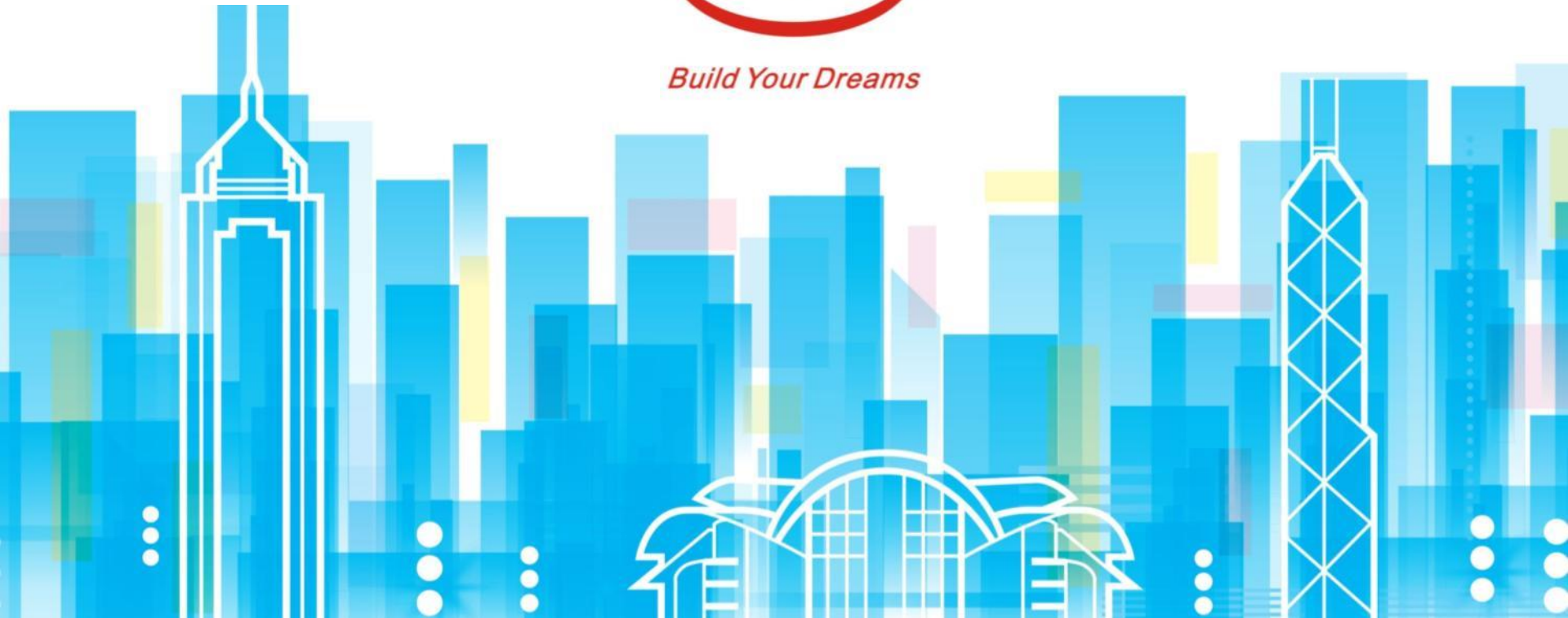


Electrified Public Transport



Build Your Dreams





Electrified Public Transport

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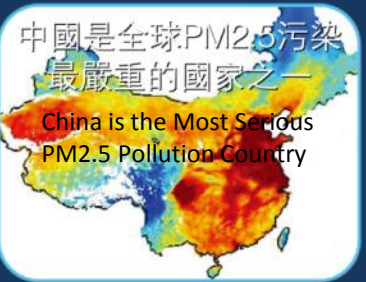
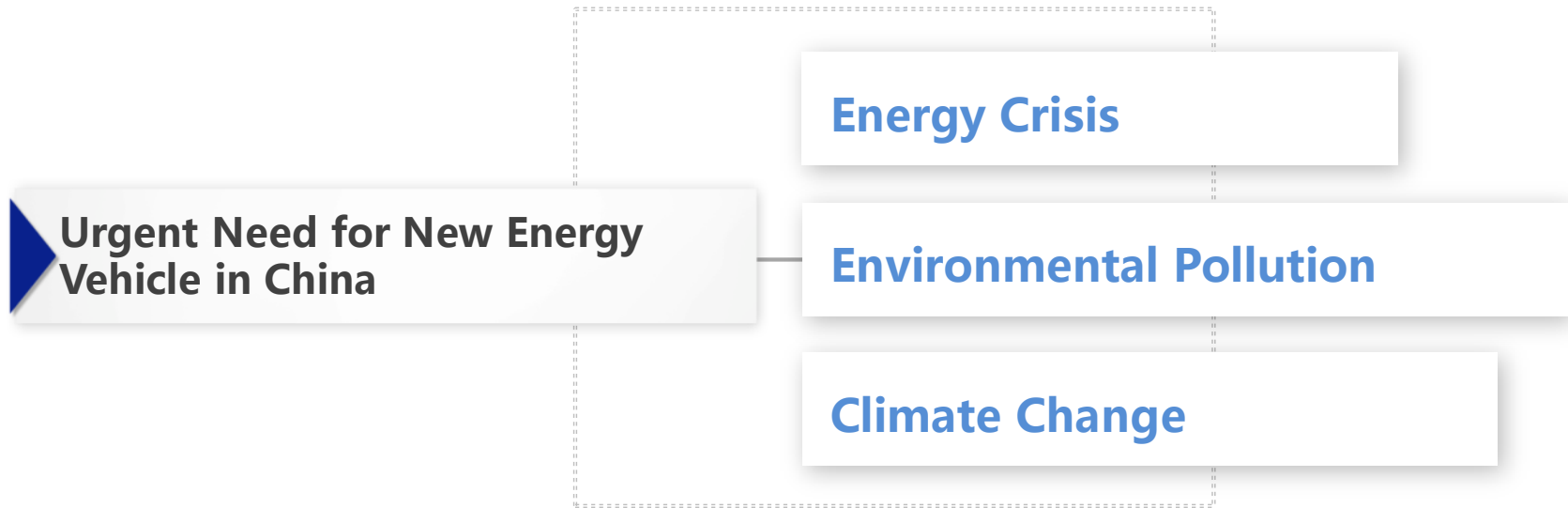
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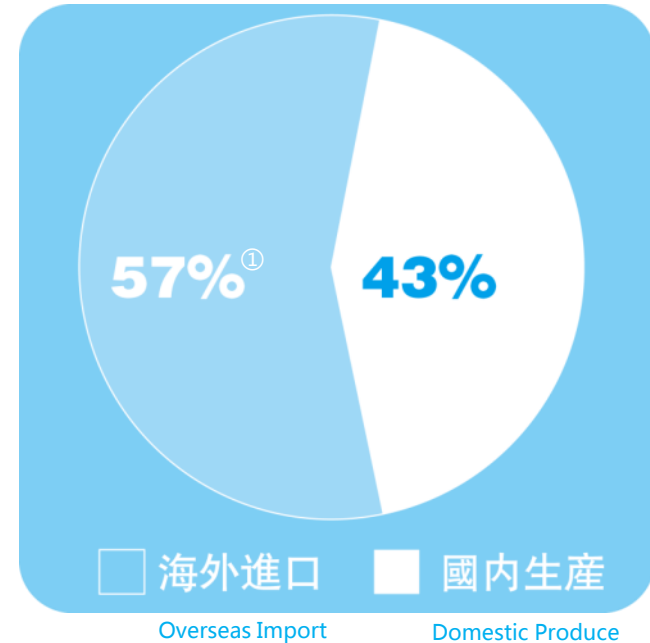


