

Legal Statement

The purpose of the information in this presentation is to guide ICA programs and provide members with information to make independent business decisions.

Antitrust guidelines

ANTITRUST GUIDELINES FOR COPPER INDUSTRY TRADE ASSOCIATION MEETINGS

The following guidelines with respect to compliance with antitrust laws of the United States, Japan and European Community¹ are intended to govern the conduct of participants in copper industry trade association meetings, both at the meeting itself and in informal discussions before or after the formal meeting.

Price. Competitors should not discuss future prices (including terms of sale) of their products. There is no blanket prohibition against the mention of or reference to current or past prices but limits must be observed. Such references or mentions should occur only when necessary in connection with the development of association programs. For example, reference to a particular price level in comparing the cost of a copper product to a competing product is permitted. Whenever possible, such references should be discussed in advance with legal counsel.

Competitive Information. Competitors should not discuss the market share of a particular copper producer or copper fabricator's products. Furthermore, nothing should be said at a meeting which could be interpreted as suggesting prearranged market shares for such products or producer production levels. The overall market share of copper products may be discussed with regard to competition with non-copper products and general market acceptance.

New Products. Competitors should not encourage or discourage the introduction of a new product by another competitor or reveal a particular copper company's plans to change the production rate of an existing product or to introduce a new product. No company should disclose to another company whether it is in a position to make or market a new product. New products may be discussed in a technical manner or from the standpoints of competition with non-copper products and general market acceptance. In addition, proposed methods for and results of field and laboratory testing can be considered.

The Role of Legal Counsel. Legal counsel attends association meetings to advise association staff and other meeting attendees regarding the antitrust laws and to see that none of the matters discussed or materials distributed raise even the appearance of antitrust improprieties. During the course of a meeting, if counsel believes that the discussion is turning to a sensitive or inappropriate subject, counsel will express that belief and request that the attendees return the discussion to a less sensitive area.

A paper entitled
"Copper Industry Trade Associations and the Antitrust Laws"
is available upon request.

10/92, 5/93, 10/10

¹ Other foreign competition laws apply to International Copper Association, Ltd. (ICA's activities worldwide.



How Important are Electric Vehicles for Future Copper Demand



Fred Ni

April 3, 2017



Who is BYD?

1st in Bloomberg's 2009 BusinessWeek Top Performing Tech100

(above Apple, Google, Yahoo, Amazon, Microsoft etc...)

15th in Fortune magazine's Top 51 Change the World Company

(above IBM, Intel etc...)

BYD electric vehicle sales triumph at the Top of the World

(above Tesla, BMW, Mitsubishi, Nissan, Toyota etc...)

1st company in the World to provide full vertical integration in green

energy technologies

(Electric Vehicle, Solar, Energy Storage)

BYD is the Only Chinese Automaker backed by Warren Buffett

What makes BYD different?

BYD has over **12,580** patents, owning over **50** industry initiative technologies

The Global Leader in New Energy Vehicles



Rank	Company	Country
1	BYD	CHN
2	APPLE	USA
3	TENCENT HOLDINGS	CHN
4	AMAZON.COM	USA
5	TATA CONSULTANCY	IND
6	PRICELINE.COM	USA
7	CENTURYLINK	USA
8	COGNIZANT TECH.	USA
9	INFOSYS TECH	IND
10	SOFTBANK	JPN
11	WPG HOLDINGS	TWN
12	MEDIATEK	TWN
13	NTT DATA	JPN
14	DAKUTEN	JPN



