

POST COVID FUTURE OF ELECTRIC VEHICLES GLOBAL AND INDIA

ET Auto Webinar
April 21st 2020

Agenda

Introductions

1. Covid-19 & Macro Environment
2. Global and Indian Light Vehicle Production Impact
3. Global and Indian EV Forecasts Post COVID - 19
4. Impact if COVID in EV Business Model and OEMs Strategies
5. Industry Expectations from the Government & Role of Government

FROST & SULLIVAN PANELISTS

SARWANT SINGH



**Managing Partner,
Global Head -
Mobility**
Frost & Sullivan

JOSE SERRAS PEREIRA



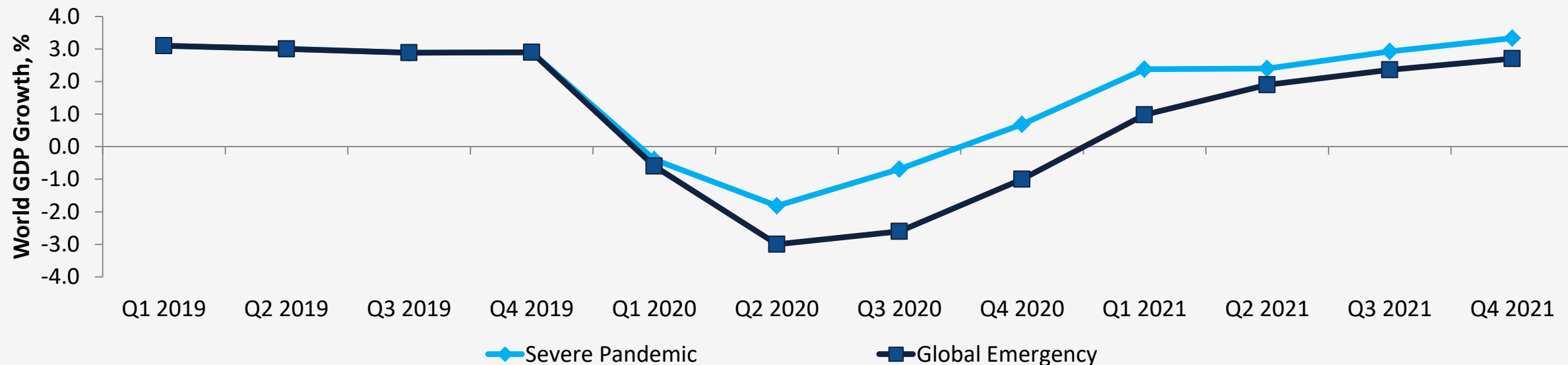
Director - Mobility
Frost & Sullivan



COVID-19 IMPACT & ECONOMIC SCENARIOS

2020 GLOBAL RECESSION NOW DEFINITE; YEAR-LONG RECESSION EXPECTED UNDER GLOBAL EMERGENCY SCENARIO

Quarterly GDP Growth, Global, 2019-2021

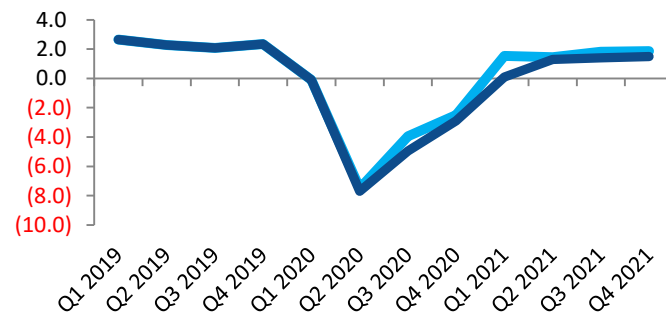


Scenario	Details
Severe Pandemic	35+ countries to register 3000+ cases by mid-April, 20 countries to register 10,000+ cases, with lockdowns to continue through April-May.
Global Emergency	80+ countries to register 5000+ cases by mid-May, 35 countries to register 10,000+ cases, with severe spread across Asia, Africa, and LATAM

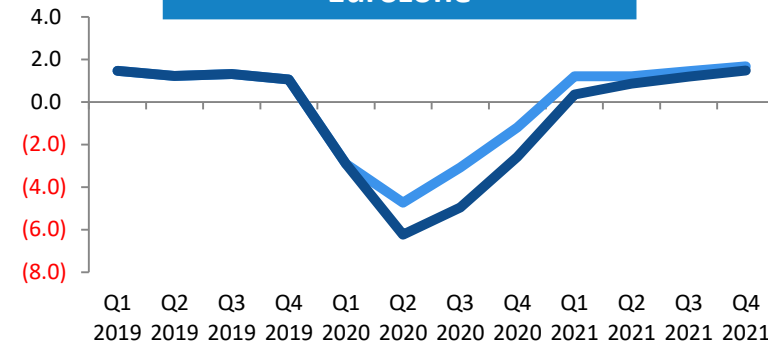
GLOBAL GDP IMPACT BY KEY REGIONS: SOUTH ASIA MIGHT JUST ESCAPE FROM 2020 RECESSION