▶ 2011 China Oil Consumption

China's dependency on foreign oil has increased during the past century, from 32% to 57% in 2011, almost exceeding the warning level (60%) of the degree for foreign dependency. The foreign oil dependency rate of the US is 53%. In 2011, China's crude oil output was 270 million tons, while import volume was 358 million tons and total oil consumption was 628 million tons. This is a severe energy situation^①

In 2012, both the production and sales volumes of China's automobile business exceeded 19 million, car ownership in China exceeded 100 million. At present, consumption of diesel fuel by automobiles accounts for 65% of the total national consumption. New vehicles account for 70% of the annual increase in oil consumption^③. China's current oil reserves can only sustain for 30 days^④

2011 China Oil Source Proportion



China has become the world's largest energy consumer. The energy problem has become an issue of strategic national safety, which has created a more pressing need for China to develop new energy vehicles over other countries.^⑤

① Chinese Energy Policy White Paper

② China Association of Automobile Manufacturers

③ Ministry of Industry and Information Technology of the People's Republic of China

④ Ministry of Commerce of the People's Republic of China

⑤ BP World Energy Statistics 2011

▶ **PM2.5 comes mainly from vehicle emissions and is hazardous to people's health**

Only 1% of city dwellers in China live below the level of 40µg density, and 60% live above 60µg^① density. However, the WHO standard for PM2.5 density is under 20µg/m³. ②

PM2.5 is hazardous to human health. If the density of PM2.5 rises by 20µg/m³, it could cause 340,000 people death.



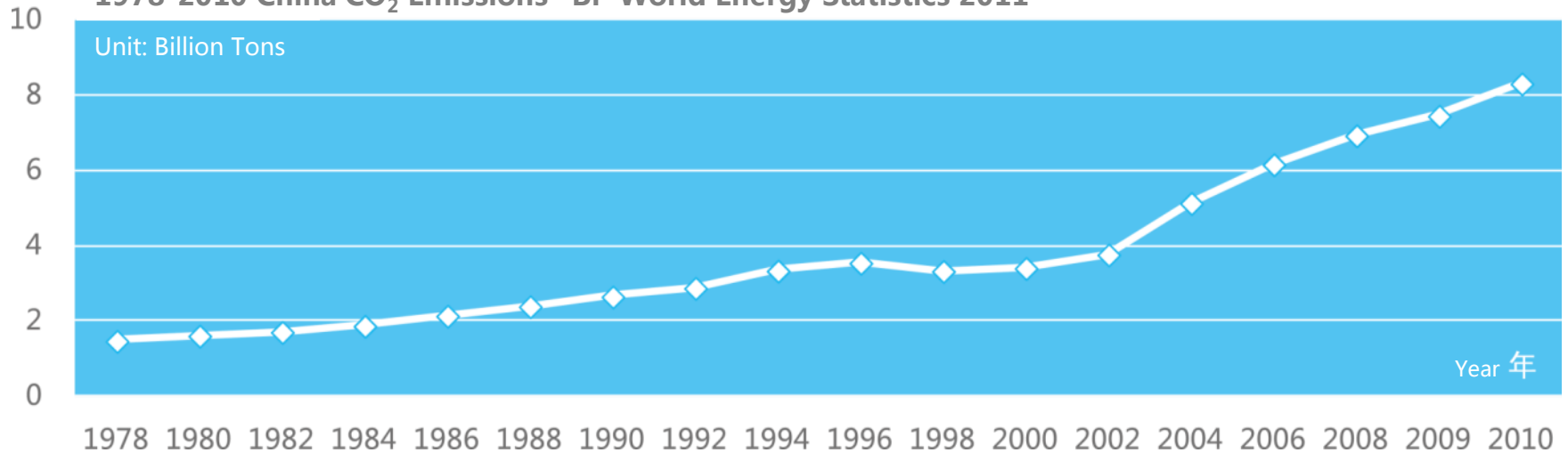
Source : ① 《Workers' Daily》 http://media.worker.cn/grrb/2011_12/02/GR0601.htm