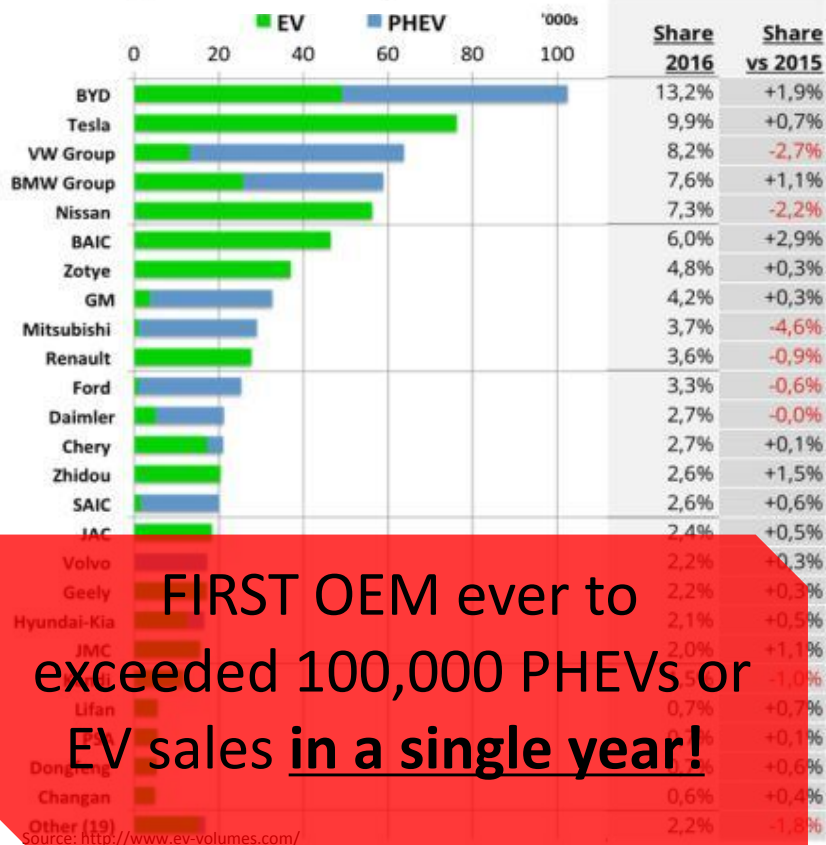


BYD is the largest EV, Ebus and battery manufacturer in the world!

Sales by Make

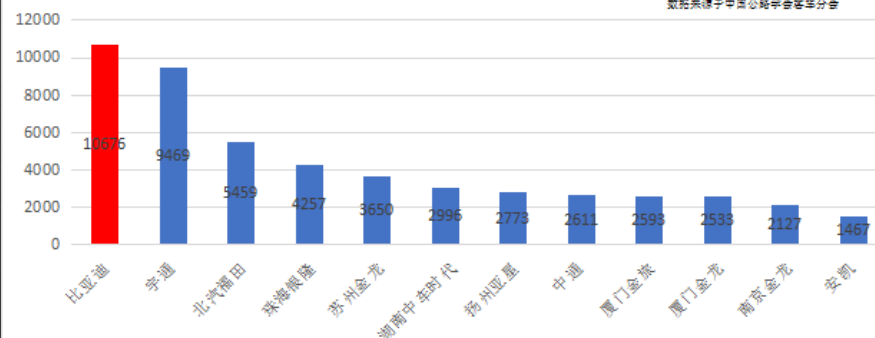
>=10m Electric Bus Sales
Ranking

Global Plug-in Volume 2016 by Make



FIRST OEM ever to
exceeded 100,000 PHEVs or
EV sales in a single year!

2016年10米以上新能源大客车销量表 (辆)



By 2020, China plans to have over 200 000 electric buses on its roads, accompanied by a network of close to 4 000 charging stations dedicated to buses (EVI, 2016b). [Shenzhen is already envisioning an all-electric bus fleet](#) in 2017, Guangzhou in 2019, Foshan by 2020.



