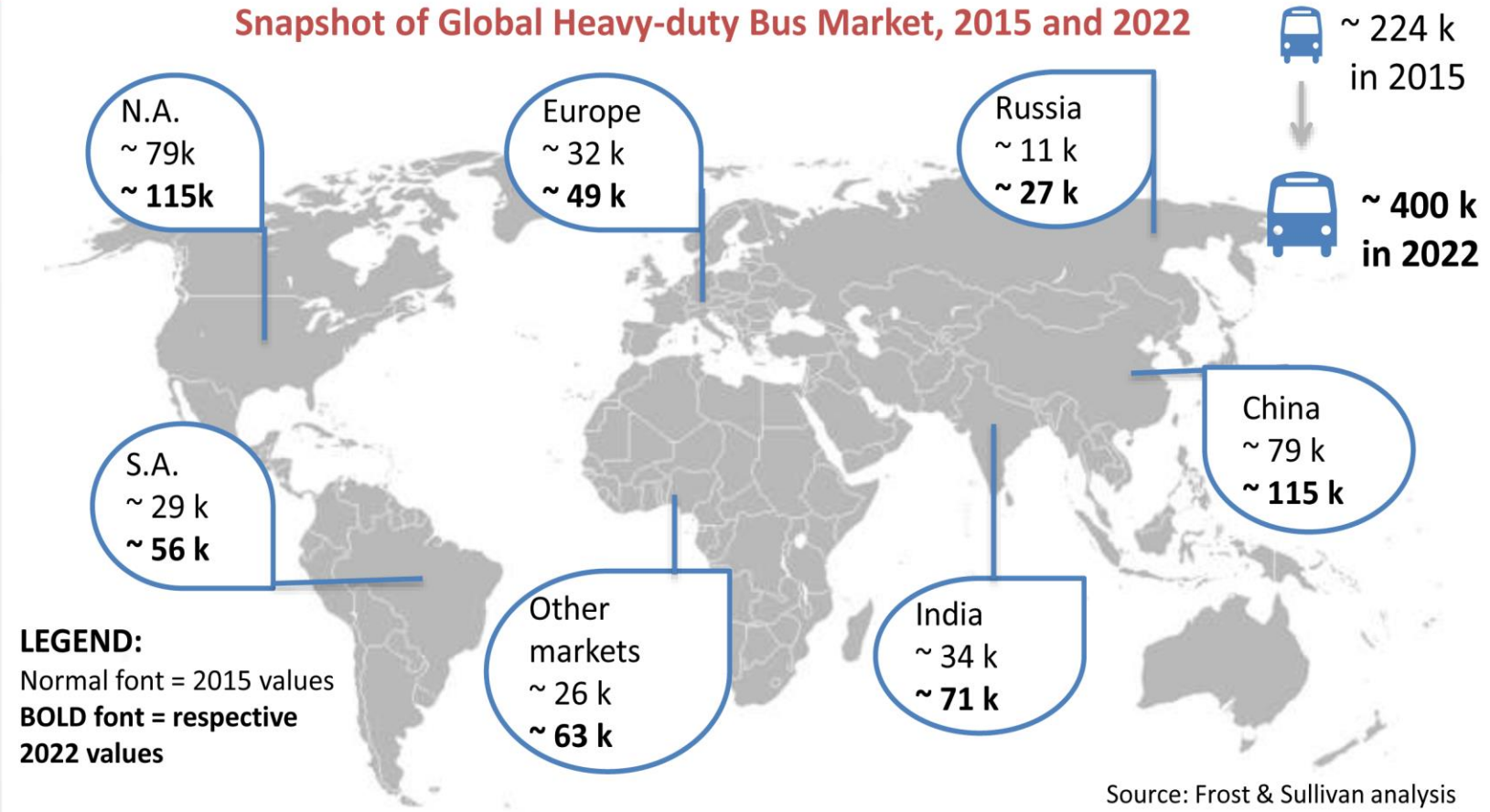
Analysis of the bus and coach market for Chinese OEMs

- Introduction
- Overview of the markets worldwide
- Key drivers shaping the bus and coach industry – shifting priorities
- A snapshot of China and the important developments in New Energy Vehicles

Global HD Bus Market – CAGR of 8.6%



HD Buses includes - Transit Buses, Coaches, Shuttle Buses, and School Buses more than 9m in length and more than 8T GVWR

Key drivers - Shifting priorities + Speed of change

Previous key drivers

Emission compliance (NOx+PM)
Technology innovation (Safety)
Fuel efficiency of IC engine

→

New key drivers

Climate change and CO_2 reduction
Air quality in cities
Reduced dependency on fossil fuels

↓

New entrants to the bus industry

e.g. Battery and electric drive suppliers
Charging infra-structure
Telematic service experts

Internal combustion engine to remain the mainstay of bus and coach sector!

WHY?