② UNEP(United Nations Environment Programme)

▶ The Harmfulness of CO₂

- Intensified flood and drought disasters
- Cause various kinds of diseases and are harmful to people's health

1978-2010 China CO₂ Emissions— BP World Energy Statistics 2011



Excessive car emissions will cause global climate warming, accelerate glacier melting and sea horizon rising – after 400 years, even Shanghai will disappear.

From 1906 to 2005, global earth temperature has increased by 0.74°C at a rate of 0.2°C every 10 years.

From 1951 to 2009, China's ground temperature has increased by 1.38°C at a rate of 0.23°C every 10 years.



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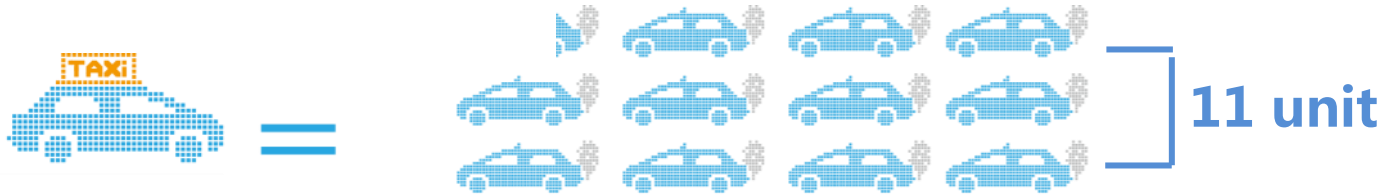
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Environmentally Friendly – Pure Electric Taxi



The Emissions of One LPG Taxi in a Given Day is Equivalent to **11** Gasoline Private Cars



Pure Electric Taxi Consumes 0 liters LPG per Day

Change to **27,051** Pure Electric Taxis

Save 490 Million Liters Diesel per Year

Reduce 0.75 Million **CO₂** Tons per Year ^①

1 Subsidize 1 Pure Electric Taxi **+**

11 Reduce 11 Private Cars' Emissions **-**

11 Equal to Subsidizing 11 Private Cars **=**

① Exeter University, UK



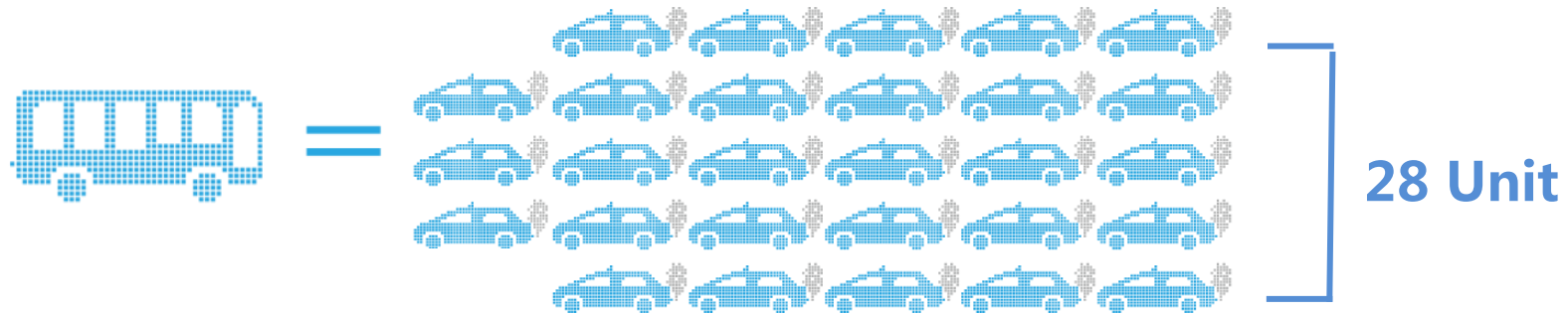
Fuel Saving and Emission Reduction per Pure Electric Taxi

Time Period	Fuel Savings (Liters)	CO2 Emission Avoidance (Tons) ^①	Trees Planted (Units) ^②
1 day	50	0.13	0.07
1 month	1,521	2.3	1.3
1 year	18,250	27.6	15

① Exeter University, UK ②IN-EN.com <http://www.in-en.com/>



Environmentally Friendly – Pure Electric Bus



The Emissions of One Bus in a Given Day is Equivalent to **28** Gasoline Private Cars

Change to 17,046
Pure Electric Buses

Save 778 Million Liters
Diesel per Year

Reduce 2.12 Million
Tons per Year



1 Subsidize 1 Pure
Electric Bus



28 Reduce 33 Private
Cars' Emissions



28 Equal to Subsidizing
28 Private Cars





Total Environmental Benefits

The emission from **27,051** taxis in Singapore is equivalent to the emission from **297,561** private cars

The emission from **17,046** buses in Singapore is equivalent to the emission from **477,288** private cars

**All Total 774,849
Private Cars**

If we change all the taxis and diesel buses in Singapore to pure electric taxis and pure electric buses

