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STUDIES

OIES CHINA PROGRAMME:

An update on China's EV Revolution

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About the OIES China Programme

- Launched in 2019, the OIES China Energy Research Programme, is a centre of analytical excellence offering **insights into the factors that inform China's energy policies and choices** and their pivotal role in global energy markets.
- Providing **academic expertise and rigor to inform business players and governments** on China's energy policies, on clean energy advances and challenges and on their implications for markets.
- **Independent experts** with decades of **experience working in and with China**, with extensive contacts in the private sector, government and NGO community in Europe, the US and China.
- **Research Fellows** include: Michal Meidan, Anders Hove, Philip Andrews-Speed, Mike Chen, Barbara Finamore, Yan Qin and David Sandalow.
- The China programme also draws on the wider OIES network, offering a **unique combination of deep technical energy expertise with extensive China knowledge**.



Background and contents

- **Updates on the latest 2022 EV statistics from various Chinese organizations:**
 - EV sales and market share: China and the world
 - EV sales by vehicle price, type, size
 - EV batteries and the growth of LFP share
 - EV emissions
 - EV charging: number of chargers, electricity consumption
 - Charging experience
- **Additional analysis from the author's prior research,**
- **Summary of 2023 research questions**

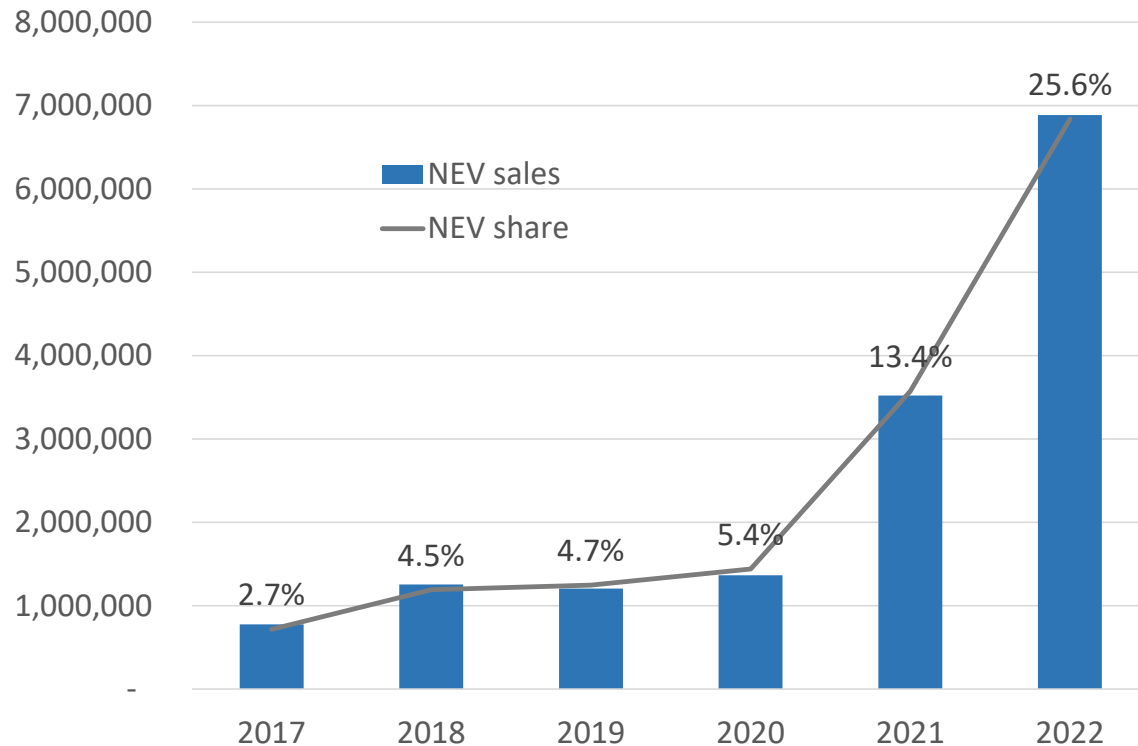
The contents also discussed on the OIES podcast of February 2023, “An update on China’s EV Revolution”:

<https://www.oxfordenergy.org/publications/oies-podcast-an-update-on-chinas-ev-revolution/>