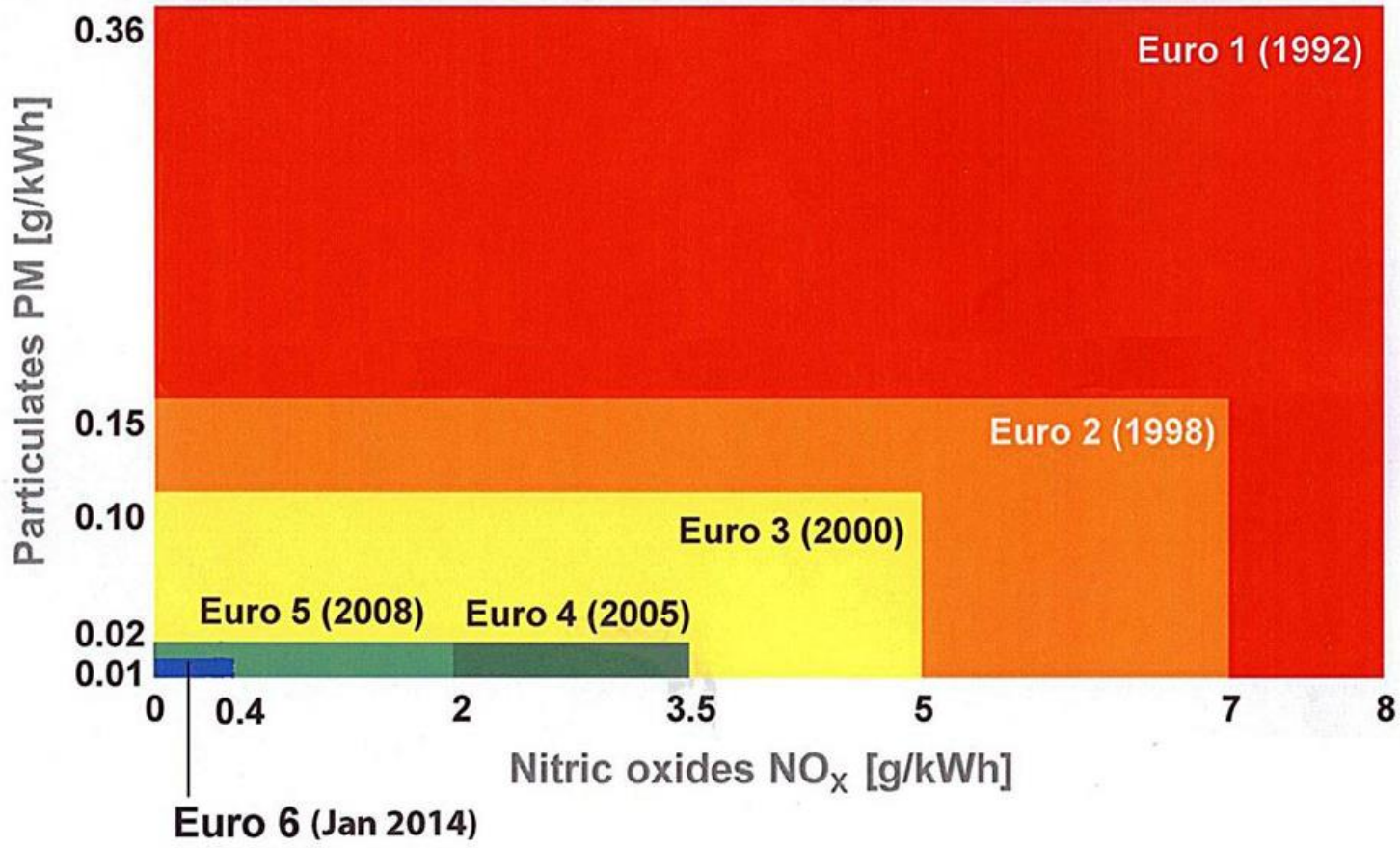
History / Investment

Diesel / gas vehicles - Energy efficient, globally available, ready fuel infra-structure

