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ACCELERATING NEW ENERGY VEHICLE UPTAKE IN CHINESE CITIES

ASSESSMENT OF POLICIES FOR PRIVATE PASSENGER CARS IN LEADING CITY MARKETS

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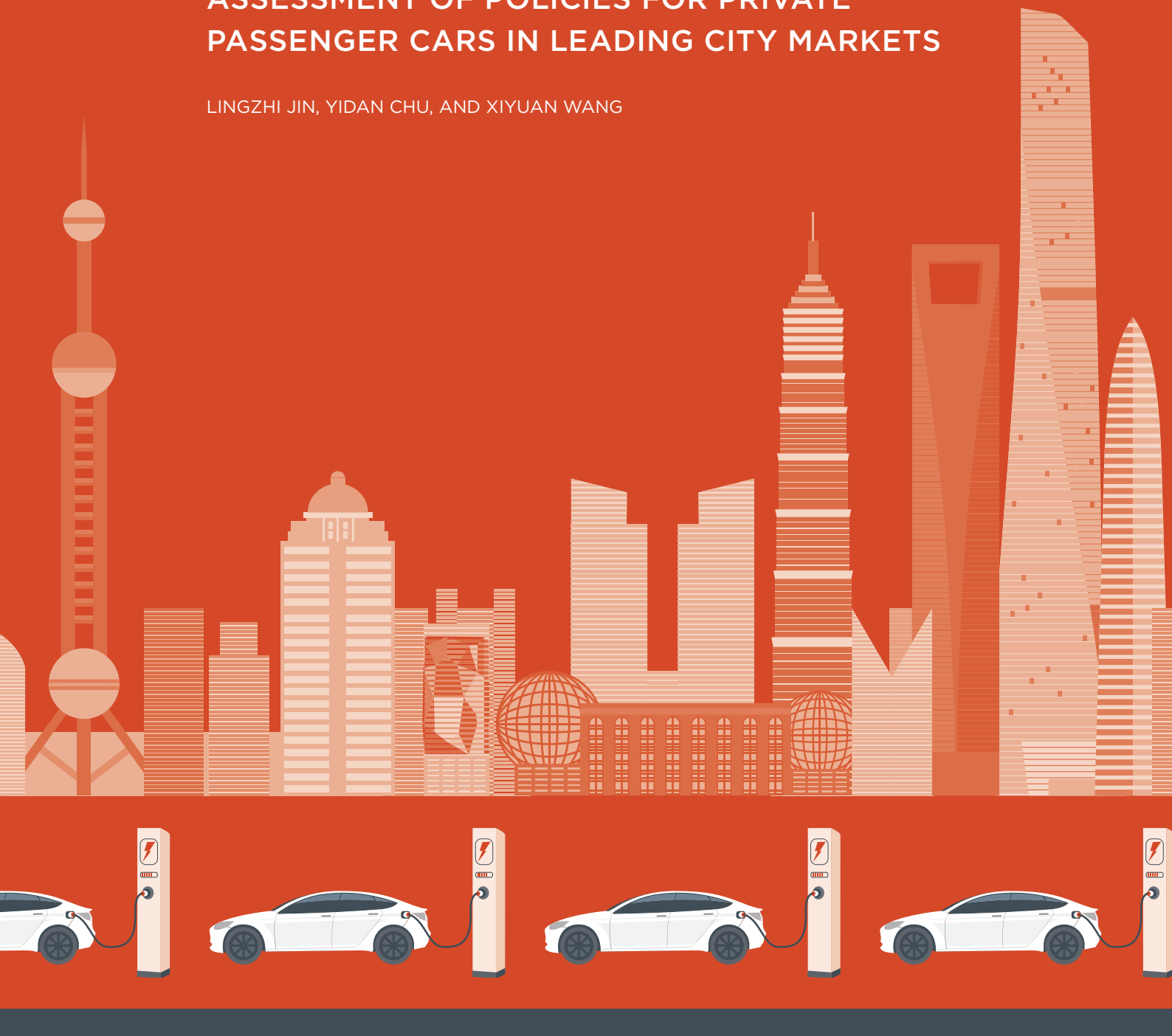

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EXECUTIVE SUMMARY

Focused on 13 leading cities in China, this work is a comprehensive overview of major city-level government incentives for private new energy passenger car (NEPC) consumers in 2020 as compared to 2015, the last year for which ICCT analyzed the incentives. We assess policies supporting battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) by comparing them to market performance. For context, this paper also includes an overview of central government policies for new energy vehicles (NEVs) and the level of charging infrastructure build-out in the 13 cities.

We catalogued 19 promotional actions in place in 2020 across the cities and they are listed in Table ES1. On average, cities deployed 10 different policies, and the range was four to 15.

Table ES1. Summary of NEPC incentives by city, 2020 (cities listed in descending order of new NEPC sales in 2020)

City	City-level actions																			
	City planning					Direct consumer fiscal incentives							Indirect consumer incentives							Total incentives
	Pilot city (2009–2010)	Pilot city (2013–2014)	NEV Deployment target	Charging infrastructure planning	NEVs to the Countryside city	Vehicle replacement rsubsidies	BEV usage Subsidies	PHEV usage Subsidies	Home charger Subsidies	Charging fee subsidy and reduction	Parking fee reduction	Road toll reduction	Public charger subsidies	Charging in existing neighborhoods	Dedicated parking space	NEV-ready building code	Preferential access to license plate	Preferential road access	Battery recycling subsidies	
Shanghai	●	●	●	●						●			●	●	●	●	●			10
Beijing	●	●	●	●									●		●	●	●	●		9
Shenzhen	●	●	●	●		●	●	●		●	●		●			●	●		●	13
Guangzhou	●	●	●	●			●			●			●		●	●	●			10
Tianjin	●	●	●	●						●			●	●		●	●	●		10
Chengdu	●	●	●	●	●	●			●	●	●		●	●		●		●		13
Liuzhou			●	●						●	●		●	●	●	●		●		9
Haikou	●	●	●	●	●		●	●		●	●		●	●	●	●	●	●		15
Nanjing		●	●	●		●				●	●		●		●	●				9
Xiamen	●	●	●	●						●	●		●			●				8
Sanya			●	●			●	●		●	●		●	●	●	●	●	●		12
Zaozhuang			●	●							●					●				4
Ningde		●	●	●						●	●	●			●	●				8
Total Cities	**8**	**10**	**13**	**13**	**2**	**3**	**4**	**3**	**1**	**11**	**9**	**1**	**11**	**6**	**8**	**13**	**7**	**6**	**1**	**130**

To further assess the different levels of policy effort across cities, we quantitatively evaluated the benefits that different city policies bring to an individual private NEPC consumer. Figure ES1 shows these monetized private car consumer benefits for the three car models selected for this analysis: the 120 km electric range Wuling Hongguang Mini BEV, the 445 km electric range Tesla Model 3 BEV, and the 148 km electric range Li One PHEV.

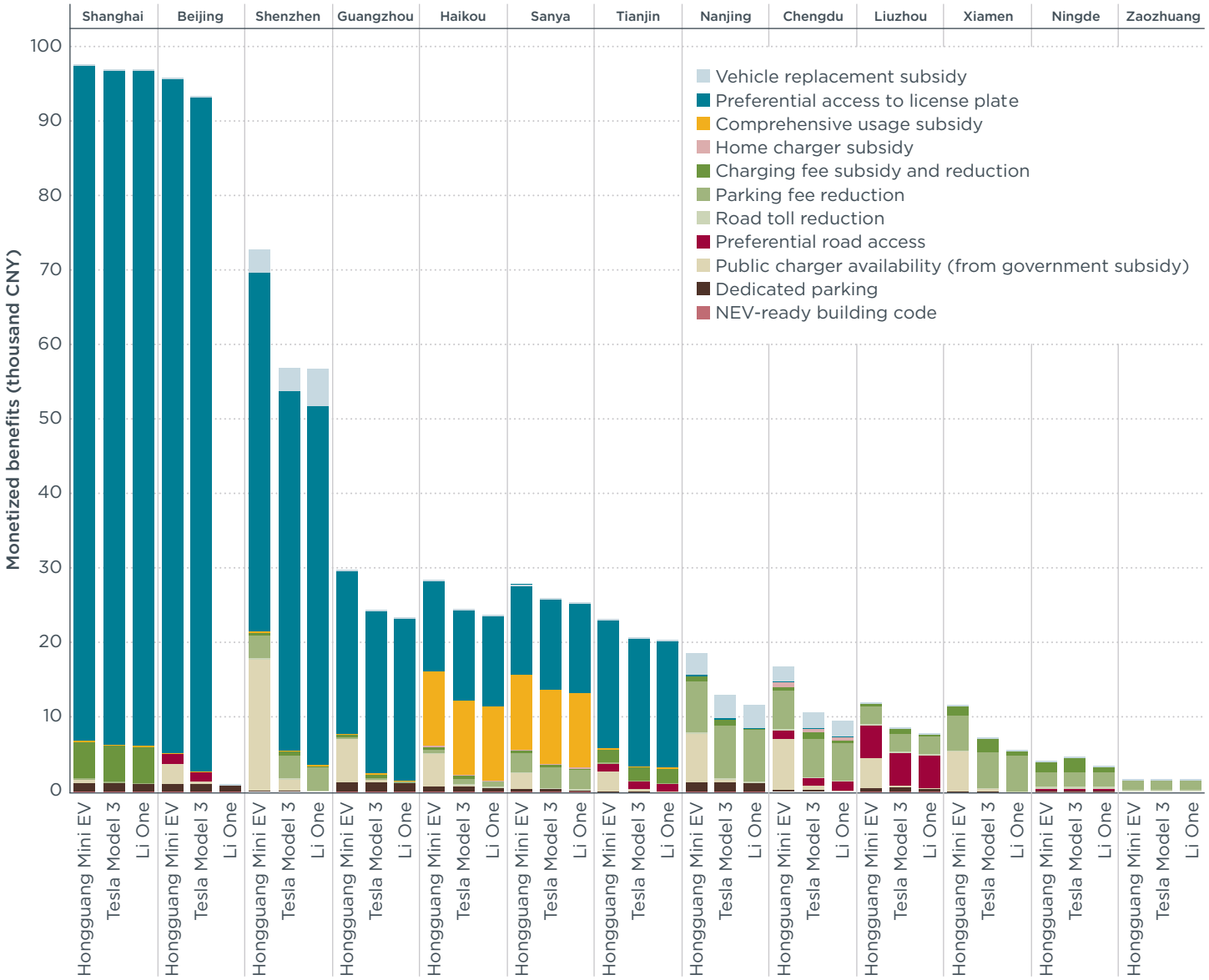

Figure ES1. Monetized private consumer benefits from city incentives for the three selected models in 2020.

Different from 2015, we find that purchase subsidy was no longer the main incentive in 2020. This was certainly influenced by central government guidance to shift to use-phase incentives. We find that preferential access to vehicle license plates provided the most consumer benefit in 2020 in those cities that had a limit on the annual number of license plates for conventional fuel vehicles. Following that were use-phase incentives such as parking fee reduction and government support for public charger availability. For a shorter-range NEPC like the Hongguang Mini BEV, public charger availability provides a significant benefit to consumers. In 2020, most cities provided similar benefits to BEVs and PHEVs, although some favored BEVs. Beijing's incentives were almost all geared toward BEVs and thus the monetized consumer benefit for the Li One in Beijing is zero.

The following additional highlights emerge from the analysis.

As vehicle technology matures and the market expands, many smaller cities have been developing their own locally suited strategies to advance NEPCs. For example, Haikou and Sanya have employed a coordinated provincial strategy in combination with local incentives and Liuzhou has targeted product development and outstanding

consumer engagement. NEVs to the Countryside programs, which have operated at the central and provincial levels since 2020, have brought more NEPCs to smaller cities and towns and promoted more equitable access to clean technology.

The most widely adopted direct fiscal incentive was fee reduction and the most widely adopted indirect incentive focused on charging availability. Charging fee reduction and parking fee reduction were the two most widely adopted fiscal incentives. Fee reductions were usually applied to all NEPCs, thus avoiding any preferential treatment for local brands. Cities also strived to ensure charging availability through NEV-ready building codes of various stringencies, and many provided incentives for the construction and operation of public chargers.

Cities continued to improve public charging infrastructure availability while actively addressing different challenges and needs. As the NEPC stock grows, one area that cities are currently focused on is charging in existing multi-unit dwellings. Emerging good practices include unified installation and unified management (this is when all chargers are installed and/or managed by a single party), a demand-based approach, clarified responsibility, coordinated organization from the municipal government, and adequate and consistent after-sales service.