Quarterly GDP Growth, Regions, 2019-2021

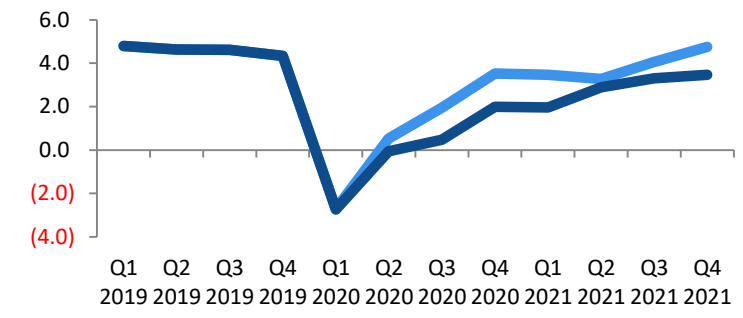
The United States



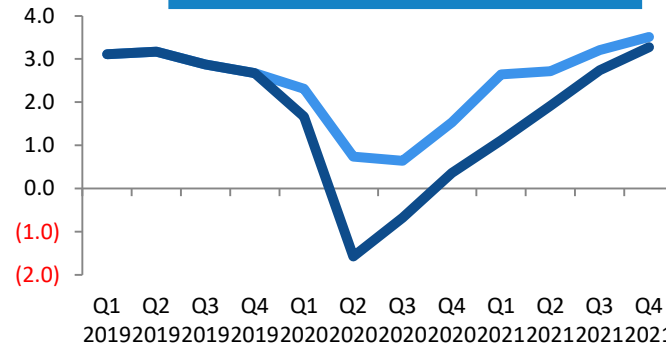
Eurozone



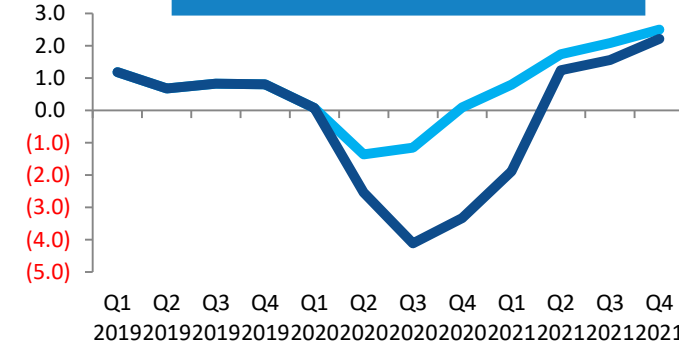
Asia Pacific



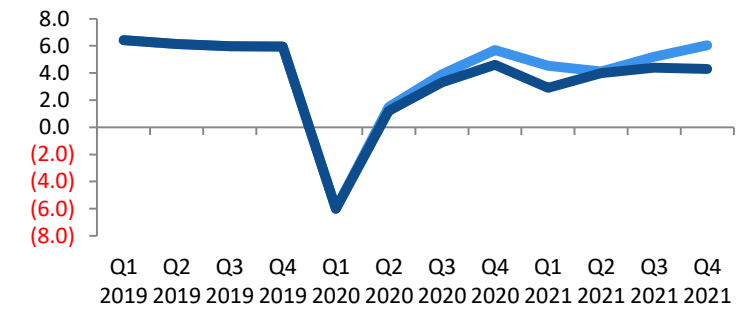
South Asia



Middle East



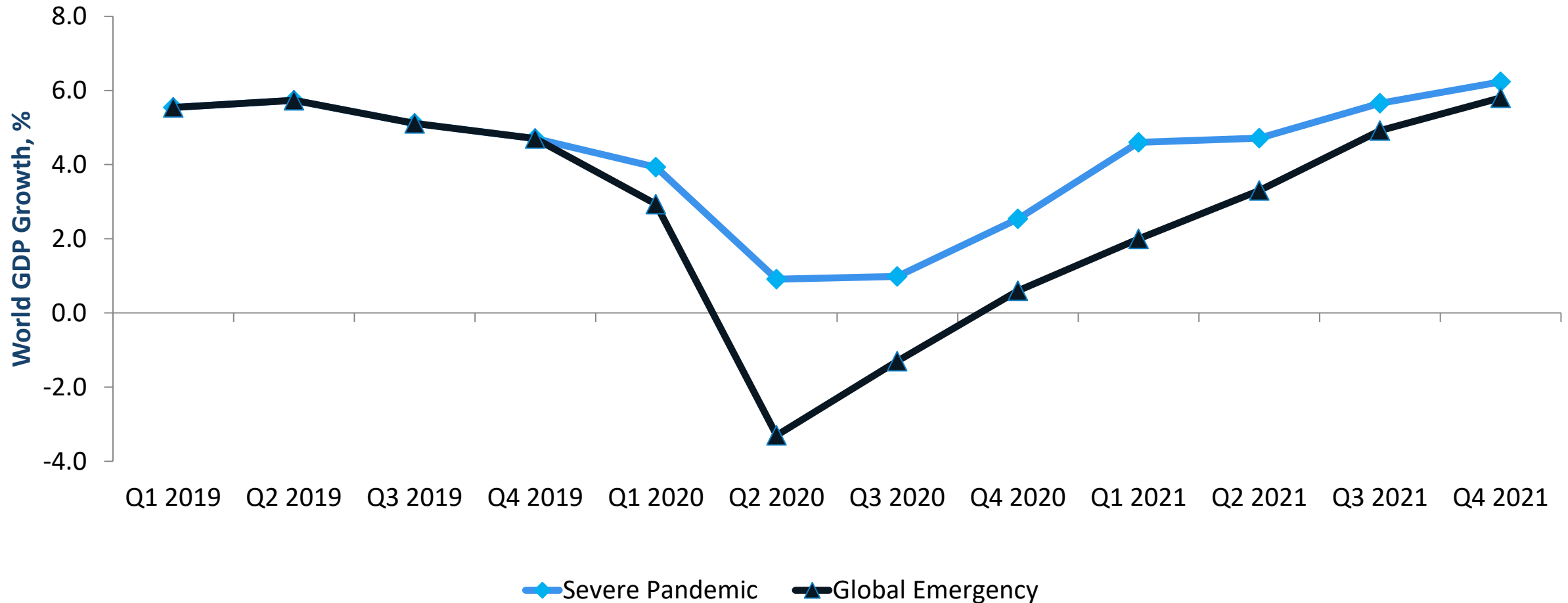
China



Severe Pandemic Global Emergency

INDIA'S 2020 ANNUAL GROWTH COULD BE BETWEEN 2.1% AND -0.3%, DEPENDING ON THE SCENARIO, WITH 2021 RECOVERY TO 4-5% LEVELS

Quarterly GDP Growth, India, 2019-2021

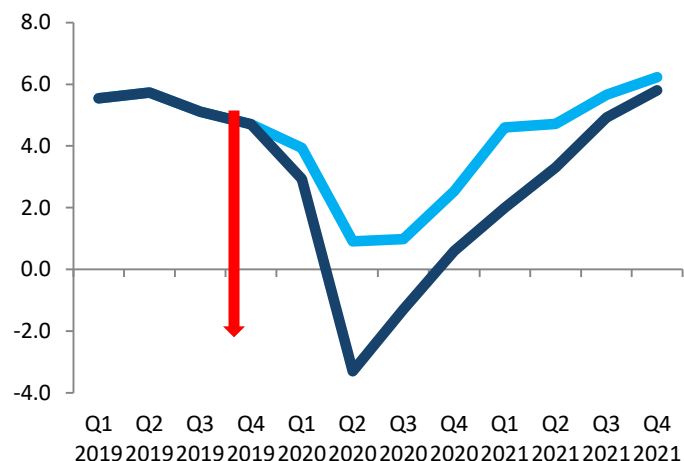


Source: IMF; Worldometer; Frost & Sullivan

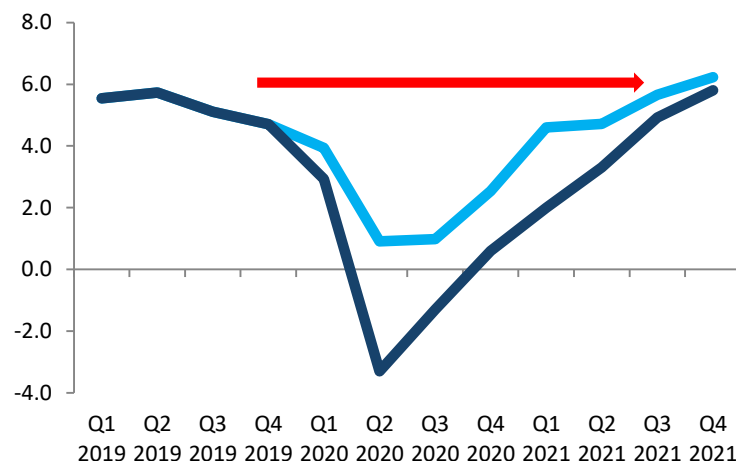
INDIA'S 2020 QUARTERLY GROWTH COULD SLIP TO AS DEEP AS -3.3%; SLOWDOWN/ RECESSION TO LAST TWO QUARTERS

Quarterly GDP Growth, India, 2019-2021

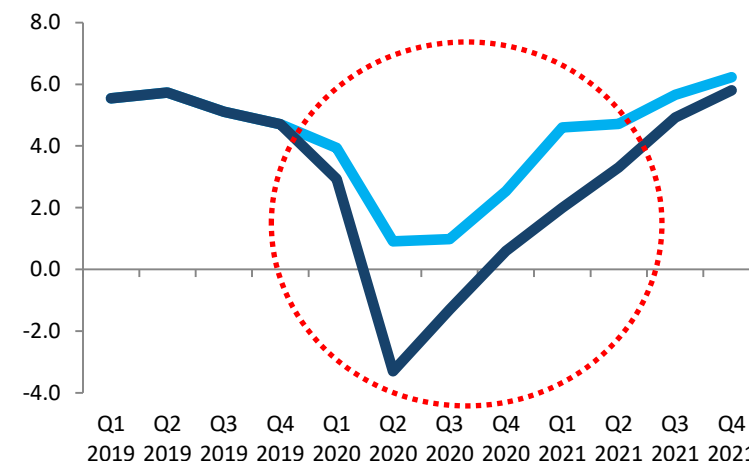
Depth of Disruption



Length of Disruption



Shape of Recovery



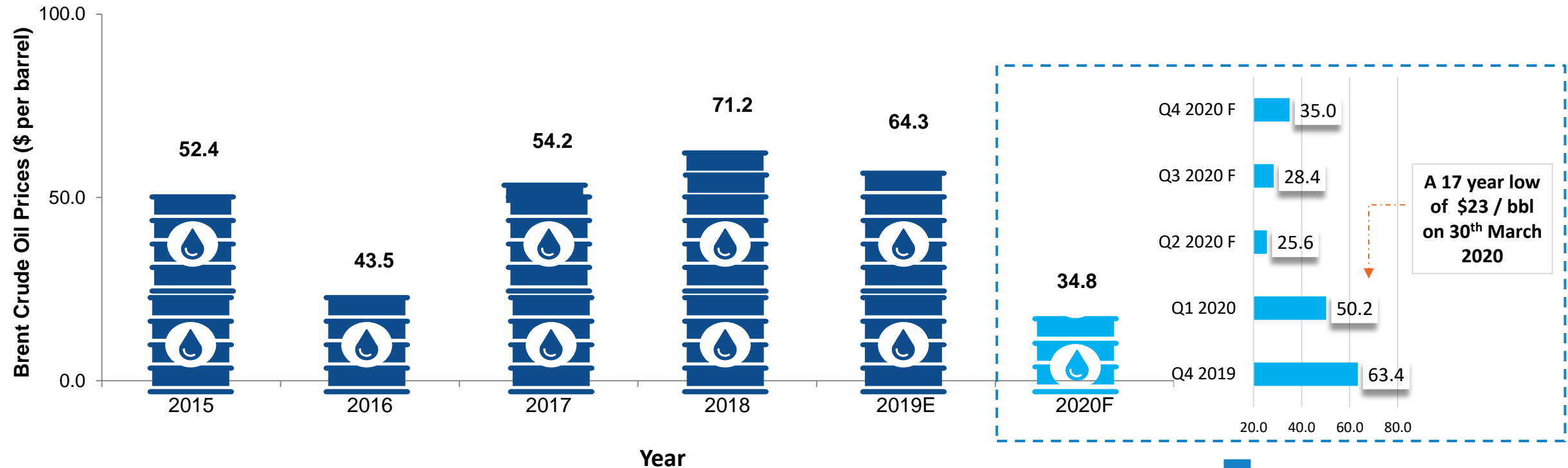
Severe Pandemic Global Emergency

Severe Pandemic	GDP growth to drop to 0.9% in Q2	Growth to slow to 0.9% and 1.0% in Q2 and Q3 respectively	A stretched V-curve. Recovery to start from Q3 2020. Full recovery by Q3 2021.
Global Emergency	GDP growth to drop to -3.3% in Q2	Technical recession in Q3 – Q4 2020	A stretched V-curve with sharp dent . Recovery to start from Q4 2020. Full recovery by Q4 2021.

Source: IMF; Worldometer; Frost & Sullivan

2020 BRENT CRUDE OIL PRICES TO SLIDE \$34.8 OR LESS

Changing Business and Economic Scenario: Annual Average Brent Crude Oil Prices, Global, 2015-2020F



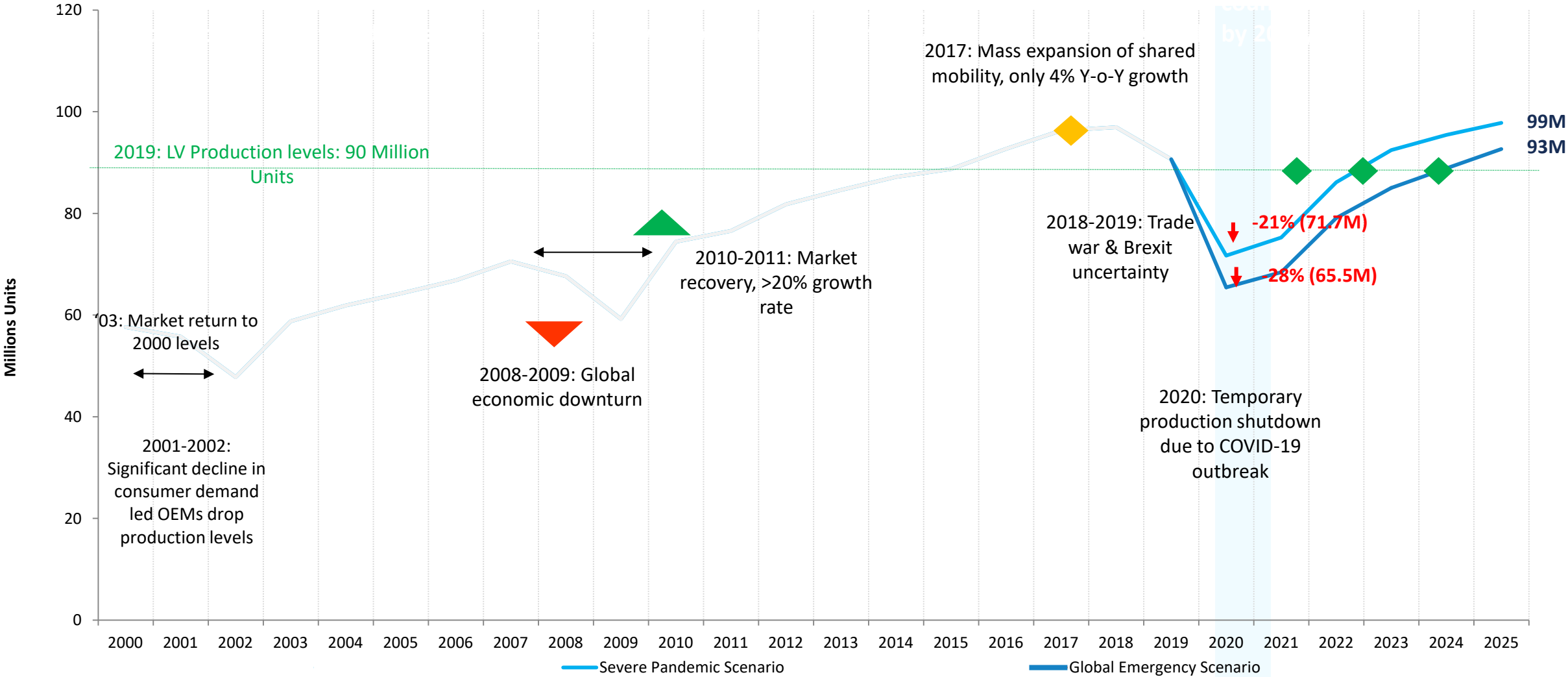
An expected pick-up in demand for motor and aviation fuel in H2 2020, should help an uptick in prices.