Clean diesel - Euro VI and beyond, Bio-diesel or gas hybrids

EU Emissions Standards

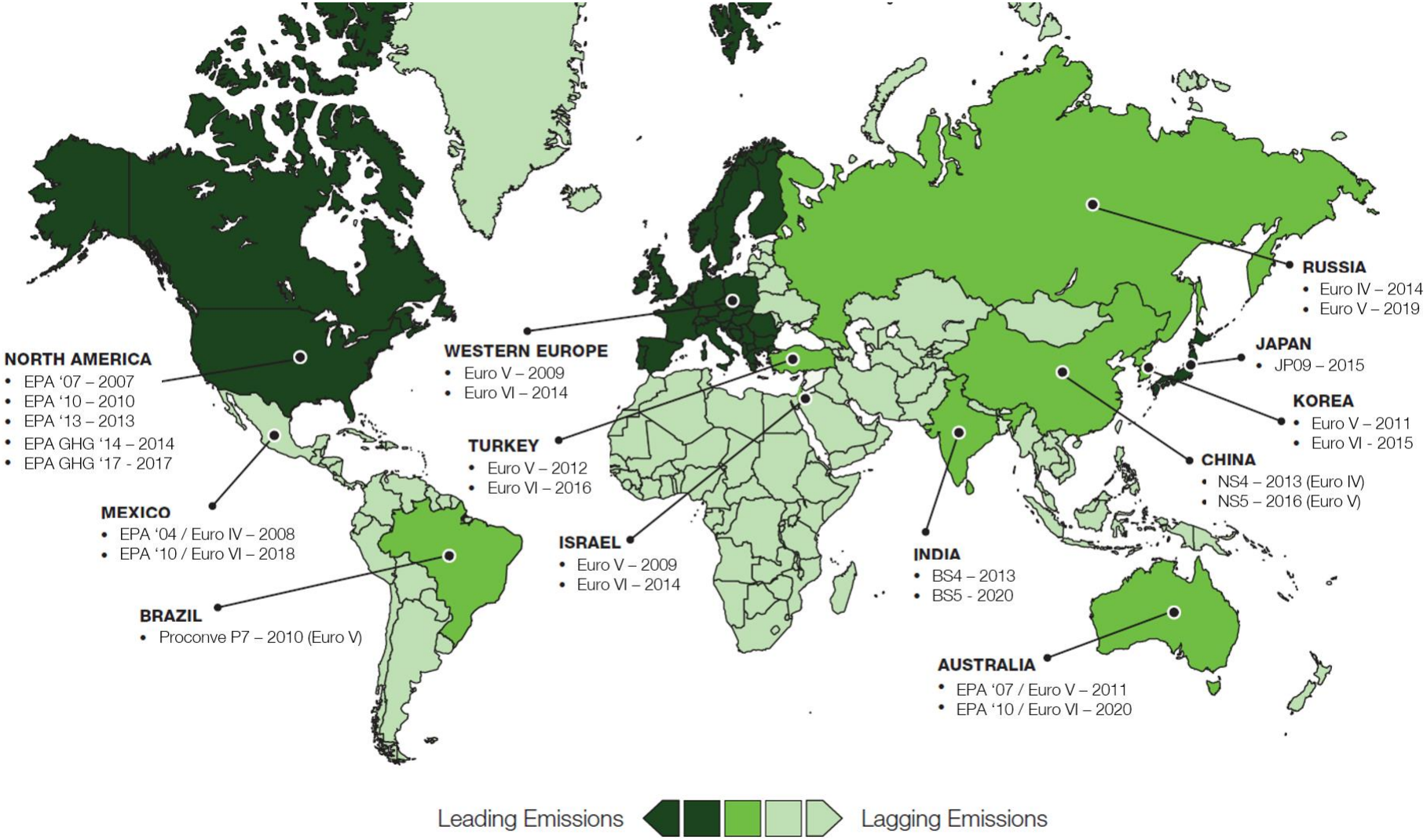
Exhaust emissions Euro 1–6



Source: Cummins (For reference purposes only and does not depict specific details related to emissions standards and implementation dates)

A Euro-6 bus emits 95% less NOx than a Euro-5 bus.

Source: SMMT



Source: Cummins (For reference purposes only and does not depict specific details related to emissions standards and implementation dates)

Worldwide Regulatory Emissions Map - Heavy-Duty Diesel

Red Italics are Estimates

Territory	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
South Africa	Pre-Euro II unclear				Euro II / EPA 98													
China - Nationwide	Stage III (Euro III)							Stage IV (Euro IV)		*Stage V (Euro V)*				*Stage VI (Euro VI)*				
China - Beijing		Stage IV (Euro IV)				Stage V (Euro V) (Mar.1)			+DPF(Jan)		*Jing VI(Draft)*							
Taiwan	Euro IV / EPA 04				Euro V / EPA 10								Stage VI (Euro VI)					
European Union	Euro IV		Euro V				Euro VI A **		Euro VI B (NG only)	Euro VI C **	*Euro VI D*							
India	BS II			BS III							BS IV w/OBD Stage II		*BS VI*					
Brazil	Euro III				Euro V (w/OBD)								*Euro VI A*					
Chile - Metro Regions	Euro III / EPA 98				Euro IV / EPA 04				Euro V / EPA 07									
Chile - Metro Bus	Euro III / EPA 98						Euro IV / EPA 04		Euro V / EPA 07									
Colombia - Truck	Euro II / EPA 94							Euro IV										
Ecuador	Euro II / EPA 94																	
Mexico		Euro IV / EPA 04									*Euro VI A ** / EPA 13*							
Peru	Euro III																	
Venezuela	Euro I / EPA 91																	
US/Canada	EPA 07		EPA10			EPA13	EPA14		EPA 16	EPA17				*EPA 21*				
Japan				NOx = 0.7 g/kWh; PM = 0.01 g/kWh J-OBD I						*NOx = 0.4 g/kWh; PM = 0.01 g/kWh; J-OBD II from Oct.1 2018*								
Russia	Euro III		Euro IV w/o OBD				Euro IV w/OBD1 (UNECE Reg49.05 C *)					Euro V (UNECE Reg49.05(B2, C, OBD G, K, F) *					*Euro VI*	
Australia	Euro IV / EPA 04			Euro V / EPA 07									*Euro VI A/ EPA1*	*Euro VI B*		*Euro VI C*		