Based on this work, we suggest that cities set specific and actionable targets and design matching policies to achieve them. Setting more detailed targets and policies and assigning accountability would help to facilitate better implementation. For example, Chengdu made NEV-ready building codes by type of building and type of construction, and Liuzhou specified targets for charging infrastructure and dedicated NEV parking spaces by district and set intermediate targets every 6 months.

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INTRODUCTION

China's new energy vehicle (NEV) market, which includes battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEVs), has been growing rapidly over the past decade. The wholesale number of new NEVs exceeded 3.5 million in China in 2021, based on data from the China Association of Automobile Manufacturers; that led the global market for the seventh consecutive year and represented 51% of the world's total new NEV sales. Of those 3.5 million vehicles, 3.3 million were passenger cars. Recently, ICCT published a detailed NEV market update for China through 2020 (Chu et al., 2022) and another paper comparing the market in 2020 to 2021 (Chu & He, 2022).

This analysis focuses on private new energy passenger cars (NEPCs) and is a comprehensive overview of the major city-level government policies and incentives in place in 2020. ICCT previously studied policies that were in place in 2015 (He et al., 2018) and this report is an update of that analysis. We assess the policy drivers against market performance and include updates regarding central policies where relevant. Though 2020 was a unique year, given the onset of the COVID-19 pandemic, the city policy landscape did not change abruptly at this time and many of the NEV policies in place in 2020 were a continuation of policies from the prior 2 or 3 years. Additionally, some of the policies adopted in 2020 were part of the planning for the next 5 years, and many others adopted in 2020 that were meant to stimulate consumption continued past the end of the year.

This report focuses on BEVs and PHEVs in 13 leading cities. There were only a few thousand fuel cell electric passenger cars sold in 2020 and major local policies for them only got underway in late 2020, after the central government released details for FCEV pilot cities (Jin & He, 2020). The 13 cities were chosen based on considerations of their NEPC market share within their respective city class, their location, and data availability.

In China, cities are unofficially classified into different tiers based on their populations, economic characteristics, and other development factors. Tier 1 and New Tier 1 cities are highly developed metropolitan areas with large populations, many of which are centrally administered municipalities or provincial capitals. Figure 1 shows the top 8 cities in terms of NEPC market share in each city class except for Tier 1, as there are only four cities in this class. For the 13 cities in this analysis, we ultimately selected all four Tier 1 cities (Shenzhen, Shanghai, Beijing, and Guangzhou), three New Tier 1 cities (Tianjin, Chengdu, and Nanjing), one Tier 2 city (Xiamen), four Tier 3 cities (Liuzhou, Sanya, Haikou, and Ningde) and one Tier 4 city (Zaozhuang). Including cities from different tiers provides a more comprehensive picture of the policies to support development of the private NEPC market.

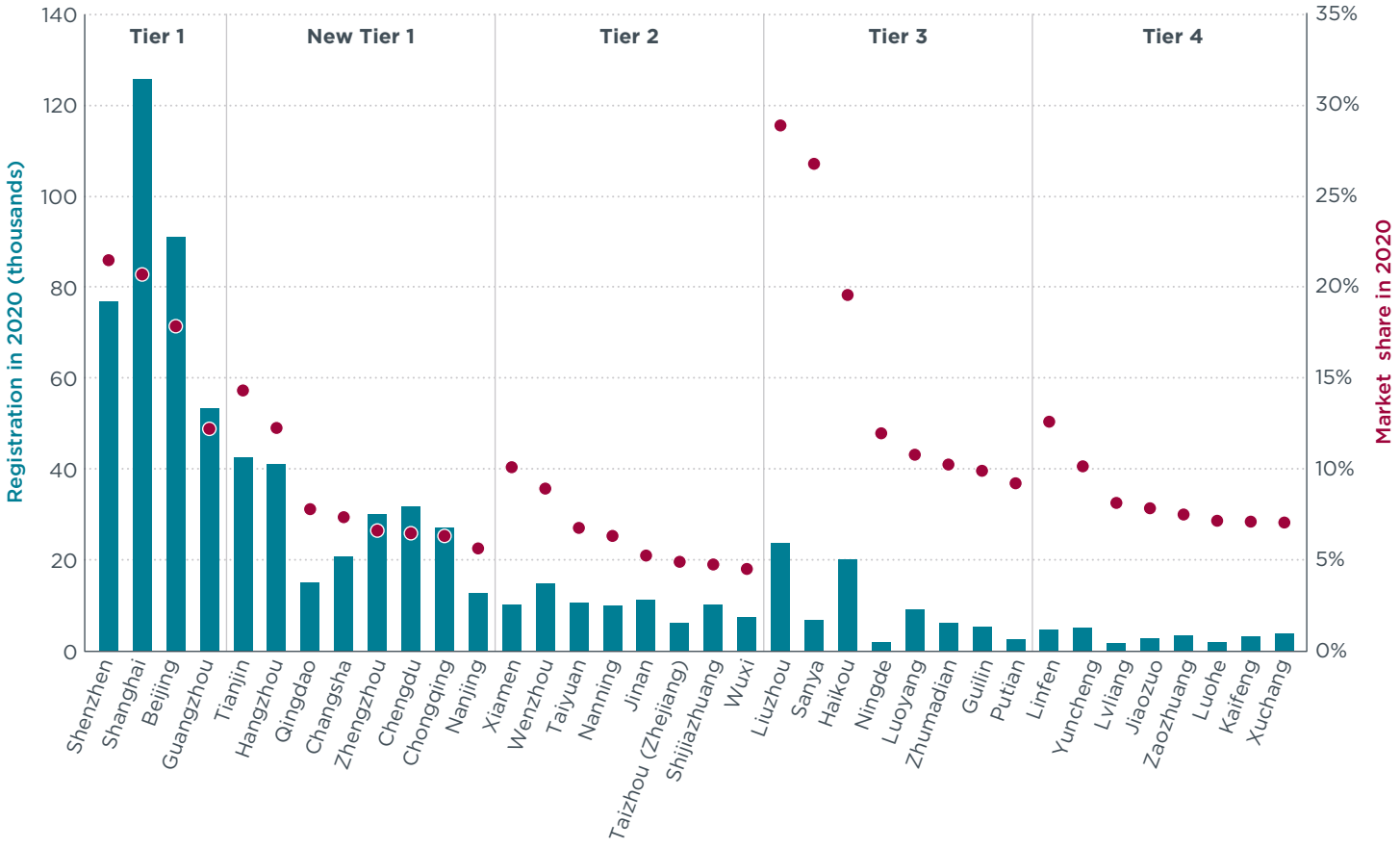

Figure 1. NEPC registrations and market share of leading cities in 2020. Cities are grouped by tier first and then listed from left to right in descending order of NEPC market share in 2020.

This paper also presents our quantitative evaluation of the benefits that different city-level NEPC policies bring to an individual private NEPC consumer. Consumer benefits are inherently difficult to quantify, given the potentially vastly different conditions of each consumer, but such quantification is helpful in understanding the full picture of how policy efforts support NEPC adoption. Because the goal of the quantification is to consider how different levels of city policy efforts might drive NEPC adoption, we assumed similar consumer behaviors across cities.

In the following sections, we provide an overview of central policies as a context for city-level policies. Following that is an in-depth review of city action plans and incentives in the 13 cities. Subsequently, methodology updates for quantifying consumer benefits are detailed, and those are followed by a discussion of the results. Finally, we draw conclusions and make recommendations for cities seeking to accelerate their NEPC uptake.

CENTRAL POLICIES

Below we focus on major updates to central policies since 2015. For a comprehensive review of central policies through 2015, see He et al. (2018).

CENTRAL PLANNING

Among China's foundational actions to promote NEV deployment are its industrial development plans, which were detailed in Chu (2021). The first plan covered 2012–2020 and set goals that included total NEV production or sales of 5 million by 2020. It also set national targets for NEV battery energy density (> 300 Wh/kg) and battery cost (< CNY 1.5/Wh) by 2020. The second plan covers 2021 to 2035 and raises the market goals by setting an approximately 20% NEV sales penetration target by 2025 for the entire vehicle fleet and specific targets for public fleets. It also sets a goal of reducing the fleet-average electricity consumption of new battery-electric passenger cars to 12.1 kWh/100 km by 2025.

NEV PURCHASE SUBSIDY

Central government NEV subsidies have played a significant role in driving the market for NEVs in China, especially in the early stages. China's first nationwide NEV subsidy program was initiated in 2013. As shown in Figure 2, the subsides were phased down five times, first in 2014, and the technical requirements were also gradually tightened. The program was initially scheduled to cease by the end of 2020, but China extended it to 2022, albeit with a reduced amount per vehicle (Cui & He, 2020).

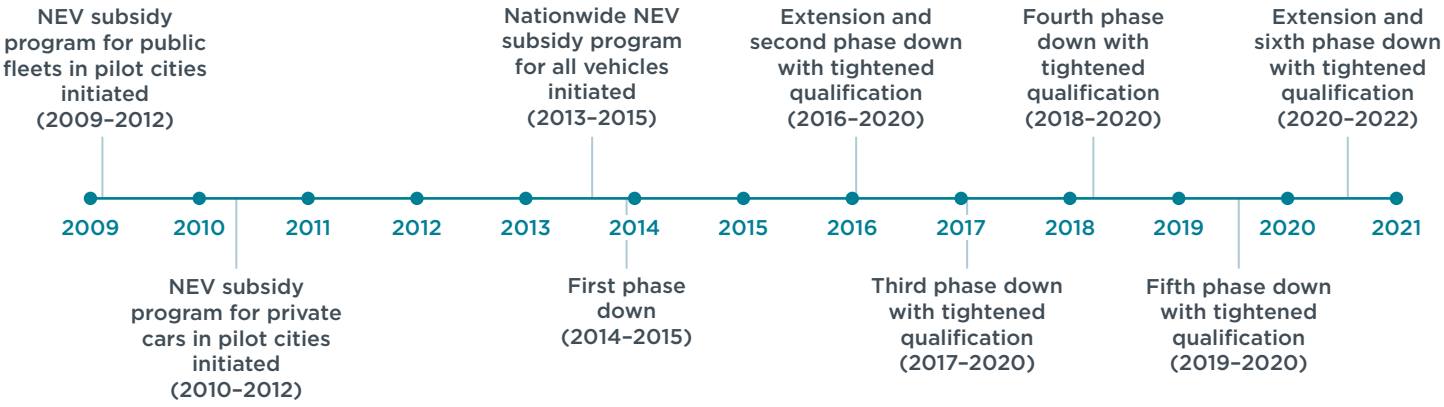

Figure 2. Timeline of China's national subsidy program for NEVs.

In 2019, the central government encouraged local governments to remove their purchase subsidies for most NEVs, except for electric buses and FCEVs, and said that other financial support would be reduced if local governments continued to provide subsidies (Ministry of Finance of the People's Republic of China, 2019). Cities accordingly began switching to use-phase incentives, but after the central government extended the central purchase subsidy and initiated other economic stimulus measures in 2020, a few cities provided a use subsidy that was similar to a purchase subsidy as part of their own policy packages to stimulate consumption. (More details are in the sub-section on use subsidies below.)

TAX INCENTIVES

In China, consumers enjoy two types of NEV tax incentives. The first is exemption from vehicle purchase tax. This has been offered since 2014 and is set to continue through the end of 2023 (Ministry of Finance of the People's Republic of China, 2014, 2022; National Development and Reform Commission of the People's Republic of China,

2020). Non-NEV buyers pay a one-time vehicle purchase tax of 10% of the price. Since 2012, most NEV drivers have also been exempt from paying the annual vehicle and vessel tax, which is an annual savings of CNY 510 on average for a typical gasoline car with a 1.6 L engine (He et al., 2018). The technical requirements for NEVs to qualify for these tax incentives are more relaxed than those that apply to the central purchase subsidy and therefore most NEV drivers enjoy these tax benefits.

REGULATORY INCENTIVES IN VEHICLE EFFICIENCY STANDARDS

China tightened its fuel efficiency standards for new passenger cars in a way that favored producing NEVs. The current Phase V efficiency standard sets a national fleet-average target of 4 L/100 km by 2025, a 20% reduction from the Phase IV target in 2020. Passenger car manufacturers and importers are required to meet corporate average fuel consumption (CAFC) targets that are calculated based on a corporate's products produced domestically or imported annually, to ensure the national target is met. NEVs are assigned multipliers—a specific number of credits above 1—and are defined as 0 L/100km in the calculation of CAFC.