China EV sales continue to grow

China New Energy Vehicle (NEV) sales, 2017-2022, and market share



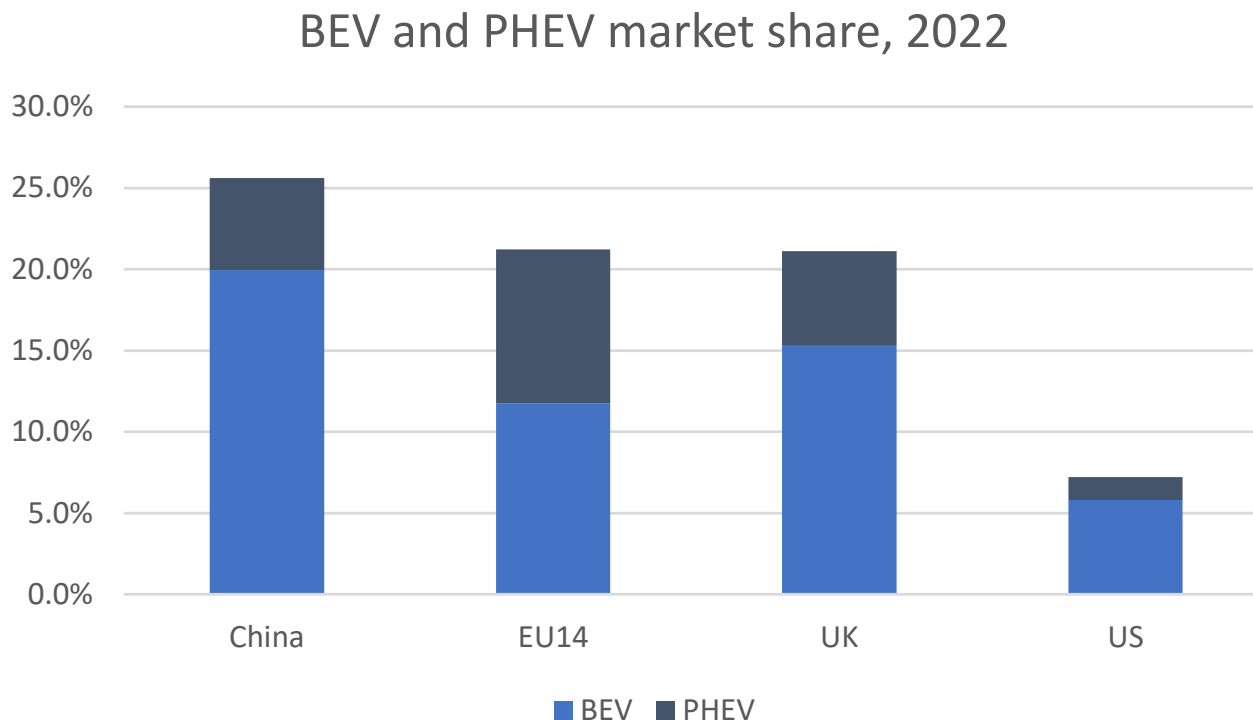
Source: CAAM 2023

- 10 million possible in 2023, almost 40% market share



China NEV market ahead of other major regions

2022 NEV market shares



Source: CAAM 2023, EV Volumes, ACEA 2023

Note: China share represents all vehicles, other countries light-duty passenger vehicles only

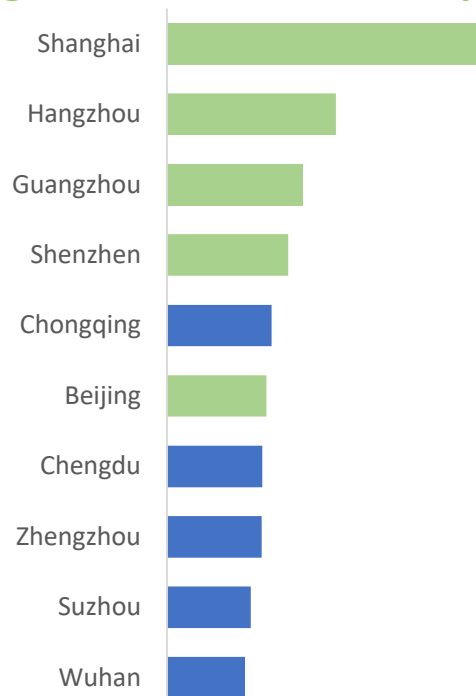
- China remains well ahead of other major auto markets in EV penetration



Several factors other than subsidies at work

Top NEV cities in Dec 2022

(green indicates license plate limit)



Source: CPCA/WAYS 2023

Customer satisfaction results

	NEV	Fossil vehicle
Overall	81	80
Brand image	81.9	81.4
Quality/reliability	81.3	80.0
Sales/service satisfaction	81	78

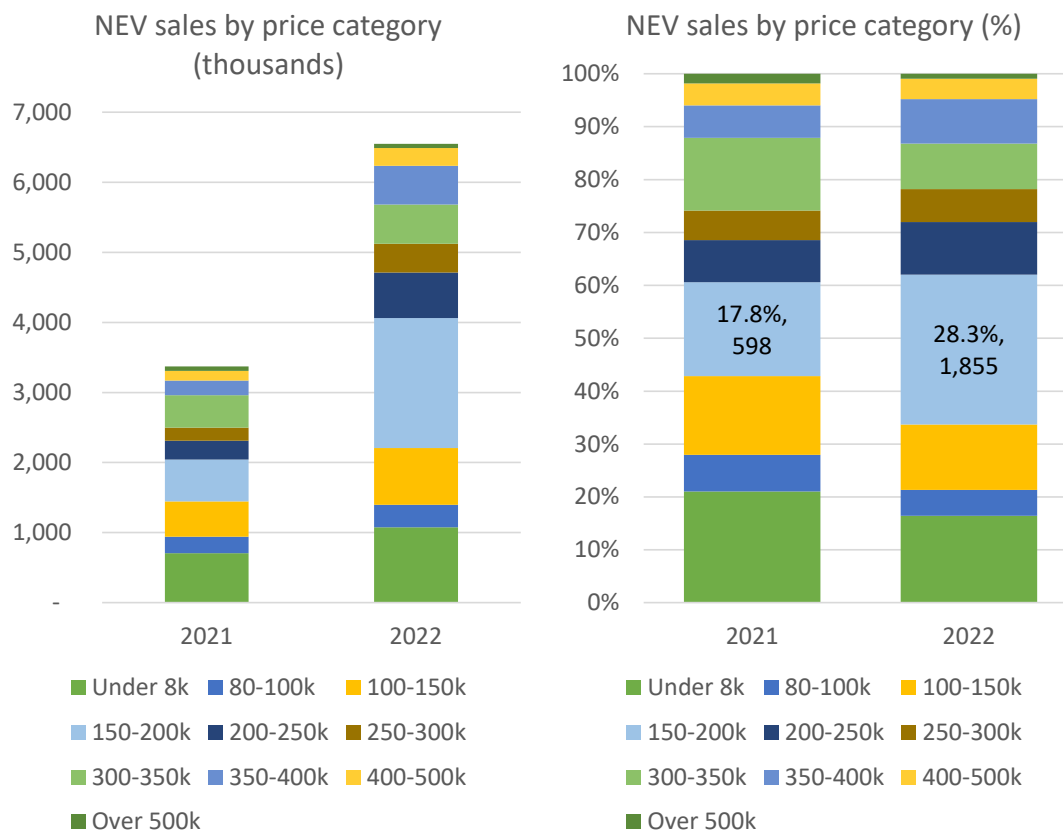
Source: China Association of Quality, 2023

- Local subsidies and license plate restrictions contributed to high urban EV sales, above 50% market share in Shanghai and Hangzhou in December
- NEVs perform better on customer satisfaction metrics; NIO, BMW, Mercedes, BYD, and Tesla scoring well, smaller and lower-end vehicles scoring below fossil vehicles