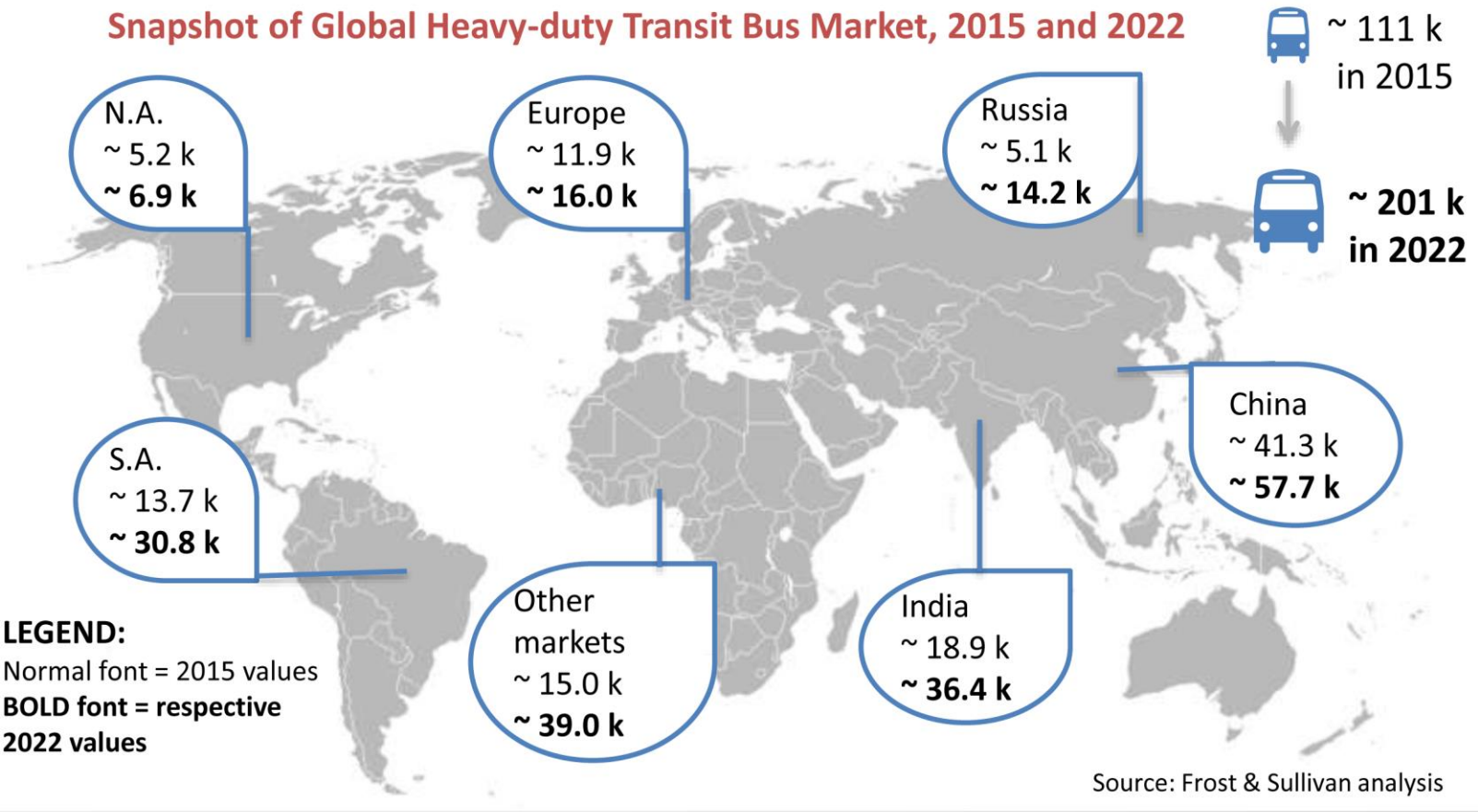
Patterned cells: Start indicates date for 'new types'; end indicates date for 'existing types'.

* applies to the letter character, to the specific application date, with the OBD level and whether NOx control was applicable

** applies to the phase in requirements for OBD & IUPR

Source: Cummins (For reference purposes only and does not depict specific details related to emissions standards and implementation dates)

Global HD Transit Bus Market – CAGR of 8.4%



Transit Buses includes – City/Urban Buses more than 9m in length and more than 8T GVWR

New key drivers

Climate change + CO_2 reduction (Paris climate conference (COP21))

