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Stratas Advisors: Global Automotive Service

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Agenda

- Global Automotive Service Overview
- China Market Update
- India Market Update
- US Market Update
- Key Takeaways

Global Automotive Service Overview

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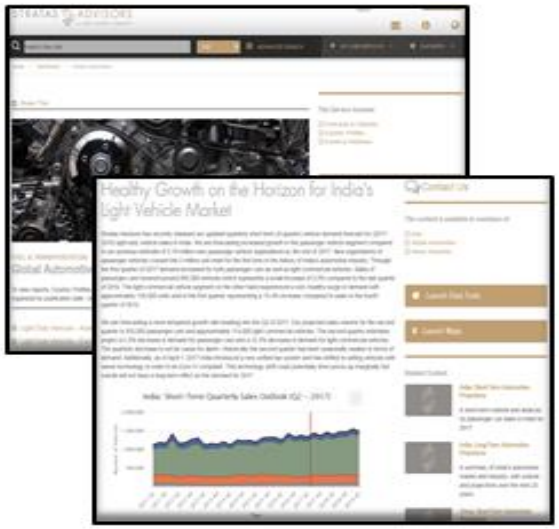
Global Automotive Service (GAS)

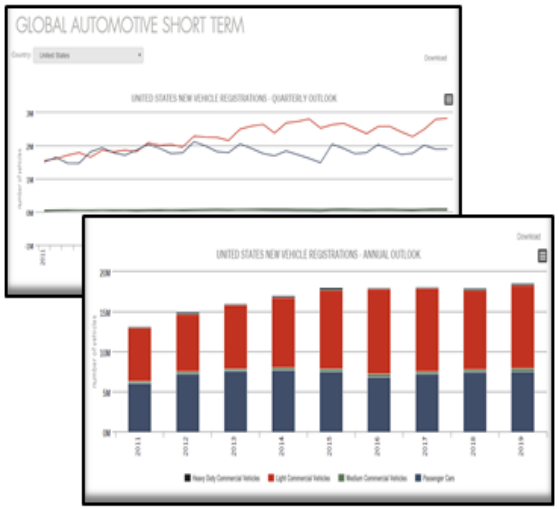
Automotive industry analysis and forward looking projections

- Analysis: Country level analysis of short and long term trends, technology, and policy
- Short-Term Forecast: 8-quarter new registration demand outlook by country for commercial vehicles and passenger cars
- Long-Term Forecast: Outlook of light-duty vehicle demand by vehicle powertrain/fuel type and by country to 2035 updated annually

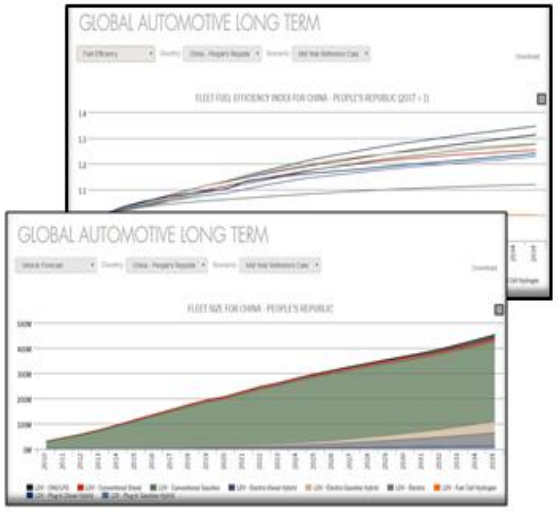
Market Profiles and Analysis



Short-Term Forecasts



Long-Term Forecasts to 2035



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China Market Update

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China Market Trends

China's local production is creating a strong basis for global expansion

New Registration and Fleet Growth (2013-2017)

- 5.2% CAGR in LDV new registrations
- 20.0% CAGR in LDV fleet
  - 102 million new vehicles to the fleet

Foreign OEMs no longer required to have domestic majority partners

- 2018 – New Energy Vehicles (NEVs) and special purpose vehicles
- 2020 – Commercial vehicles
- 2022 – Passenger vehicles and 2 + 2 Restrictions (maximum of 2 PV and 2 CV operations)

China Passenger Car Sales by Brand (2016, domestically produced)		
Brand	**Domestic Partner Manufacturer**	**Market Share**
Volkswagen	FAW, SAIC (Shanghai)	12.7%
Buick	Shanghai-GM	5.2%
Honda	GAC, Dongfeng	5.1%
Changan	Chang'an	4.9%
Hyundai	BAIC (Beijing)	4.8%
Toyota	FAW, GAC	4.5%
Nissan	Dongfeng, Zhengzhou	4.3%
Ford	Chang'an	4.0%
Haval	Great Wall	4.0%
Geely	Geely	3.3%

China Emissions and Fuel Efficiency Policies

China's Stage 6 Emission Standard and CAFC work hand in hand

China 6 Combines Best Practices Euro 6 Standards for Emissions

- China 6a will take effect in 2020, while China 6b will come in 2022
- Applies to vehicles up to 3,500 kg
- China 6a generally mimics the Euro 6 Standard, except:
  - China 6a is fuel agnostic – CO and NOx levels are the same for all vehicles
  - China 6a regulates N_2O and methane emissions

Corporate Average Fuel Consumption (CAFC) Standards Aim to Reduce Fuel Consumption

- Fleet average target of 5.0 L/100km driven by 2020
- Indexed to curb weight

China 6a Emissions Standard (July 2018)

Vehicle Type	CO g/km	THC g/km	NMHC g/km	NOx g/km	N_2O g/km	PM g/km	PN #/km
Passenger Vehicle < 2,500 kg	0.7	0.1	0.068	0.06	0.02	0.0045	6.0×10^{11}
LDV < 1,305 kg	0.7	0.1	0.068	0.06	0.02	0.0045	6.0×10^{11}
1,305 kg < LDV < 1,760 kg	0.88	0.13	0.09	0.075	0.025	0.0045	6.0×10^{11}
LDV > 1,760 kg	1.0	0.16	0.108	0.082	0.03	0.0045	6.0×10^{11}

China New Energy Vehicle (NEV) Policy

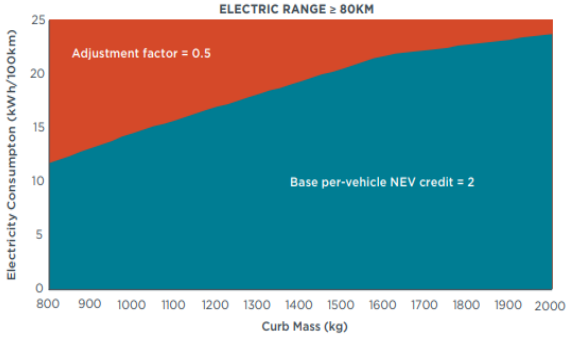
China's NEV policy promotes xEVs and FCVs to reduce GHG emissions