BYD is the largest rechargeable battery manufacturer

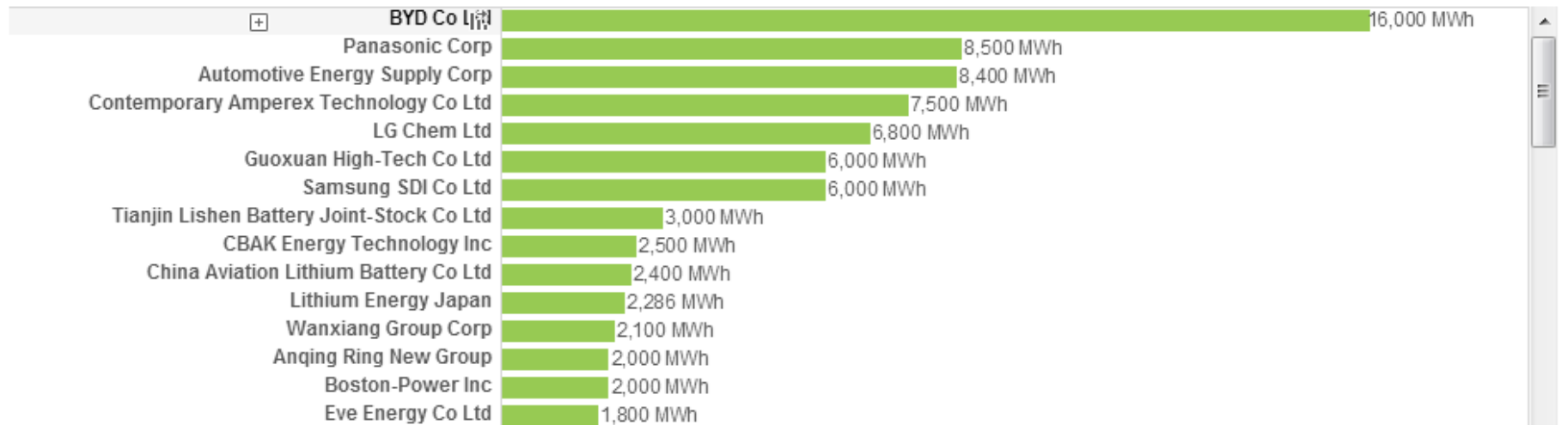
Battery Manufacturing Database-Fully Commissioned

Status

Fully commissioned

Capacity by manufacturer (MWh)

Select the "+" sign to view the capacities of the individual plants and plant phases



Source: Bloomberg Finance



BYD specializes in
BATTERY
making



20 years of battery manufacturing experience.

The world's **largest** Iron-phosphate battery output capacity, covering **20%** of global capacity.



