Public Transportation'

#### 4.5.2 Ruikang Logistical EV-Carsharing in Chongqing

Chongqing Ruikang Logistical EV-Carsharing is the first company who adopts logistical EV-Carsharing at a large scale in city logistics distribution. The EV-Carsharing project is operated by Chongqing Ruikang New Energy Auto Co., Ltd. which was set up in June 2013. [8]



Figure 6: Logistical EV-Carsharing in Chongqing

The logistical service of Ruikang has its own characteristics, such as fixed logistical distribution routine, short mileage of single trip, building charging station based on distribution routine, intensive distribution aiming at low-carbon of domestic initiation, etc. Till now, nearly 120 EV-cars of the EV mode 'DongFeng Xiaokang' has been put in service, delivering express among university campus and huge residential community.

## 5 Challenges and suggestions

Although EV-Carsharing is in explosive growth driven by national and local governments' political will and leadership as well as various enterprises' business effort, progress is slower than expected or planned. There are few stations and small size EV-Carsharing fleets with general less than 100 EVs in a city. The economy of operating companies is poor while it is not convenient to rent EVs from fewer stations thus customers' acceptance is very low so far.

Main challenges and suggestions are pointed out and proposed as follows.

- As a new urban travel-mode, EV-Casharing was not recognized its characteristics of public service to a certain degree officially but just a general car rental business. Besides operating licenses are difficult to obtain and layout of stations lacks of support from governments, the biggest obstacle is that chaos and confusion appeared on commercial operation, asset categories, traffic rule such as whether it is required to limit line as usual, tax management in some cities without clear classification of EV-Carsharing. Central and local governments should give a clear classification for EV-Carsharing. In addition, local governments should integrate EV-Carsharing into cities' development planning, land use planning and transport planning for sustainable urban mobility based on regarding EV-Carsharing's public characteristics.
- Usage of EV-Casharing in Governments and public institutions is not much. Governments should actively take the lead of deploying EV-Carsharing as official fleets and purchase the service for private trip to play an exemplary role.
- The majority of local governments would like to support the use of local EV, which is not conducive to EV-Carsharing companies using more appropriate EV models. Local government should open local market to form fair competition.

- There is very little publicity on EV-Carsharing. Governments should strengthen the propaganda and educate consumers
  - EV-Carsharing was practiced by different operating companies and cities with little coordination or communication. Codes and industry standards are in lack on technology, service flow, payment, insurance, emergency rescue, etc. Industry associations should be established to address common issues and form standards for operation.
  - Most EV modes currently on the market are in preparation for the private purchaser but not suitable for EV-Carsharing fleets. EV makers should try to develop more suitable EV modes with reasonable price and size and make front loading equipment easy to dock with EV-Carsharing backstage management system.
  - Insufficient charging facilities are currently the biggest bottleneck for EV usage. Governments should coordinate various forces to address unreasonable distribution, insufficient number and differed charging standards and payment methods, etc.
  - Operators should strive to improve technology and operation ability, positively cooperate with EV makers, car rental companies, charging facilities operators, insurance companies, etc. to provide better travel service for consumers.
- In short, EV-Carsharing shows limitless market prospects in China in the context of there are 0.5 billion smartphone users and 0.25 billion drivers while private car purchase and traffic are controlled as well as traffic congestion and haze aggravates. Governments, enterprises, research institutions and consumers should work together to help improve technology, operation, and economic efficiency for EV-Carsharing and make it contribute more significantly for sustainable urban mobility.

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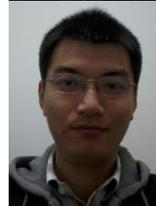
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