Source: International Energy Agency (IEA); U.S. Energy Information Administration (EIA) ; Frost & Sullivan



IMPACT TO AUTOMOTIVE INDUSTRY

ANNUAL LIGHT VEHICLE PRODUCTION GLOBAL TO DECLINE BY ABOUT 21%



Note: Light Vehicles include Passenger Vehicles and Light Commercial Vehicles with GVWR of up to 6 MT

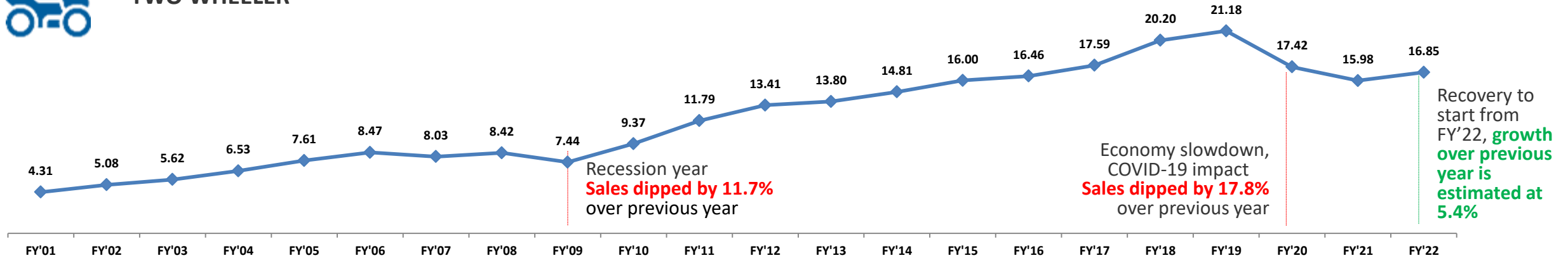
IMPACT ASSESSMENT FOR THE MOBILITY INDUSTRY IN INDIA DUE TO COVID19



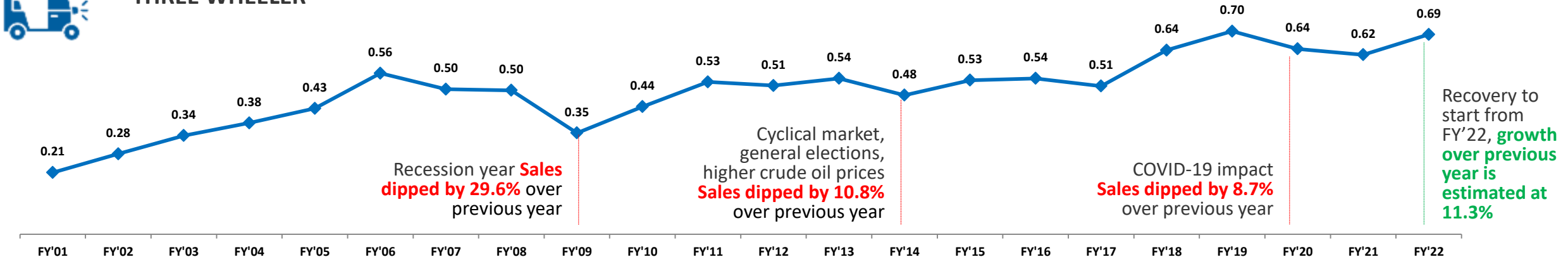
Sales volumes in India likely set back by 4 years; recovery expected FY22* onwards. Currently India's economy is facing a slowdown and on top COVID19 had hard impact on domestic sales; expected recovery to start by year 2022



TWO WHEELER



THREE WHEELER



* Financial year 2021 in India starts from 1st April 2020 to 31st March 2021

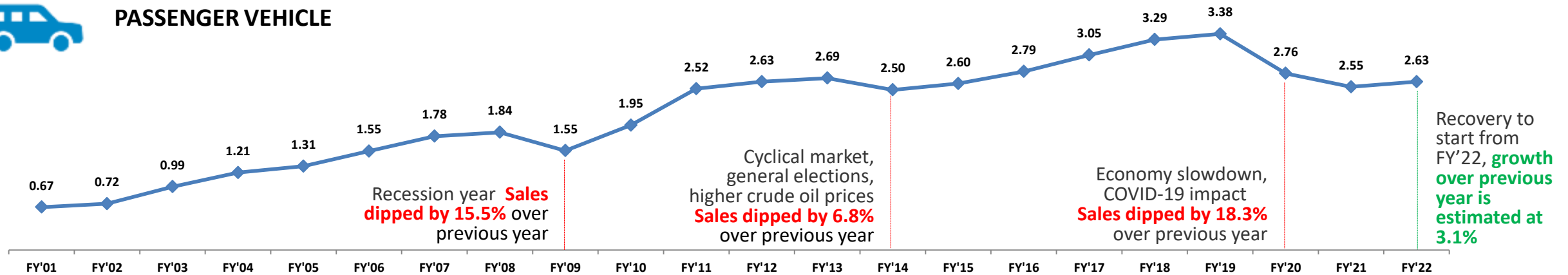
IMPACT ASSESSMENT FOR THE MOBILITY INDUSTRY IN INDIA DUE TO COVID19



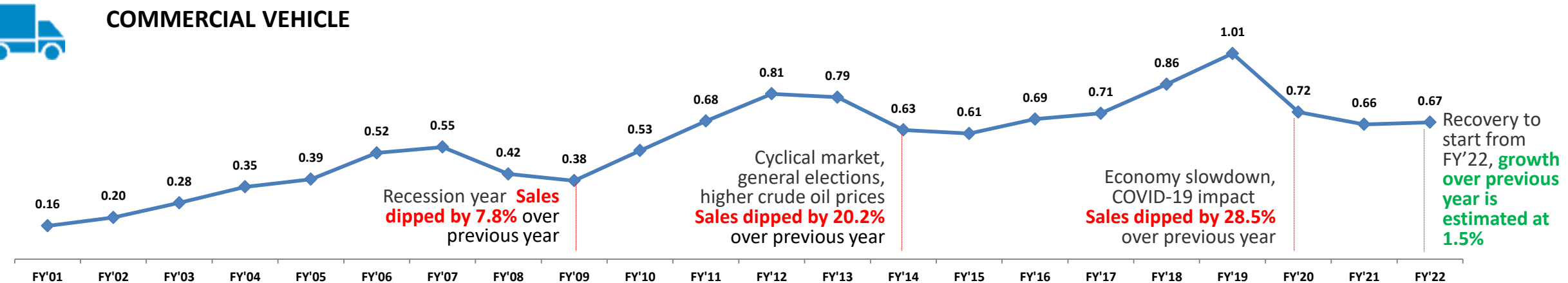
Sales volumes in India likely set back by 4 years; recovery expected FY22* onwards. Currently India's economy is facing a slowdown and on top COVID19 had hard impact on domestic sales; expected recovery to start by year 2022



PASSENGER VEHICLE



COMMERCIAL VEHICLE



* Financial year 2021 in India starts from 1st April 2020 to 31st March 2021

Source: Frost & Sullivan analysis

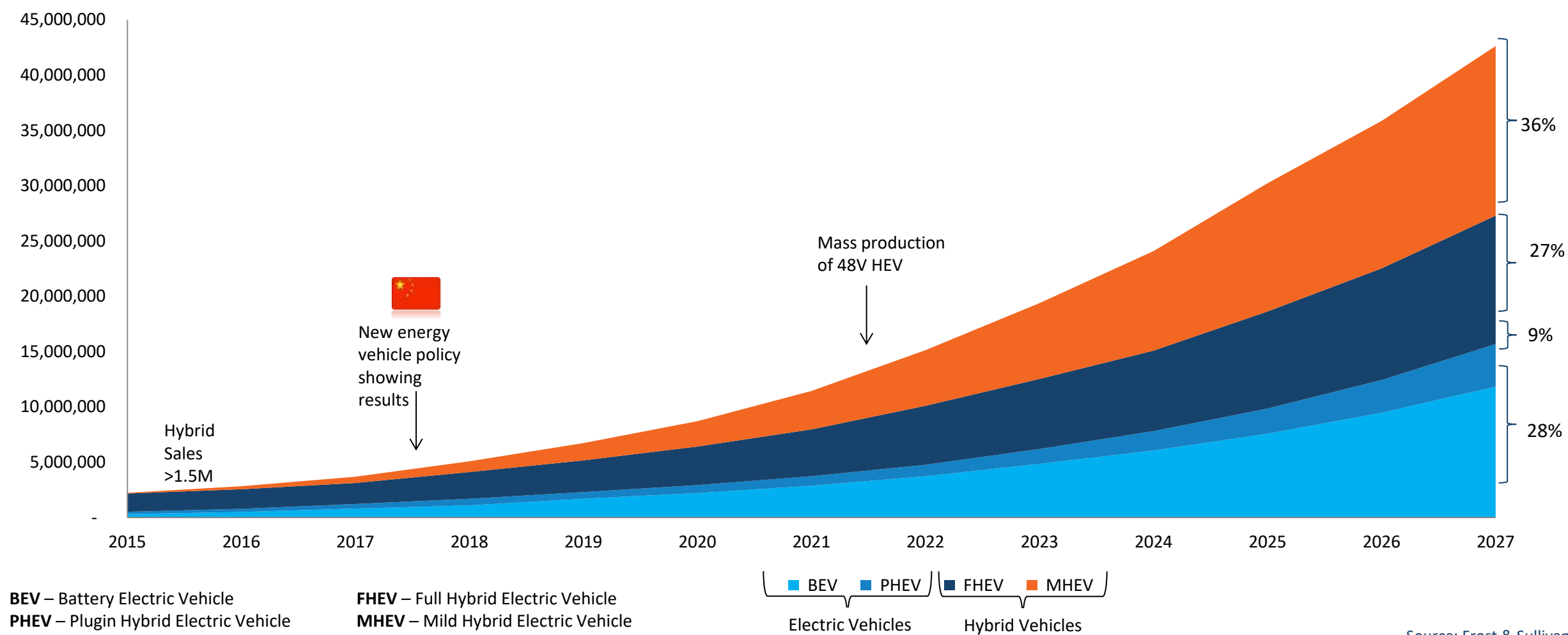


ELECTRIC VEHICLE OUTLOOK GLOBAL AND INDIA

GLOBAL UPTAKE OF XEV – 2015 TO 2027

IN AN OPTIMISTIC SCENARIO, XEVs ARE LIKELY TO ACCOUNT FOR 30-35% OF THE TOTAL PASSENGER VEHICLE SALES BY 2027 WITH AN ESTIMATED VOLUME OF 43 MILLION

Total xEV Market: Sales Forecast of Hybrid And Electric Vehicles, Global, 2015–2027