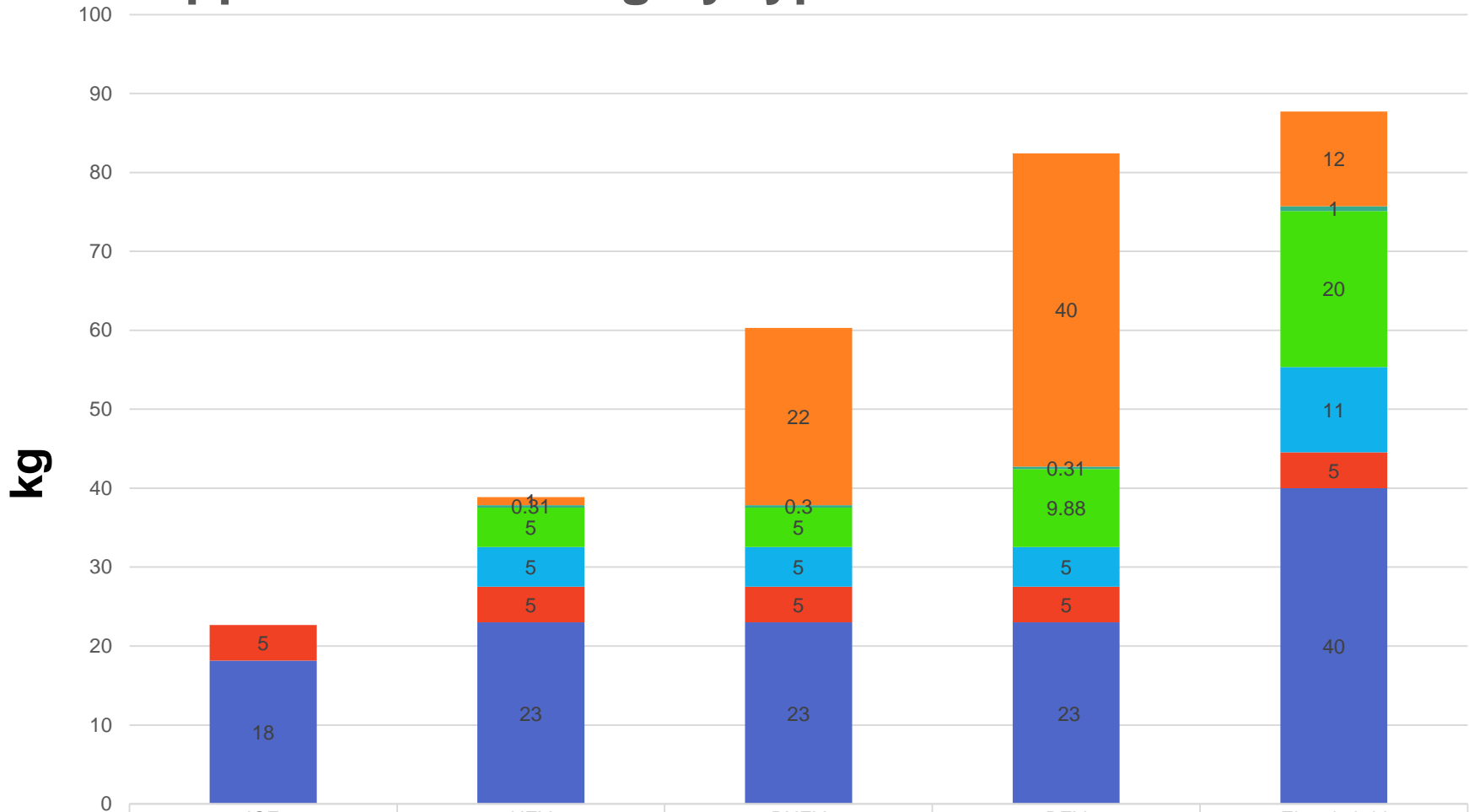
BYD New Energy Vehicle Global Footprint





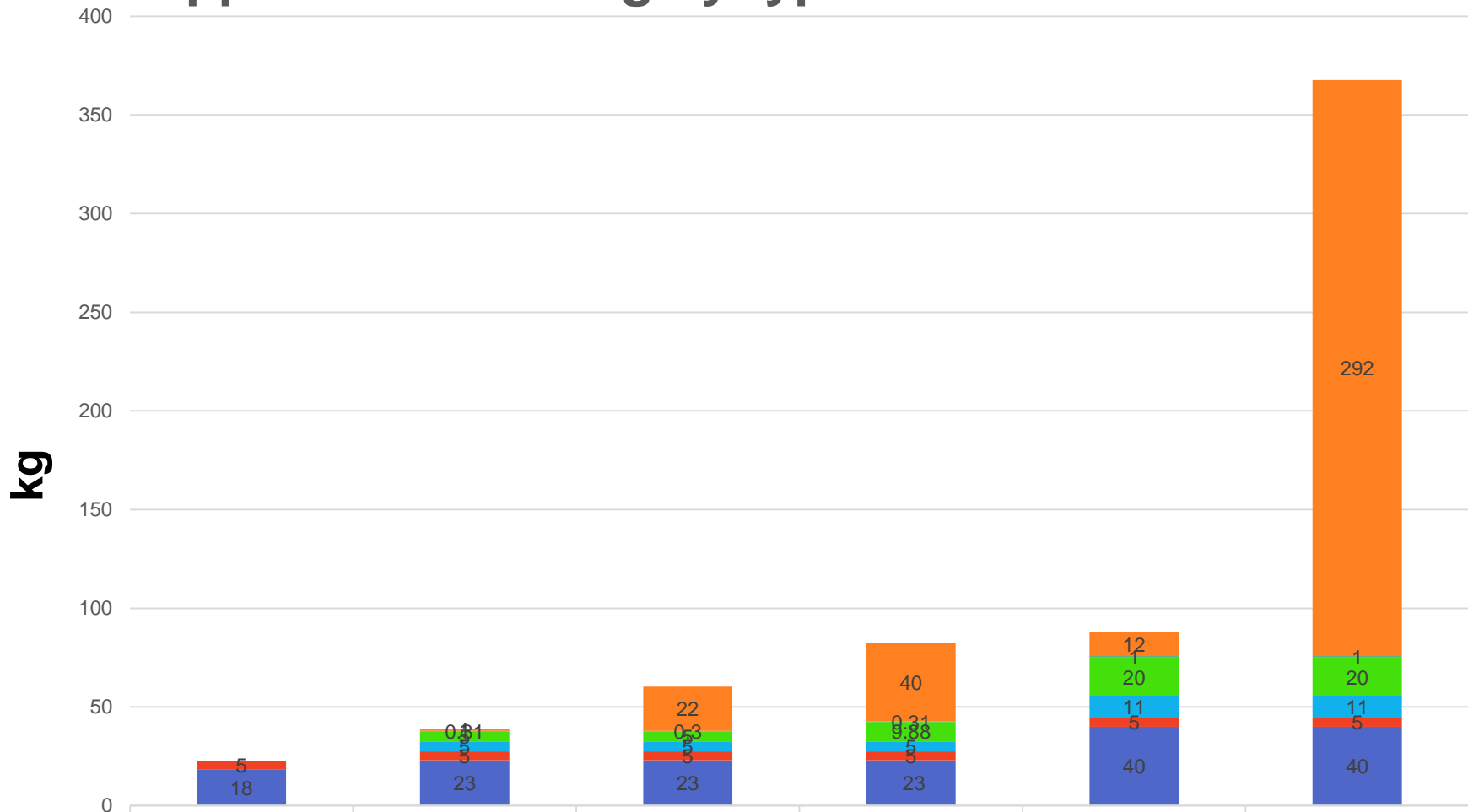
With Total New Energy Vehicle Market Coverage,
BYD Will Carry Out Transport Electrification to the Fullest!