Mid-range NEVs showed strongest growth

NEV sales by price category, 2021 versus 2022

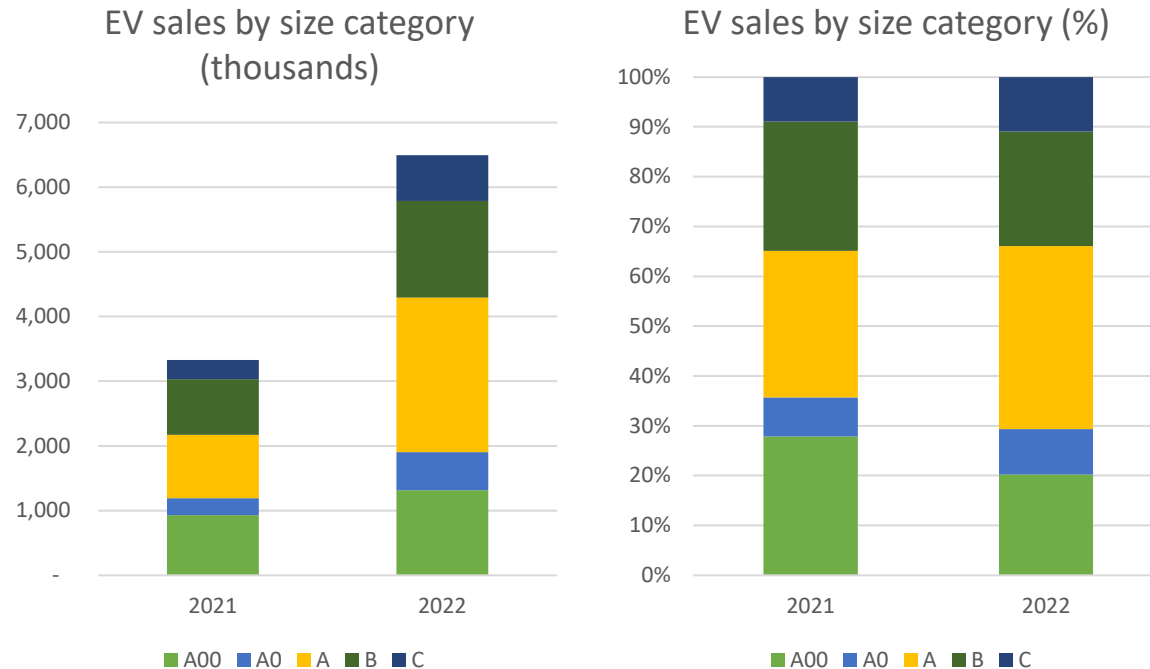


- RMB 150,000 – 200,000 is roughly US\$ 24,000 – 30,000
- All categories showed strong growth, led by mid-range categories



Larger-size NEVs showed strongest growth

China NEV sales by size category, 2021 versus 2022



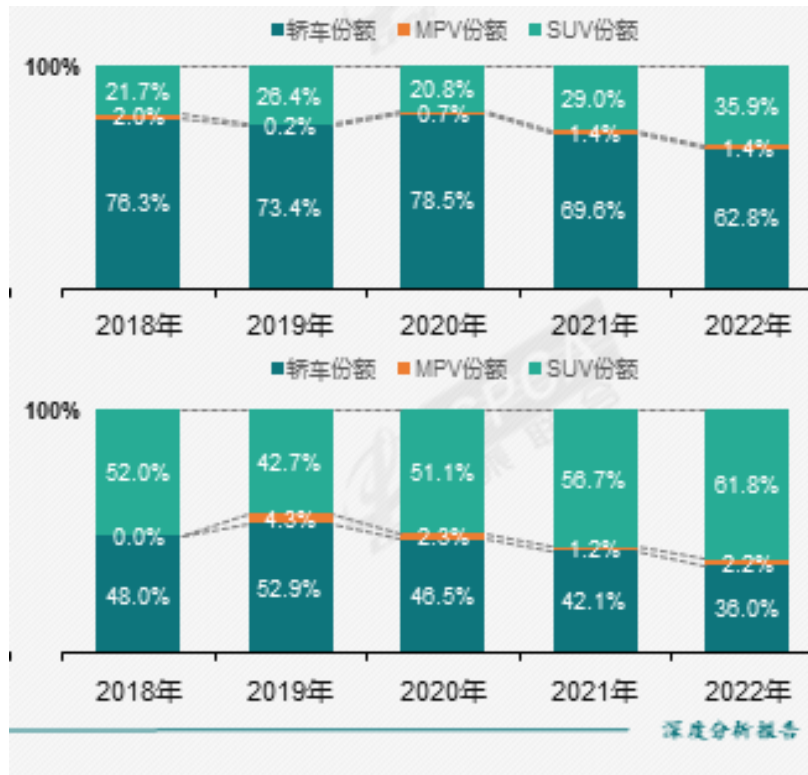
Source: CAAM 2023

- Micro-EVs (class A00) continued to lose market share, while other categories grew
- Strongest growth of A-class sedans