Sales Weighted-Percentage LDV Fleet Target

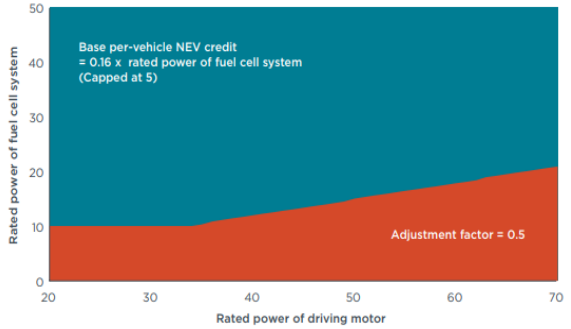
- 2019 target – 10%, 2020 target – 12%
- Applies only to Passenger Cars; takes effect in 2019
- Policy creates market for NEV credit trades among OEMs
- OEMs who produce or import 30,000+ PCs annually will be required to comply

NEV Credits (2018 Onward)	
Per vehicle credits	**Credit Structure**
BEVs	(0.012 × electric range + 0.8) × adjustment factor [capped at 6]
PHEVs	2 × adjustment factor
FCVs	(0.16 × fuel cell system rated power) × adjustment factor [capped at 5]
Adjustment factor is a function of curb mass and energy consumption, incentivizing lower energy consumption by weight.	

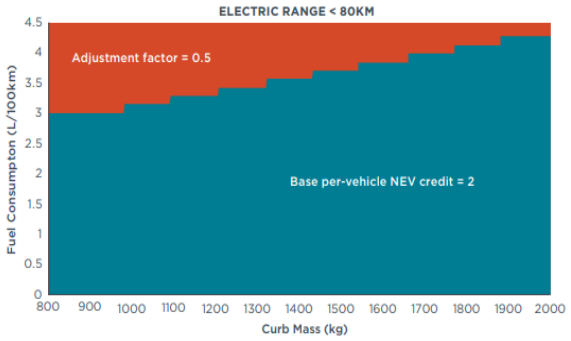
PHEV Adjustment Factor: > 80km Range



FCV Adjustment Factor



PHEV Adjustment Factor: < 80km Range



BEV Adjustment Factor

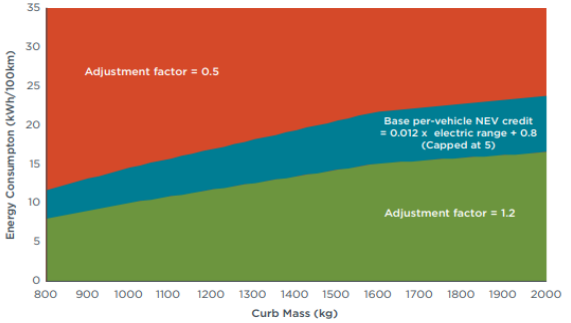


Image source: ICCT

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China Electric Vehicles

Broad governmental support is boosting China's EV market

Current EV Charging Infrastructure

- Approximately 450,000 charging points
  - 51% growth during 2017
- Approximately half of the global EV market is in China
  - 47% of EVs sold globally are Chinese-made

Public Sector EV Support

- Approximately 385,000 EV buses nationally
  - 90,000 were purchased in 2017
- Shenzhen has purchased over 16,000 buses
  - Complete fleet replacement
- Yutong and BYD dominate the domestic EV bus market
  - 17% of the national bus fleet is electrified

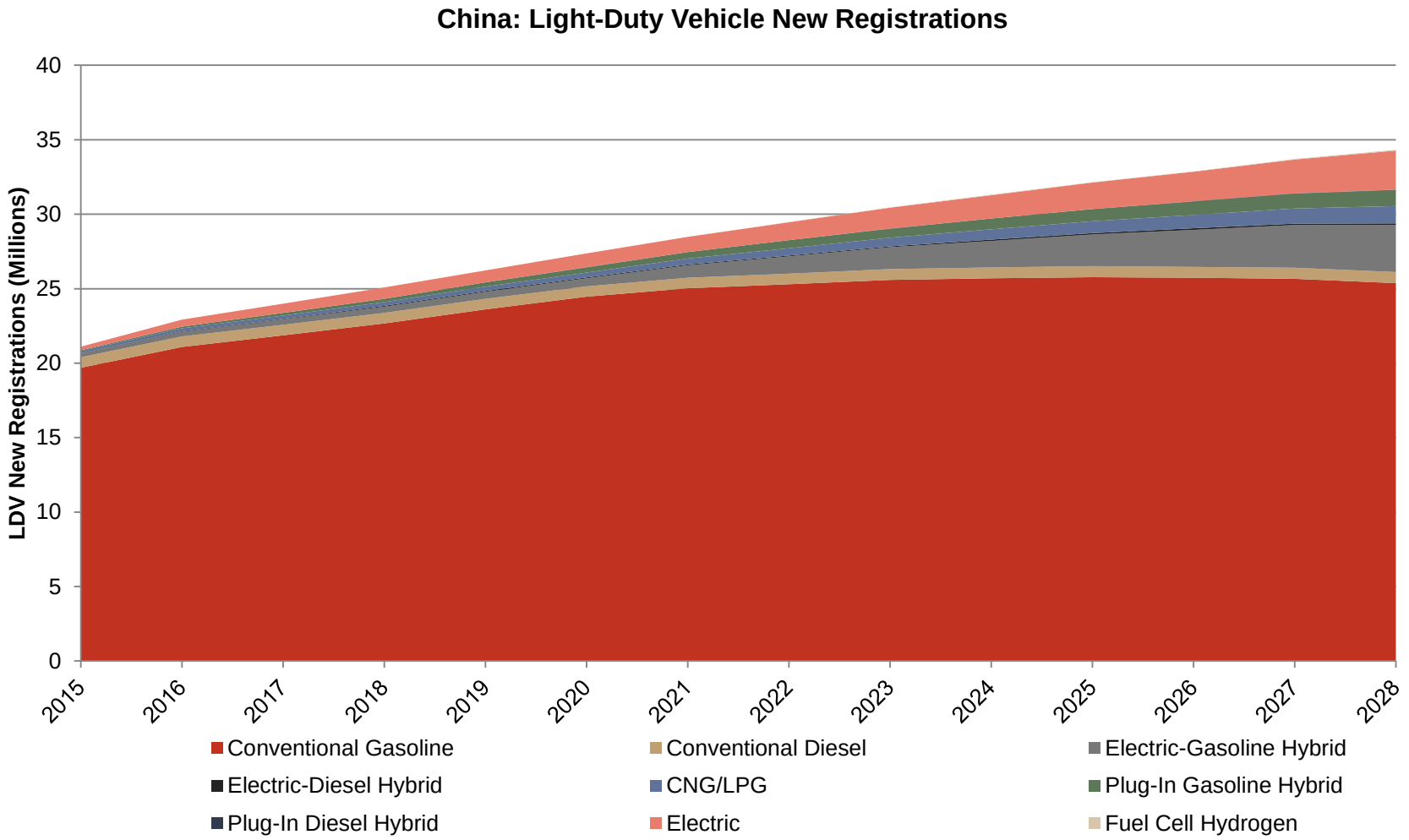
Shifting Subsides

- China's governmental subsidies for consumer EVs are pushing longer ranges and stronger batteries
  - 400+ km EV range: 50,000 RMB (up from 44,000 in 2017)
  - Minimum range for subsidy: 150 km (up from 100 km in 2017)
  - Minimum energy density for subsidy: 105 Wh (up from 90 Wh)