Urban migration + air quality in cities

Reduced dependency on fossil fuels

Impact of new entrants to the bus sector

Diesel or Gas Hybrid Electric

→ Electric Diesel (NG) Hybrid

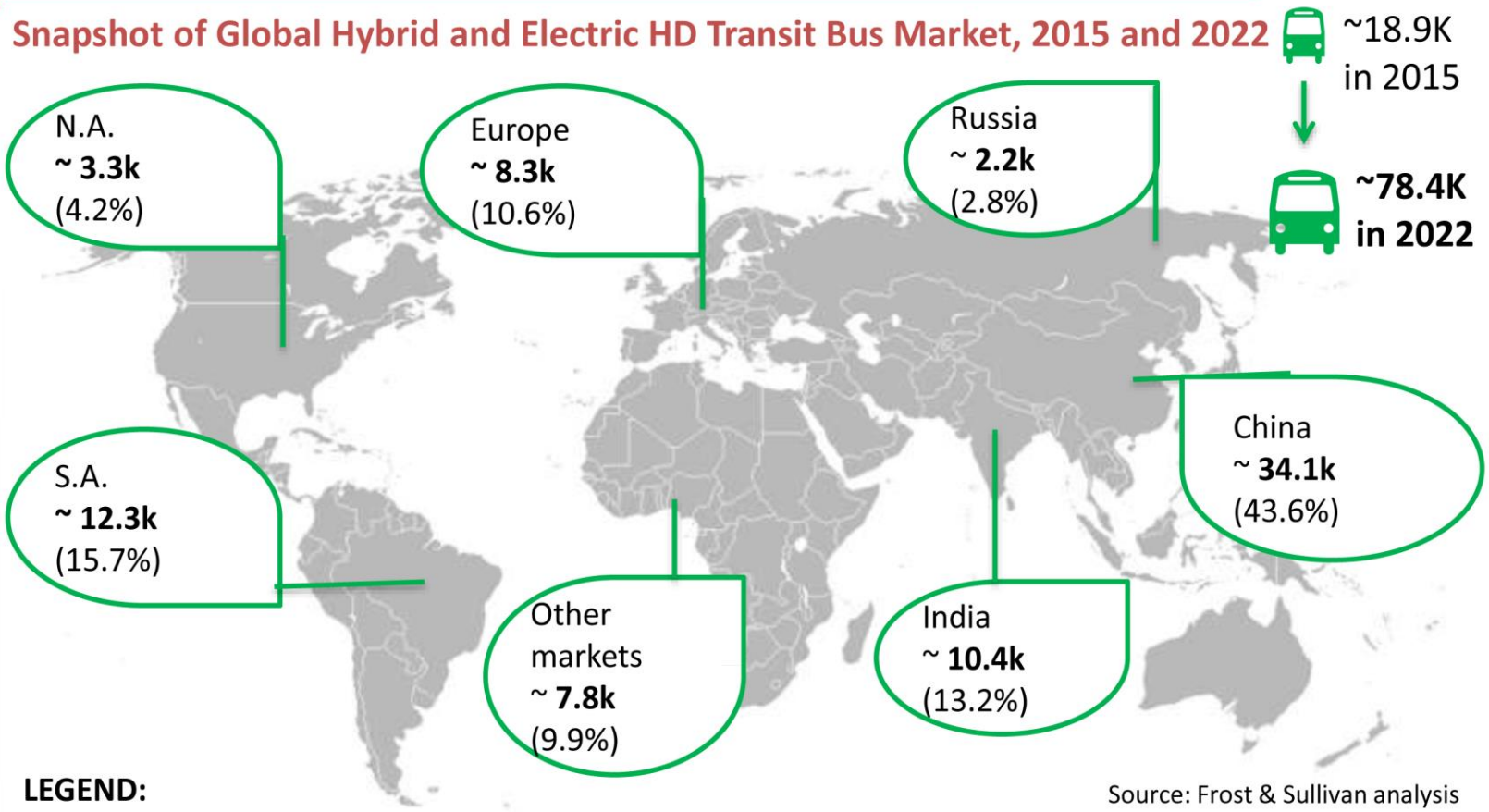
→ Electric Bio-diesel (Methane)

Full Electric (plug-in)

→ Full Electric buses (fast charge)

→ Full Electric (fuel cell)