Larger-size NEVs showed strongest growth

China NEV sales by size category, 2021 versus 2022



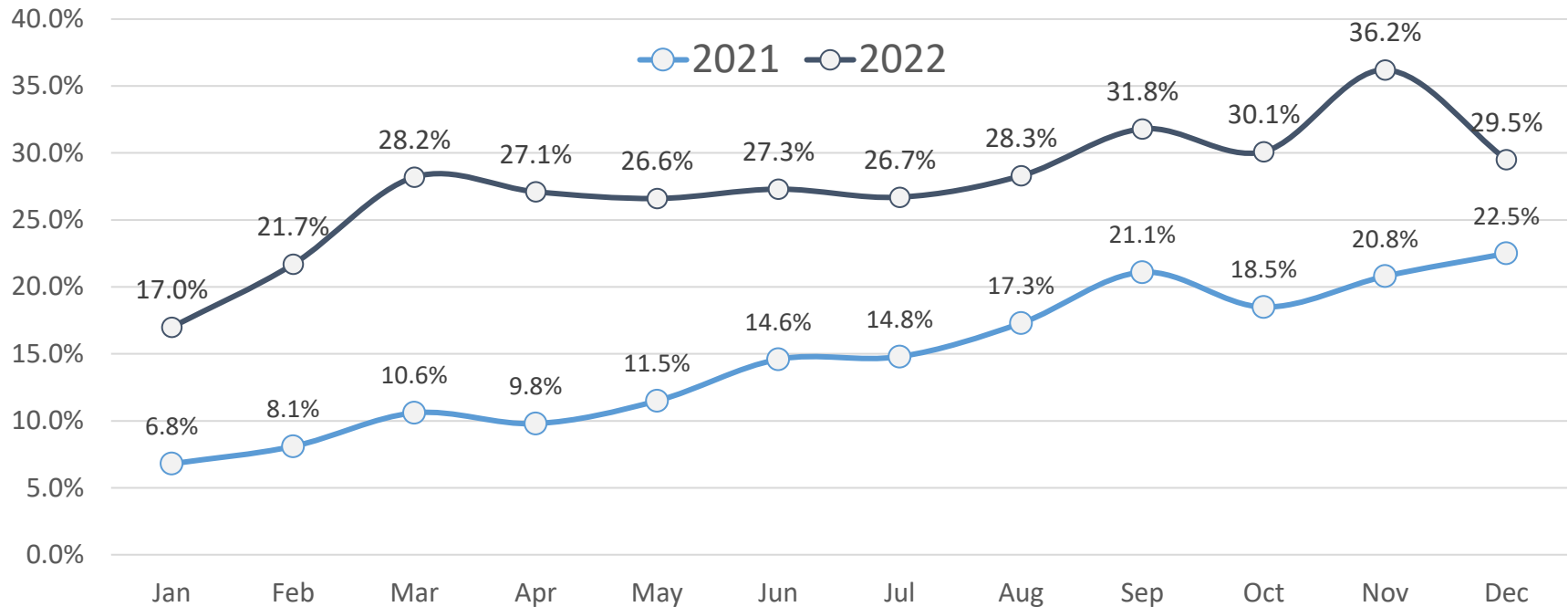
Source: CPCA 2023

- SUV share rising in both BEV and PHEV categories
- PHEV capturing more of SUV market



Monthly market share reached 36% in Nov

Monthly passenger NEV market share, 2021 and 2022



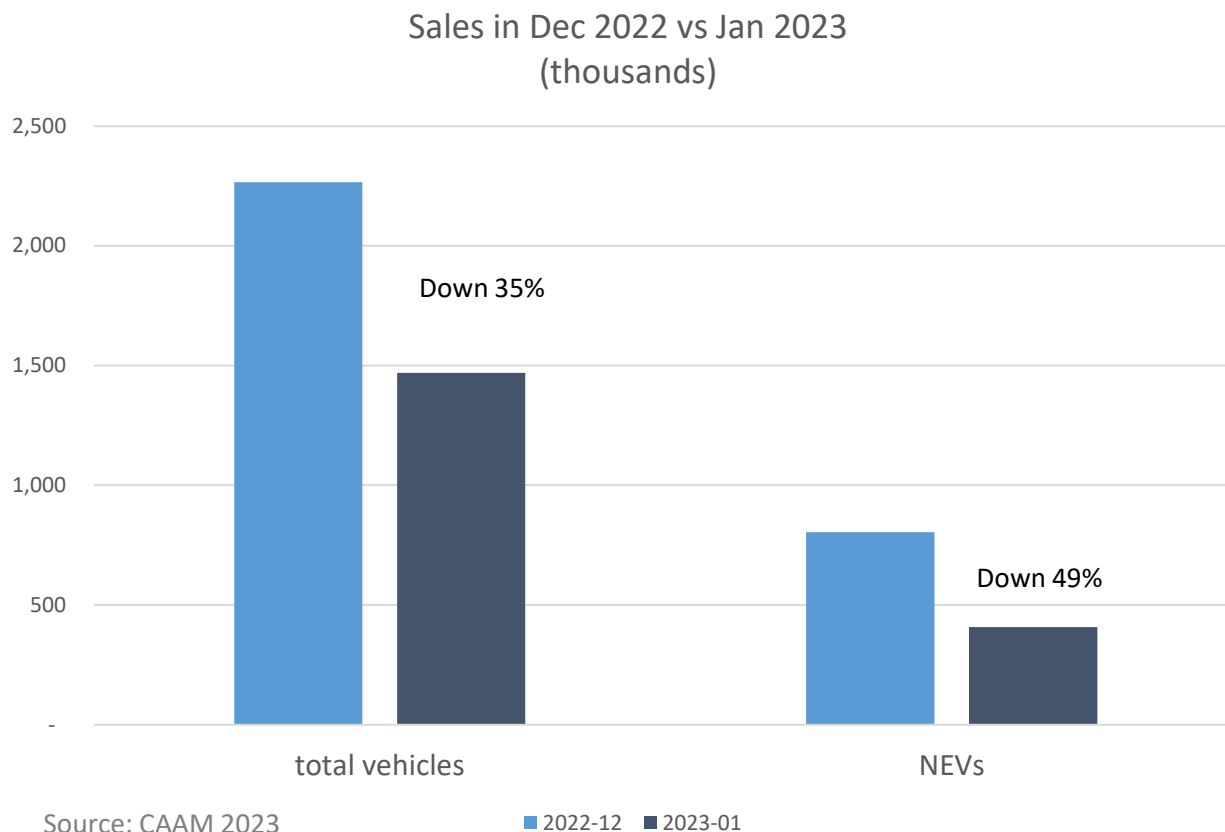
Source: CPCA 2023

- NEV market share slipped in Dec 2022, possibly due to inventory timing and early consumer rush to lock in subsidies



2023 subsidy end hit NEV sales

Monthly sequential vehicle and NEV sales

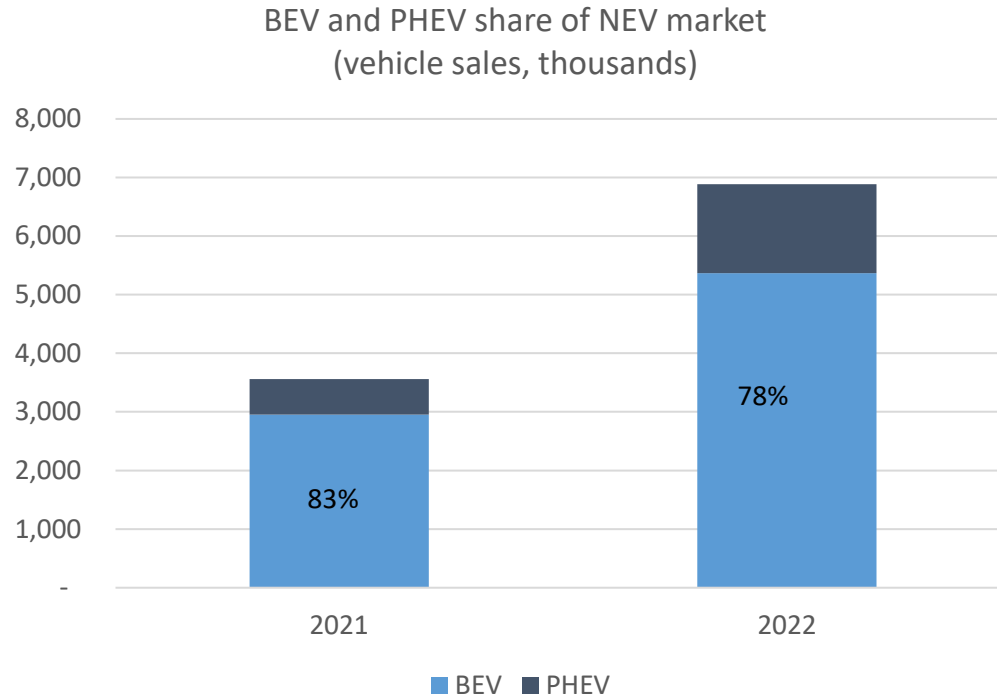


- Affected by Chinese New Year, all vehicle sales fell in January 2023, but NEV sales fell more
- January NEV sales still strong versus prior year numbers