Chinese EV Sales (2017)	
Model	**Market Share**
BAIC EC-Series	13%
Zhidou D2 EV	7%
BYD Song PHEV	5%
Chery eQ	5%
JAC iEV6S/E	4%
BYD e5	4%
Geely Emgrand EV	4%
BYD Qin PHEV	3%
SAIC Roewe eRX5 PHEV	3%
Zotye E200	3%
Source: Clean Technica	

China LDV New Registrations (2018-2028)

China's LDV Registrations are projected to have growth through 2028



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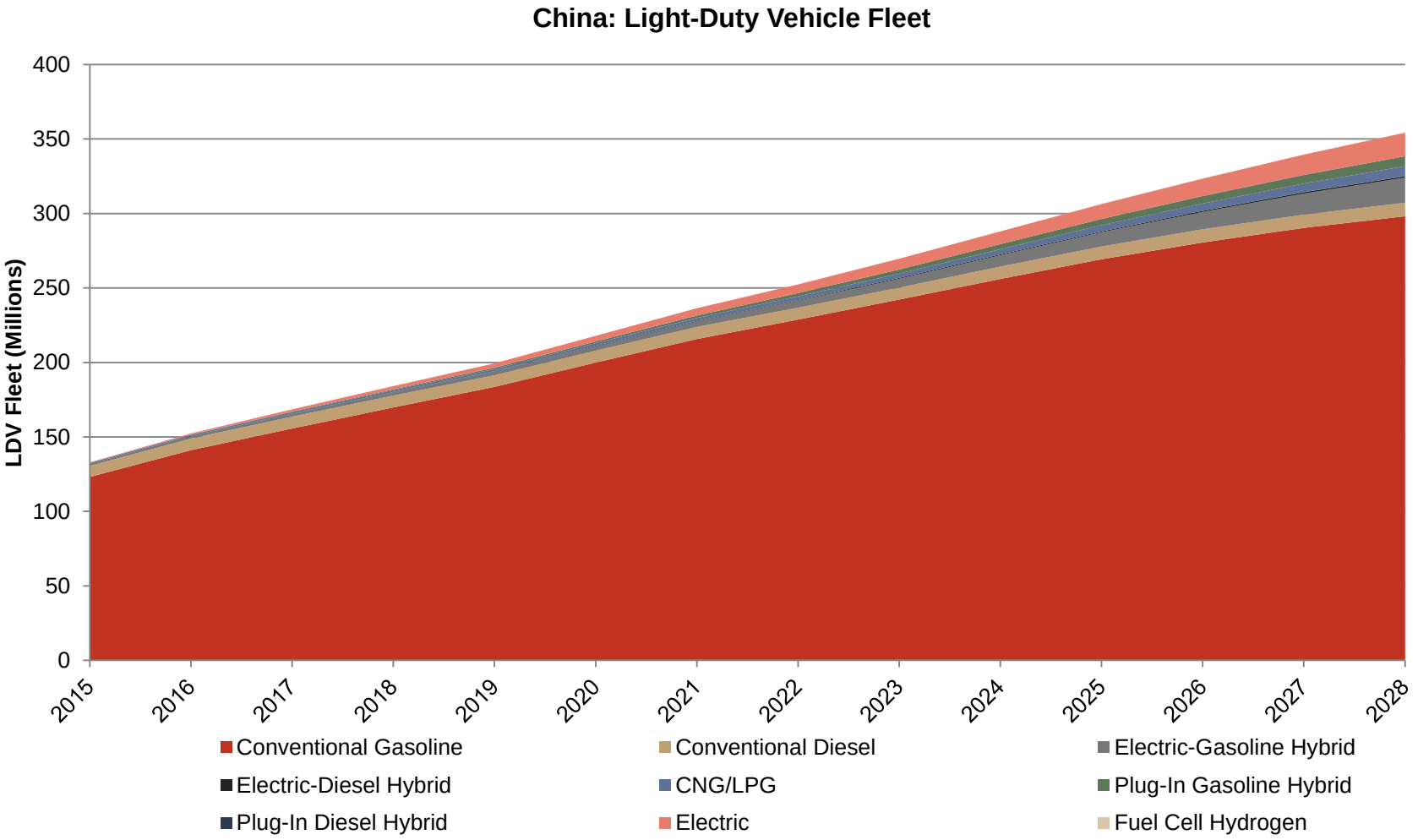
China LDV Fleet by Powertrain (2018-2028)