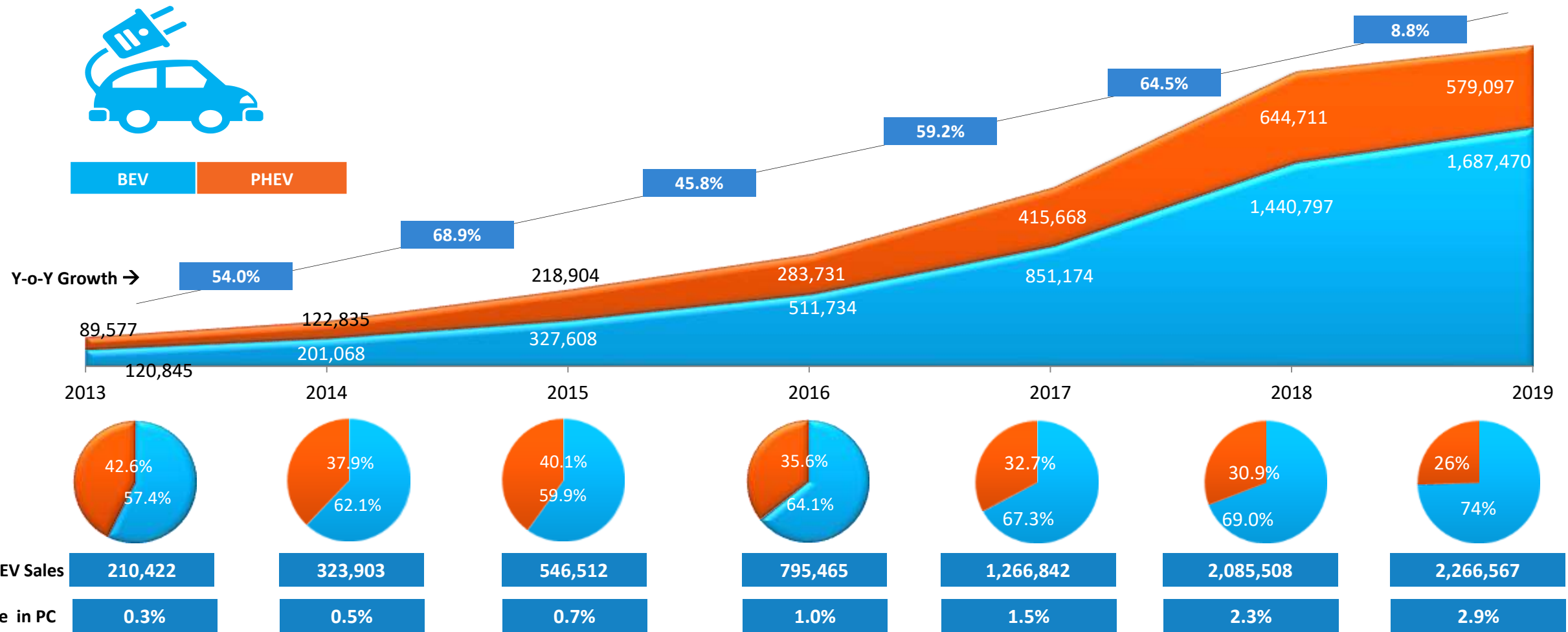


Source: Frost & Sullivan

HISTORIC EV SALES

OVER 2.27 MILLION ELECTRIC VEHICLES WERE SOLD IN 2019 WITH A LOWEST Y-O-Y GROWTH RATE IN 2019. CHINESE EV MARKET FELL FLAT DUE TO PHASE OUT OF INCENTIVES

Electric Vehicle Outlook: Historic EV Sales, Global, 2013-2019



Note: All figures are rounded and FCEVs have been excluded in the pie chart. The base year is 2019.

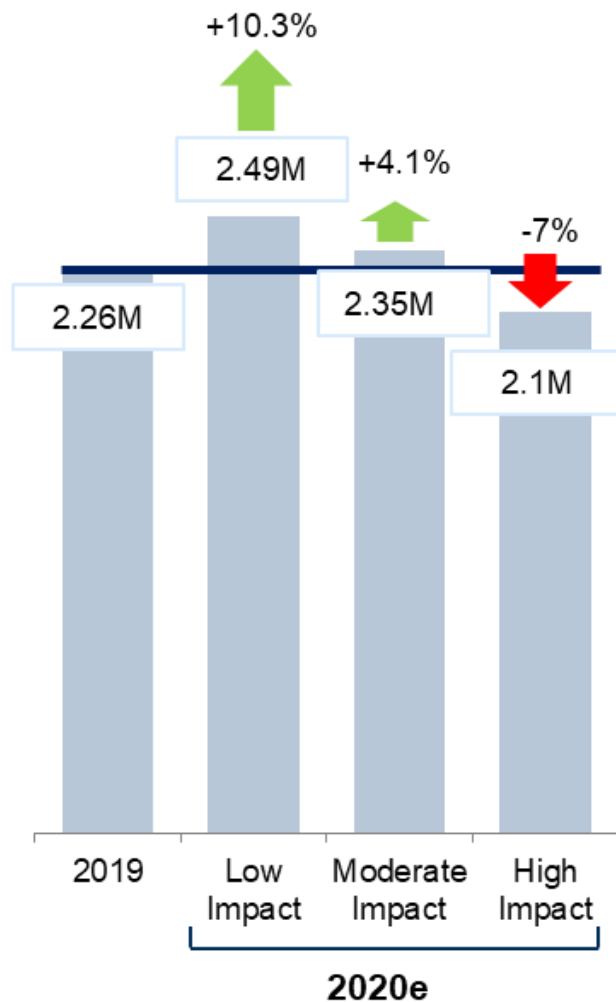
Source: Frost & Sullivan

IMPACT OF COVID-19 ON GLOBAL EV SALES

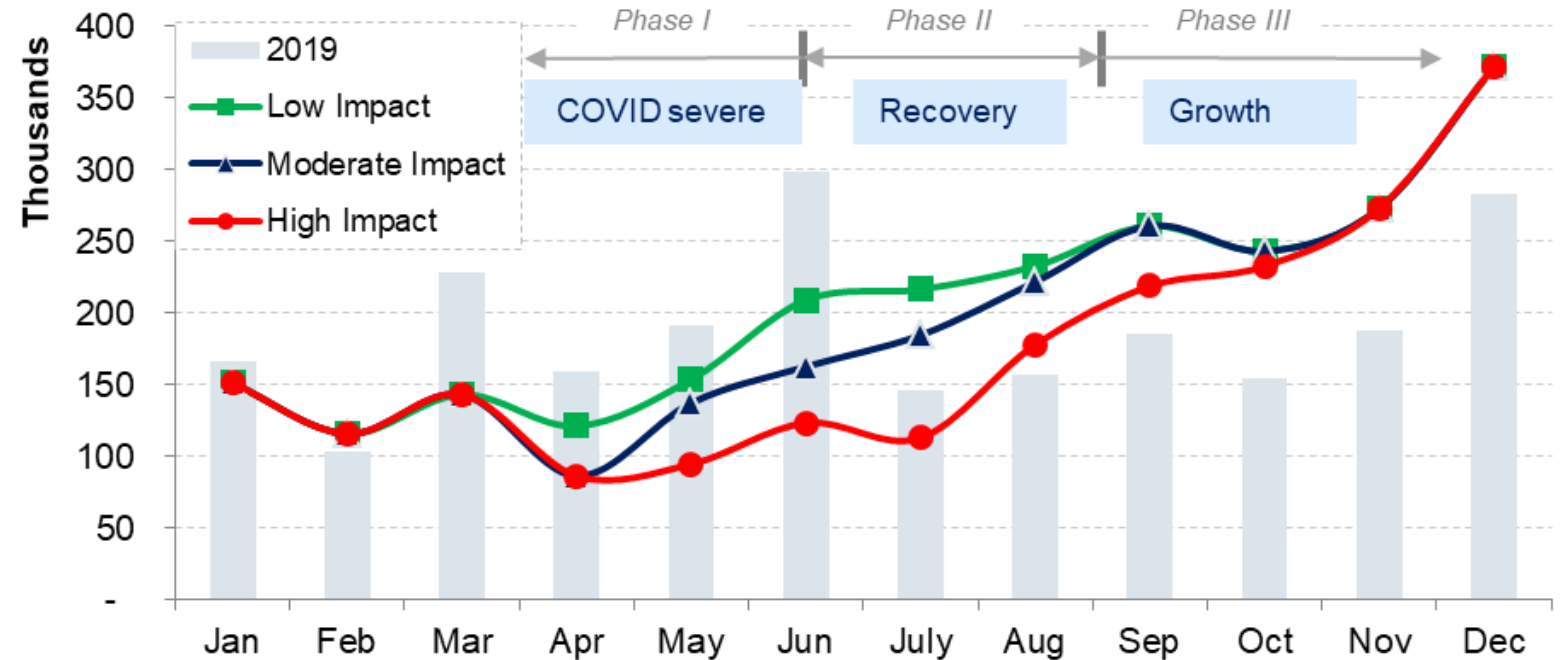


EVs will see flat growth in Moderate Impact

Impact of COVID-19, Global, 2019-20



Impact of COVID-19 on EVs: Scenario Estimates, Global, 2019-2020



Scenario	Lockdown	Recovery	Countries
Low Impact	2-3M	1-1.5M	US 🇺🇸 CH 🇨🇳 JP 🇯🇵 SK 🇰🇷
Moderate Impact	3-4M	1.5-2M	European Countries 🇪🇺 [open borders challenge]
High Impact	4-5M	1.5-2M	No country as of now

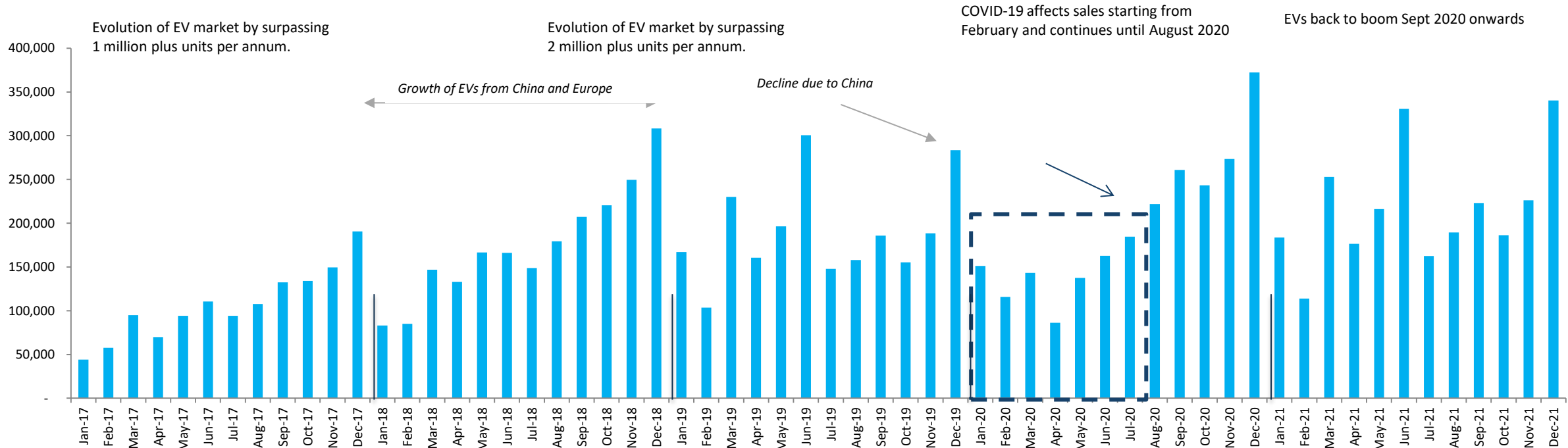
Source: Frost & Sullivan

GLOBAL ELECTRIC VEHICLE MONTHLY OUTLOOK PRE AND POST COVID



Despite an impact on EV sales in the short-term, recovery is likely to be swift due to supply push

Identifying Growth Opportunities in Electric Vehicles: Electric Vehicle Sales by Month, Global, 2017-2021e