NEV MANDATE

Since 2019, car manufacturers that sell at least 30,000 conventional fuel cars, either domestically produced or imports, have been required to meet an NEV credit target. The credit targets increase by 2% each year from 10% in 2019 to 18% in 2023. These are credit targets instead of sales targets because a single NEV could be assigned more than one credit. The sales share of NEVs based on these credit targets are estimated to be 11% in 2022 and 13% in 2023 (Chen & He, 2022). China has a dual-credit policy to manage the NEPC targets in parallel with the fuel efficiency standard. A manufacturer has a CAFC credit surplus if its actual CAFC is lower than its target and has an NEV credit surplus if its actual NEV credits are higher than its credit target. A surplus of both CAFC and NEV credits by the end of a year is regarded as compliance, but flexibility options are also offered (Chen & He, 2021; Cui, 2018).

CHARGING INFRASTRUCTURE AWARDS

From 2013 to 2020, China offered charging infrastructure funding to cities that met their target for new "standard NEV" registrations (Ministry of Finance of the People's Republic of China, 2014).[1] The targets varied among different city groups and were strengthened each year, with key areas for air pollution control usually having the highest targets. In 2020, Beijing, Shanghai, Tianjin, and cities in Hebei, Shanxi, Jiangsu, Zhejiang, Shandong, Guangdong, and Hainan provinces could receive a CNY 126 million award for public charging infrastructure for deploying 70,000 standard NEVs, and an additional CNY 11 million for each additional 6,000 vehicles (Ministry of Finance of the People's Republic of China, 2016). The requirements and the amount of the award were less for other areas. The cap was CNY 200 million per city.

Notably, in 2019, the central government encouraged local governments to focus more on support for charging infrastructure after the elimination of most local purchase subsidies for most NEVs. As a result, most local governments offered support for the construction and operation of charging infrastructure.

NEVS TO THE COUNTRYSIDE

To support NEV sales in smaller cities and suburban areas, China has organized a national NEVs to the Countryside program each year since 2020. The program is usually led by the Ministry of Industry and Information Technology (MIIT) and targets

1 An NEPC counts as one standard NEV. Other types of NEVs, such as buses and vehicles for construction, are counted as multiple standard NEVs.

Tier 3 or below cities, towns, and rural areas. During the event, local governments publish their supportive policies, if any, and eligible manufacturers present their NEV models and discounts. The models presented are expected to have certain criteria that meet the needs of rural areas. This program enables more people to gain access to NEV information, products, and service and thus encourages a more equitable NEV transition.

BATTERY REUSE AND RECYCLING

China is projected to face a large-scale decommissioning of batteries from NEVs in a few years and adequate reuse and recycling is essential for the sustainability of the industry. Since early 2016, the central government has issued different policies to regulate and encourage good practices in NEV battery recycling. These include an extended producer responsibility system and traceability management, a national coding regulation, and requirements regarding battery cascade utilization and recycling operations, including setting recovery rates.

CITY NEW ENERGY PASSENGER CAR GOALS AND PLANNING

Cities have developed their own NEV action plans and they often have specific targets for deployment of NEVs and charging infrastructure. The NEV targets are usually defined in terms of stock, sales, and market share, and some are broken down by vehicle type. Charging infrastructure targets are often defined in terms of stock, new installation, service radius, and ratio of NEV to charger. Some are broken down by charger type: public, semi-public (used by a group of people, like those at a workplace or for fleets), or private; and direct current (DC) fast charger, Level 2, or Level 1. Table 1 summarizes the NEV and charging infrastructure deployment targets in select cities in 2020.

Table 1. City-level NEV and charging infrastructure deployment targets, 2020.

City	NEV deployment target	Charging infrastructure target
Shanghai	Annual sales of new NEVs reach 60,000 in 2020	Service radius less than 1 km in central urban areas and less than 2 km in areas outside the outer ring
Beijing	NEV stock reaches 400,000 in 2020	Average service radius of less than 5 km in plain areas and less than 0.9 km in key areas such as central urban areas and Tongzhou New Town
Shenzhen	Cumulative sales of new private NEPCs are 40,000 between 2016 and 2020 and total NEV stock reaches 120,000 in 2020	Number of public chargers reaches 153,000 and service radius is less than 0.9 km in central urban areas by the end of 2020
Guangzhou	NEV stock reaches 200,000 by the end of 2020, including 170,000 private and rental vehicles	Number of chargers reaches 100,000 in 2020 and an additional 180 charging stations and 160,000 kWh of charging capacity is installed in 2020[a]
Tianjin	Sales of new NEVs reach 20,000 per year from 2018 to 2020 and NEV share of vehicle stock reaches 4.5% in 2020	Number of public chargers reaches 20,000 in 2020 and an additional 4,000 are installed in 2020[a]
Liuzhou	NEV stock reaches 71,100 by the end of 2020	Number of chargers > 7 kW reaches 3,000 by the end of 2020
Sanya	Cumulative sales of new NEVs reach 6,000 from 2016 to 2020	Number of public chargers reaches 2,320 in 2020, 12,930 in 2025, and 34,780 in 2030, and there is one centralized charging station for every 2,000 NEVs in urban areas by the end of 2020

[a] Guangzhou and Liuzhou's targets did not specify public chargers and could include private or semi-public chargers.

All of the NEV deployment targets listed above were met in 2020. Not only that, but because many of the targets were set 2 to 4 years before 2020 and there was rapid development in the NEV market in China in recent years, some cities significantly exceeded the targets. For example, Shanghai's sales of new NEVs exceeded 120,000 in 2020, twice the target set in 2018. Shenzhen's NEV stock exceeded 453,000 in 2020, almost quadruple the target set in 2016, and the sales of new NEPCs in 2020 alone were over 60,000.

Regarding charging infrastructure, some targets were met and others were not. Although Shenzhen and Guangzhou fell short of their stock targets, Shenzhen's total number of public chargers made it the leader in the country and Guangzhou was not a laggard. Tianjin and Liuzhou both met their targets in terms of total number of chargers by the end of 2020.

Other than the vehicle and charging infrastructure targets above, many cities also have targets regarding industry competitiveness. Such targets are usually in terms of NEV production, industrial output value, number of leading enterprises or clusters, and number or coverage of charging and smart transportation infrastructure. As these policies are not directly related to consumers, they are not detailed in this paper.

CITY NEW ENERGY PASSENGER CAR INCENTIVES

This section reviews city planning and major incentives, both direct fiscal and indirect, offered to private NEPC consumers. Though some of the incentives do not distinguish between private consumers and ride-hailing cars, the focus is on private NEPCs in this analysis and therefore incentives described in this section do not necessarily apply to fleets.

Direct fiscal incentives provide monetary value to consumers. The direct fiscal incentives included in this analysis are *vehicle replacement subsidy*, *use subsidy*, *home charger subsidy*, *charging fee subsidy and reduction*, *parking fee reduction*, and *road toll reduction*.

Indirect incentives are ones that offer other, non-monetary benefits that are unavailable to owners of conventional combustion engine cars. Indirect consumer incentives included in this analysis are *government support for public charging infrastructure availability* and *charging in existing multi-unit dwellings*, *dedicated parking spaces*, *NEV-ready building codes*, *preferential access to a vehicle license plate*, *preferential road access*, and *battery reuse and recycling subsidy*.

Many of the benefits of the incentives vary depending on technology and the configuration of the vehicle, and we chose three representative models to illustrate. As shown in Table 2, they are the Tesla Model 3 and the Li One, the best-selling BEV and PHEV models, respectively, in 2020, and the Wuling Hongguang Mini EV, the best-selling micro NEPC in 2020.[2] We included the latter because micro NEPCs were still very popular in some local markets.

Table 2. Specifications of the three representative models

Specification	Wuling Hongguang Mini EV	Tesla Model 3	Li One
Type	Microcar/A00	Mid-size/B	SUV
Technology	BEV	BEV	PHEV
Curb weight (kg)	665	1,614	2,300
Length (mm)	2,917	4,694	5,020
Engine capacity (L)			1.2
Fuel consumption (L/100km)			8.8
Battery capacity (kWh)	9.3	52.9	38.5
Electric range (km)	120	445	148
Maximum torque (N.m)	85	375	240/290 (front/rear)
Maximum power (kW)	20	202	100/140 (front/rear)
MSRP (CNY)	32,800	291,800	328,000
Energy consumption (kWh/100km)	8.8	12.4	16.9

2 In China, the term microcar is used for the smallest cars that have a wheelbase between 2 m and 2.3 m, and a length of 3.65 m or less. They resemble the Smart Fortwo.

DIRECT FISCAL INCENTIVES

Vehicle replacement subsidy

Three of the 13 cities offered upfront vehicle replacement subsidies in 2020. They required consumers to retire a conventional fuel car and replace it with an NEPC. Table 3 shows the subsidies that were available to the three selected models and the maximum amounts for each. Shenzhen provided two vehicle replacement incentives: one from the municipal government (General Office of the Shenzhen Municipal People's Government, 2020) and one from the Bureau of Commerce (Shenzhen Municipal Bureau of Commerce, 2020). The municipal government provided CNY 20,000 to luxury NEPCs and CNY 10,000 to economy cars. The Bureau of Commerce offered CNY 3,000 to NEPCs that cost less than CNY 300,000 and CNY 5,000 to those that cost more than that amount. The three models we selected for this analysis do not meet all of the technical parameters set in the first policy and thus would not receive that subsidy, but they all qualified for the second one.

The other two cities that offered a replacement subsidy, Chengdu and Nanjing, set certain requirements on the replaced vehicle. Chengdu required that the replaced vehicle be certified to the China 3 or earlier emission standard, and the new vehicle must be either an NEV or certified to the China 6 emission standard (Chengdu Municipal Bureau of Commerce, 2020). In Jiangsu Province, where Nanjing is located, the replaced vehicle had to have been registered before 2000 (Jiangsu Provincial Development and Reform Commission, 2020).

Table 3. City vehicle replacement subsidy in CNY, 2020

City	Tesla Model 3 BEV	Wuling Hongguang Mini BEV	Li One PHEV	Maximum for BEV	Maximum for PHEV
Shenzhen	3,000	3,000	5,000	25,000	25,000
Chengdu	2,000	2,000	2,000	2,000	2,000
Nanjing	3,000	3,000	3,000	3,000	3,000

Use subsidy

Four of the 13 cities provided use subsidies for new NEPCs in 2020. They were usually one time, upfront subsidies given to private consumers who purchased a new vehicle and were without mileage requirements, meaning that they did not need to drive a certain mileage after purchase to qualify. The subsidies in these cities were called comprehensive use subsidies and were aimed at reducing overall vehicle use cost and stimulating consumption during the pandemic (General Office of the Shenzhen Municipal People's Government, 2020; Guangzhou Municipal People's Government, 2020; Hainan Provincial Department of Commerce, 2020). These subsidies were similar to purchase subsidies in that they were one time, upfront subsidies, but they differed in that consumers had to apply for them from the city government after purchase, instead of being deducted at the point of sale.

Table 4 shows the use subsidies available to the three selected models and maximum amounts available for each. Our selected models did not meet all of the technical requirements set in these city policies and thus did not qualify, but the maximum amount a BEV or PHEV could receive is included for reference. Note that consumers in Shenzhen could not receive the use subsidy in addition to the vehicle replacement subsidy, which is of the same amount; consumers could only receive one of those subsidies for a new vehicle.

Table 4. City NEPC use subsidy amounts in 2020 (CNY)

City	Tesla Model 3 BEV	Wuling Hongguang Mini BEV	Li One PHEV	Maximum for BEV	Maximum for PHEV
Shenzhen	—	—	—	20,000	10,000
Guangzhou	—	—	—	10,000	—[a]
Haikou	10,000	10,000	10,000	10,000	10,000
Sanya	10,000	10,000	10,000	10,000	10,000

[a] As this policy required that the electric range be no less than 400 km for cars and no less than 500 km for SUVs, we consider this policy to be mainly for BEVs.

Home charger subsidy

Only one city, Chengdu, provided a home charger subsidy in 2020. It was CNY 100/kW for alternating current (AC) chargers and 200 CNY/kW for DC chargers, up to CNY 200,000 per charger (Chengdu Municipal Bureau of Economy and Information Technology, 2019). This was a one-time subsidy and applied to both private chargers and semi-public chargers such as workplace chargers or those dedicated for fleets.

Charging fee subsidy and reduction

Eleven cities offered charging fee incentives in 2020. There are generally three forms of such incentives: charging fee subsidy, limit on charging service fee, and reduction in electricity price.

Shanghai, Tianjin, and Ningde provided a charging fee subsidy of CNY 5,000, CNY 2,000, and CNY 4,000, respectively, for new NEPCs (General Office of Tianjin Municipal People's Government, 2020; Ningde Municipal People's Government, 2020; Shanghai Development and Reform Commission, 2020a, 2020b). These were all targeted subsidies that could only be used to offset charging fees. Shanghai's subsidy was distributed to an individual's designated account, which is connected to both the individual's municipal power company account for home chargers and their payment account on the municipal platform for public charging fees. The subsidy was paid out to private consumers at CNY 150 per month until reaching CNY 5,000 and could be used to offset the charging fees on the two accounts. Tianjin's subsidy could be applied through the State Grid's payment app and used to offset charging fees incurred at different charger providers. Ningde required that the new NEPC be locally produced, and the subsidy was in the form of a pre-paid card for charging fees.[3] None of our selected models met Ningde's requirements.