China's Light-Vehicle Fleet is projected to have sustained growth through 2028



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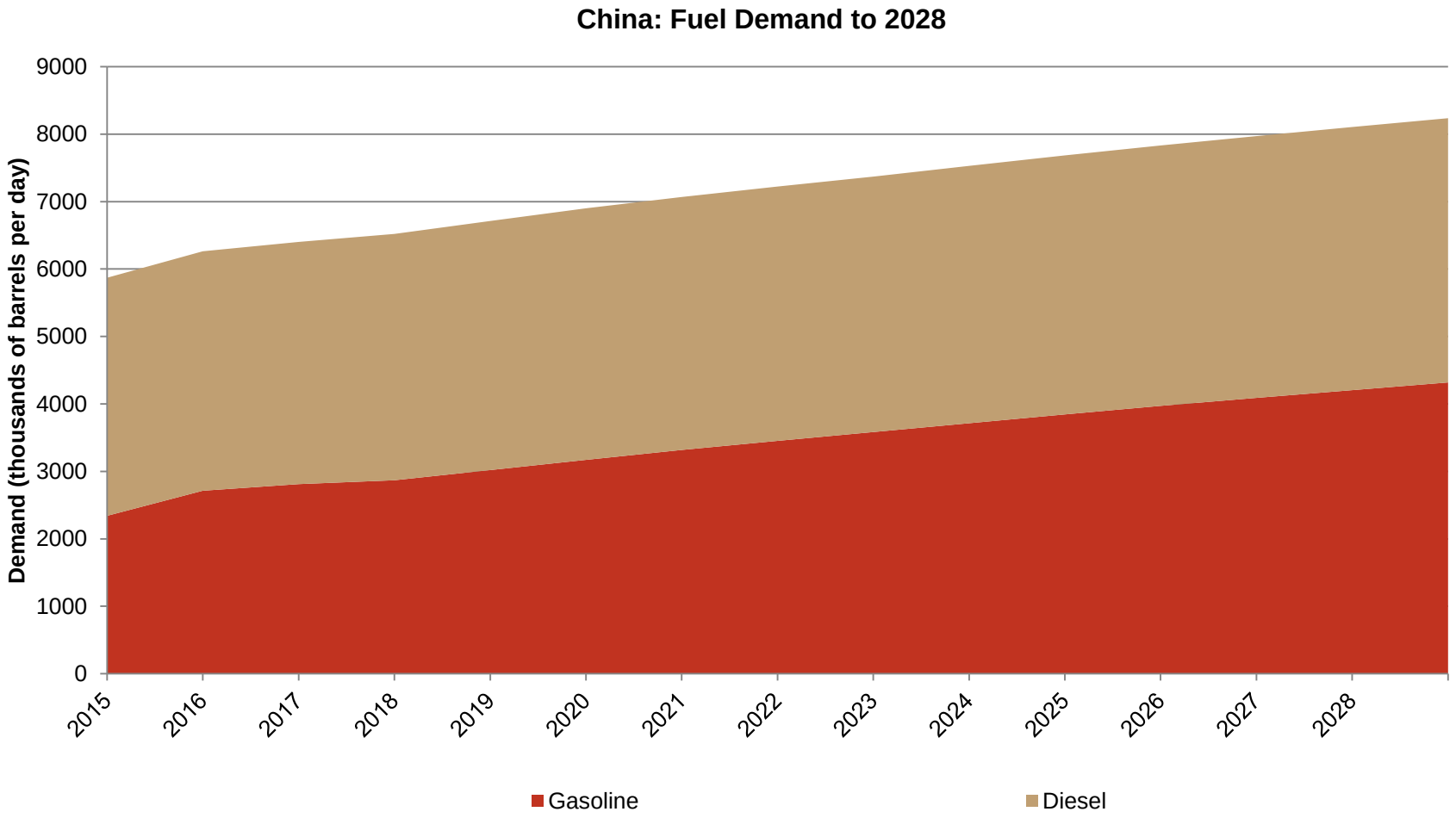
Vehicle Fleet Energy Demand – China

Vehicle fleet attributes drive road sector energy demand outlooks



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India Market Update

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India Market Trends

India's automotive market continues its rapid expansion

Fleet Growth (2013-2017)

- 7.9% CAGR in LDV fleet growth

India Automotive Market						
	2013	2014	2015	2016	2017	CAGR %
Passenger Vehicles	2,503,509	2,601,236	2,789,208	3,047,582	3,287,965	7.1%
Three Wheelers	480,085	532,626	538,208	511,879	635,698	7.3%
Two- Wheelers	14,806,778	15,975,561	16,455,851	17,589,738	20,192,672	8.1%
Total LDV	17,790,372	19,109,423	19,783,267	21,149,199	24,116,335	7.9%

Increased Competition in the Indian Market

- Maruiti Suzuki market dominance has eroded as new domestic and foreign OEMs strengthen positions

India Automotive Market Share by Manufacturer and Vehicle Segment (2017)					
Passenger Vehicles		**Two Wheelers**		**Commercial Vehicles**	
Maruiti Suzuki	51%	Hero	37%	Tata Motors	41%
Hyundai	16%	Honda	30%	Mahindra	29%
Mahindra	7%	TVS	14%	Ashok Leyland	17%
Tata Motors	6%	Bajaj	9%	VECV	7%
Honda	5%	Yamaha	4%	Force	3%
Toyota	4%	Royal Enfield	4%	Isuzu	2%
Renault	3%	Suzuki	2%	Suzuki	1%
GM	3%	Others	<1%	Others	<1%

India Legislation and Taxes

India has policies to encourage xEV market growth

FAME Scheme – Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles

- FAME Phase 1 (Through Q1 2019): Lowers retail prices for EVs
- FAME Phase 2 (Delayed to 2020): Rs 8,730 crore funding has been announced
  - Rs 5,550 crore for demand-side incentives
  - Rs 2,500 crore for EV buses
  - Rs 1,000 crore for EV 4 wheelers
  - Rs 750 crore for high-speed 3 wheelers
  - Rs 600 crore for high-speed 2 wheelers

New Goods and Services Tax (GST) Scheme

- Introduced in 2017, the new scheme reduces the categories of vehicles for GST into two categories
  - xEV and non-xEV

Bharat Stage 6 Emissions Standards

- Effectively bring India into compliance with EU-level emissions standards for LDV, HDV, and 2-wheelers
- Will go into effect for vehicles produced in April 2020

Vehicle Tax Rates by Vehicle Category (2017 Onward)	
Vehicle Category – Goods and Services Tax (GST)	Tax
Electric – Passenger cars, commercial vehicles, 3 wheelers, 2 wheelers	12%
Passenger cars, commercial vehicles, 3 wheelers, 2 wheelers	28%
Vehicle Category – Compensation Cess (additional tax)	
>4 meter passenger vehicles (Petrol, Diesel, CNG, Ethanol, methanol, hybrid electric and fuel cell)	+ 15%
<4 meter passenger vehicles (petrol, CNG, Ethanol, Methanol)	+ 1%
<4 meter passenger vehicles (diesel, Ethanol, Methanol)	+ 3%
>350cc displacement 2 wheelers	+ 3%
10 – 13 seater public transport vehicles	+ 15%
Source: The Society of Indian Automobile Manufacturers	

India Electric Vehicles

EVs have a future in India but hurdles remain

Current EV Charging Infrastructure

- Approximately 300 charging points total
- Mahindra – red markers
  - Exclusively for their customers
  - Approximately 110 dealers
- Community charging stations – green markers
  - Approximately 130 charging points
- Rapid Charge – blue markers
  - Approximately 15 charging points

Proposed/Future EV Charging Infrastructure

- 4,500 – ABB India
- 500 – Maharashtra
- 150+ – Fortum and NBCC

Conflicting Guidance is Weakening EV Market

- Lack of clear timeline and mission from India's government is hindering xEV adoption and infrastructure development across the country