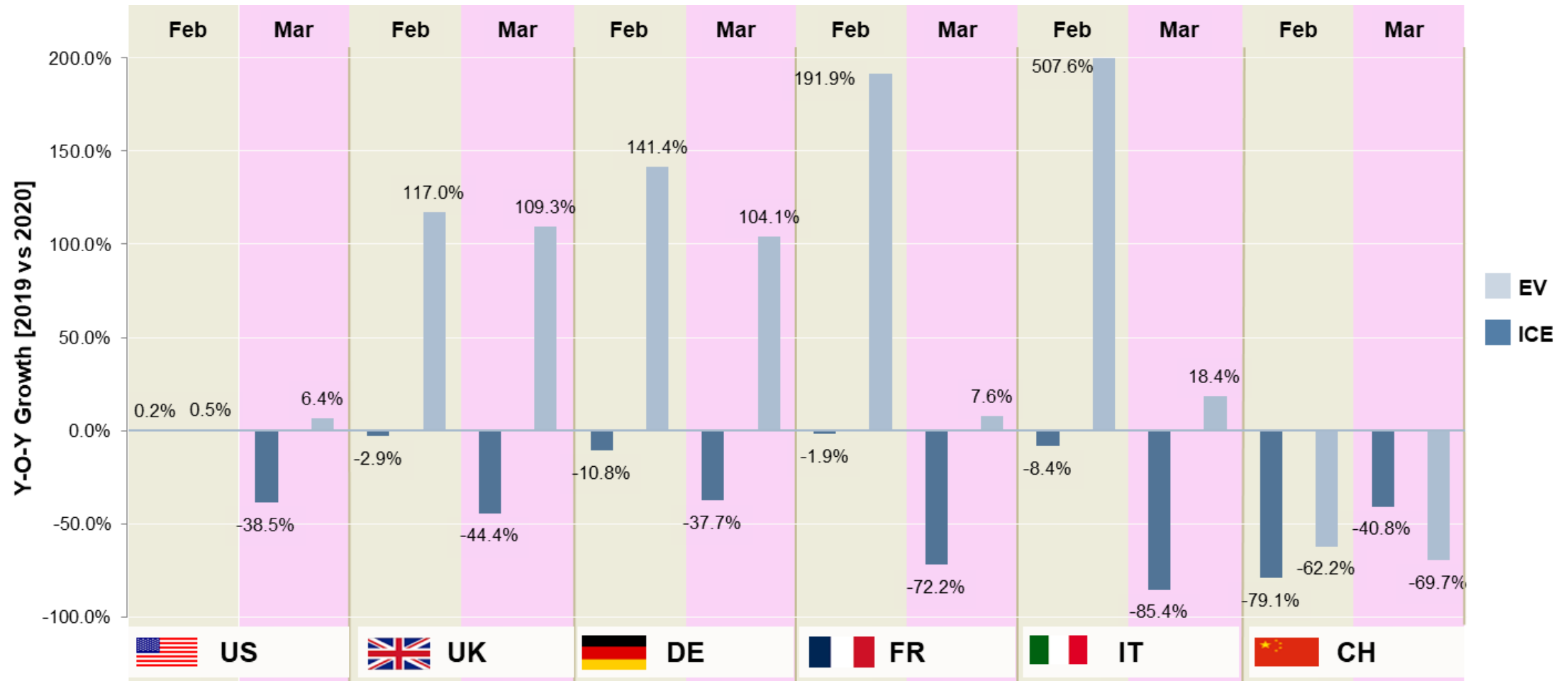


	Models	Charging Stations	Battery Cell Production	EV Estimated Sales
2020 Est. (without COVID Impact)	35	1-1.2+ million	108,000 MWH	~2.7 Million
2020 Est. (with COVID Impact)	28	900k-1 million	100,000 MWH	~2.5 Million
IMPACT	MEDIUM	LOW	LOW	LOW

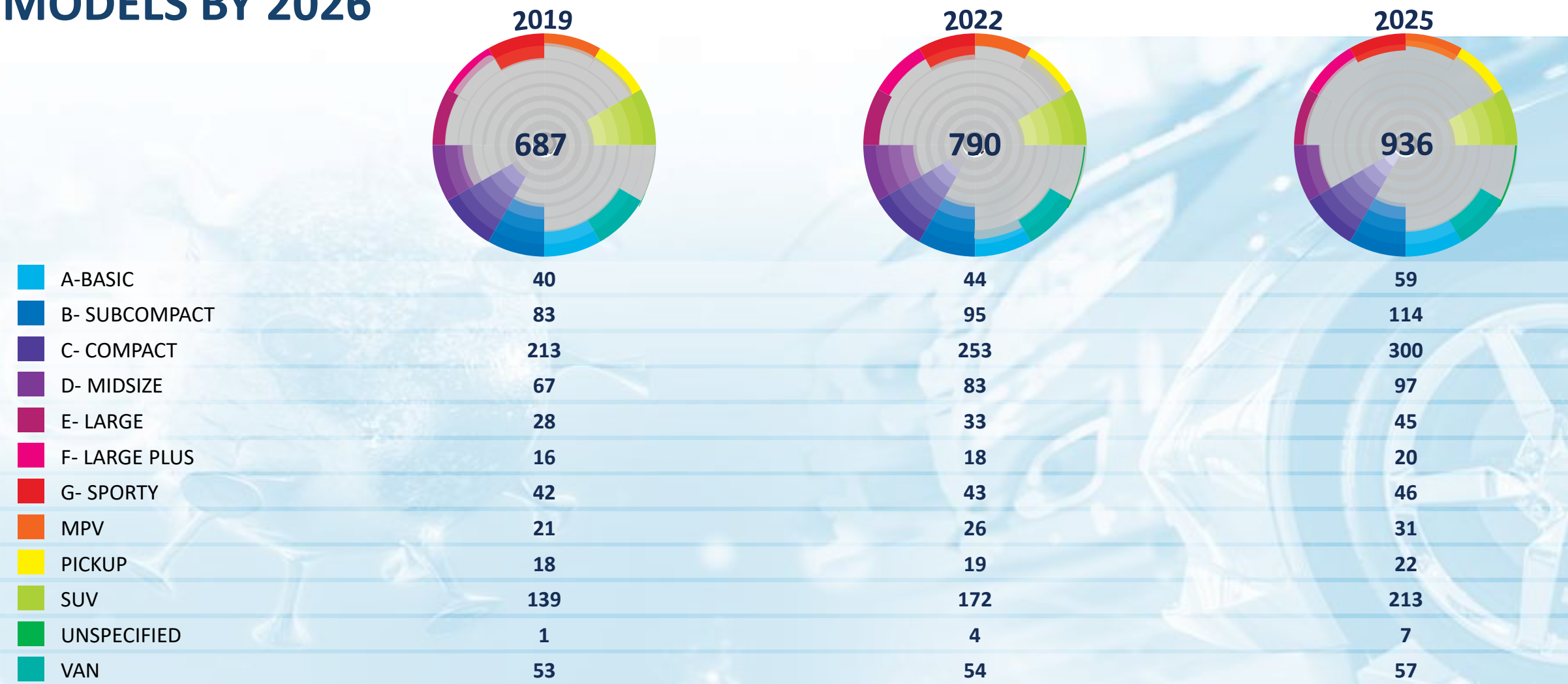
Source: Frost & Sullivan

EV'S HAVE NOT BEEN IMPACTED BY COVID-19 IN EUROPE.

ICES ARE HITTING ROCK BOTTOM DECLINE, EVS SHOWS A GROWTH EVEN IN SEVERELY IMPACTED COUNTRIES SUCH AS ITALY & FRANCE.



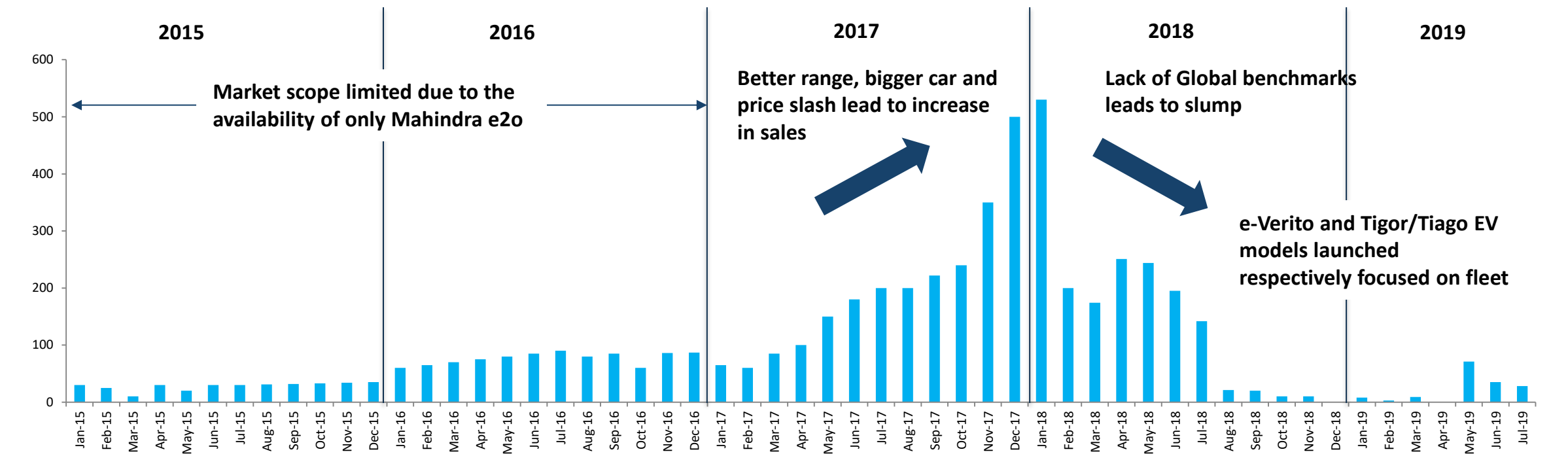
GLOBAL EV MODEL ANALYSIS : A FEW MODEL LAUNCHES COULD BE POSTPONED BUT OVERALL GLOBALLY WE SEE AROUND 1000 EV + PHEV MODELS BY 2026