PHEVs making a comeback as SUV sales rise

China NEV sales by size category, 2021 versus 2022, thousands



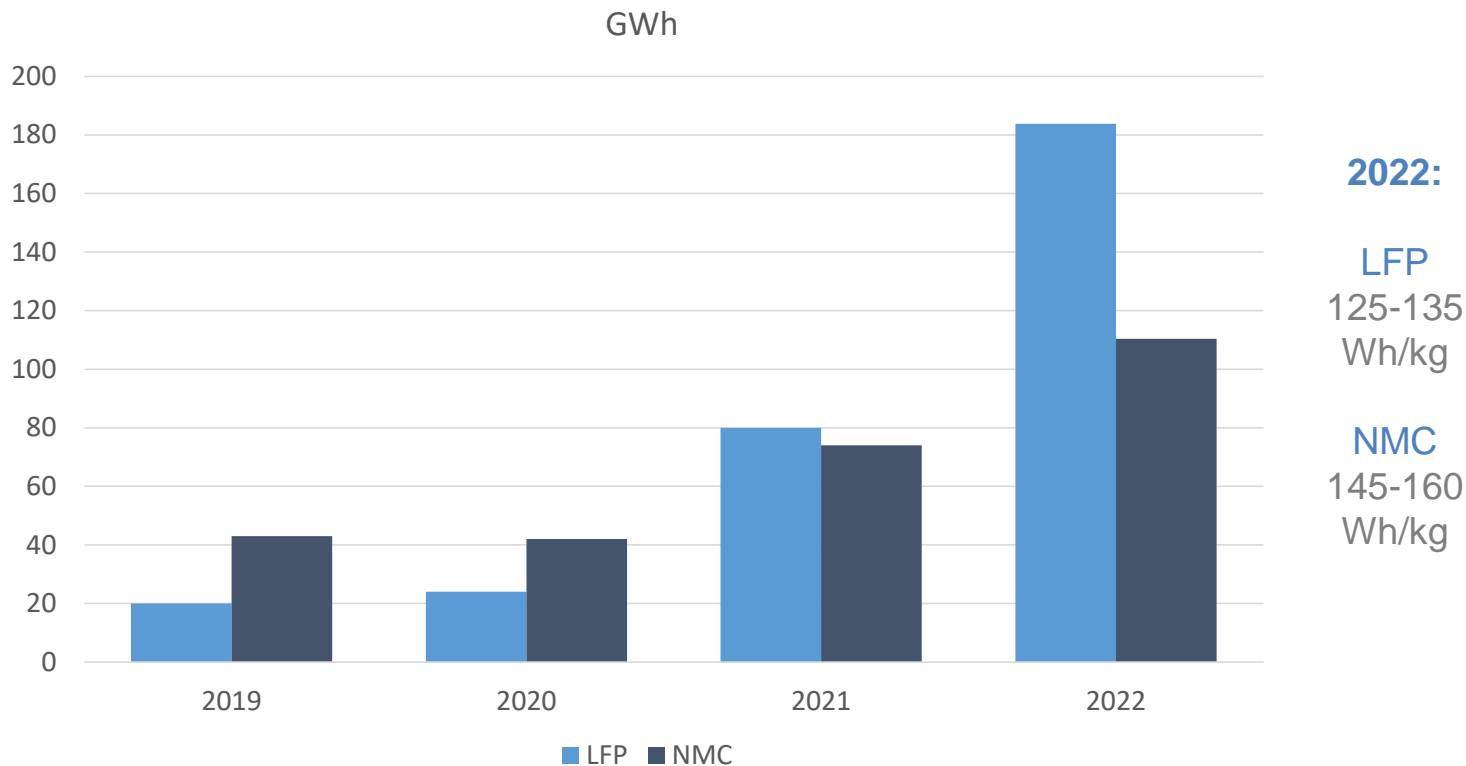
Source: CAAM 2023

- PHEV sales grew by around 150%, compared to 80% for pure EVs
- Main reason appears to be more SUV models in the PHEV category