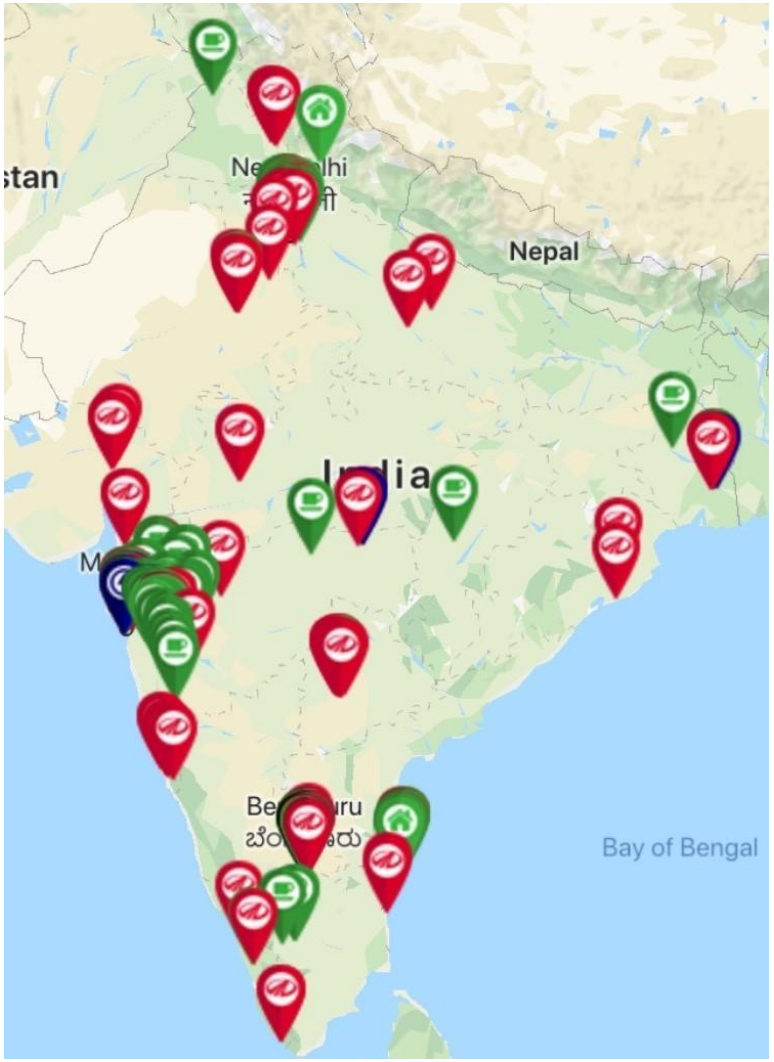

Image source: RE:Charge India

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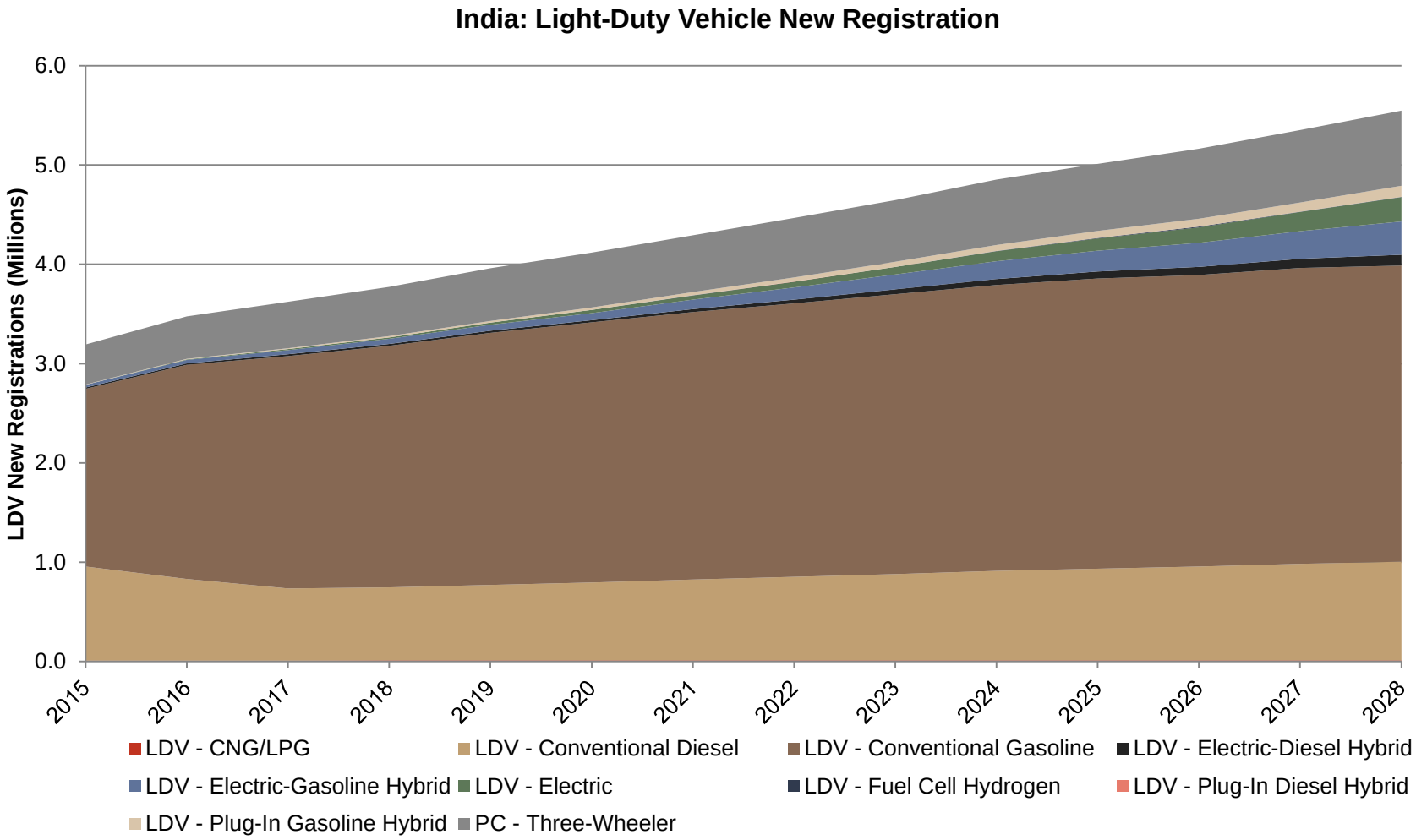
India LDV New Registrations (2018-2028)