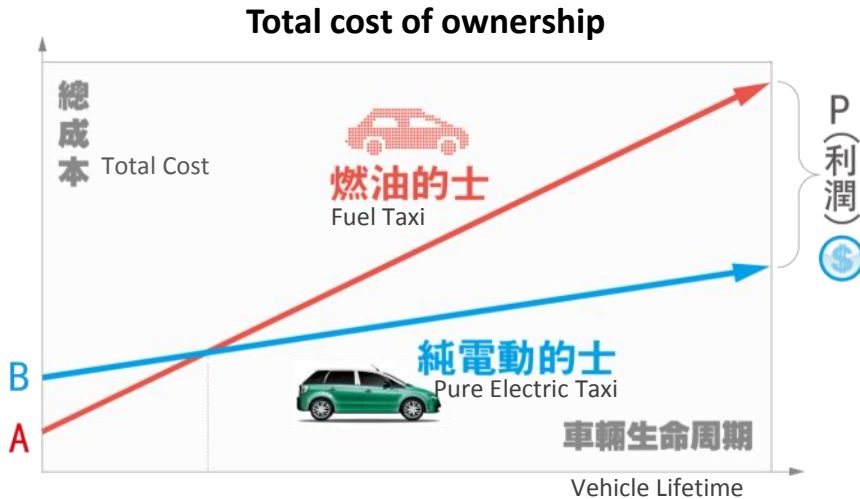
$$\frac{77.5 \text{ (Unit: 10,000)}}{77.5 + (81 - 4.4) \text{ (Unit: 10,000)}} \times 100\% = 50\% \text{ vehicle emissions will be avoided each year}$$

↓
↑
↑

The Population of Singapore Motor Vehicles
The Amount of Singapore Bus and Taxi

Source: Exeter University, UK

\$ Economic Benefits of Pure Electric Taxi



A. The purchase cost of an LPG taxi B. The purchase cost of an electric taxi
 P. The operating cost saved as a result of the difference in LPG and electricity prices

Daily Driving Range is 500 Km	Diesel Taxi	Pure Electric Taxi
Operation 365 Days per Year		
Fuel Consumption per 100Km	10	26
Fuel Price/Electric Price(SGD)	1.2	0.27
Vehicle Price(SGD)	37,000	70,000
Purchase Tax (SGD)	30,000	0

Unit: SGD	Diesel Taxi	Pure Electric Taxi	Cost Saved Compared with Diesel Taxi and Electric Taxi (SGD)
Operating Expense Per Km	0.12	0.07	0.05
Operating Expense Per Day	60	35	25
Operating Expense Per Month	1,800	1,053	747
Operating Expense Per Year	21,900	12,812	9,089
Operating Expense For 8 Years	175,200	102,492	72,708
8-year Increased Cost	Vehicle Price	(SGD)	-33,000
	Purchase Tax (SGD)		30,000
8-year Saved Cost			69,708



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The Pure Electric Taxi with the Longest Driving Range

Driving Range : 300 KM

Charging Time : 2h

AC Charging

500 Patents



The Largest Operational Pure Electric Bus Fleet with the Most Stability and Reliability

Driving Range : 250 KM

Charging Time : 5h

In-Wheel Motor

AC Charging

300 Patents



BYD Pure Electric Taxi e6 Promotion Plan in Singapore

- 2013 Trial Run 100 electric taxis**
- 2014 Mass operation 500 electric taxis**
- 2015 Mass operation over 1000 electric taxis**

**Exploring the Idea for Co-existence of the
Sale and Lease Models
Searching for Charging Partners**



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Six Misunderstandings about Electric Vehicles

1. High Price
2. Short Lifetime
3. Safety
4. High Cost in Maintenance
5. Inconvenience of Charging
6. Environmental Friendliness





The Life of a BYD Electric Taxi is Far Beyond Users' Requirements

Definition of electric taxi life: The cumulative distance that can be travelled before normal basic use cannot be satisfied on a single charge.

1. A BYD e6 Pure Electric Taxi has a Life of Over 1 million Km

Regarding practical usage, a pure electric vehicle with a driving range of over 200 Km on a single charge can meet the demands of daily use. The BYD e6 can run for 300 Km under standard conditions before needing recharging, which means when it runs for 200 Km it uses just 70% of the battery power.

By conservative estimation, the battery capacity of the BYD e6 pure electric taxi remains at more than 75% after 4,000 charging cycles. $4,000 \times 260 = 1,040,000$ Km

Life of 1 million km can completely meet the demands of a taxi or a private car.

Life of a Pure Electric Vehicle – BYD e6 Pure Electric Taxi as an Example	
Initial Driving Range(Km)	300
Charging Cycle(Times)	4,000
SOC	≥ 75%
Reduced Driving Range (Km)	≥ 225 (300Km*75%)
BYD e6 Pure Electric Taxi Lifetime ≥ 4,000*260 km=1.04 million Km	