LFP greatly increased its market share

China NEV battery consumption, LFP versus NMC, 2019-2022



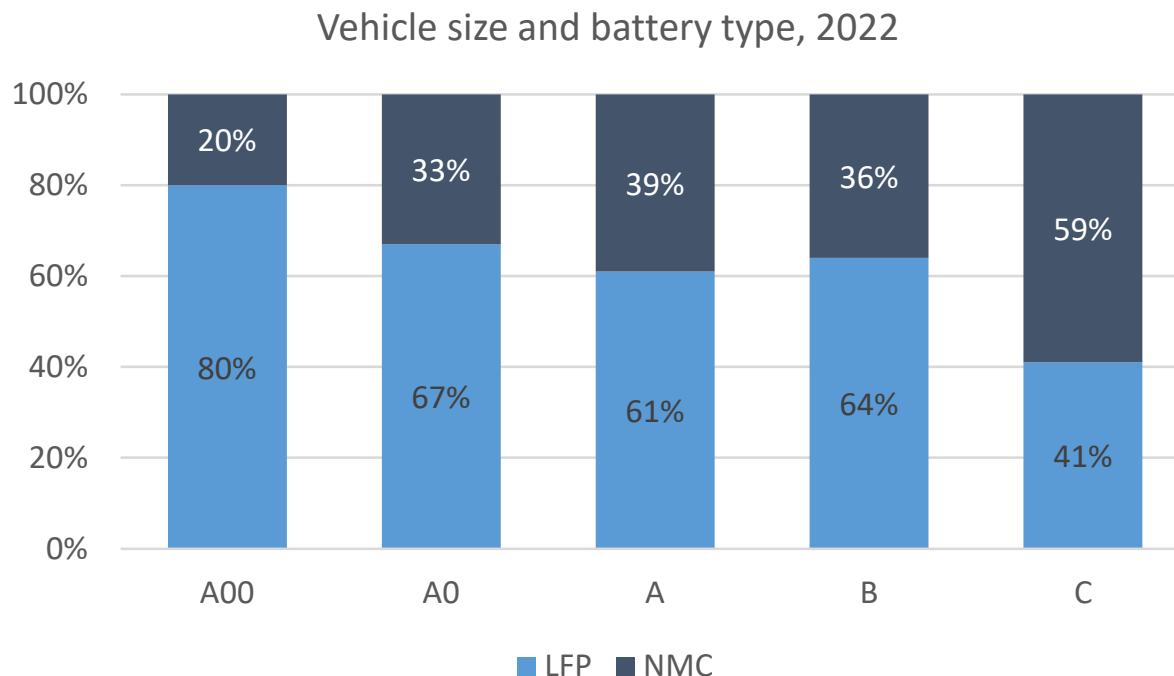
Source: China Car Stats, 2023

- LFP captured 62% of NEV battery market in 2022, up from just over one-third in 2020
- LFP and NMC production both grew, by 155% and 144%, respectively



Larger vehicles use more NMC batteries

China NEV sales by size category, 2021 versus 2022



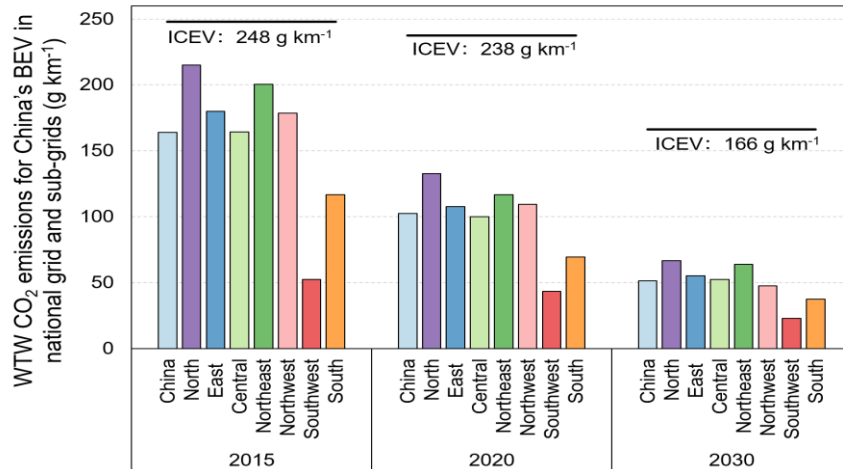
Source: China Car Stats, 2023

- LFP market penetration rose most in smaller, cheaper vehicles
- Still, LFP captured over 60% share in all categories except C-class vehicles (C-class = 10% share)



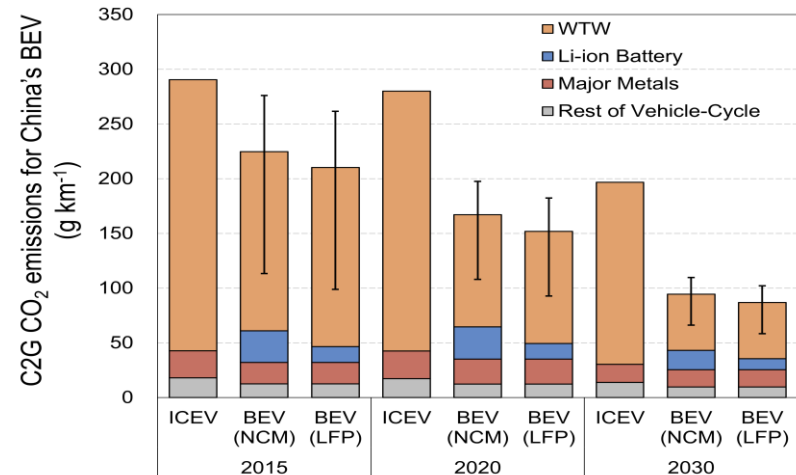
EV adoption contributes to carbon neutrality goals

EV, ICEV life-cycle well-to-wheels CO₂, 2015-2030



Source: Tsinghua School of the Environment, 2022

CO₂ of different battery types, 2015-2030



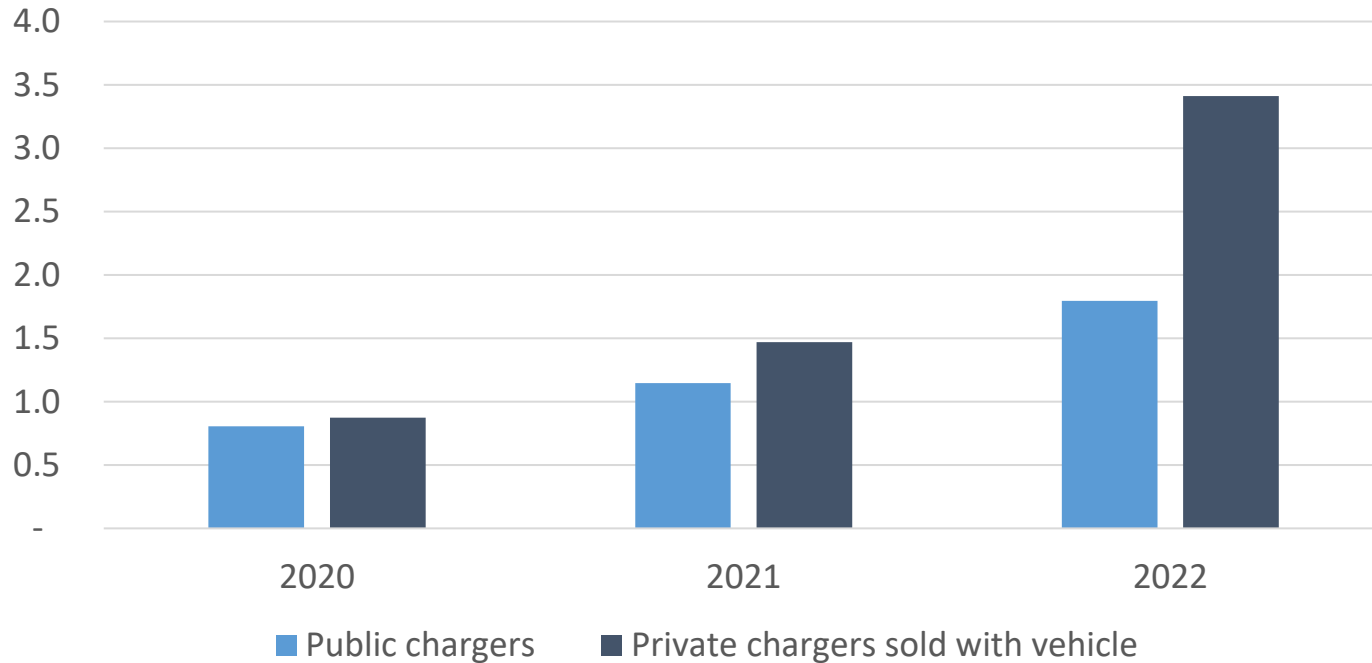
Source: Tsinghua School of the Environment, 2022