Source: Frost & Sullivan

E-PASSENGER CAR HISTORICAL SALES IN INDIA

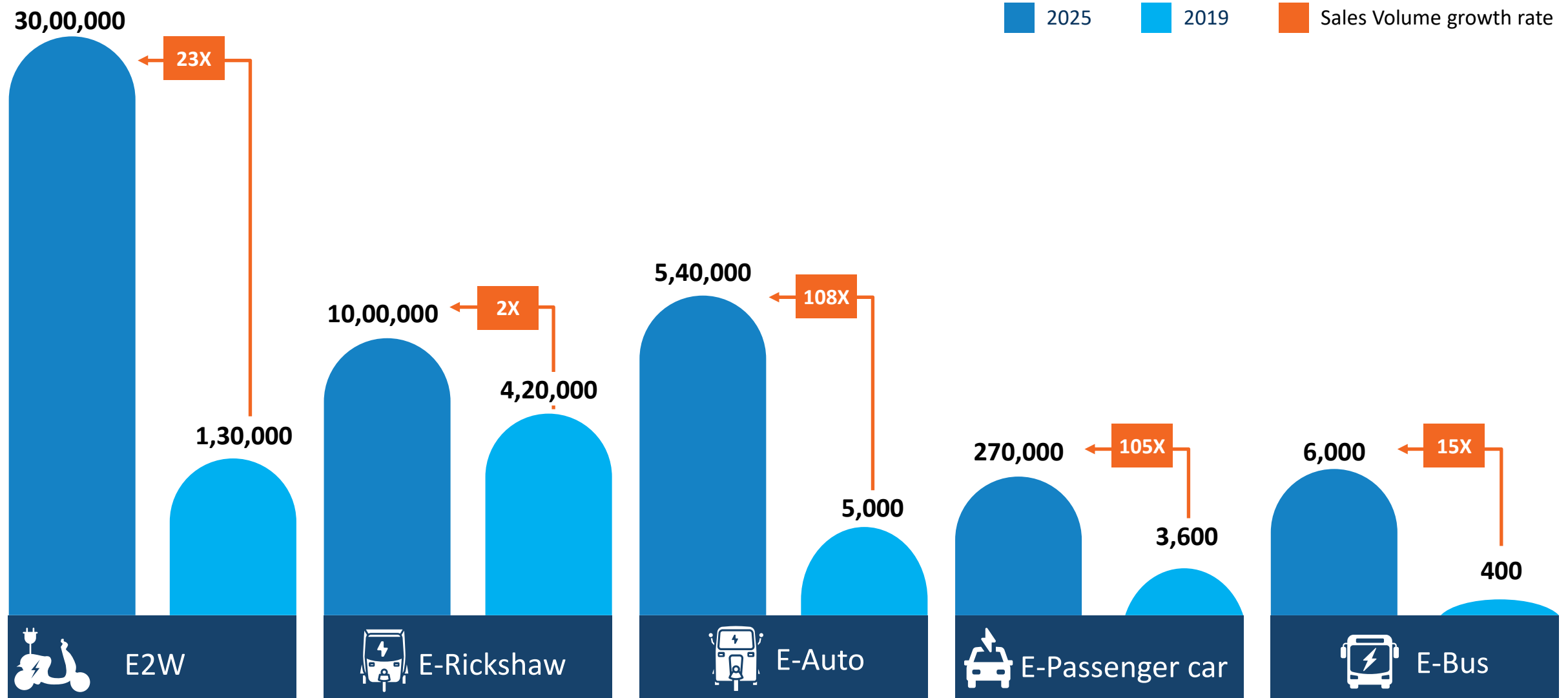
LACK OF LONG RANGE EVS AND COST OF ACQUISITION HAS BEEN THE MAJOR RESTRAINT FOR EV UPTAKE IN INDIA. GOVERNMENT NEEDS TO ENCOURAGE EV IMPORTS WITH TAX BENEFITS OR AGGRESSIVELY ACCELERATE “MAKE IN INDIA” TO ACHIEVE MILESTONES



	Models 	OEMs 	Charging Stations 	Range Anxiety 	Battery cell production 
Challenge 2018	5	4	293	150 kms	0 GWh
Scenario 2025	75	19	AC: 1,58,000 DC: 5,400	>400 kms	30-40GWh

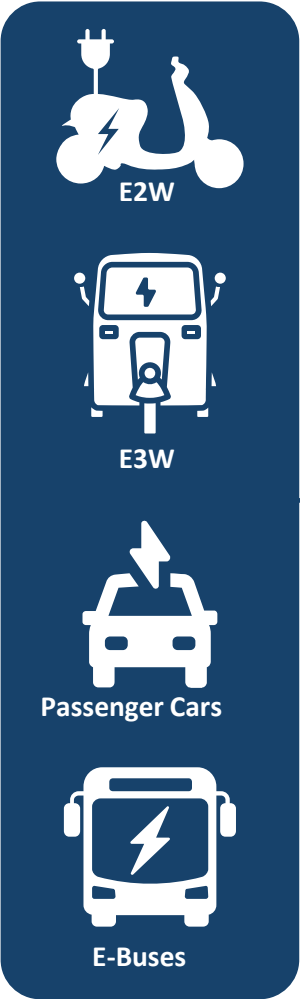
MARKET FORECAST TO 2025

E-RICKSHAWS, E-AUTOS AND E-2W ARE THE MOST PROMISING SEGMENTS FOR ELECTRIFICATION IN INDIA; EXPECTED TO ACCOUNT FOR OVER 4 MILLION UNITS BY 2025



PERSPECTIVE: MARKET SIZE OF EV COMPONENT INDUSTRY IN 2025

ELECTRIC VEHICLE VALUE CHAIN IN INDIA IS EXPECTED TO REACH \$4.8 BILLION IN 2025



Electric motors \$1.23 BILLION



Batteries \$1.86 BILLION



Power electronics \$1.47 BILLION



Charging stations \$0.230 BILLION



KEY TRENDS

1/3rd
Of the EV motor market will emerge from demand in EV Buses in India in 2025

67%
Will be the Passenger Car segment's share in Battery Market in 2025

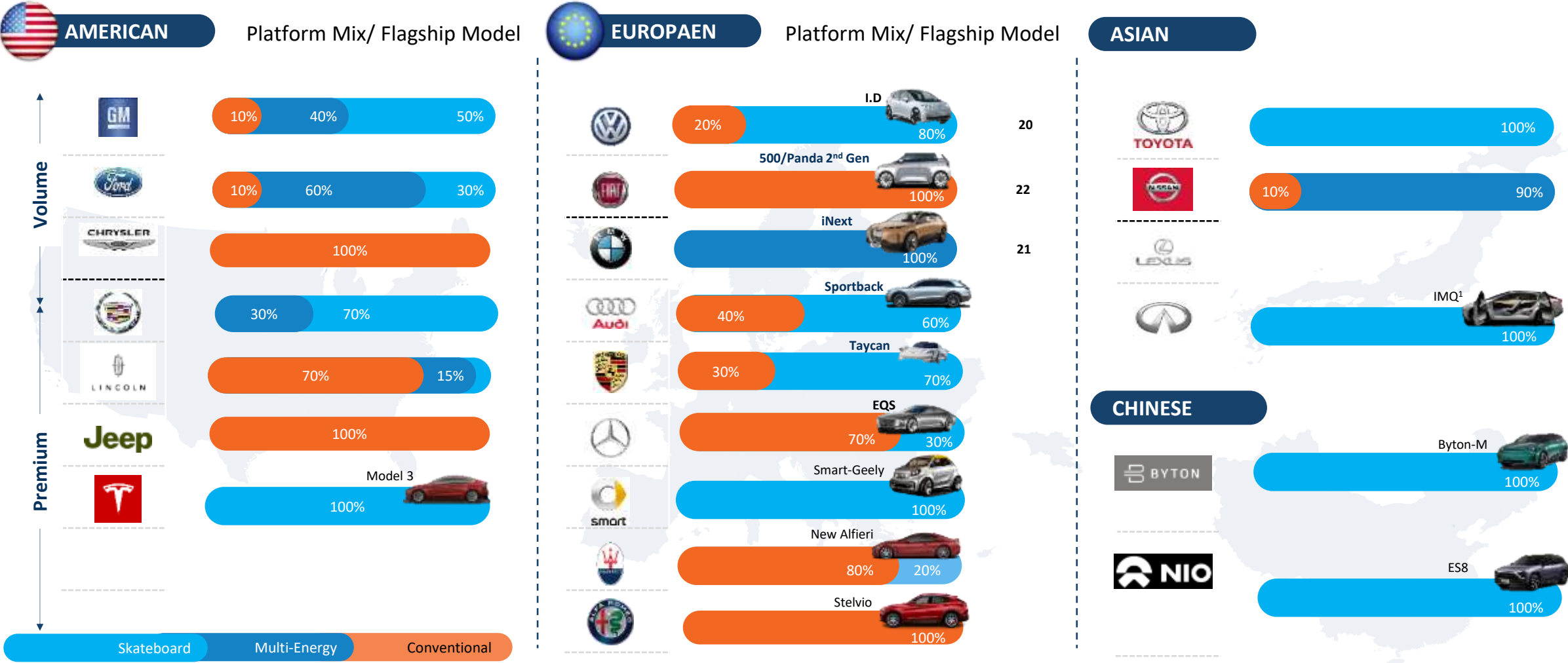
15.6 Million KWh
Will be the total demand for Li-Ion battery pack in 2025

61%
Will be the 2W vehicle segments' share in the Power electronics market in 2025



XEV BATTERY & MOTOR TECHNOLOGY TRENDS AND THERMAL MANAGEMENT STRATEGIES

PLATFORM MIX: 13 GLOBAL OEM BRANDS TO LAUNCH BEVS ON “SKATEBOARD PLATFORM”

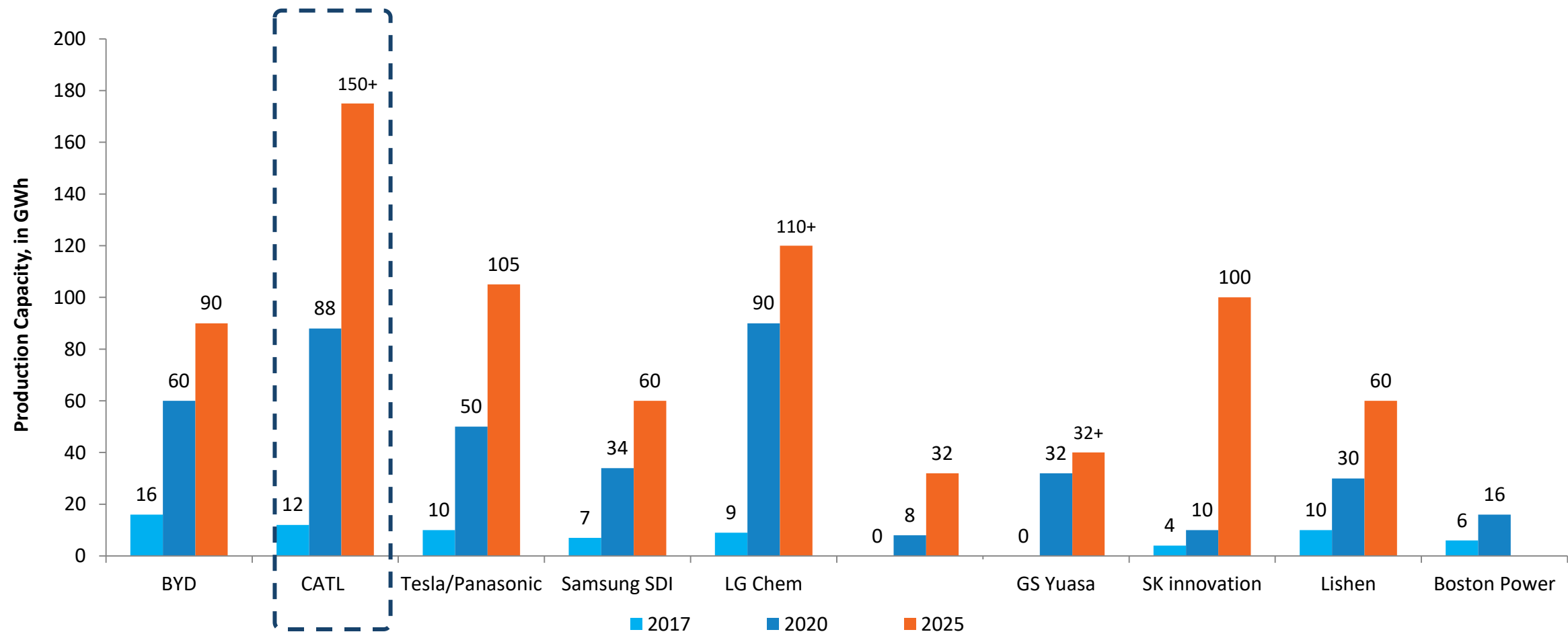


Note: 1). Might be camouflaged as dedicated skateboard (ought to surely come of a CMF C/D derivative) which will be developed leveraging Dongfeng alliance partnership out of China. Test bed for this learning is the KWID platform becoming electrified before the learnings will be passed on to CMF C/D or whichever will be devoted to build EVs for Nissan/Infiniti.