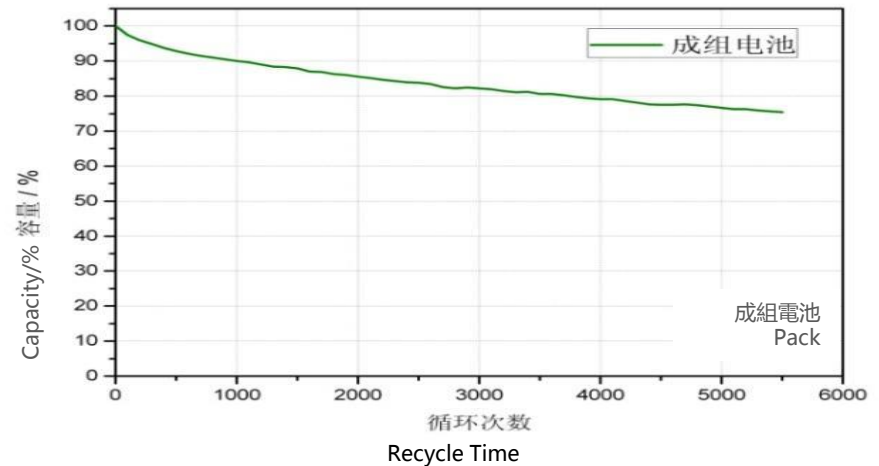
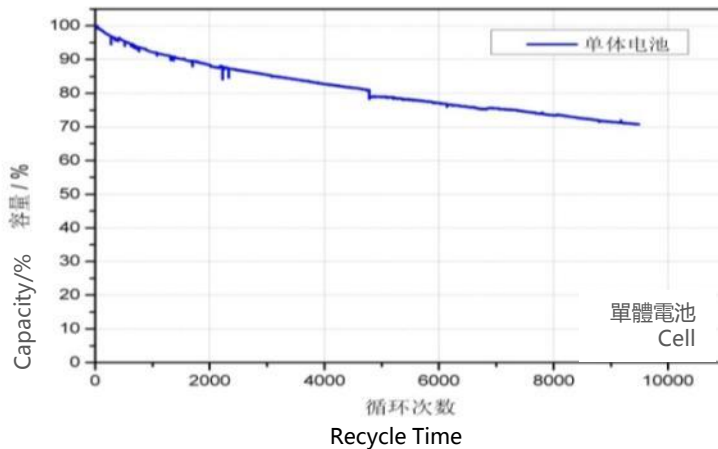
二、Rigorous Scientific Test Validation

1、BYD professional lab test data

After 9,500 cycles, the battery capacity of a single battery still remains at 70.7%.

How the test is done: with 6 cycles of charging and discharging per day, this 9,500-cycle test takes 5 years to get the data.

2、Battery packs are tested under continuous load, therefore the surface temperature of the battery could reach up to about 40°C. Even under such harsh conditions, the capacity remains at 85% after 2,000 cycles, over 75% after 4,000 cycles.

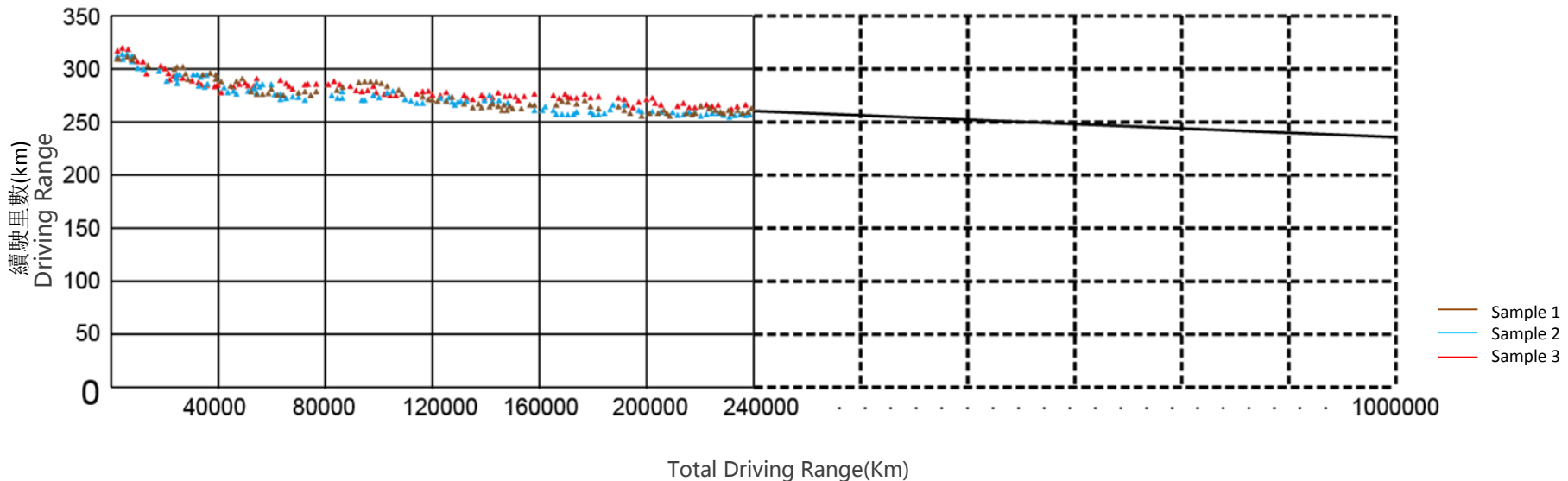


三、BYD e6 taxi operation case in Shenzhen

1. BYD successively introduced 800 e6 pure electric taxis in Shenzhen from 2010. By Mar 2013, the accumulated mileage of the whole fleet had reached up to 55 million Km, and the highest mileage of a single e6 taxi is nearly 300,000 Km.
2. After the accumulated mileage has reached 200,000 Km, the driving range of e6 on a single charge can still reach more than 250 Km, and the battery capacity remains at more than 85%. The capacity degradation rate obviously slows down.
3. The temperature in Shenzhen is generally high all year round, and air conditioning is on all the time, which consumes more electricity than in other cities. Taxi drivers usually accelerate quickly and brake suddenly. These influence the battery life. However, its life still can fully satisfy the taxi operation requirements.