- NEV push initially began as an industrial strategy, but increasingly can contribute to carbon targets
- EV life-cycle emissions falling dramatically due to improved energy density, lower grid carbon
- EV emissions are at least 40% lower than ICEV emissions in all regions of China
- This assumes EV charging uses the average kWh produced by the grid in these regions, and does not account for time-of-use charging characteristics



Charging infrastructure grew at pace

China cumulative charging installations



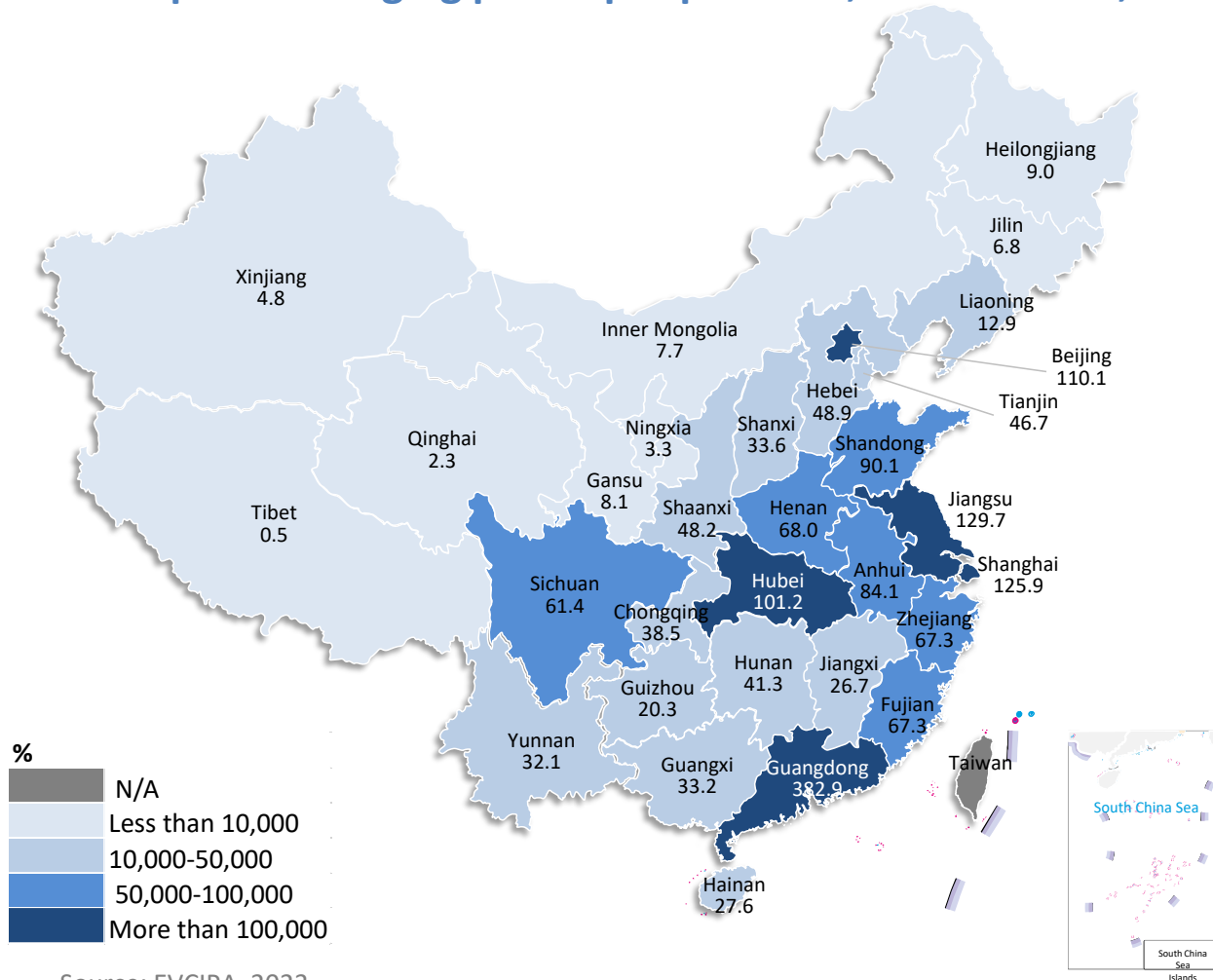
Source: EVCIPA, 2023

- EVCIPA estimates China has 1.7 million public chargers, of which 800,000 are DC chargers
- Almost 3.5 million chargers installed with vehicle purchase, indicating at least half of EV buyers have private charging access
- Numbers likely omit some private chargers installed separately