India's Light-Vehicle Fleet is projected to have strong growth through 2028



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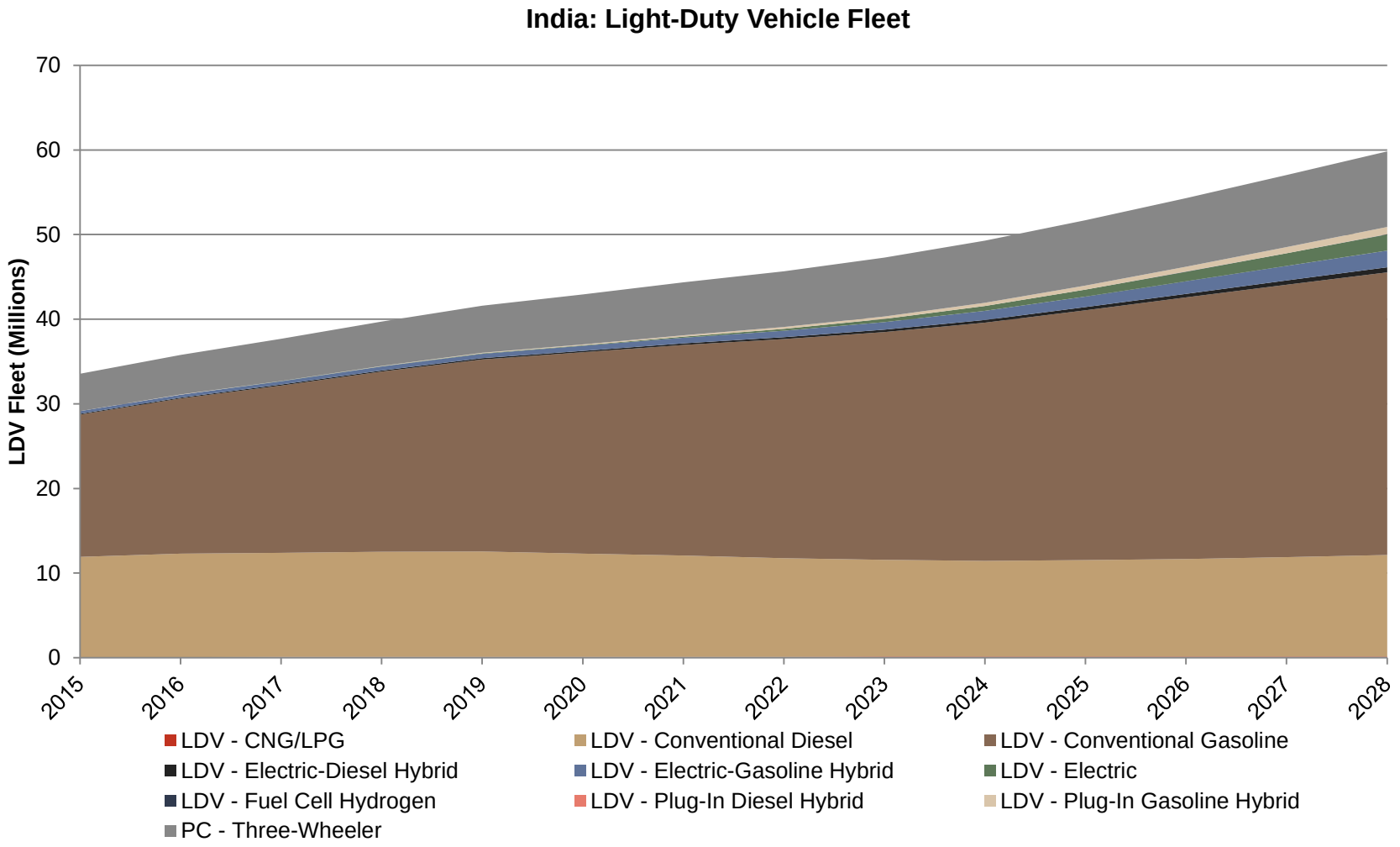

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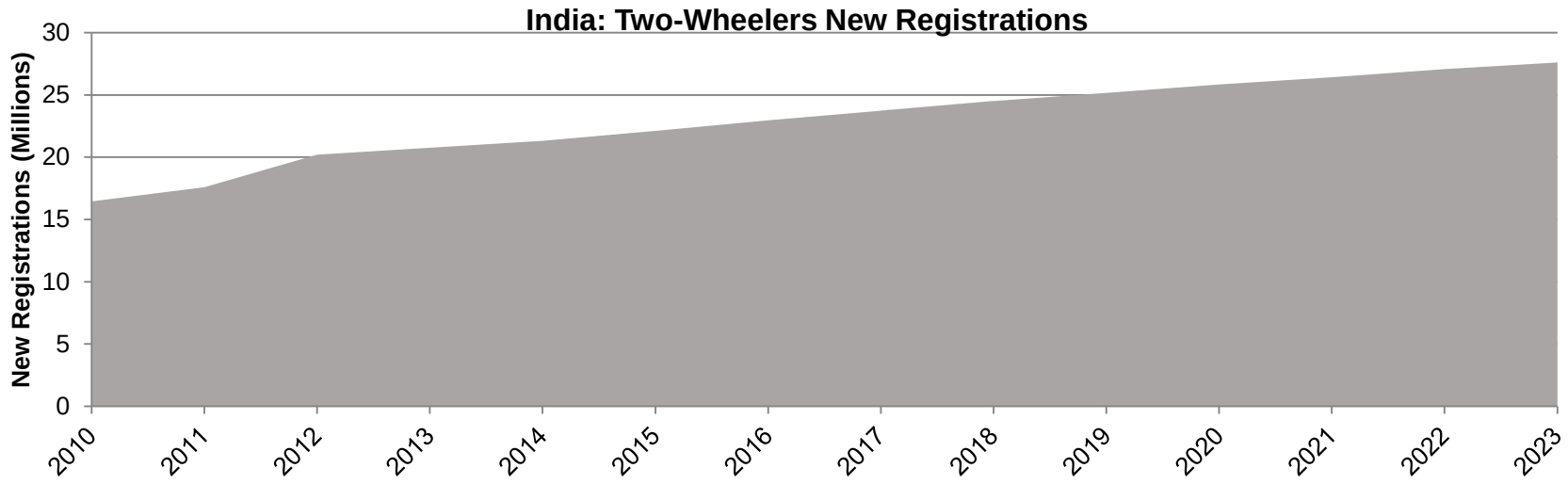
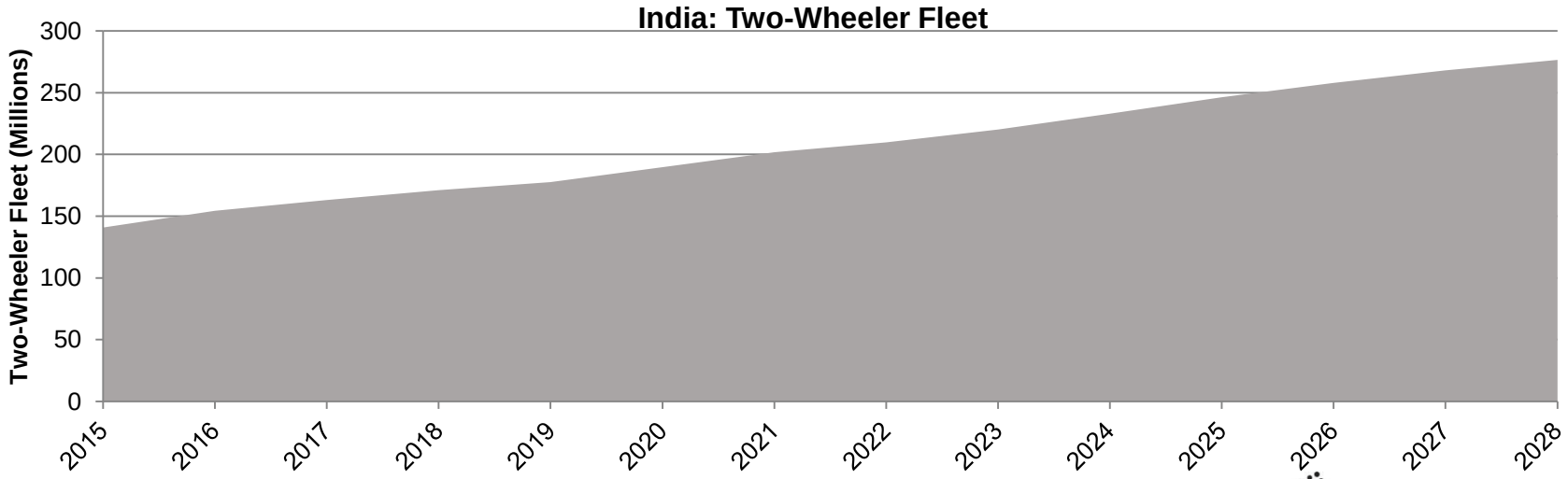
India Two-Wheelers Outlook (2018-2028)