Driving Range Variation

Sample Analysis of e6 Pure Electric Taxi



▶ BYD Choose Fe Battery to Make Sure BYD Electric Vehicle Safety

A、Heat Stability BYD Choose LiFePO4 Battery

Battery safety is categorized into "electricity safety" and "heat safety"

	LiCoO2	LiMn2O4	LiFePO4
Heat Stability	Resolve and release O ₂ at 180°C	Melting temperature is higher than LiCoO2	Stable structure even at 600°C. No O ₂ release
Energy Density	150-160 Wh/kg	Lower than LiCoO2, and higher than LiFePO4 battery	100-110 Wh/kg
Applicability	Cell phone, laptop	Vehicles (Japanese car)	Vehicles, energy storage station
Chemical Principle & Lifetime		Under 50 degrees, the cathode material Mn will melt into electrolyte, shortening the lifetime	Ferric iron is very stable and will never have chemical changes. Long lifetime

BYD choose the highest safety Lithium Iron Phosphate battery to ensure the safety of the car.

Fe Battery not only meets all China's standards, but it also passes the stringent US FMVSS standard

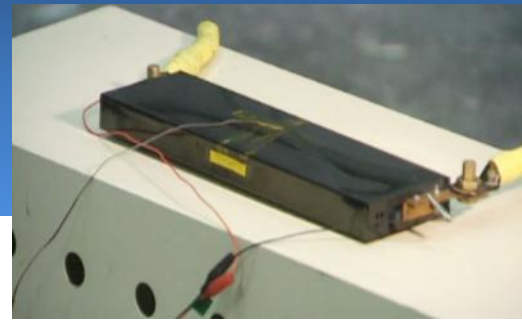
B、 High Safety Performance to Withstand Harsh and Extreme Tests

During the R&D process, the Fe Battery is put through harsh and extreme tests, including flames, short circuit, prod, strike, high temperature, extrusion and overcharge, to make sure the Fe Battery is safe enough to handle all kinds of extreme situations which may arise.

Flames



Short Circuit



Prod



Strike



High Temperature

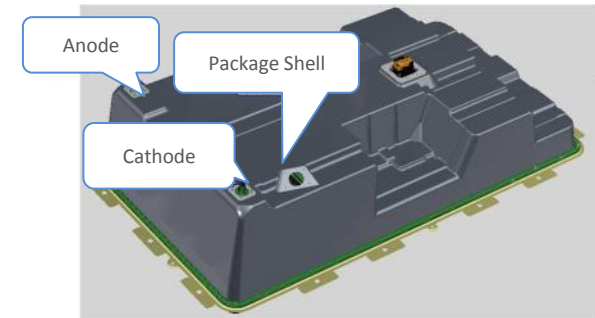
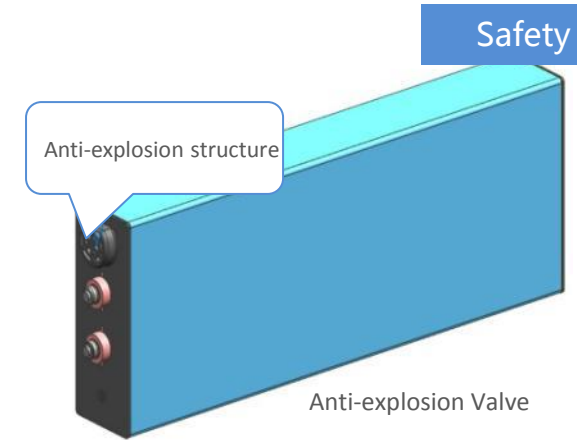


Extrusion

C、 Multiple Safety Protection Measures

Taking the BYD e6 pure electric taxi as an example, the battery cell, battery module and the whole battery system incorporate all necessary safety design features and multiple measures to ensure safety and protection.

1. Anti-explosion valve design ensures that the battery can start up and release the pressure, to prevent the battery from exploding in case of an abnormal situation.
2. High pressure safety design prevents accidents from happening.
3. Battery module high resistance / high performance design – modules and shells use plastic insulating material certified by UL, offering excellent insulation performance.
4. Flame-retardant materials of battery pack interior and external induction design can eliminate hidden danger by man.



Battery module and package shell insulation protection

D、 Tests by US and China Authorities Affirm BYD Fe Battery

The BYD e6 pure electric taxi not only passes China’s compulsory tests about vehicle collision safety, electric system safety, battery safety and so on, but also meets the criteria of FMVSS, US-NCAP, IHSS cycle test and ECE R100.

E、 5.26 Incident Evaluation by Third Party Experts

The type and severity of 5.26 traffic accident is extremely rare

Super speed impact + two collisions, electric arc ignited combustible interior materials.

BYD e6 power battery didn't explode

After 30 minutes of burning, another 30 minutes of water logging, sun exposure and rain in the parking spot, the power battery did not explode.

72 battery cells, **75%** of all 96 cells of the e6 battery were not damaged and still worked.

24 cells, **25%** of the e6 battery cells, received burns to the aluminium alloy shell and battery plate – but the setting of the battery plate remained intact, and no cracks appeared.

No flaws in the safety design

The design of the battery system in relation to the installation layout on the vehicle, the insulation protection and the high voltage system is practical.