SUPPLY-DEMAND - BATTERY PRODUCTION CAPACITY TO 2025

LG CHEM AND CATL WILL LEAD THE IN TERMS OF PRODUCTION BY 2025.

Battery Production Capacities, Global, 2017-2025

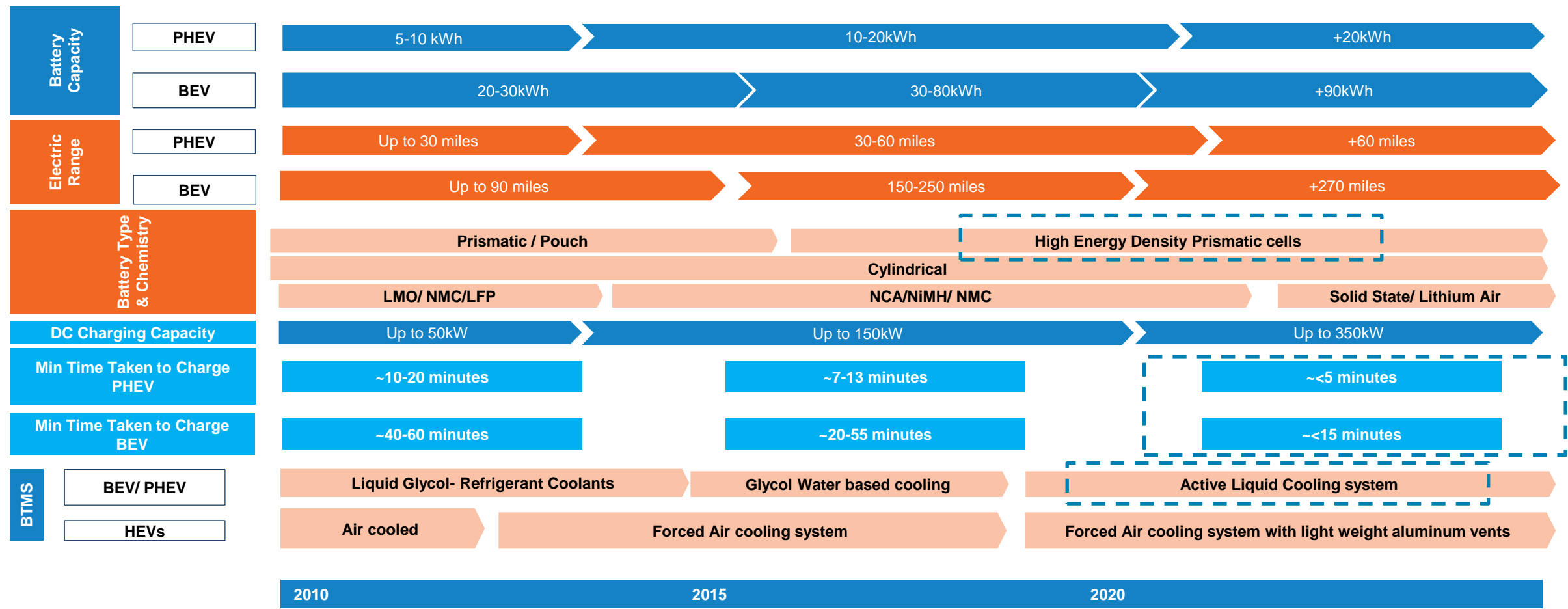


Source: Industry data, Frost & Sullivan

BATTERY SPECIFICATION ROADMAP

THE TREND IS MOVING TOWARDS HIGHER BATTERY CAPACITIES OVER 60KWH TO INCREASE THE RANGE OF AN ELECTRIC VEHICLE UP TO 200 MILES ON A SINGLE CHARGE.

Electric Vehicle Market : Battery Capacity and Range Roadmap, Global, 2010–2020



Source: Frost & Sullivan

BATTERY PORTFOLIO – BATTERY SUPPLY CHAIN BY BATTERY CELL CHEMISTRY

PRISMATIC NMC BATTERIES WILL BE THE KEY BATTERY TECHNOLOGY ADOPTED ACROSS KEY OEMS IN EU AND NA. CYLINDRICAL NCA BATTERY WILL BE PREDOMINANTLY USED BY TESLA PRODUCED BY PANASONIC.

Electric Vehicle Market : Battery Capacity and Range Roadmap, Global, 2010–2020

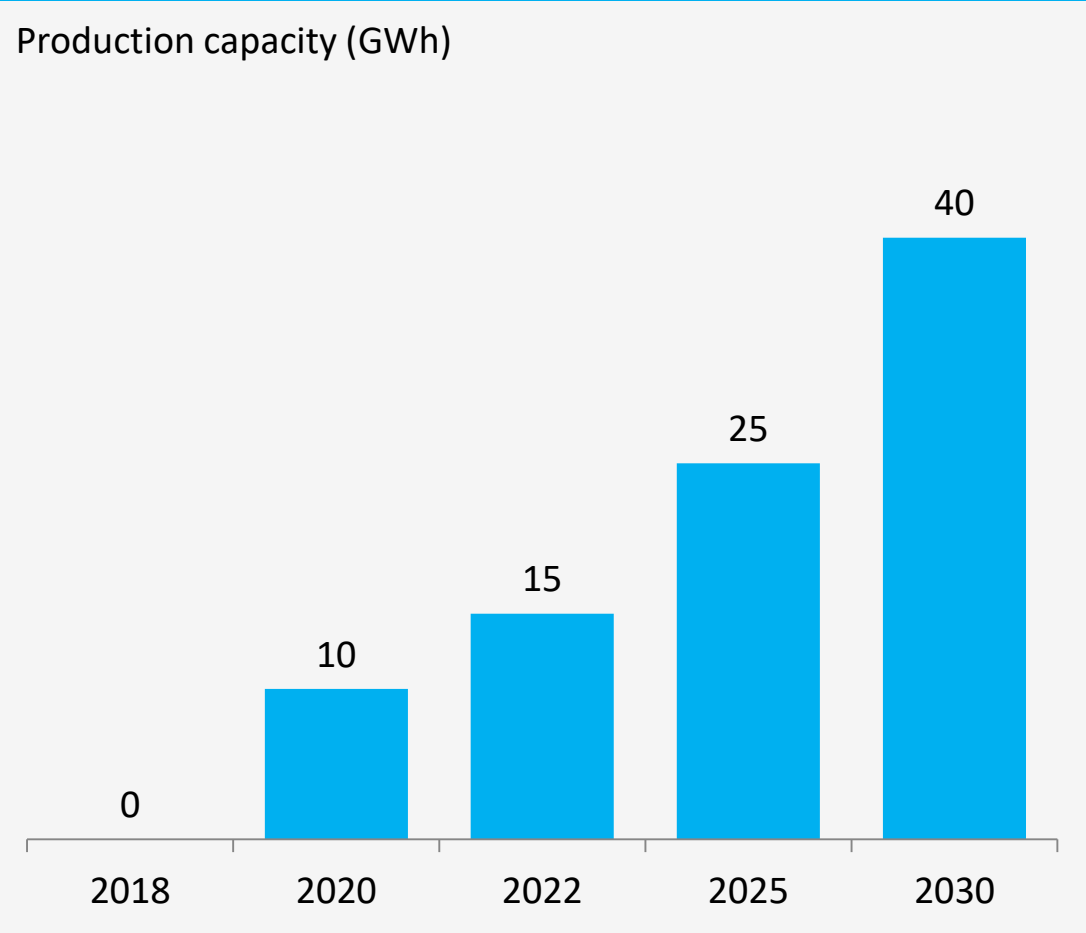
Battery Chemistry/ Battery Type	Lithium Cobalt Oxide (LCO)	Lithium Manganese Oxide Battery (LMO)	Lithium Iron Phosphate (LFP)	Lithium Nickel Manganese Cobalt Oxide Battery (NMC)	Lithium Nickel Cobalt Aluminum Oxide Battery (NCA)	Lithium Titanate Battery (LTO)
Cylindrical			 		   	
Prismatic			    	    		 
Pouch		 		    		

Source: Frost & Sullivan

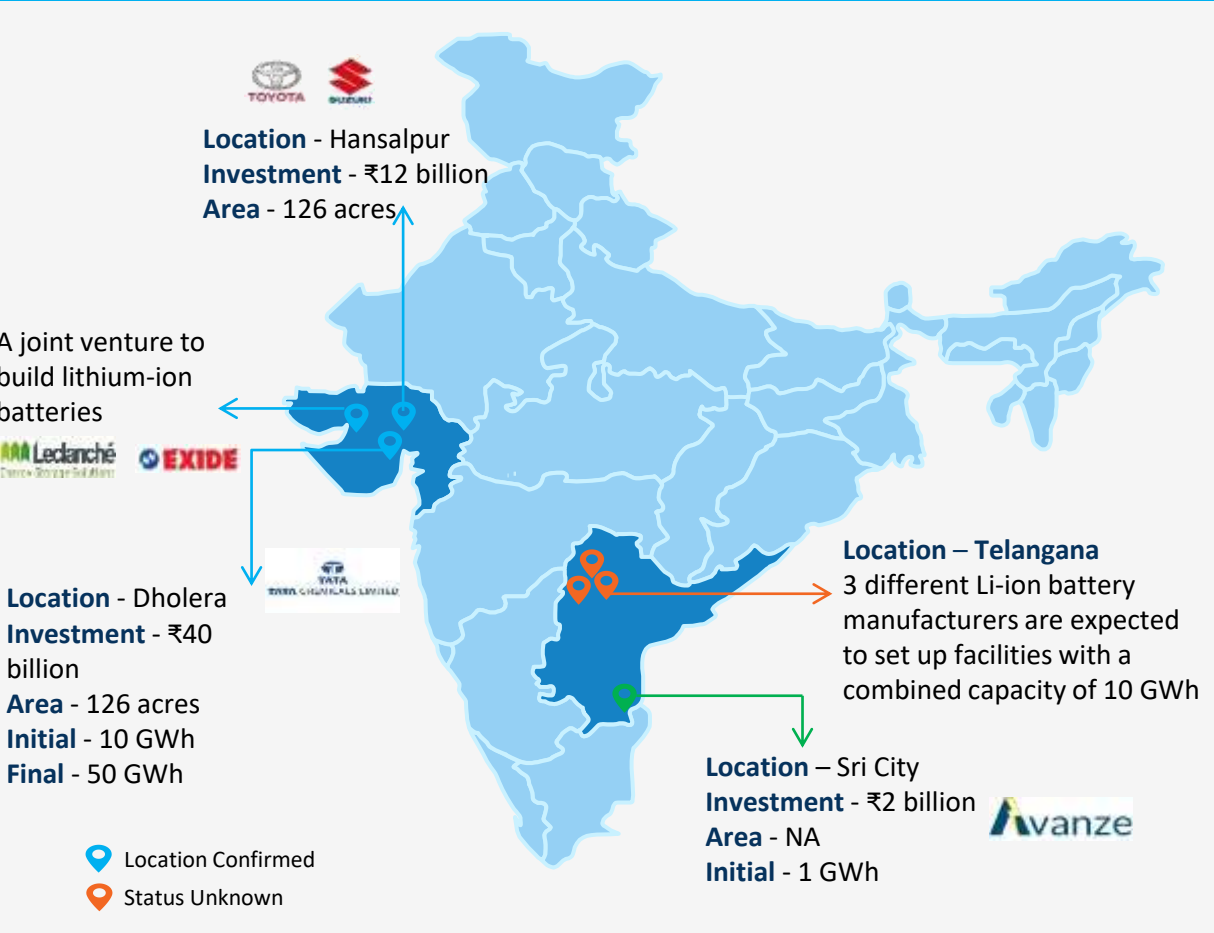
LI-ION PRODUCTION TO BOOM IN INDIA

INDIA TO HAVE 40GWH OF INSTALLED LI-ION CAPACITY MAKING IT ONE OF THE FASTEST GROWING INDUSTRIES OF THE NEXT DECADE

Lithium-ion Battery Production and Installed Capacity Predictions, India, 2018-2030