Copper content in kg by type of electric vehicle



	ICE	HEV	PHEV	BEV	Ebus hybrid
Battery		1	22	40	12
Inverter		0.31	0.3	0.31	1
Electric Motor		5	5	9.88	20
HV Wire		5	5	5	11
Other	5	5	5	5	5
LV Wire	18	23	23	23	40

Copper content in kg by type of electric vehicle



	ICE	HEV	PHEV	BEV	Ebus hybrid	Ebus BEV
Battery		1	22	40	12	292
Inverter		0.31	0.3	0.31	1	1
Electric Motor		5	5	9.88	20	20
HV Wire		5	5	5	11	11
Other	5	5	5	5	5	5
LV Wire	18	23	23	23	40	40



64 kg Cu for a BYD Tang PHEV (100 km EV Range)

Battery pack- 22.5 kg, Motor-3.5 kg Cu, Cables-28 kg Cu, others-10 kg Cu



Build Your Dreams—



Over 110 kg Cu for a BYD e6 (The most popular E-taxi in the world)

Battery pack- 66.6 kg, Motor- 5.25 kg, Cables- 28.5 kg, others- 10 kg



Build Your Dreams—



224 kg Cu for a BYD 12m Electric Bus

Battery packs- 128.6 kg, Motors- 12 kg, HV Cables- 48 kg, LV Cables- 30.3 kg, other controlling systems- 5 kg Cu



Build Your Dreams-



346.3 kg Cu for a BYD 18m Articular Electric Bus

Battery packs- 217.3 kg Cu, Motors- 24 kg Cu, HV Cables- 60 kg Cu, LV Cables- 40 kg, other controlling systems- 5 kg



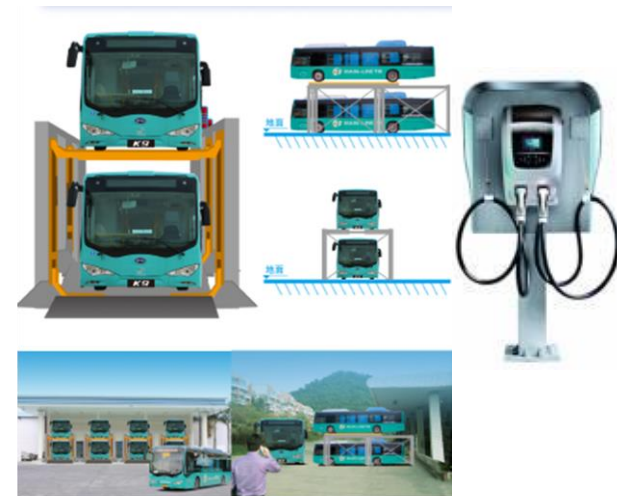
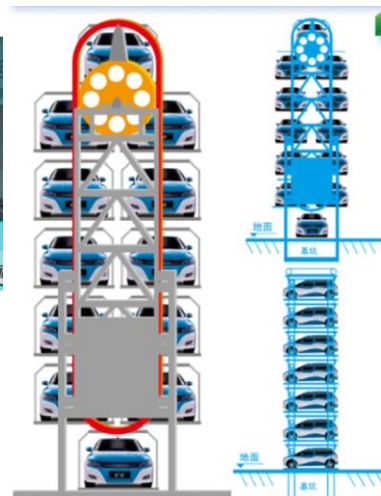