▶ Same or Even Lower Maintenance Cost of Electric Taxi than Traditional Car (with reference to the case of Shenzhen)

Parameter	Gasoline Taxi	BYD e6 Taxi
Maintenance Rate per Year	26	15
Cost for One Maintenance Service (RMB)	350	500
Maintenance Cost per Year (RMB)	9,100	7,500
Maintenance Frequency	Every 5,000-7,000 Km after first free maintenance	Every 10,000 Km after first free maintenance
Maintenance Items	Engine oil, gear oil, fuel filter, air filter, oil filter, brake fluid, steering fluid, antifreeze	Gear oil, brake fluid, steering fluid, antifreeze

Besides the fuel cost, the maintenance cost of the a pure electric taxi is much lower than a traditional gas taxi,
saving 1,600 RMB per year and 8,000 RMB in 5 years.

▶ **Maintenance Cost Comparison between BYD Pure Electric Bus and Diesel Bus (with reference to the case of Shenzhen)**

Battery, motor and electronic control unit, the three key components of the BYD electric bus, have a warranty of 8 years.

After-sale Maintenance Cost

Model	Maintenance Cost for 50, 000 Km	Maintenance Items	Maintenance Features
Diesel Bus	3,500(RMB)	Engine, transmission, brake system	Short warranty, high component price and high labour charges
BYD Pure Electric bus	1,800(RMB)	Low-voltage apparatus, lube and antifreeze	Long warranty, low component price and low labour charges

Besides fuel cost, the maintenance cost of a pure electric bus is much lower than a traditional diesel bus, with the average of 1.5 times of maintenance service needed, it saves **2,550 RMB per year and **12,750 RMB** in 5 years.**

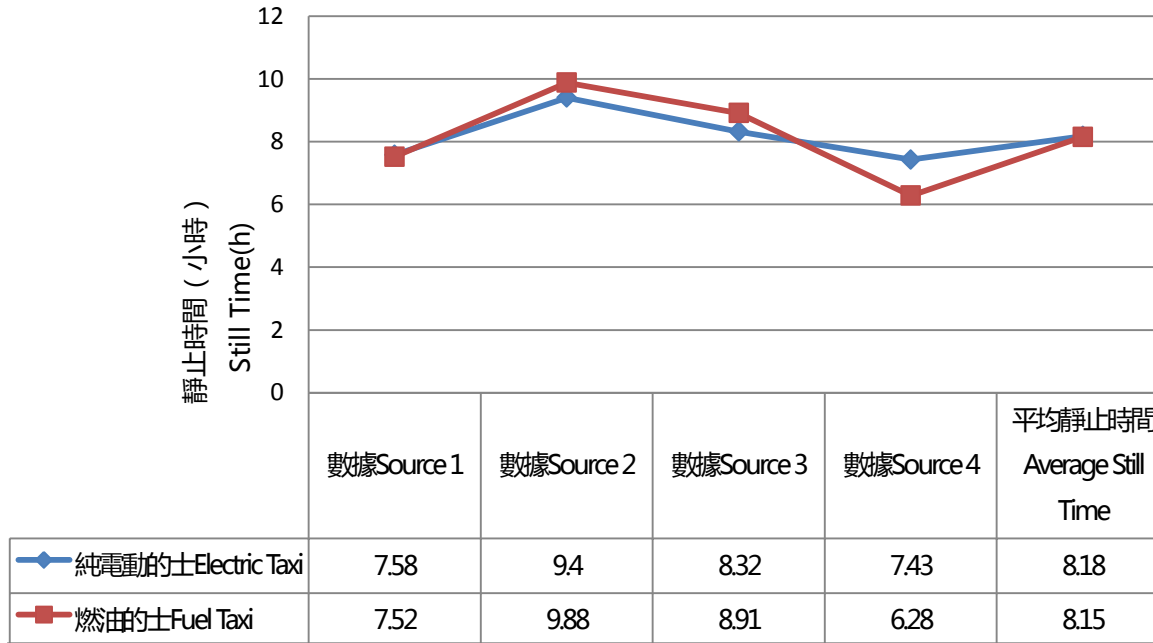
Note: Aug 2011 to Sep 2012 actual operation data. Traditional Fuel bus maintenance cost is estimated.

▶ Electric Taxi Charging is Convenient, with No Influence on Taxi Operating Time

Charging Time

Taxi GPS data indicates that taxis run 66% of the time everyday, and remain stationary 34% of the time (about 8.16 hours). The time required to charge the BYD e6 is much less than its stationary time. Charging time does not occupy the operating time at all.

The charging time is very flexible. The BYD e6 can be charged during lunch or shift change, or whenever the car is close to the charging stations depending on actual operation. It is easy to achieve a 500 km driving range per day.