Eight cities put a limit on the maximum charging service fee that a public charger can charge, which is a separate fee from the cost of the electricity. This limit was CNY 0.6/kwh in Chengdu and CNY 1.68/kwh in Nanjing, with the rest of the cities, Shenzhen, Guangzhou, Haikou, Sanya, Liuzhou, and Xiamen, in the CNY 0.65–0.9 /kWh range. For context, charging fees are generally in the range of CNY 0.8–1/kWh in central areas in Beijing and CNY 0.7–1/kWh in Shanghai.

Regarding the cost of electricity, electricity pricing for centralized commercial charging and battery swapping facilities falls under either the category of *general industrial and commercial user* or *large industrial user* and this is based on transformer capacity.[4] For large industrial users, China uses a two-part electricity pricing system that includes a variable electricity fee based on consumption and a fixed capacity fee based on

3 If it is a new replacement vehicle with the same license plate as the retired car, the retired car must be certified to the China 3 emission standard or below.

4 The facility should be in a relatively concentrated area and provide services for a charge, but local governments have some flexibilities in determining the sites. For example, in Chengdu and Beijing, it should be a fixed location that has at least three chargers/battery swapping facilities, 60 kW of installed power, and can operate at this site for at least one year (Chengdu) or three years (Beijing) (Beijing Municipal Commission of Urban Management, 2019; Chengdu Development and Reform Commission, 2020).

transformer capacity or demand. However, the electricity fee for large industrial users is generally lower than it is for general industrial and commercial users. The central government required that the electricity fee for large industrial users be implemented for centralized commercial charging and battery swapping facilities and that the capacity fee be waived until 2025 (National Development and Reform Commission, 2018). On top of this, Xiamen and Ningde halved the electricity price for these centralized commercial charging facilities. In Xiamen, the increase in total charging fee from phasing out the reduced electricity price and the reduced charging service fee in 2021 was about CNY 0.3/kWh (Sina news, 2021).

Though not included in our quantification of consumer benefits, due to its highly variable nature, the central government required centralized commercial charging facilities to implement time-of-use rates (National Development and Reform Commission, 2014) and many local governments and grid companies also provided time-of-use rates to residential users. Time-of-use rates fluctuate by time of day and are based on the costs to serve the electricity demand. Consumers can lower their bill by shifting their electricity purchase to times when demand is low and cost is less.

Parking fee reduction

Parking fee reduction has become more popular in China over the past couple of years. Nine of our target cities had this in place in 2020 (Table 5). Generally, such incentives allow NEPCs to park for free for a couple of hours or to park for a reduced fee, and they usually apply to parking that the city government has some control over pricing, including street parking, parking for public facilities such as public schools and museums, and parking funded by the government.

Table 5. City parking fee reductions, 2020

City	Type of parking	Incentive
Shenzhen	Street parking and charging in parking facilities subject to government pricing	First 2 hours free
Chengdu	Street parking and government-funded parking facilities	First 2 hours free
	Government-funded park and ride	Fee reduced by half from 07:00 to 19:00
Liuzhou	Steet parking and parking for public facilities	Free
	Public parking that is subject to government pricing, such as at airports, bus stations, ports, tourist attractions, and those built by companies that are on the government's financing platform	First 2 hours free
Haikou	Parking for public facilities such as public schools, stadiums, museums, libraries, and youth activity centers	First half hour free
Nanjing	Street parking	First hour free
Xiamen	87 government-funded public parking facilities	First 2 hours free
Zaozhuang	Public parking that is subject to government pricing and those funded entirely or partially by the government	First 2 hours free
Ningde	Government-funded public parking	First 2 hours free
Sanya	Street parking	From 08:00 to 22:00, first hour free; free the rest of the time
	Multi-story parking that is subject to government pricing, as well as those at airports, bus stations, ports, and transportation hubs	First half hour free, and 2 hours free at charging in garages subject to government pricing and then fee reduced by half after that.
	Parking for tourist attractions, public medical institutions, residential neighborhoods without an agreed-upon fee with a provider, and single-level parking that is fully funded by the government	First hour free
	Parking for public facilities such as public schools, stadiums, museums, libraries, youth activity centers, and more	Free

Sources: General Office of the Shenzhen Municipal People's Government, 2020; Chengdu Municipal Bureau of Economy and Information Technology, 2019; Liuzhou Price Bureau, 2017; Haikou Development and Reform Commission, 2020; Nanjing Bureau of Urban Management, 2017; Fujian Provincial Department of Industry and Information Technology, 2020; Shandong Provincial Energy Administration, 2019; Ningde Municipal People's Government, 2020; Sanya Development and Reform Commission, 2020.

Road toll reduction

Only one city, Ningde, offered road toll reduction in 2020. All NEPCs with local license plates could travel free of charge between the five highway toll stations in the urban district (Ningde Municipal People's Government, 2021). These five stations are in different areas of the city and the driving distance between them is approximately 66 km. The toll for a regular conventional fuel car with fewer than seven seats is CNY 0.6/km.

INDIRECT CONSUMER INCENTIVES

Subsidy for public charging infrastructure

Most of the governments in our target cities provided subsidies for the construction of and/or the operation of public or semi-public charging infrastructure. Table 6 shows the most common types of subsidies and explains how they work, with examples.

More cities offered operation subsidies in 2020 than in 2015 and a construction subsidy based on charger power has also become more popular. In 2015, many cities subsidized a certain percentage of the construction or investment cost, up to a certain limit. By 2020, some cities, including Shanghai and Beijing, had begun to link subsidies to an evaluation of charging facilities based on factors such as safety, maintenance of the chargers, data connectivity, and consumer rating because it encourages better management and performance. A city can offer one or more of these incentives and the incentives can target different types of charging, such as public, workplace, and residential neighborhood chargers.

Table 6. Public charging infrastructure subsidies, mechanisms, and examples in target cities, 2020

Type of subsidy	Mechanism	Example
Construction	Based on power	Shenzhen provided a subsidy of CNY 400/kW for DC chargers, CNY 200/kW for 40 kW or above AC chargers, and CNY 100/kW for those below 40 kW.
	Percentage of construction/ charger cost, with a cap	Guangxi Province (where Liuzhou is) offered a 20% subsidy with a cap of CNY 30,150 for building a DC charger and CNY 1,150 for an AC charger.
Operation	Based on energy charged, with a cap	Chengdu provided a progressive subsidy for the operation of charging facilities based on annual electricity charged: CNY 0.1/kWh within 10 million (inclusive) kWh; CNY 0.15/kWh for between 10 million kWh and 20 million (inclusive) kWh; and CNY 0.2/kWh for above 20 million kWh.
	Based on evaluation and energy charged, with a cap	Shanghai's subsidy was based on an annual evaluation of performance of businesses and charging facilities. For qualified businesses, their charging facilities that passed the evaluation were assigned one of three tiers and a higher subsidy (per kWh) was given to better performers, with an annual cap. The best tier got CNY 0.8/kWh, up to 1,000 kWh/kW per year.
	Based on evaluation, energy charged, and power, with a cap	Beijing's subsidy had two parts: a regular one based on kWh charged, and an annual one based on power of chargers. For qualified businesses, the first one is CNY 0.1/kWh, up to 1,500kWh/kW•year. The second one was tied to evaluation of the facilities where better performers received more, with a cap. The best ones got CNY 106/kW-year, up to CNY 200,000/facility•year.

Sources: Shenzhen Development and Reform Commission, 2020; Guangxi Zhuang Autonomous Region Department of Finance, 2019; Chengdu Municipal Bureau of Economy and Information Technology, 2019; Shanghai Development and Reform Commission, 2020; Beijing Municipal Commission of Urban Management, 2018.

Charging in existing multi-unit dwellings and neighborhoods

Access to charging infrastructure remains one of the key factors in advancing NEV uptake. One prominent challenge in China is that most people live in multi-unit dwellings in urban areas and this is less common in some other countries. Unlike new buildings and parking lots, which are usually required to be "NEV ready," China's existing neighborhoods, some of which were built decades ago, pose challenges for installing new chargers.

Though subsidies come in a variety of forms, in our summary table at the end of this section, we included cities that had a dedicated program for promoting

charging infrastructure in existing multi-unit dwellings and neighborhoods and those that provided specific subsidies or incentives for such efforts. Examples are demonstration neighborhoods in Shanghai, Tianjin, Liuzhou, Haikou, and Sanya, where multiple residential neighborhoods were selected each year as pilots for charger installation. Additionally, Chengdu and Liuzhou provided subsidies for electricity capacity expansion and to property management companies for facilitating private charger installation.

One emerging trend is unified installation and unified management, which means that chargers in a neighborhood are installed by one party and maintained by the same or another single party, usually the company that owns or operates the charging infrastructure. This is instead of residents having to install their own chargers from potentially different providers and it is being piloted in many cities, including Shanghai, Tianjin, Chengdu, Fuzhou, Beijing, and Tianjin. Tianjin's program is a leading example and it features a demand-based approach where pilot neighborhoods were selected based on needs submitted by individuals, neighborhood committees, or property management companies. It clarified the responsibilities of different stakeholders, including neighborhood committees, charging infrastructure providers, property management companies, and homeowners' associations. It also specified that charging infrastructure owners and operators should work with property management companies to ensure adequate and consistent after-sales service such as maintenance and repairs. Another important factor is that the Municipal Development and Reform Commission gave guidance to and coordinated efforts from different stakeholders and screened companies so that only those qualified and deemed to have the capacity to maintain the infrastructure were eligible.

Dedicated parking space

Eight cities had requirements regarding dedicated parking spaces for NEVs. They generally required that 10% to 20% of parking spaces be dedicated to NEVs. Table 7 shows these requirements and the type of parking involved.

Table 7. Requirements for dedicated parking spaces for NEVs in target cities, 2020

City	Type of parking	Incentive
Shanghai	Public parking	10% of spots reserved for NEVs
Beijing	Public parking	10% of spots should have chargers and conventional fuel vehicles should avoid occupying these spaces; at least one dedicated spot for NEVs
Guangzhou	Any location with charger	NEVs have priority in using these spaces
Liuzhou	Multiple locations such as government offices, business parks, ports, new residential neighborhoods, tourist attractions	10%–20% of spots for NEVs and target by end of 2020 is 6,500 spots
Haikou	Street and public parking facilities	Requires "a certain percentage" for NEVs (not specified)
Nanjing	Public parking	10% of spots for NEVs
Sanya	New public parking	20% of spots should have chargers, with an increased parking fee for non-NEVs using those spots, and at least one dedicated spot for NEVs
Ningde	Tourist attractions, schools, and new public parking	20% of spots for NEVs

Source: Shanghai Municipal Commission of Transportation, 2016; Beijing Municipal Commission of Urban Management, 2018; Guangzhou Municipal Transportation Bureau, 2019; Liuzhou Development and Reform Commission, 2020; Jiangsu Provincial Development and Reform Commission, 2020; Sanya Development and Reform Commission, 2019; Ningde Municipal People's Government Office, 2020,

Note that in Liuzhou, there are approximately 15,000 additional small parking spots that were created for micro NEPCs (Bloomberg News, 2021) like SAIC-GM-Wuling's Baojun E100 and the Hongguang Mini EV.

NEV-ready building codes

All 13 cities in this analysis have NEV-ready building codes. Requirements usually differ for new construction and existing structures, and the former is easier to regulate. Some cities have detailed requirements for different types of parking, such as residential, public and/or state-owned facilities, and tourist attractions. Table 8 shows the requirements for residential and public parking. There are generally two types of requirements: One that requires a certain percentage of NEV-ready spots, meaning that these spots should be ready for new charger installation if needed, and another that requires that a certain percentage of spots be equipped with chargers, meaning that these spots should have chargers installed as part of construction of a new space or the renovation of an existing space.