Cu consumed in BYD chargers

BYD Charger	Units Installed by 2016	Cu used per charger	Cu Used
3.3 kW	120,765	0.7 kg	84,535.5 kg
7 kW	4,704	1 kg	4,704 kg
40 kW	6,663	1.5 kg	9,994.5 kg
80 kW	4,009	3 kg	12,027 kg
100 kW	127	5 kg	1,425 kg
200 kW	158	8 kg	
Total			134,707.5 kg



Kowloon 6 Charging Adapters

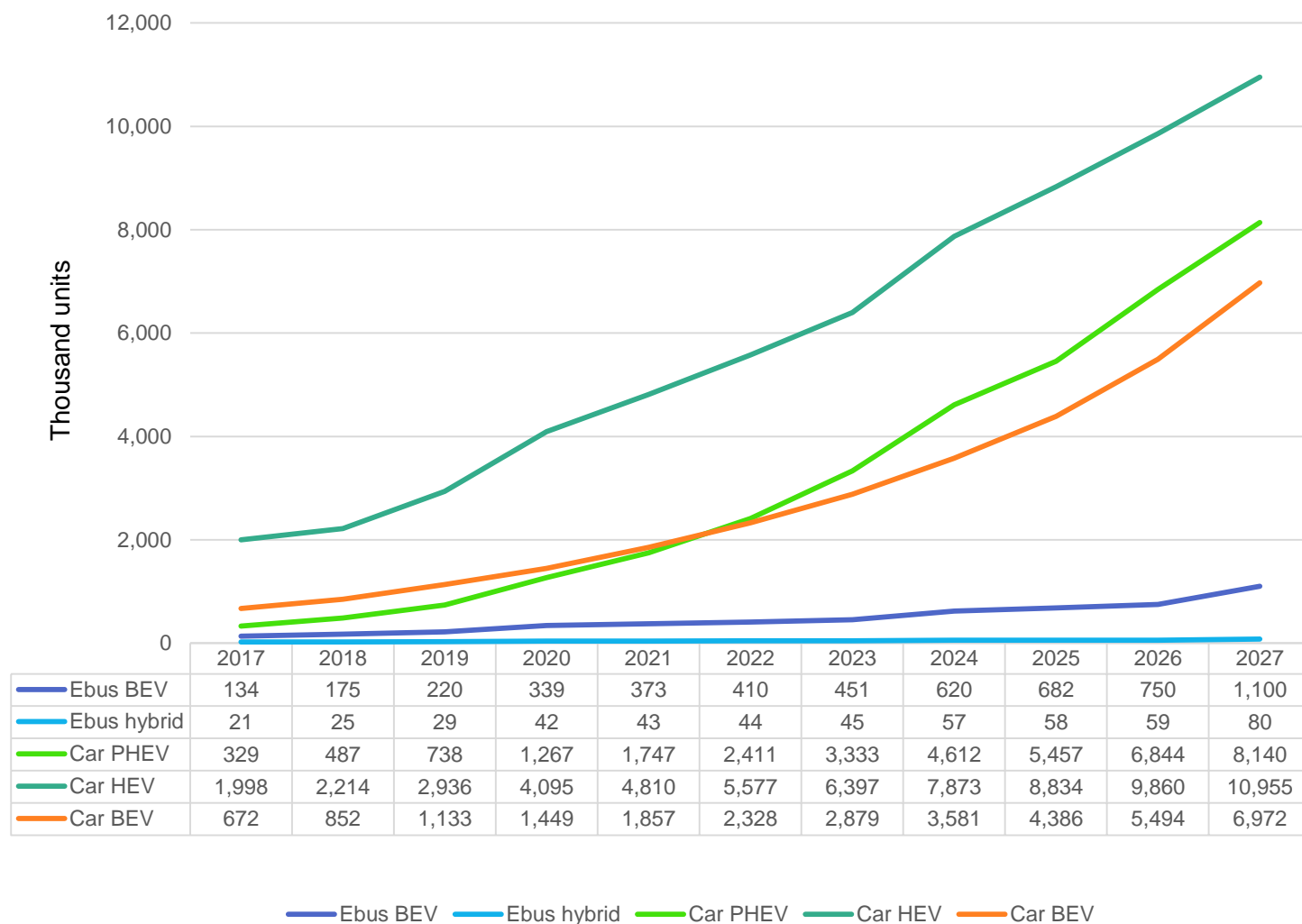




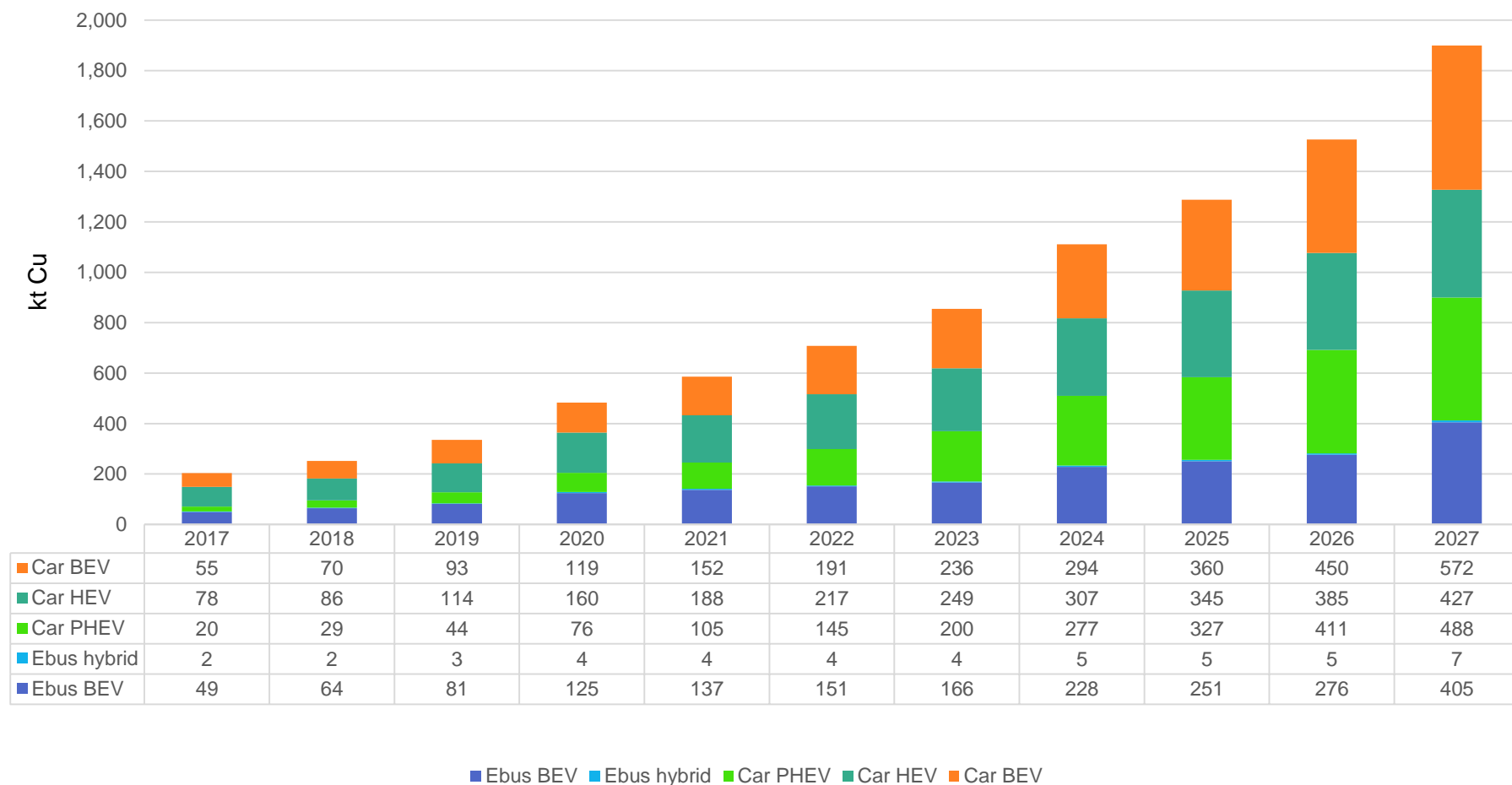
Cu consumed in BYD electric vehicles

Vehicle	2016 Sales	Cu Used
Qin PHEV	21,868	65 kg per vehicle (average)
Tang PHEV	31,405	
PHEV subtotal	53,273	3,462,745 kg
Qin EV	10,656	110 kg per vehicle (average)
E6 (EV)	20,605	
E5 (EV)	15,639	
T3 (EV)	5	
EV Subtotal	46,905	5,159,550 kg
Battery Bus & Coach	13,278	224 kg per vehicle (average)
Battery Truck	859	
Commercial Vehicle subtotal	14,137	3,166,688 kg
Total	114,315	11,788,983 kg

Electric vehicle forecast - IDTechEx