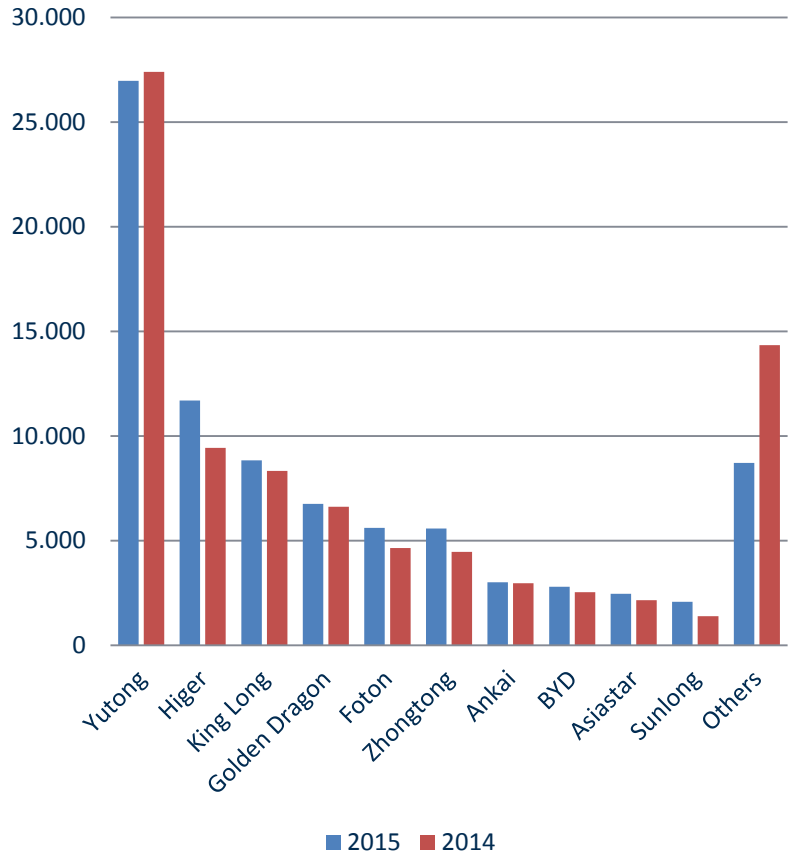
The Green Push – From 1 in 7 to 1 in 3



% denotes the respective region's forecast share of new energy buses in total global HD transit bus sales in 2022.

China - Large bus and coach sales 2015 v 2014

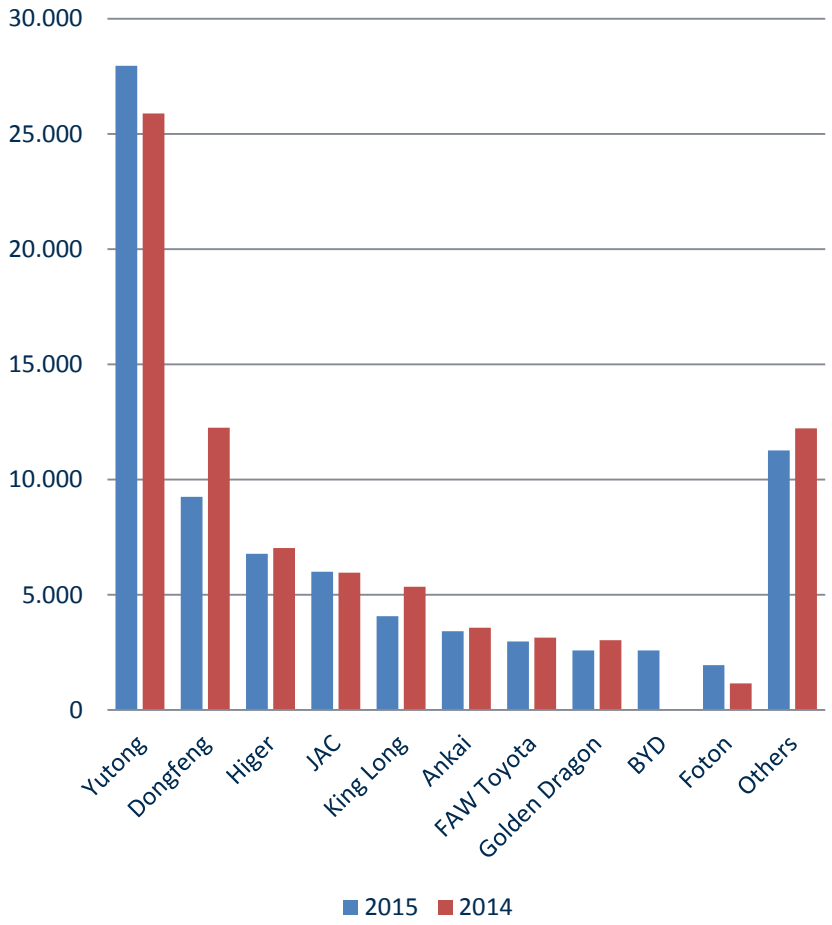
Manufacturer	2015	2014	% Chg
Yutong	26,973	27,398	-1.55
HIGER	11,691	9,431	23.96
King Long	8,840	8,335	6.06
Golden Dragon	6,760	6,619	2.13
Foton	5,609	4,649	20.65
Zhongtong	5,579	4,460	25.09
Ankai	3,016	2,959	1.93
BYD	2,792	2,533	10.23
Asiastar	2,466	2,148	14.80
Sunlong	2,084	1,383	50.69
Others	8,721	14,337	-39.17
Total	**84,531**	**84,252**	**0.33**