Table 8. NEV-ready building codes, 2020

City	New construction				Existing parking			
	Residential		Public parking		Residential		Public parking	
	% of NEV-ready spots	% of spots with a charger	% of NEV-ready spots	% of spots with a charger	% of NEV-ready spots	% of spots with a charger	% of NEV-ready spots	% of spots with a charger
Shanghai	10%		10%					
Beijing	100%	18%		20%				10%
Shenzhen	100%	30%	100%	30%		10%		10%
Guangzhou	100%			30%, fast charger				
Tianjin	100%			10%				
Chengdu	100%	10%	18%–30%[a]	6%–10%[a]		6%–10%[a]		6%–10%[a]
Liuzhou			100%	10%–20%				10%–20%
Haikou	100%			20%				20%
Nanjing	100%		10%	10%				
Xiamen	100%	20%	20%					
Sanya	100%			20%				20%
Zaozhuang	100%			15%		A certain percentage, not specified		15%
Ningde	100%							

[a] Depending on district. The central urban district has the most stringent requirements.
Sources: Shanghai Municipal Commission of Transportation, 2015; Beijing Municipal Commission of Planning and Land and Resources Management, 2017; Shenzhen Development and Reform Commission, 2017; Guangdong Provincial Department of Environmental Protection, 2018; Tianjin Development and Reform Commission, 2017; Chengdu Municipal Government, 2020; Liuzhou Development and Reform Commission, 2020; Hainan Provincial Development and Reform Commission, 2019; General Office of the Nanjing Municipal Government, 2017; Jiangsu Provincial Development and Reform Commission, 2020; Fujian Provincial Development and Reform Commission, 2017; Hainan Provincial Development and Reform Commission, 2019; Shandong Provincial Energy Administration, 2019; Ningde Municipal People's Government Office, 2020.

Preferential access to vehicle license plate

Some city governments continued to impose an upper limit on new PC registrations in 2020. Table 9 shows that five of the cities in this analysis and Hainan Province, where Haikou and Sanya are located, had an annual quota system for license plates issued. The lottery winning rate column shows the average chance of getting a license plate for individual consumers in 2020, and the last column shows the average auction price result from the bidding on a license plate, if applicable.

Guangzhou and Tianjin had a quota that was only for energy-saving PCs. This was in addition to the PC quota and gave energy-saving car buyers a better chance of

receiving a plate because they could participate in the lottery for energy-saving cars as well as the general lottery for all PCs. Tianjin added an additional regional quota in 2020: Anyone with a Beijing or Hebei Province Hukou who met certain criteria, for example, is a Tianjin resident and if they do not have a car, they can participate in the auction.[5] Winners of the auction must, however, purchase the car in Tianjin. NEPCs were exempted from quota systems in many other cities, except for Beijing. The central guidance is to *not* limit the number of NEVs through a license plate quota system (National Development and Reform Commission of the People's Republic of China, 2019), and Beijing is the only city that has a quota on NEPCs. Based on the NEPC quota system and applications in Beijing as of 2020, there was an 8-year waiting period to receive an NEPC license plate.

If we exclude Hainan Province, the average lottery winning rate across the cities we examined was 1% or less, and the average auction price was tens of thousands of yuan. The combination of economic cost, opportunity cost, and the difficulty of getting a license plate for a conventional fuel car is a strong driver of NEPC adoption.

Table 9. Details of quotas, 2020

Area	Mechanism			Quota				Average lottery winning rate		Average auction price (CNY)
	PC	Energy-saving PC[a]	NEPC	Total for 2020	PC	Energy-saving PC	NEPC	PC	Energy-saving PC	PC
Shenzhen	Auction + lottery	—	No restriction	105,600	105,600	—	—	0.25%	—	48,288
Guangzhou	Auction + lottery	Lottery	No restriction	176,896	150,983	25,913	—	0.69%	80.94%	21,916
Shanghai	Auction	—	No restriction	173,726	173,726	—	—	—	—	90,734
Beijing	Lottery	—	BEV only and no lottery, but limited quota each year	112,400	38,200	—	74,200	0.03%	—	—
Tianjin	Auction + lottery + regional quota	Lottery	No restriction	135,000	125,000	10,000	—	1.02%	21.52%	17,183
Hainan province	Lottery[b]	—	No restriction	243,488	243,488	—	—	29.08%	—	—

[a] These are hybrid vehicles with fuel consumption that is a certain percentage of the regulatory limit. The percentage was 65% in Guangzhou and 60% in Tianjin (General Office of the Guangzhou Municipal People's Government, 2018; Tianjin Municipal People's Government, 2019).
[b] Hainan's Notice on Measures and Management of the Stock of Passenger Cars indicates a combination of auction and lottery (Hainan Provincial People's Government, 2018), but in 2020 only the lottery was implemented.

5 The Hukou system in China is a household registration system. A person with a Beijing Hukou is likely to be a long-time resident of Beijing.

Preferential road access

In six of the cities in our study—Beijing, Tianjin, Chengdu, Liuzhou, Haikou, and Sanya—private NEPCs were exempted from certain traffic restrictions (Table 10).

Table 10. Road access restrictions for conventional fuel PCs and preferential access for NEPCs, 2020

Type of restriction	Mechanism	Time of restriction	Example
Weekday	Last digit of license plate (restricted on 1 out of 5 weekdays)	Working hours, usually 07:00 –19:00 or 20:00	Restricted road access based on last digit of license plate within Fifth Ring Road in Beijing from 07:00–20:00 and battery-electric passenger cars exempted
	Last digit of license plate	Rush hours only	Restricted road access based on last digit of license plate within Ring Expressway in Chengdu from 07:30–09:30 and 17:00–19:00 and NEPCs exempted
Heavy pollution day	PCs below certain emission standards	All times when pollution reaches a certain level	In Beijing, light-duty gasoline vehicles certified to the China 1 and China 2 standards were banned from the road during orange warnings, and China 3 and above certified vehicles were restricted based on odd/even license plate during red warnings. BEVs were exempted.
	Odd/even license plate (restricted every other day)	All times when pollution reaches a certain level	Tianjin restricted vehicles based on odd/even license plate during red warnings and NEVs were exempted
Non-local license plate	Additional restrictions on non-local license plate	All times	Hainan Province imposed a 120-day limit per calendar year on road access for non-local PCs, with certain exemptions for local businesses and residents. Private NEPCs were exempted.
Regular	Restriction in smaller areas	All times	Liuzhou exempted NEPCs from traffic restrictions based on odd/even license plate on Liujiang Bridge
	Specific incentive for NEPCs	All times	In Liuzhou, NEPCs can use bus-dedicated lanes

Sources: Beijing Municipal People's Government, 2016, 2019; Chengdu Traffic Management Bureau, 2020; General Office of Tianjin Municipal People's Government, 2019; Hainan Provincial Public Security Department, 2019; Liuzhou Public Security Bureau Traffic Police Department, 2018.

Battery reuse and recycling subsidies

Only Shenzhen provided a recycling subsidy for NEV traction batteries in 2020 (Shenzhen Municipal Bureau of Finance, 2018). A subsidy of CNY 20/kWh was given to manufacturers selling NEVs in Shenzhen to be used specifically for NEV traction battery recycling, with a cap of 50% of the cost. This is supplemented by a growing municipal NEV traction battery recycling monitoring system. More cities are expected to incentivize or require battery reuse and recycling practices in the future, following existing policies and future policies and guidance that are likely to come from the central government that will provide more details.

SUMMARY OF CITY INCENTIVES

Table 11 catalogues the incentives described above across the 13 cities. Implementation of the 19 actions, including five related to planning, seven direct consumer fiscal incentives, and seven indirect consumer incentives, varied by city. Most cities had city-level NEPC/NEV targets and charging infrastructure planning. Some cities were among the 25 cities in the "Ten Cities, Thousand Vehicles" NEV pilot program that ran during 2009 and 2010, and some were in it when it ran again during 2013 and 2014 (Jin et al., 2021). Two of them participated in the 2020 national NEVs to the Countryside program. NEV-ready building codes were adopted by all cities. Charging fee subsidy and reduction and public charger subsidies were also available in most cities. Other major incentives were parking fee reduction (nine cities), dedicated parking spaces (eight cities), preferential access to a license plate (seven cities), and preferential road access (six cities). Haikou, Shenzhen, and Chengdu were the leaders in terms of the number of NEPC promotional actions taken.

Table 11. Overview of NEPC incentives by city, 2020. Cities are listed in descending order of number of new NEPC sales in 2020.

City	City-level actions																			
	City planning					Direct consumer fiscal incentives							Indirect consumer incentives							Total incentives
	Pilot city (2009–2010)	Pilot city (2013–2014)	NEV Deployment target	Charging infrastructure planning	NEVs to the Countryside city	Vehicle replacement rsubsidies	BEV usage Subsidies	PHEV usage Subsidies	Home charger Subsidies	Charging fee subsidy and reduction	Parking fee reduction	Road toll reduction	Public charger subsidies	Charging in existing neighborhoods	Dedicated parking space	NEV-ready building code	Preferential access to license plate	Preferential road access	Battery recycling subsidies	
Shanghai	●	●	●	●						●			●	●	●	●	●			10
Beijing	●	●	●	●									●		●	●	●	●		9
Shenzhen	●	●	●	●		●	●	●		●	●		●			●	●		●	13
Guangzhou	●	●	●	●			●			●			●		●	●	●			10
Tianjin	●	●	●	●						●			●	●		●	●	●		10
Chengdu	●	●	●	●	●	●			●	●	●		●	●		●		●		13
Liuzhou			●	●						●	●		●	●	●	●		●		9
Haikou	●	●	●	●	●		●	●		●	●		●	●	●	●	●	●		15
Nanjing		●	●	●		●				●	●		●		●	●				9
Xiamen	●	●	●	●						●	●		●			●				8
Sanya			●	●			●	●		●	●		●	●	●	●	●	●		12
Zaozhuang			●	●							●					●				4
Ningde		●	●	●						●	●	●			●	●				8
Total Cities	**8**	**10**	**13**	**13**	**2**	**3**	**4**	**3**	**1**	**11**	**9**	**1**	**11**	**6**	**8**	**13**	**7**	**6**	**1**	**130**

METHODS OF QUANTIFYING NEW ENERGY PASSENGER CAR POLICY BENEFITS

Of the 14 direct and indirect consumer incentives listed in Table 11, we quantified 12 of them. The battery recycling subsidy was not quantified because it is too early for it to materialize in consumer benefits such as reduced prices, and policies to promote charging in existing neighborhoods was not quantified because these were only applied in a few neighborhoods. Further, the benefits of public charger availability were not quantified for PHEVs such as the Li One, as PHEVs can run on conventional fuel and consumers are not likely to experience range anxiety. Only the benefits from public charger availability supported by the government were included in our assessment.

Our previous paper, He et al. (2018), described the methods and data sources for the quantification and this section provides details of only the updates made and new methods employed. We used a 4-year average vehicle retainment time and a 4.35% discount rate, same as in the previous analysis.

Charging fee

Our previous method of quantifying the charging fee was based on the energy efficiency of a given model and an average daily driving distance and it did not fully account for situations where PHEV users seldom drive on electricity. A utility factor of 26%, representing the fraction of mileage on the electric motor, was added here for PHEVs and it is based on data about real-world use in China (Plötz et al., 2020).

Dedicated parking space

We calculated the monetary value of a dedicated NEV parking space by the time saved in finding a parking location. The following equation was used to calculate the benefit in a single year:

$$AB = ST_{search} \times WTP \times 12 \times AF_{difficulty}$$

AB	annual benefit
ST_{search}	saved time (minutes) in searching for a parking space
WTP	willingness to pay (WTP; in CNY/month) to reduce search time by 1 minute
$AF_{difficulty}$	adjustment factor reflecting the relative difficulty of finding parking

Based on a study conducted in the United States (Guerra & Daziano, 2020), the WTP to reduce parking search time by 1 minute is around 9% of the monthly parking cost. We assumed the typical monthly parking cost is CNY 150 and thus the corresponding WTP to reduce search time by 1 minute is CNY 13/month. We assumed that every 10% increase in the requirement of dedicated public NEV parking reduces search time by 2 minutes. For requirements that do not apply to all public parking, for example, only to new parking, or multiple locations but not all, this reduction rate was halved. For cities that had such requirements but did not set a specific percentage, we assumed 10%. The adjustment factor evaluates how difficult it is to find a parking spot in these cities, or how likely it is for an NEPC driver to spend time searching. We assumed a normalized adjustment factor of 1 for cities that were among the top 10 most difficult to find a parking space (Tech China, 2022), 0.8 for cities that were among the top 10 in vehicle stock, and 0.5 for the rest of the cities.