Coastal provinces lead on charging infrastructure

Number of public charging points per province, in thousands, 2022

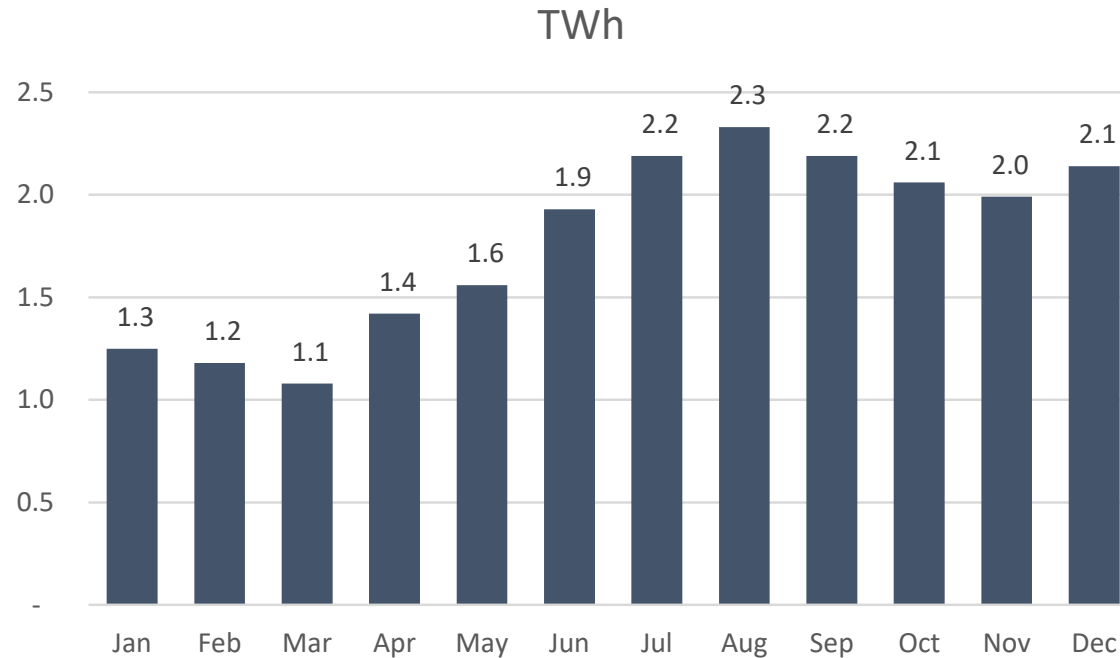


Source: EVCIPA, 2023



Public charging demand fairly modest

China NEV public charging electricity consumption rising quickly



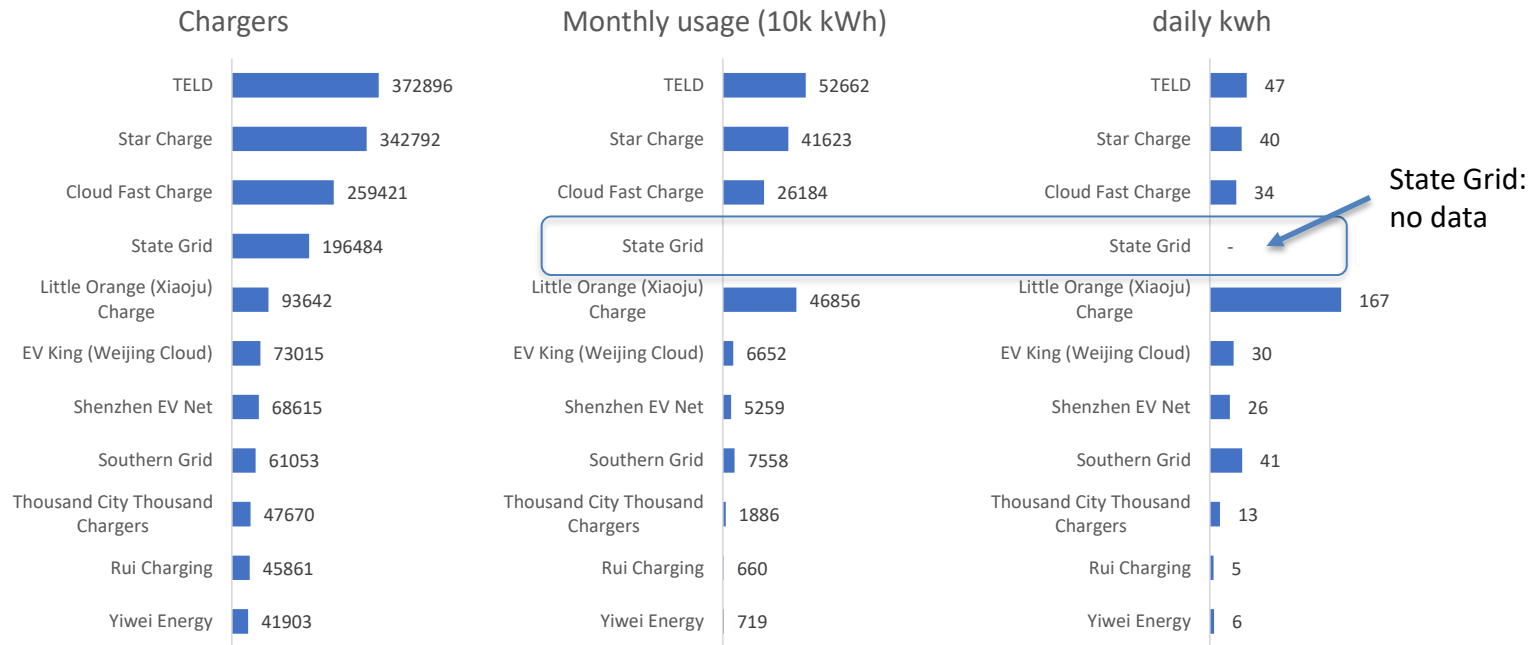
Source: EVCIPA, 2023

- Public chargers delivered 213.3 TWh in 2022, just 0.25% of total electricity consumption
- 2H may have been affected by pandemic situation
- Assuming 15 million NEVs at year-end, December consumption represents 140 kWh per vehicle, sufficient for 1000 km – suggesting large fraction of drivers use public charging regularly
- May be over-weighted towards larger vehicles and fleet vehicles



Utilization numbers are low

The average charging post is used about once per day



Source: EVCIPA, 2023

- Officials report average utilization of 10% across all public chargers, 1% for highway chargers
- EVCIPA publishes monthly charging numbers and electricity use data, shown above
- Clusters around 40-50 kWh/day, but several lower than this amount



Charging payment seamless, but given low utilization, operations and maintenance not always good



At left, CAMS charger with WeChat QR code for unlocking space, payment

Below, non-operating X-Charge station shown as available in car navigation, apps



Source: Anders Hove photos, Beijing, 2022

- Interoperability: Most EV charging uses WeChat or AliPay, does not require app download or RFID card
- Long-distance charging on highways controlled by State Grid, reports of queues and broken chargers
- Apps and chargers still don't communicate, broken chargers still shown as visible on apps
- Charging providers have inadequate incentive to maintain chargers or communicate with apps
- Battery swap has issues with queues and is limited to certain brands



2023 EV research questions

- **China EV critical minerals** supply chain, policies, markets, and institutions – and how can Western governments respond to Chinese dominance?
- **EV charging experience in China** versus Europe and U.S.: how do policy makers, market participants, and EV customers evaluate progress in their local markets?
- **EVs and the grid in China:** While numerous smart charging and V2G pilots have taken place, the lack of a wholesale power market could hinder grid integration of EVs in China. How can we evaluate and track progress on EV grid integration policy and technology in China?



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