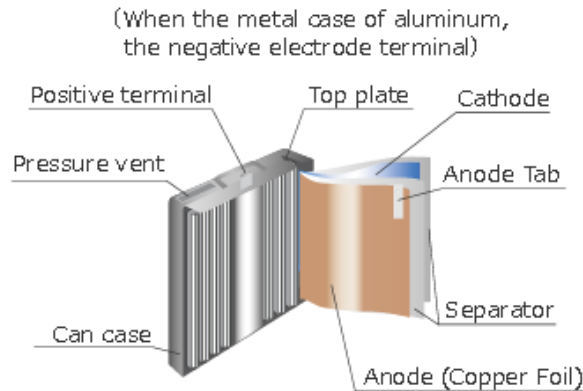


Electric vehicle Cu demand in kt



What are the most used form factors?

*Copper foils
battery anode
current
collectors*



A typical battery electric vehicle 33 Ah cell can have 0.79 m² of Cu foil. Cu foils can range from 6 µm to 20 µm. 20% of the battery module composition is copper.

*Windings in
electric motors*



A pure electric vehicle electric motor can contain **over a mile of copper wire in its stator windings.**

*Copper rotors
for electric
motors*

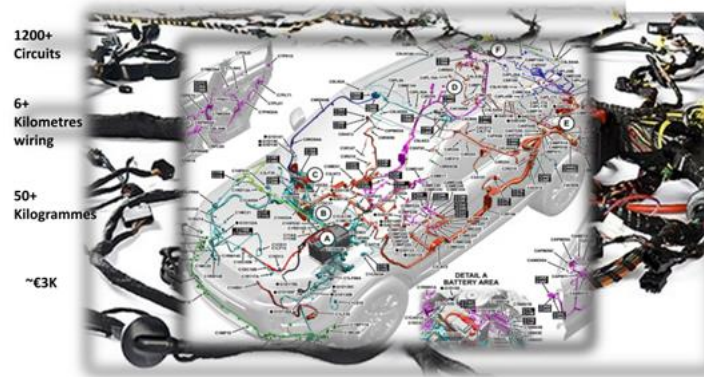


Figure 14 - Copper die cast rotor for the traction motor application.

An induction motor can have 13% in weight in its rotor if it is made out of copper.

What are the most used form factors?

Wiring



A car can have 6 km of wiring.

Copper busbars



Battery packs use these to connect modules and cells.

Charging infrastructure



Both conductive and “wireless charging” use copper wiring.

Material intensity factors in electric vehicles

	Increase Cu	Decrease Cu
Battery	<ul style="list-style-type: none"> • Larger battery capacity • Increasing EV range • Number of cells/pouch, more Cu foil layers • Smaller cells • Number of modules more busbar connections 	<ul style="list-style-type: none"> • Higher energy density chemistries (NMC) • Thinner current collectors (thinner Cu foil)
Electric Motor	<ul style="list-style-type: none"> • Induction motor • Cu rotor 	<ul style="list-style-type: none"> • Permanent magnet motors • Aluminium as substitute
HV Wire	<ul style="list-style-type: none"> • Higher Power • +Larger vehicle (Bus) 	+Wiring cooling + Power electronics switches +Powertrain Integration + Lower voltage (48V)
LV Wire	+ More electronics + Energy Harvesting	+ Printed electronics + Wireless sensors