NEV-ready building codes

We quantified the benefits of NEV-ready building codes only for residential parking because the benefits of NEV-ready building codes for public parking are mostly reflected in public charging availability. Getting a charger installed in a residential parking spot can be a rather lengthy process. Therefore, the benefits to individual

consumers were estimated based on time savings. We used the equation below to calculate this monetary benefit for a single year.

$$AB = (NP \times (ST_{charger} \times Re_{charger,NP} + ST_{ready} \times Re_{ready,NP}) + EP \times (ST_{charger} \times Re_{charger,EP} + ST_{ready} \times Re_{ready,EP})) \times WG$$

AB	annual benefit
NP	likelihood to use a new parking lot
EP	likelihood to use an existing parking lot
$ST_{charger}$	saved time (hr) with an "equipped with a charger" requirement
ST_{ready}	saved time (hr) with an NEV-ready requirement
$Re_{charger,NP}$	requirement for percentage of spots equipped with a charger in new construction
$Re_{ready,NP}$	requirement for percentage of NEV-ready spots in new construction (minus those already required to be equipped with a charger)
$Re_{charger,EP}$	requirement for percentage of spots equipped with a charger in existing parking
$Re_{ready,EP}$	requirement for percentage of NEV-ready spots in existing parking (minus those already required to be equipped with a charger)
WG	average national hourly wage

We calculated the potential saved time in the two brackets after the NP and EP parameters. We assumed it takes 6 hours to get a charger installed in a residential spot and that an NEV-ready requirement saves 2 hours. The percentage requirements in the policy were used to assess how likely a driver is to use either type of spot. For example, if a city requires that 100% of new residential parking be NEV-ready and 10% be equipped with a charger, then a car owner has a 10% likelihood of being able to use a spot already equipped with a charger, saving 6 hours' time, and a 90% likelihood of getting an NEV-ready spot, saving 2 hours' time. The likelihood of an NEPC owner residing in a new neighborhood was assumed to be 20% and we assumed an 80% chance of living in an existing neighborhood.

RESULTS AND DISCUSSION

Figure 3 shows the monetized consumer benefits for the three selected PC models.

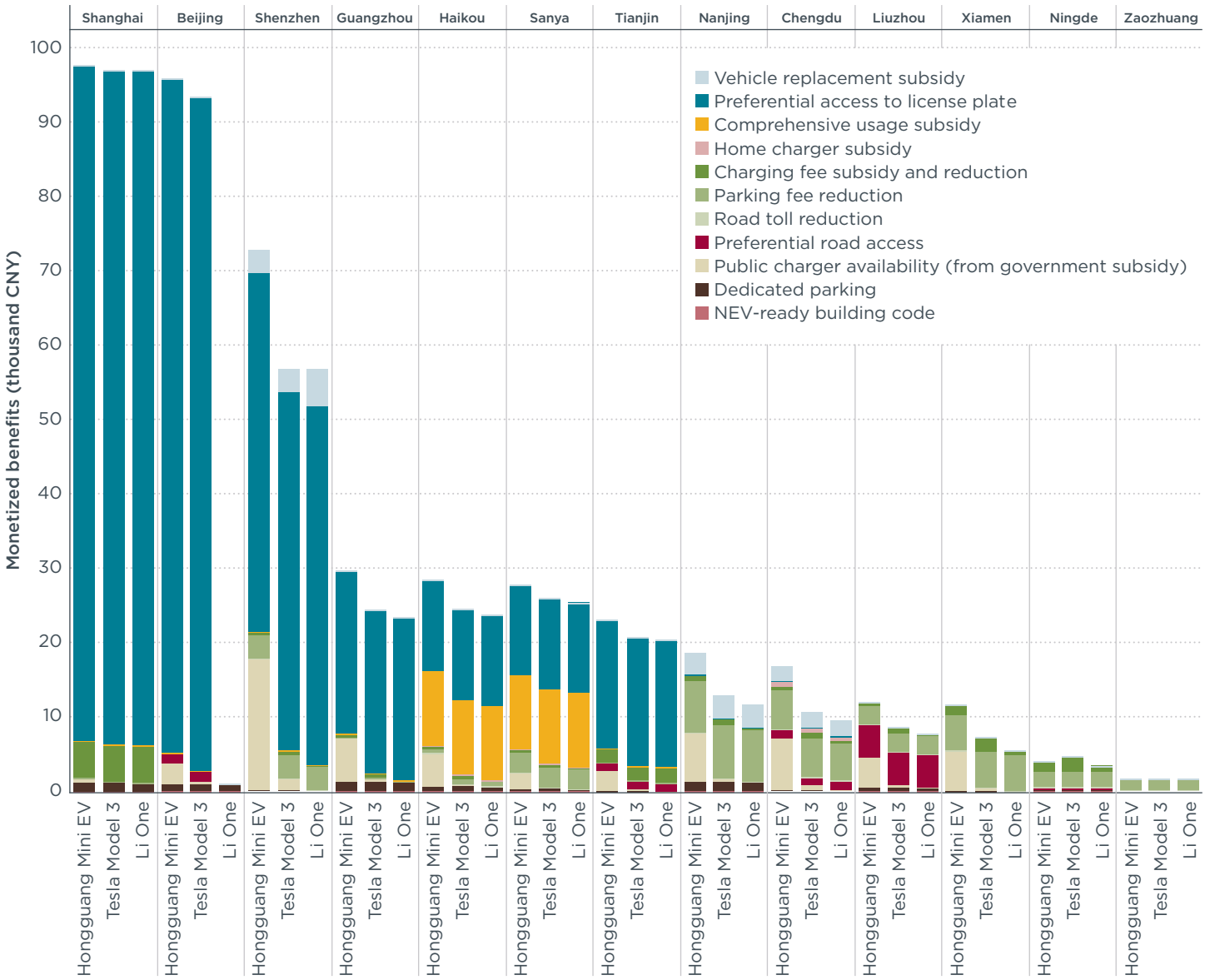

Figure 3. Monetized private car consumer benefits from city incentives for the three selected models, 2020.

The prior analysis for 2015 found that purchase subsidy was the main incentive, but here we see that for cities with a license plate quota, that was likely the main driver for owning an NEPC and that is reflected in the high value of a license plate. For cities without a quota, benefits from use-phase incentives are the majority of the value. In some cases, the benefit could be a fair portion of the vehicle price. For example, in Liuzhou, the monetized benefits that apply to the Hongguang Mini BEV over a 4-year period of ownership are about CNY 11,000, 20% of the price of the city's most popular NEPC model in 2020, SAIC-GM-Wuling's Baojun E200, which is also a microcar.

Additionally, for a shorter-range NEPC like the Hongguang Mini BEV, public charger availability provides a significant benefit to consumers. The Tesla Model 3 also benefits, but with its longer electric range, there is not as much need for a public charger for daily use as there might be for a microcar.

In 2020, most cities provided similar benefits to BEVs and PHEVs, and favored BEVs in some cases. Beijing's incentives were almost all geared toward BEVs, and thus monetized consumer benefit for the Li One there is zero. The higher vehicle replacement subsidy for the Li One than the BEVs in Shenzhen is not because of the technology but rather due to the higher price of the Li One (recall that details are in the vehicle replacement subsidy section).

Monetized consumer benefits largely align with NEPC market uptake (Figure 4). Tier 1 cities generally had more benefits and higher market share, and a couple of New Tier 1 and Tier 3 cities were similar.

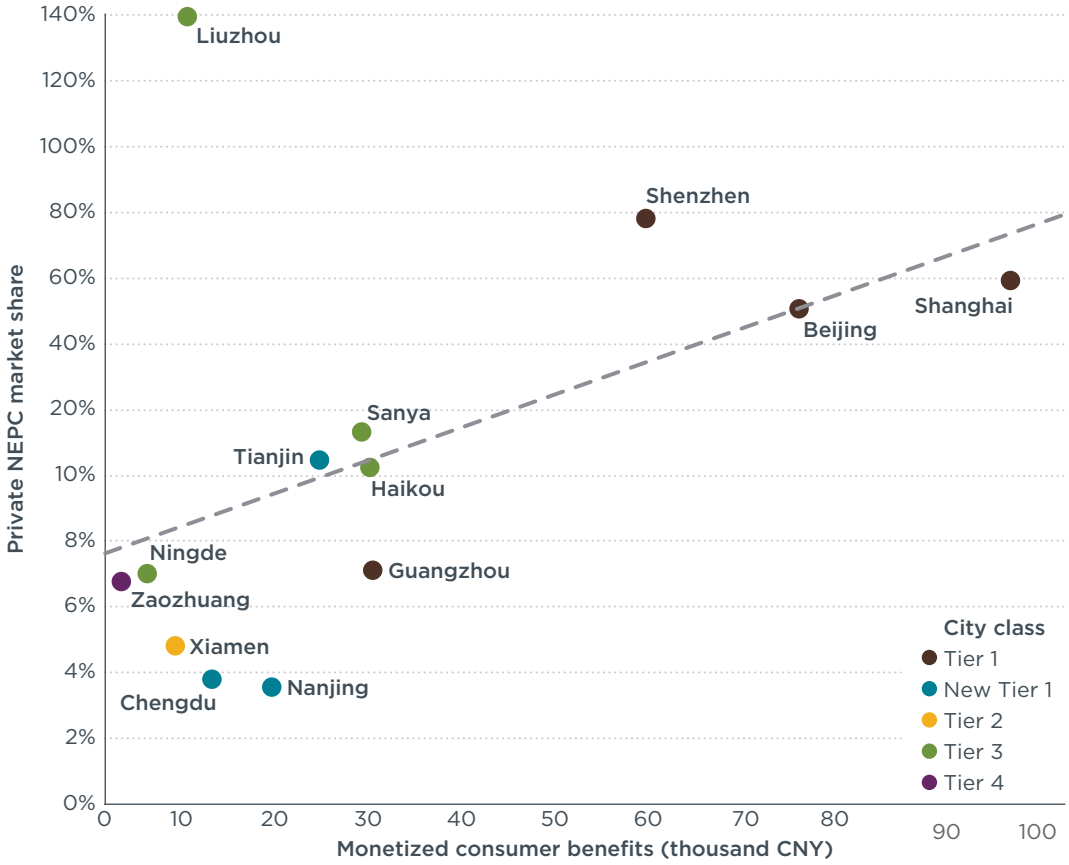

Figure 4. Monetized private consumer benefits and private NEPC market share by city, 2020. Benefits are weighted by sales.

Liuzhou offered relatively few benefits but had a high share of battery-electric passenger cars. This is largely due to targeted product development, market strategy, outstanding consumer engagement from very early on, and the municipal government's efforts to make these vehicles convenient to use. As early as 2017, Liuzhou and SAIC-GM-Wuling initiated a 10-month test drive campaign for the Baojun E100 micro NEPC, which was being specifically developed for smaller cities; Liuzhou residents were invited to provide feedback to improve the car. More than 15,000 people participated and over 70% of them ultimately bought a vehicle. Since then, the manufacturer has released new models with longer electric range, the E200 and E300, but kept the price generally below CNY 50,000. Given that most people use these microcars for their daily commute to work and for short trips, regular 2.2 kW sockets work well for overnight charging and those sockets are cheaper than level 2 chargers. In addition, these microcars can park at the thousands of small parking spaces created specifically for them by the city, some of which are on sidewalks. The low purchase price, low use cost, and convenience together contributed to the success of these cars in Liuzhou.

Figure 5 compares public charging availability by the end of 2020 in cities using three metrics: total number of chargers, number of chargers per million population, and NEPC-to-charger ratio. The number of public chargers mostly follows the city tiers. Notably, cities like Guangzhou, Chengdu, and Xiamen have more fast chargers than level 2 chargers. In terms of public chargers per million population, Shenzhen ranks first, and is followed by Ningde, Sanya, Shanghai, and Haikou. Most cities have three to six NEPCs per public charger. The reason behind Liuzhou's higher ratio is that many of its popular models are charged with household sockets, as mentioned above. If we include the 23,000 household sockets for charging NEPCs, this ratio would be three-to-one in 2020.