Source: China buses

Medium bus and coach sales 2015 v 2014

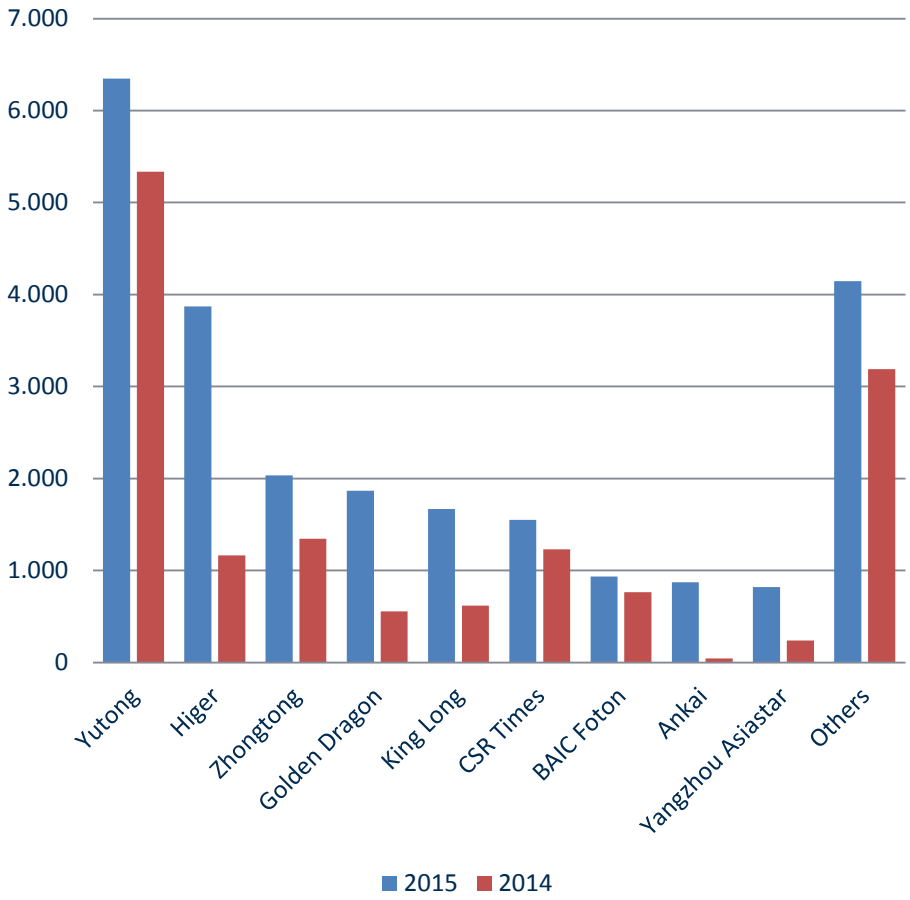
Manufacturer	2015	2014	% Chg
Yutong	27,957	25,880	8.03
DONGFENG	9,256	12,250	-24.44
Higer	6,786	7,033	-3.51
JAC	5,997	5,964	0.55
King Long	4,072	5,357	-23.99
Ankai	3,428	3,575	-4.11
FAW Toyota	2,976	3,141	-5.25
Golden Dragon	2,590	3,027	-14.44
BYD	2,583	0	n/a
Foton	1,946	1,161	67.61
Others	11,263	12,224	-7.86
Total	**78,854**	79,612	**-0.95**