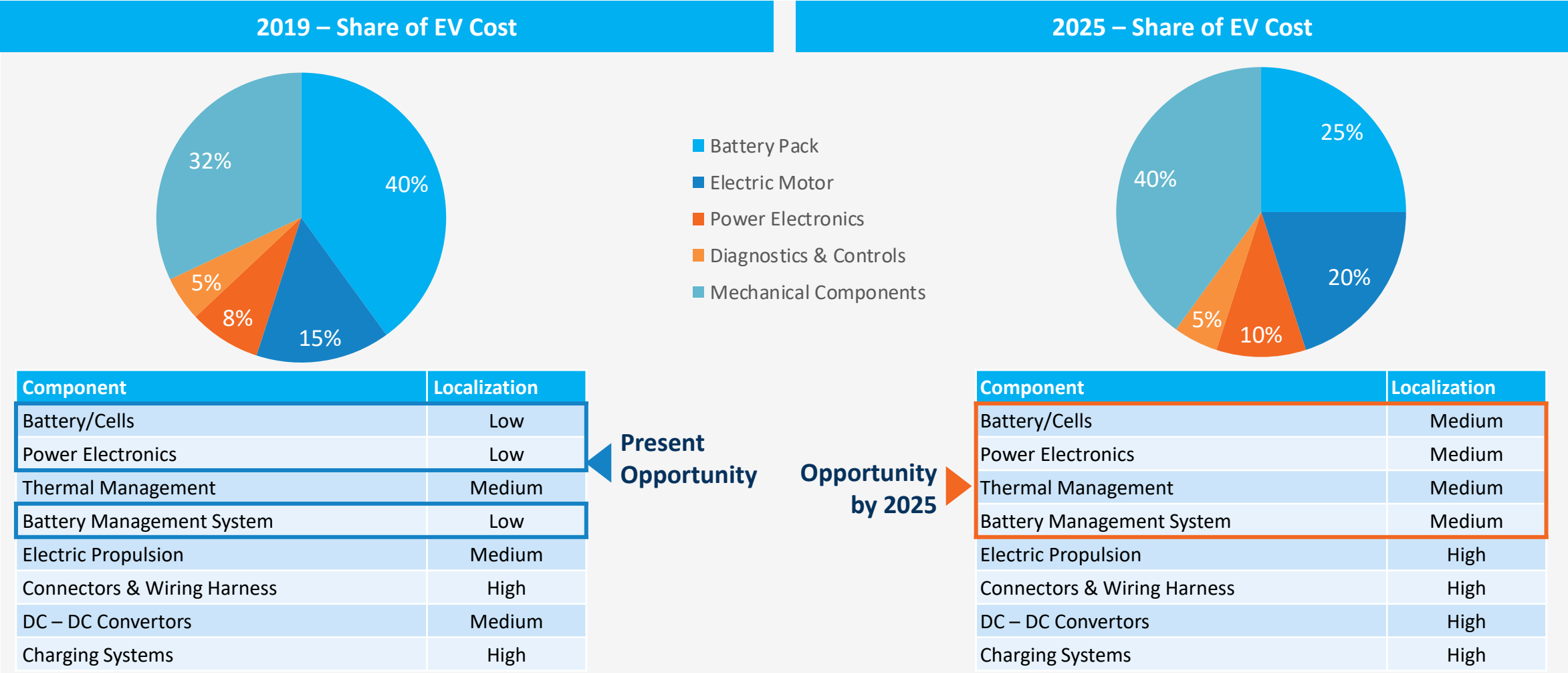


Li-ion Production Plants Expansion, India



ELECTRIC VEHICLE COMPONENT LOCALIZATION

BATTERIES, POWER ELECTRONICS, THERMAL MANAGEMENT, AND BATTERY MANAGEMENT SYSTEM TO OFFER SIGNIFICANT OPPORTUNITIES TO LOCALIZE AND ESTABLISH A COMPREHENSIVE SUPPLIER ECOSYSTEM IN INDIA BY 2025



INDUSTRY EXPECTATIONS FROM SELF AND GOVERNMENT



Focus on investment in localized manufacturing across the value chain, skills improvement and building EV Infrastructure in the country boosted by short term incentives



Immediate Actions



Ensure continued investment in Resources and skill shift from Mechanical to Electrical, Electronics and Software skills



Set up quick response team to deal with supply chain challenges (QRT)



Draw extended credit lines & financial support mechanism to dealers & suppliers



Policy Recommendations



Government should develop a scrappage scheme and incentivise Energy efficient vehicles with tax breaks and subsidies



Boost EV Infrastructure including set and implement a fast charging consortium that builds fast charging network every 50mn on Indian highways



Build value chain capabilities from cell, power electronics, motors and boost localisation through SMEs



Re-Strategize



Govt – Industry partnership to develop Giga Battery production plans



Localise supply chain



Build partnerships and JVs as the EV shift requires huge investments

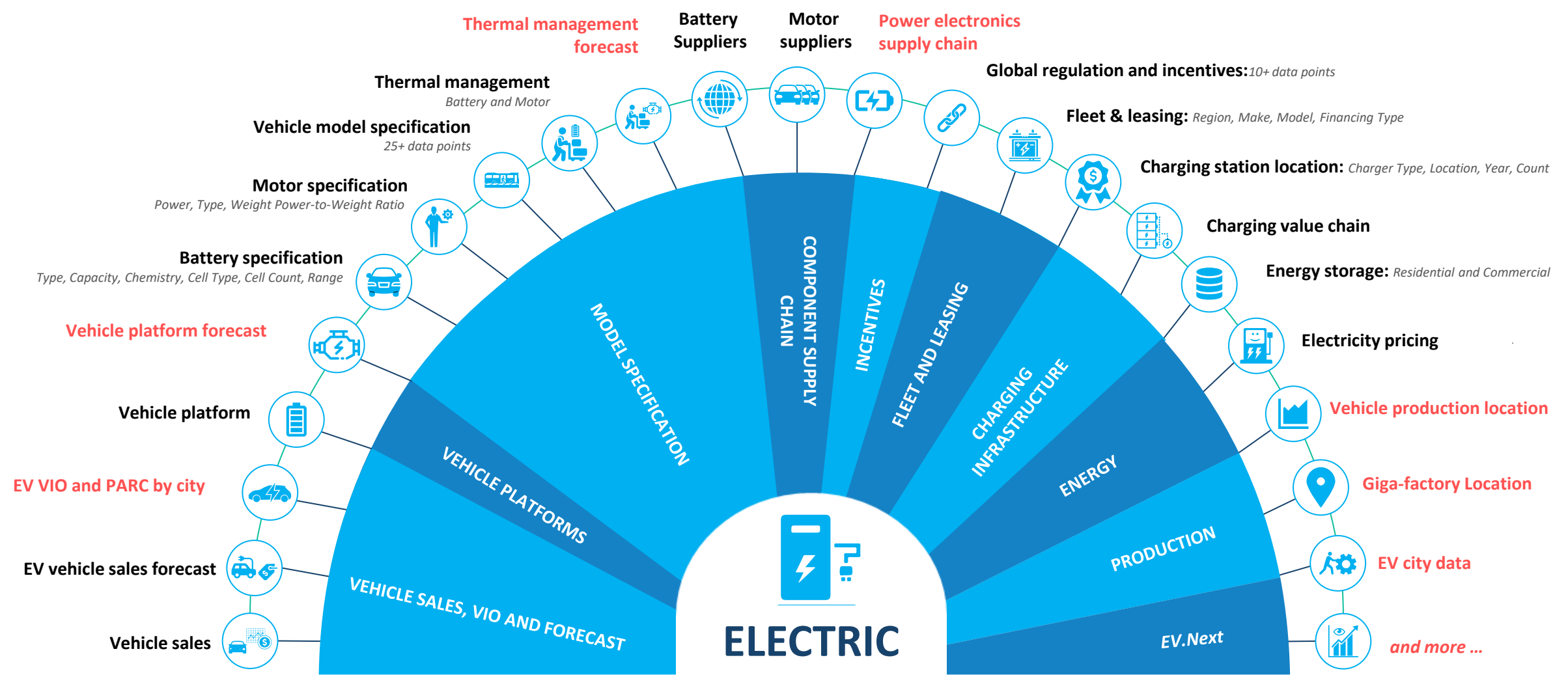


F R O S T & S U L L I V A N

PROMETHEUS

Mobility and EV Data Intelligence Platform

PROMETHEUS: 15 ELECTRIC DATASETS CURRENTLY COVERING OVER 1 MILLION DATA POINTS, 90+ COUNTRIES AND 350+ MODELS



PROMETHEUS PLATFORM

10 CORE INTELLIGENCE MODULES ON THE PLATFORM: INTERACTIVE DATA INTELLIGENCE PLATFORM WITH DATA ANALYTICS FUNCTIONALITY

EV SALES AND
FORECAST



EV FLEET & LEASING



EV INCENTIVES &
REGULATION



EV CHARGING & SECOND LIFE



EV SUPPLY CHAIN, VEHICLE
SPEC. & PLATFORMS



COMPETITIVE BENCHMARK AND
OEM PROFILES



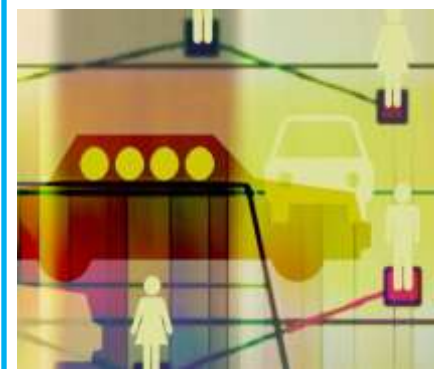
COUNTRY PROFILES



AUTONOMOUS DRIVING



NEW MOBILITY



VALUE ADDED
ANALYSIS



Source: Frost & Sullivan

Sarwant Singh

Managing Partner
Automotive & Transportation

Email: sarwant.singh@frost.com

Jose Serras-Pereira, PhD

Mobility Consulting - Director

Office: London
Email: jose.pereira@frost.com