India's Two-Wheelers are projected to have sustained growth through 2028





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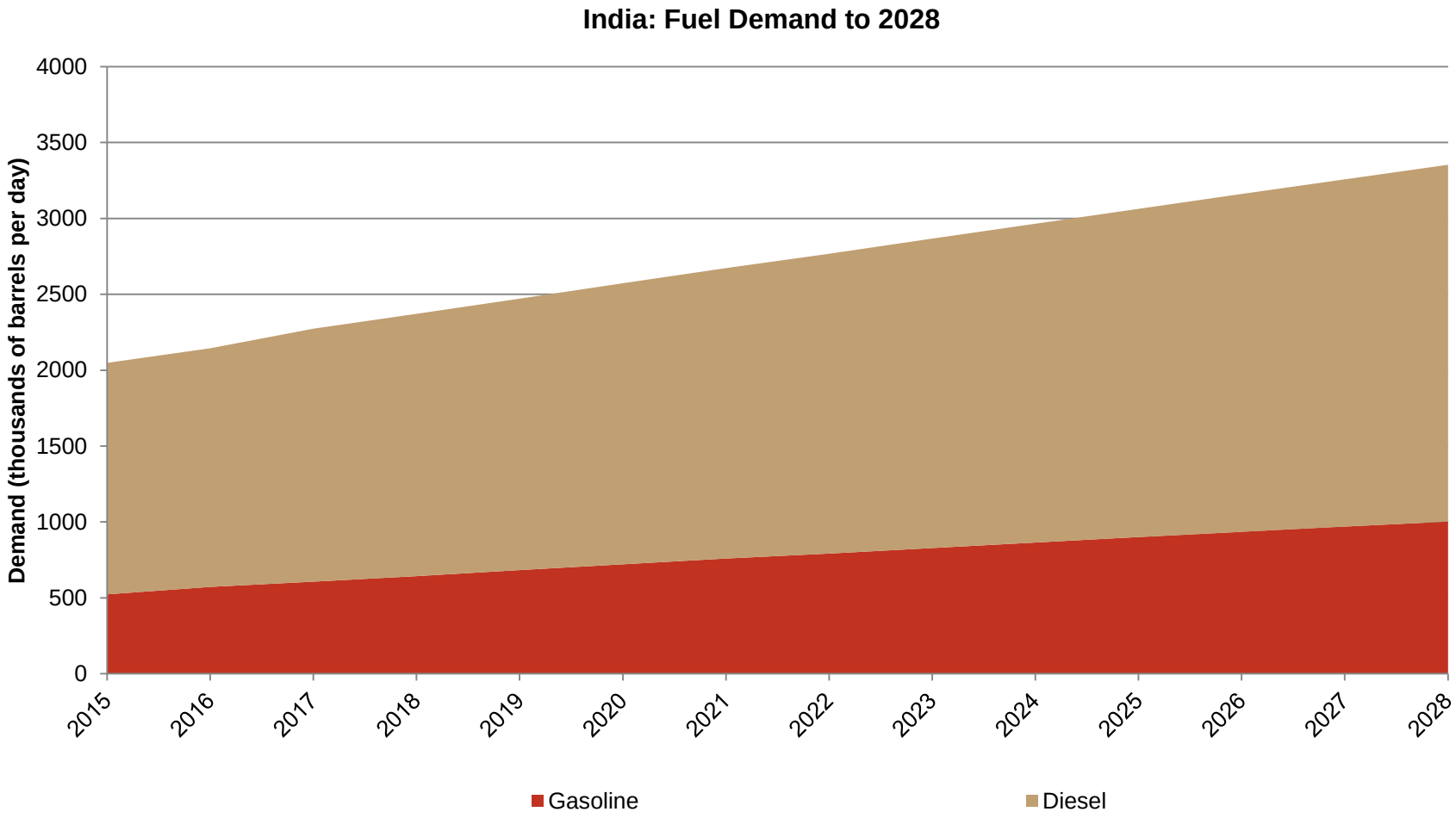
Vehicle Fleet Energy Demand – India

Vehicle fleet attributes drive road sector energy demand outlooks



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U. S. Market Update

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USA Market Trends

The USA LDV market remains mature and light truck- and SUV-heavy

New Registration and Fleet Growth (2013-2017)

- 5.5% CAGR in LDV new registrations
- 1.9% CAGR in LDV fleet
  - Added approximately 89 new vehicles to fleet

Light Truck Market Key for U.S. Market Growth

- Light-duty trucks have outsold passenger cars since 2014, bringing the class into near parity with passenger cars as components of the light duty vehicle market. Given manufacturer trends, light-duty trucks will remain a big player in the market.

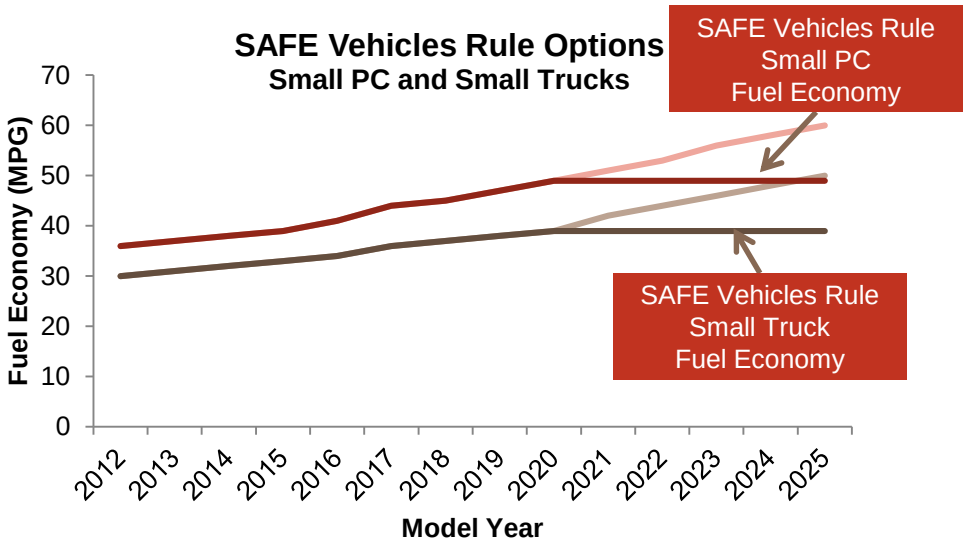
U.S. Automotive Market Share by Brand and Vehicle Segment (2017)					
Passenger Vehicles – 9.5 million			**Light Trucks – 9.7 million**		
Toyota	14.9%	910,600	Ford	17.2%	1,908,203
Honda	12.3%	752,563	Chevrolet	12.8%	1,425,102
Nissan	10.9%	664,268	Toyota	11.0%	1,218,578
Chevrolet	10.5%	640,777	Jeep	7.4%	828,522
Ford	9.1%	555,838	Nissan	7.0%	775,781
Hyundai	6.8%	417,055	Honda	6.6%	734,264
Kia	6.0%	366,108	GMC	5.0%	560,687
Volkswagen	4.3%	262,029	Ram	5.0%	556,790
Source: Crain Communications					