Source: China buses

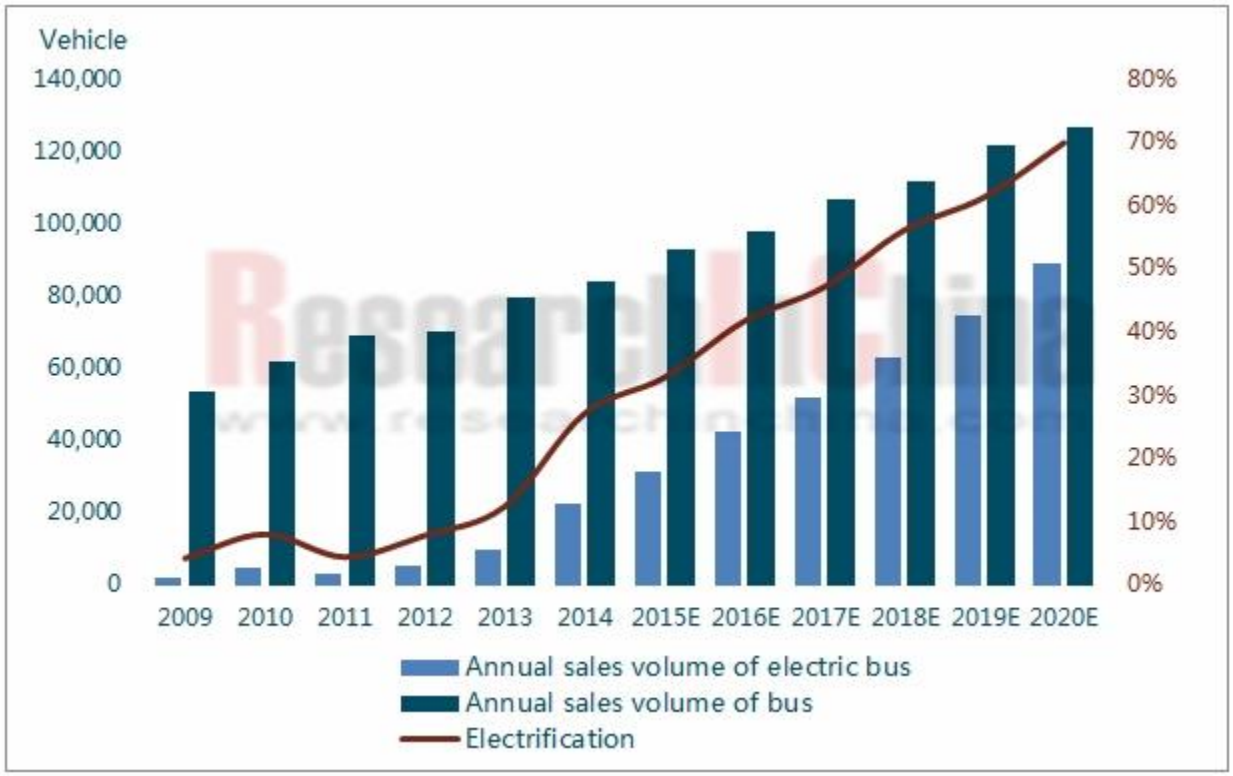
Sales of hybrid buses in 2015 vs 2014

Manufacturer	2015	2014	% Chg
Yutong	6,348	5,334	19
HIGER	3,870	1,165	232
Zhongtong	2,033	1,346	51
Golden Dragon	1,867	555	236
King Long	1,668	620	169
CSR Times	1,549	1,229	26
BAIC Foton	935	766	22
Ankai	874	45	1,842
Yangzhou Asiastar	821	238	245
Others	4,147	3,190	30
Total	**24,112**	14,488	**66**



Source: China buses

Sales Volume of Electric Bus and Electrification in China, 2001-2017E



Source: Research in China

China key figures on NEVs (New Energy Vehicles)

Thirteenth Five Year Plan (2015-2020) (Hybrid & Electric) Buses

	2015	**(Source)**	**→ 2020**
Hybrid	24,112	(CAAM)	
Electric	22,000(E)	(R.I.C)	
Total	**46,000**		**→ 200,000**

CAAM statistics for 2015 NEVs (all vehicles)

	2014	**2015**
Production	78,499	340,471
Sales	74,763	331,092

Why has China taken the lead in electric mobility?

Strategic reasons

Subsidies

Investment

Subsidy - Electric charging station subsidy allocation methodology by central

Region/Area	2014		2015	
	Registration volume (unit)	Subsidy (CNY 10,000)	Registration volume (unit)	Subsidy (CNY10,000)
Beijing-Tianjin-Hebei	5,000<=Quantity<7,000	2,700	10,000<=Quantity<15,000	5,000
	7,000<=Quantity<10,000	3,800	15,000<=Quantity<20,000	7,000
	10,000<=Quantity<15,000	5,500	20,000<=Quantity<25,000	9,000
	Quantity=>15,000	9,000	Quantity>25,000	12,000
Other Cities or City Clusters	3,000<=Quantity<5,000	1,800	5,000<=Quantity<7,000	2,400
	5,000<=Quantity<7,000	2,700	7,000<=Quantity<10,000	3,400
	7,000<=Quantity<10,000	3,800	10,000<=Quantity<15,000	5,000
	Quantity=>10,000	6,700	Quantity=>15,000	8,000

Source: MIIT

Financial subsidies (CNY10,000) for new energy large buses and coach in 2016

Vehicle type	Large bus and coach 10m<L≤12m					
Range	6km≤Range <20km	20km≤Range <50km	50km≤Range <100km	100km≤Range <150km	150km≤Range <250km	Range >=250km
All-electric powered buses and coaches	12-22	14-26	16-30	20-35	24-42	30-50
Plug-in hybrid bus (incl. range-extended model)			20	23	25	25

Source: MIIT

Lithium battery manufacturing plant regulations

MIIT - In November 2014 proposed regulations that battery manufacturers should comply with the following requirements:

- An annual output capacity for batteries should not be fewer than 100 million Wh;
- An annual output capacity of cathode materials should not be less than 2,000 tons;
- An annual output capacity of anode materials should not be less than 2,000 tons;
- An annual output capacity of the separator should not be less than 20 million sq m;
- An annual output capacity of the electrolyte should not be less than 2,000 tons;
- Actual production of the manufacturer should not be less than 50% of the production capacity.

Investments in NEV plants

Recent examples of New Energy Bus producers / facilities:

11/14: Battery maker, **Sinopoly Battery** → 100% stake in **Yunnan Wulong Auto Co**

04/15: Transport operator**, Fujian Longzhou Transportation Co** → 33% stake inelectric and hybrid bus joint venture, **Dongguan Zhongqi Hongyuan Automobile Co**

07/15: Charging infrastructure specialist, **Qingdao TELD New Energy Co Ltd** → cooperation agreement with **Dongfeng Special Vehicles** (Shiyan) on NEVs and charging infrastructure.

8/15: Aluminium extrusion company, **China Zhongwang Holdings Ltd** → cooperation with Brilliance Bus (Dalian) to develop all-aluminium all-electric buses.

2015: BYD signs e-bus assembly agreements with city authorities in Qingdao, Tianjin, Hangzhou and Guangzhou.

2015: Yutong builds 22,000 NEVs, of which 8,000 were all electric buses
Yutong granted permission for production of fuel cell buses

China OEM outlook - Conclusions

- Clear leadership in NEVs (esp. electric + hybrids)
- Strong domestic market growth
- Export opportunities with both conventional and advanced zero emission bus technologies