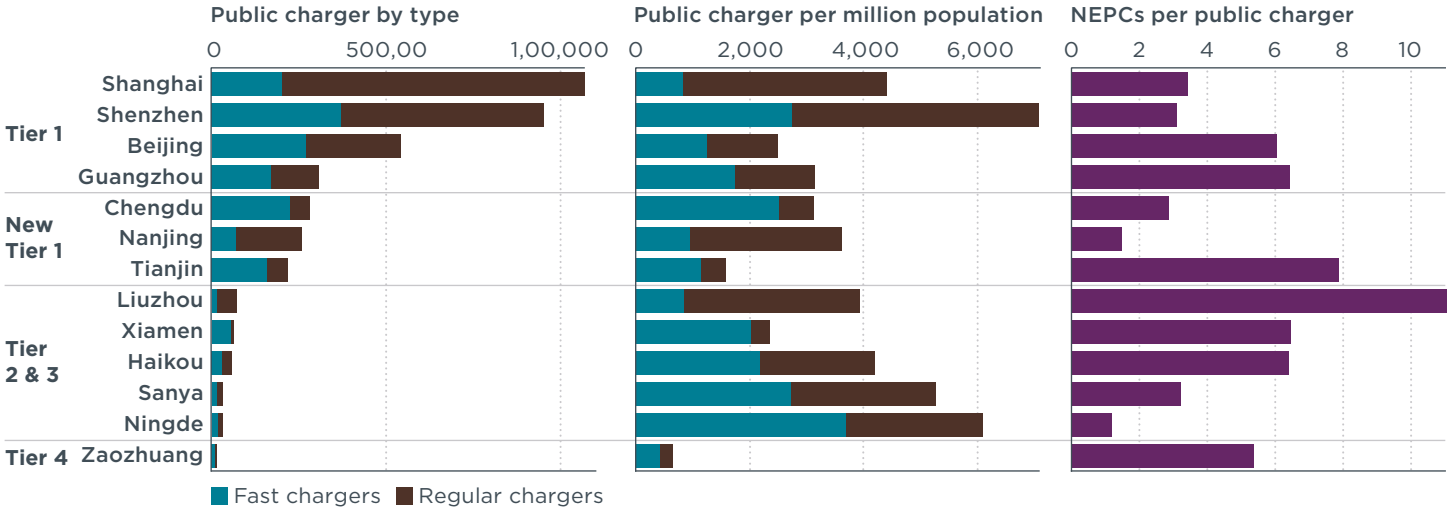

Figure 5. Public charging infrastructure deployment in 2020.

Figure 6 shows that cities have developed their own locally suited strategies over the years. For example, Shenzhen and Shanghai scored well on all of the metrics; Liuzhou benefited from its consumer-targeted strategy even though it has fewer models available; and Haikou and Sanya deployed a lot of promotional actions and also scored well on charging convenience.

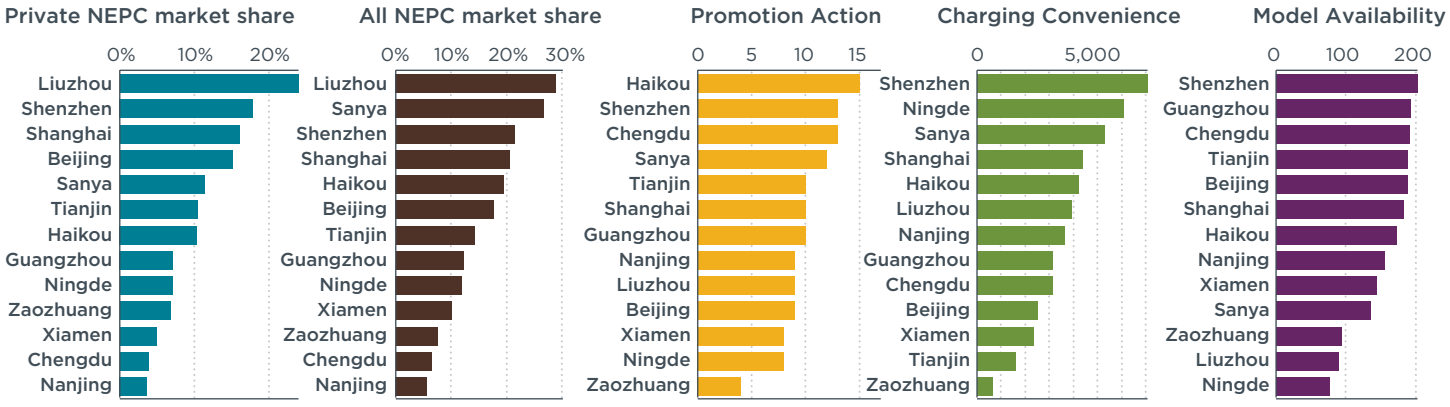

Figure 6. Cities ranked by five metrics, including number of promotional actions, charging convenience (the number of public chargers per million population), and model availability (the number of models offered), 2020.

KEY FINDINGS AND CONCLUSIONS

Having comprehensively explored and catalogued major NEPC policies for leading cities in different tiers in China in 2020 and having examined some of the forces driving the NEPC markets in these cities, the following highlights emerge:

As NEPC technology matures and the private NEPC market expands, many smaller cities have developed their own locally suited strategies to promote market maturation. In Haikou and Sanya, a coordinated provincial strategy is combined with local incentives, and in Liuzhou there is targeted product development and outstanding consumer engagement. Central and provincial NEVs to the Countryside programs have brought more private NEPCs to smaller cities and towns and this not only expands the market but also promotes more equitable access to clean technology for all.

By 2020, upfront purchase subsidies were no longer the major portion of the monetized consumer benefits. Instead, exemption from the license plate quota system and use-phase incentives were the main players. In 2019, the central government encouraged local governments to shift to use-phase incentives and remove local purchase subsidies for most NEVs, except for electric buses and FCVs. As a result, most cities shifted to use-phase incentives. In cities with a license plate quota system, exemption for NEPCs continued to be of significant value to consumers. In cities without a quota, other use-phase incentives provided the most value to NEPC consumers. Compared to 2015, **cities played a larger role in promoting NEPCs** because many of the use-phase incentives offered are initiated at the city level.

The most widely adopted direct fiscal incentives were fee reductions and the most widely adopted indirect incentives focus on charging availability. On average, the 13 cities in our analysis deployed 10 promotional actions in 2020 out of the 19 catalogued, with a range from four to 15. Charging fee reduction and parking fee reduction were the two most widely adopted incentives and such reductions usually apply to all NEPCs, thus avoiding the potential preferential treatment of local brands. Given their widespread use, it appears that fee reductions were easiest to implement for cities. Cities also strived to ensure charging availability. NEV-ready building codes of various stringencies were adopted by all cities and many cities provided incentives for the construction and operation of public chargers.

Cities continued to improve public charging infrastructure availability while addressing different challenges and needs. As the on-road NEPC stock grows, one area that cities are increasingly focused on is charging in existing multi-unit dwellings and neighborhoods. Additionally, there is an emerging principle that cities such as Shanghai, Chengdu, Fuzhou, Beijing, and Tianjin are exploring and it is unified installation and unified management. Tianjin's program also featured a demand-based approach, clarified responsibility, guidance from the municipal government, and efforts to ensure adequate and consistent after-sales service.

Based on the above, we suggest that cities set specific and actionable targets and design matching policies to achieve these targets. All cities had city-level planning and targets for NEPCs/NEVs and charging infrastructure. Cities should consider setting more detailed targets and policies and assigning accountability to facilitate better implementation. For example, Chengdu made detailed requirements for NEV-ready building codes by type of building (residential, workplace, etc.), construction (existing, new) and areas (central, surrounding, and satellite). Liuzhou specified targets for charging infrastructure and dedicated NEV parking spaces by district and set intermediate targets every 6 months.

REFERENCES

Beijing Municipal Commission of Planning and Land and Resources Management. (2017). *Beijing Local Standard "Electric Vehicle Charging Infrastructure Planning and Design Standards."* https://std.samr.gov.cn/db/search/stdDBDetailed?id=91D99E4DACDE2E24E05397BE0A0A3A10

Beijing Municipal Commission of Urban Management. (2018a). *Implementation Opinions of Beijing Municipal Commission of Urban Management and Beijing Municipal Commission of Transportation on Strengthening the Construction and Management of Charging Facilities in Parking Lots*. http://www.beijing.gov.cn/zhengce/zhengcefagui/201905/t20190522_61422.html

Beijing Municipal Commission of Urban Management. (2018b). *Notice of the Beijing Municipal Commission of Urban Management and the Beijing Municipal Bureau of Finance on Issuing the Interim Measures for the Implementation of the Evaluation and Awards for the Operation of Public Charging Facilities for Electric Vehicles in Beijing*. http://www.beijing.gov.cn/zhengce/zhengcefagui/201905/t20190522_61584.html

Beijing Municipal Commission of Urban Management. (2019, October 29). Notice on further clarifying commerical centralized charging and battery swapping facilities. https://m.evpartner.com/news/detail-48510.html

Beijing Municipal People's Government. (2016). *Announcement of the Beijing Municipal People's Government on Adopting Temporary Traffic Management Measures in Response to Heavy Air Pollution*. http://www.beijing.gov.cn/zhengce/zhengcefagui/201905/t20190522_59695.html

Beijing Municipal People's Government. (2019). *Announcement of the Beijing Municipal People's Government on the Implementation of Traffic Restrictions During the Peak Hours of Weekdays*. http://www.beijing.gov.cn/zhengce/zhengcefagui/201905/t20190522_62007.html

Bloomberg News. (2021, June 27). China's electric car capital has lessons for the rest of the world. https://www.bloomberg.com/news/features/2021-06-26/china-s-electric-car-capital-has-lessons-for-the-rest-of-world

Chen, Z., & He, H. (2021). *The second phase of China's new energy vehicle mandate policy for passenger cars*. International Council on Clean Transportation. https://theicct.org/publication/the-second-phase-of-chinas-new-energy-vehicle-mandate-policy-for-passenger-cars/

Chen, Z., & He, H. (2022, February 10). How will the dual-credit policy help China boost new energy vehicle growth? *ICCT Staff Blog*. https://theicct.org/china-dual-credit-policy-feb22/

Chengdu Development and Reform Commission. (2020, December 15). Policy interpretation of the "Notice on Clarifying Matters Related to the Identification of Commercial Centralized Charging and Battery Swapping Facilities." http://www.cdsgsl.gov.cn/policy/00000027/00002733

Chengdu Municipal Bureau of Commerce. (2020, April 21). Implementation rules for supporting automobile replacement. http://www.pkulaw.cn/fulltext_form.aspx/pay/fulltext_form.aspx?Gid=18369112

Chengdu Municipal Bureau of Economy and Information Technology. (2019). *Several Policies in Chengdu to Support the Development, Promotion and Application of Hydrogen Energy and New Energy Vehicle Industry*. http://gk.chengdu.gov.cn/govInfoPub/detail.action?id=111884&tn=6

Chengdu Municipal Government. (2020, May 17). Special plan for the construction of electric vehicle charging and swapping infrastructure in Chengdu. https://www.evpartner.com/news/12/detail-27578.html

Chengdu Traffic Management Bureau. (2020, April 7). From April 7th, Chengdu will resume the traffic restriction in an orderly manner. https://www.sc.gov.cn/10462/12771/2020/4/4/0673fa25c404436cb92ffd0f0dc3d8a3.shtml

Chu, Y. (2021). *China's New Energy Vehicle Industrial Development Plan for 2021 to 2035*. International Council on Clean Transportation. https://theicct.org/publication/chinas-new-energy-vehicle-industrial-development-plan-for-2021-to-2035/

Chu, Y., He, H., Jin, L., Wang, X., Zhang, J., Hao, F., & Li, Y. (2022). *Assessment of leading new energy vehicle city markets in China and policy lessons*. International Council on Clean Transportation. https://theicct.org/publication/china-city-markets-new-energy-sep22/

Cui, H. (2018). *China's New Energy Vehicle mandate policy (final rule)*. International Council on Clean Transportation. https://theicct.org/publication/chinas-new-energy-vehicle-mandate-policy-final-rule/

Cui, H., & He, H. (2020). *China announced 2020–2022 subsidies for new energy vehicles*. International Council on Clean Transportation. https://theicct.org/publication/china-announced-2020-2022-subsidies-for-new-energy-vehicles/

Fujian Provincial Department of Industry and Information Technology. (2020). *Three-Year Action Plan (2020-2022) on Further Accelerating the Promotion and Application of New Energy Vehicles and High-Quality Industrial Development to Promote the Construction of "Electric Fujian" (2020-2022)*. http://gxt.fujian.gov.cn/zwgk/zdjcygk/ndzdjcsxml/202007/t20200715_5323457.htm

Fujian Provincial Development and Reform Commission. (2017). *Implementation Plan on Accelerating the Construction of Charging Infrastructure to Promote the Promotion and Application of New Energy Vehicles*. https://www.xmecc.com/html/2017/11/1/201711010852512 9892349384.html

General Office of the Guangzhou Municipal People's Government. (2018). *Notice of the General Office of the Guangzhou Municipal People's Government on Printing and Distributing the Administrative Measures for the Control of the Total Volume of Small and Medium-sized Passenger Cars in Guangzhou*. http://www.gz.gov.cn/gfxwj/szfgfxwj/gzsrmzfbgt/content/post_5444859.html

General Office of the Nanjing Municipal Government. (2017). *Notice of the General Office of the Municipal Government on Printing and Distributing the Implementation Plan for the Promotion and Application of New Energy Vehicles in Nanjing during the "Thirteenth Five-Year Plan."* http://www.nanjing.gov.cn/zdgk/201810/t20181022_573741.html