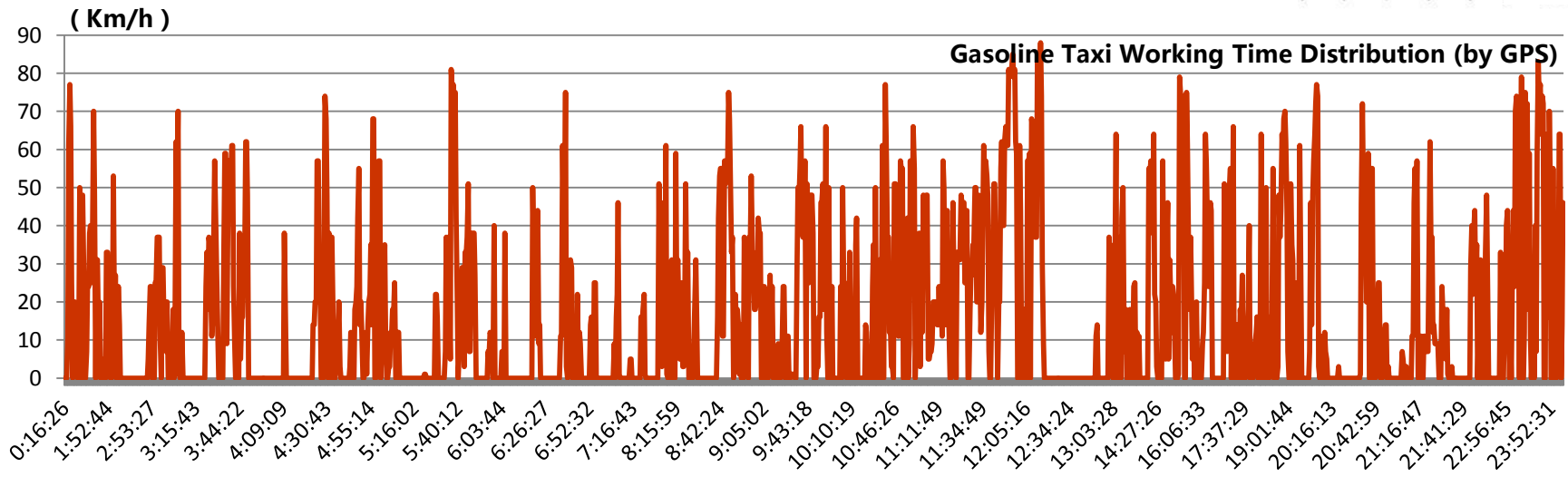
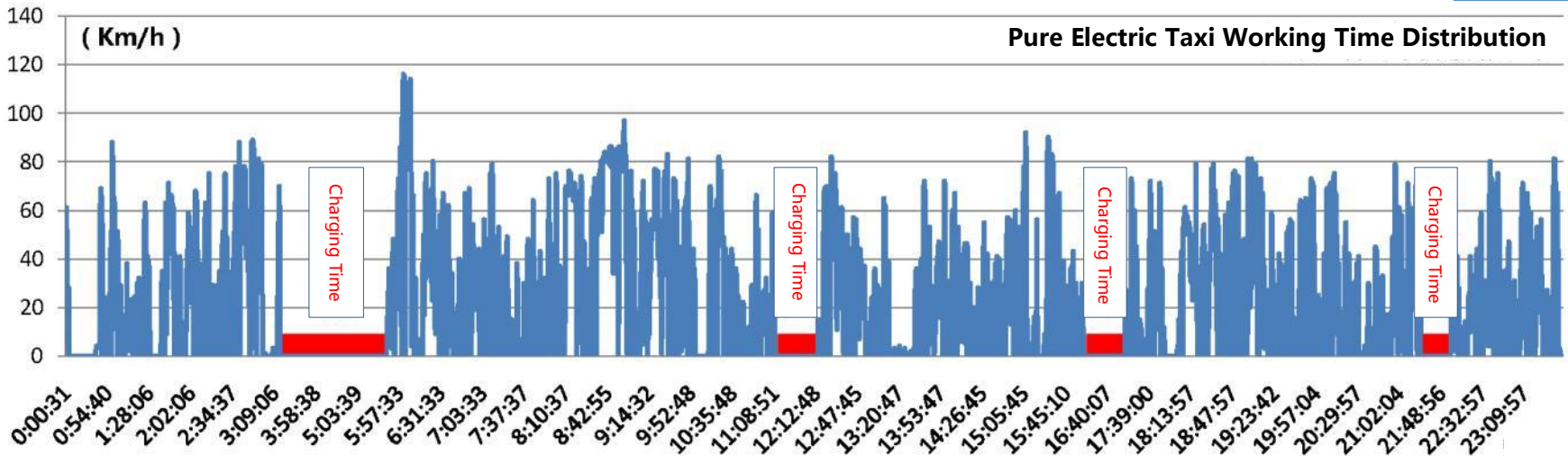


Notes: Electric taxi still time includes 3h charging time.

At the same time, pure electric taxi drivers will become more healthy by having a more regular working schedule, because they have to get rest during the charging time, reducing car accidents and hazards of occupational diseases. In view of factors of queuing, temporary breaks and so on, the total working time for electric taxis is almost the same as gasoline taxis.



Pure Electric Taxi\Fuel Taxi Daily Operation Data(From GPS)



Note: 0 km/h means that the car is still (rest, charging, waiting etc.); > 0 km/h means that the car is running.

■ means Charging Time. The data shows that the resting time of electric taxis is more concentrated and regular; the daily stationary time of fuel taxis is more disperse with more occasions of temporary resting and waiting for passengers.



Fe Battery Environmentally Friendly Features

No Pollution from the whole process!

Raw Material

Raw materials and components have no heavy metal and halide (inorganic salts and graphite), and the design can be natural degradation.
Nontoxic Electrolyte

Production



No Preservatives
Standard Module for Recycling
Little wearing of raw materials; the discarded semi-finished products can be recycled
Value recovery and utilisation of heat and electricity; all kinds of emissions meet the most stringent regulatory requirements

First Use



Vehicle Power
Zero Emissions
The first 7,000 cycles for a continuous 12-15 years

Next Use



Used on BYD Storage Service provides a platform for recycling
Storage – cut peaks and fill valleys for emergency, renewable energy storage
7,000 – 10,000 cycles for a continuous 13-27 years

Recycling



Battery Recycling, Save Resources.

- The general impressions of electric vehicles are: high price, short lifetime, high maintenance cost, inconvenience of charging, unsafe usage and not environmental friendly;
- Actually, it's inexpensive with continuous savings. The power battery has a **long lifecycle and low** maintenance cost. It's **convenient** to charge and **safe** for use, and the battery can even be recycled for use in an energy storage system, bringing huge environmental benefits.



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城市公共交通電動化

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Thank you!