General Office of the Shenzhen Municipal People's Government. (2020). *Notice of the General Office of the Shenzhen Municipal People's Government on Printing and Distributing Several Measures to Promote the Promotion and Application of New Energy Vehicles in Response to the Impact of COVID*. http://www.sz.gov.cn/szsrmzfmhwzgkml/szsrmzfmhwzgkml/gzwj/gfxwj/content/post_7785184.html http://www.sz.gov.cn/cn/xxgk/zfxxgj/tzgg/content/post_7783278.html,https://ilonghua.sznews.com/content/2020-07/15/content_23347668.htm

General Office of Tianjin Municipal People's Government. (2019). *Emergency Plan for Heavy Pollution Days in Tianjin*. https://www.tj.gov.cn/zwgk/szfgb/qk/2019Site/21site/202005/t20200520_2476764.html

General Office of Tianjin Municipal People's Government. (2020). *Several Measures to Promote Automobile Consumption*. https://www.tj.gov.cn/zwgk/szfwj/tjsrmzfbgt/202006/t20200606_2659387.html

Guangdong Provincial Department of Environmental Protection. (2018). *Notice of the Guangdong Provincial Department of Environmental Protection on Printing and Distributing the 2018 Work Plan for Winning the Blue Sky Defense War in Guangdong Province*. http://www.gd.gov.cn/zwgk/wjk/qbwj/yf/content/post_1055797.html

Guangxi Zhuang Autonomous Region Department of Finance. (2019). *Notice of the Implementation of the Financial Subsidy for the Construction of New Energy Vehicle Charging Infrastructure and Supporting Operation Services in Guangxi*. http://www.gxzf.gov.cn/gxyw/t6850685.shtml

Guangzhou Municipal People's Government. (2020). *Notice of the Guangzhou Municipal People's Government on Printing and Distributing Several Measures for Guangzhou to Prevent and Control COVID and Strive to Achieve the Annual Economic and Social Development Goals and Tasks*. https://www.huadu.gov.cn/gzjg/qzfgzbm/qfzggj/xyhdzl/zcfg/content/post_5730886.html

Guangzhou Municipal Transportation Bureau. (2019, September 18). Notice of Guangzhou Municipal Transportation Bureau on printing and distributing Guangzhou Parking Lot Operation and Management Specifications. http://www.gzparking.com/news_view.asp?id=86

Guerra, E., & Daziano, R. A. (2020). Electric vehicles and residential parking in an urban environment: Results from a stated preference experiment. *Transportation Research Part D: Transport and Environment*, *79*. https://doi.org/10.1016/j.trd.2020.102222

Haikou Development and Reform Commission. (2020, January 14). Notice on new energy vehicles parking fees in Haikou city. https://m.evpartner.com/news/detail-49293.html

Hainan Provincial Department of Commerce. (2020). *Seven Measures to Promote Consumption in Hainan Province*. https://dofcom.hainan.gov.cn/dofcom/zwdt/202009/9a6708576f7843ac97a7b198fe8c0c83.shtml

Hainan Provincial Development and Reform Commission. (2019). *Interim Administrative Measures for the Construction and Operation of Electric Vehicle Charging Infrastructure in Hainan Province*. https://www.hainan.gov.cn/data/zfgb/2019/09/4587/

Hainan Provincial People's Government. (2018, May 15). Announcement of the Hainan Provincial People's Government on management of stock of passenger cars. http://www.caam.org.cn/chn/9/cate_93/con_5217233.html

Hainan Provincial Public Security Department. (2019). *Measures for the Administration of the Passage of Passenger Vehicles with License Plates Outside of Hainan Province (Trial Implementation)*. https://www.ndrc.gov.cn/fzggw/jgsj/dqs/sjdt/201908/t20190813_1050487.html?code=&state=123

He, H., Jin, L., Cui, H., & Zhou, H. (2018). *Assessment of electric car promotion policies in Chinese cities*. International Council on Clean Transportation. https://theicct.org/publication/assessment-of-electric-car-promotion-policies-in-chinese-cities/

Jiangsu Provincial Development and Reform Commission. (2020, September 22). Jiangsu Province issues policy opinions on promoting automobile consumption. http://zwfw.nanjing.gov.cn/njszwfwglbgs/202009/t20200923_2414554.html

Jin, L., & He, H. (2020, August 19). Ten cities, thousand fuel cell vehicles? China is sketching a roadmap for hydrogen vehicles. *ICCT Staff Blog*. https://theicct.org/ten-cities-thousand-fuel-cell-vehicles-china-is-sketching-a-roadmap-for-hydrogen-vehicles/

Jin, L., He, H., Cui, H., Lutsey, N., Wu, C., Chu, Y., Zhu, J., Xiong, Y., & Liu, X. (2021). *Driving a green future: A retrospective review of China's electric vehicle development and outlook for the future*. International Council on Clean Transportation. https://theicct.org/publication/driving-a-green-future-a-retrospective-review-of-chinas-electric-vehicle-development-and-outlook-for-the-future/

Liuzhou Development and Reform Commission. (2020). *Implementation Plan for the Promotion and Application of New Energy Vehicles in Liuzhou*. http://fgw.liuzhou.gov.cn/zwgk/fdzdgknr/zcwj/fgw_qtwj/202009/t20200917_2055488.shtml

Liuzhou Price Bureau. (2017). *Notice of Liuzhou City Price Bureau on Issues Concerning Charges for New Energy Vehicles*. http://fgw.liuzhou.gov.cn/ztzl/lszt/lswj/202008/t20200815_1924455.shtml

Liuzhou Public Security Bureau Traffic Police Department. (2018). *Announcement on Further Standardizing and Strengthening the Road Traffic Management of New Energy Vehicles in Liuzhou City during the Promotion and Application Period*. http://gaj.liuzhou.gov.cn/xwzx/jwdt/202007/t20200707_1694048.shtml

Ministry of Finance of the People's Republic of China. (2014a). *Announcement on Exemption of New Energy Vehicle from Purchase Tax*. http://www.chinatax.gov.cn/chinatax/n810341/n810755/c1150779/content.html

Ministry of Finance of the People's Republic of China. (2014b). *Notice on the Incentives for New Energy Vehicle Charging Facilities*. https://www.miit.gov.cn/jgsj/zbys/wjfb/art/2020/art_9ec10737cf1d48b39e85670c8b94607d.html

Ministry of Finance of the People's Republic of China. (2016). *Notice on the "13th Five-Year" New Energy Vehicle Charging Infrastructure Incentive Policy and Strengthening the Promotion and Application of New Energy Vehicles*. https://www.winlawfirm.com/ueditor/asp/upload/file/20170629/14987164075204984.pdf

Ministry of Finance of the People's Republic of China. (2019). *Notice on Further Improving the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles*. http://jjs.mof.gov.cn/zhengcefagui/201903/t20190326_3204190.htm

Ministry of Finance of the People's Republic of China. (2022). *Announcement on Continuing New Energy Vehicles Exemption from Vehicle Purchase Tax*. http://szs.mof.gov.cn/zhengcefabu/202209/t20220926_3842633.htm

Nanjing Bureau of Urban Management. (2017). *Notice on Issues Concerning the Preferential Policies for Parking Fees for New Energy Vehicles*. http://cgj.nanjing.gov.cn/njscsglj/201810/t20181023_616268.html

National Development and Reform Commission. (2014). *The National Development and Reform Commission issued the "Notice on Issues Concerning Electric Vehicle Electricity Price."* https://www.ndrc.gov.cn/fggz/tzgg/ggkx/201408/t20140806_1073810.html?code=&state=123

National Development and Reform Commission. (2018). *Opinions on Innovating and Improving the Price Mechanism for Promoting Green Development*. http://www.gov.cn/xinwen/2018-07/02/content_5302737.htm

National Development and Reform Commission of the People's Republic of China. (2019). *Implementation Plan for Upgrading Key Consumer Goods and the Promoting Resource Recycling (2019–2020)*. https://www.ndrc.gov.cn/xxgk/zcfb/tz/201906/t20190606_962458.html?code=&state=123

National Development and Reform Commission of the People's Republic of China. (2020). *Notice on Several Measures to Stabilize and Expand Automobile Consumption*. http://www.gov.cn/zhengce/zhengceku/2020-05/03/content_5508575.htm

Ningde Municipal People's Government. (2020). *Notice of Ningde Municipal People's Government on Printing and Distributing Six Measures of Ningde City to Promote the Development of New Energy Vehicle Industry*. http://www.ningde.gov.cn/zfgbwyb/202111/t20211122_1554690.htm

Ningde Municipal People's Government Office. (2020). *Implementation Opinions on Further Accelerating "Electric Ningde."* http://gxj.ningde.gov.cn/xxgk/zcwj/202002/t20200211_1275335.htm

Plötz, P., Moll, C., Li, Y., Bieker, G., & Mock, P. (2020). *Real-world usage of plug-in hybrid electric vehicles: Fuel consumption, electric driving, and CO_2 emissions*. International Council on Clean Transportation. https://theicct.org/publication/real-world-usage-of-plug-in-hybrid-electric-vehicles-fuel-consumption-electric-driving-and-co2-emissions/

Sanya Development and Reform Commission. (2019, July 17). Implementation opinions on strengthening the construction and management of charging infrastructure in parking lots. https://www.evpartner.com/news/12/detail-46394.html

Sanya Development and Reform Commission. (2020, June 2). *Interim Measures on New Energy Vehicle Parking Fees in Sanya*. https://www.hainan.gov.cn/hainan/jtts/202006/605ddb7a60274fafa705114456431033.shtml

Shandong Provincial Energy Administration. (2019). *Implementation Opinions on Further Strengthening and Standardizing the Construction and Operation of Electric Vehicle Charging Infrastructure in the Province*. http://nyj.shandong.gov.cn/art/2019/12/26/art_100392_8487562.html?xxgkhide=1

Shanghai Development and Reform Commission. (2020a). *Interim Measures of Shanghai Municipality for Promoting the Orderly Development of the Interconnection of Electric Vehicle Charging (Exchange) Facilities*. https://fgw.sh.gov.cn/zgjjl/20200401/d4df21f6b198489db864ce2184585a4f.html

Shanghai Development and Reform Commission. (2020b, April 29). Several measures to promote automobile consumption. https://www.evpartner.com/news/12/detail-51525.html

Shanghai Development and Reform Commission. (2020c, May 7). Shanghai new energy vehicle charging subsidy implementation plan. https://www.evpartner.com/news/12/detail-51655.html

Shanghai Municipal Commission of Transportation. (2015, June 8). Interim provisions on the construction and management of electric vehicle charging facilities in Shanghai. http://www.cbea.com/zccdjcss/201812/973794.html

Shanghai Municipal Commission of Transportation. (2016, February 26). Opinions on the city's promotion of the development of the new energy vehicle time-sharing rental industry. https://m.evpartner.com/news/detail-18598.html

Shenzhen Development and Reform Commission. (2017, July 6). *Shenzhen's 13th Five-Year Plan for Climate Change*. https://www.ccchina.org.cn/Detail.aspx?newsId=73211&TId=275

Shenzhen Development and Reform Commission. (2020). *Notice of the Shenzhen Development and Reform Commission on Organizing the Subsidy Application for the Construction of New Energy Vehicle Charging Facilities in Shenzhen in 2020*. http://fgw.sz.gov.cn/zwgk/qt/tzgg/content/post_8038503.html

Shenzhen Municipal Bureau of Commerce. (2020). *Notice of the Shenzhen Municipal Bureau of Commerce on Issuing the Guidelines for the Application of "Old-for-New" Automobile Purchase Incentives in Shenzhen*. http://commerce.sz.gov.cn/xxgk/qt/tzgg_1/content/post_7961751.html

Shenzhen Municipal Bureau of Finance. (2018). *Notice on Adjusting and Improving the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles*. http://szfb.sz.gov.cn/szsczjwzgkml/szsczjwzgkml/zcfgjzcjd/zcfg/content/post_5537733.html

Sina news. (2021, January 21). *It costs an additional ten yuan to charge for an hour—The prices of many electric vehicle charging stations in Xiamen have risen*. https://fj.sina.com.cn/news/2021-01-21/detail-ikftssan9047690.shtml

Tech China. (2022, January 7). AutoNavi released the national parking lot analysis report, identifying the ten most difficult parking spots. http://tech.china.com.cn/roll/20220107/384067.shtml

Tianjin Development and Reform Commission. (2017, December 19). Measures for the administration of construction and operation of new energy vehicle charging infrastructure in Tianjin. https://www.evpartner.com/news/12/detail-33065.html

Tianjin Municipal People's Government. (2019). *Tianjin Municipal People's Government on Printing and Distributing the Notice of Tianjin Municipal Measures for the Control and Administration of the Total Volume of Passenger Cars*. http://www.tj.gov.cn/zwgk/szfwj/tjsrmzf/202005/t20200519_2366134.html

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