USA Corporate Average Fuel Economy (CAFE)

CAFE standards create a minimum fuel efficiency targets for automakers

CAFE Places A Floor On Required Fuel Economy, Not Greenhouse Gases

- The U.S. National Highway Transportation Safety Agency (NHTSA) regulates fuel economy, while the U.S. Environmental Protection Agency is tasked with GHGs
  - EPA tests fuel economy and reports the figures to NHTSA for coordination
- Burning fuel produces CO2 at a known rate (about 9 kg per gallon of gasoline consumed), so solving the CAFE formulas for fuel economy will also solve for GHG limits



Proposed Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule

- Proposed rule would freeze CAFE standards at 2020 levels, reducing improvement requirements for automotive producers
- SAFE Vehicles rule would revoke California's ability to set more stringent emissions requirements, currently followed by 40% of automobiles in the US

SAFE Vehicles Rule Changes Landscape

- The proposed rule is being negotiated, but automakers are concerned about split regulation within the United States
  - Widely differing fuel efficiency standards between the states would cause regulatory and marketing headwinds
  - Automakers have invested heavily to increase efficiency; that could be for not domestically and would have to be focused on sales abroad

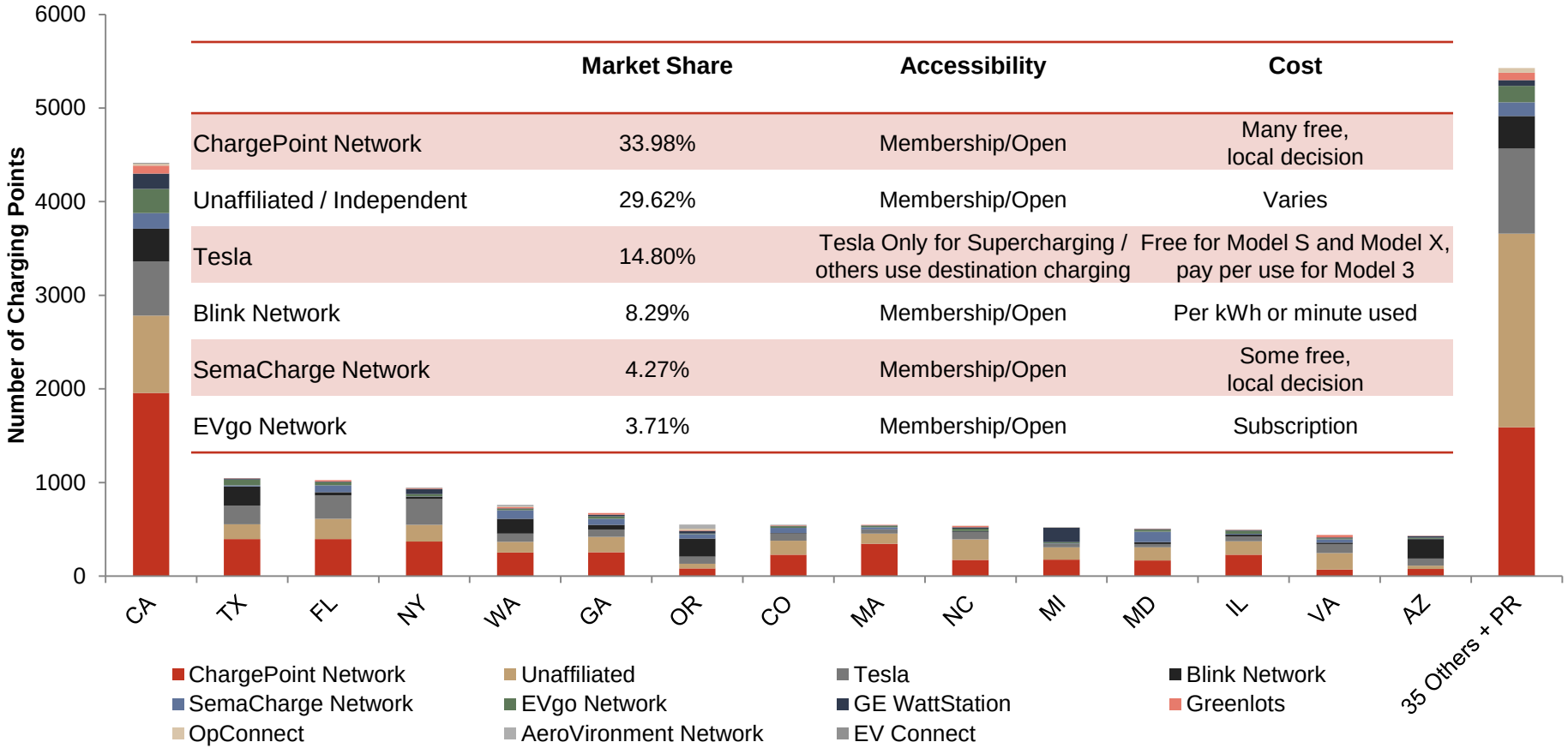
Image source: ICCT

USA EV Charging Infrastructure Leaders

California and ChargePoint lead the way for EV Charging infrastructure

EV Charging Networks in the US

	Market Share	Accessibility	Cost
ChargePoint Network	33.98%	Membership/Open	Many free, local decision
Unaffiliated / Independent	29.62%	Membership/Open	Varies
Tesla	14.80%	Tesla Only for Supercharging / others use destination charging	Free for Model S and Model X, pay per use for Model 3
Blink Network	8.29%	Membership/Open	Per kWh or minute used
SemaCharge Network	4.27%	Membership/Open	Some free, local decision
EVgo Network	3.71%	Membership/Open	Subscription



Approx. 21,000 EV charging stations vs. approx. 122,000 petrol stations in US

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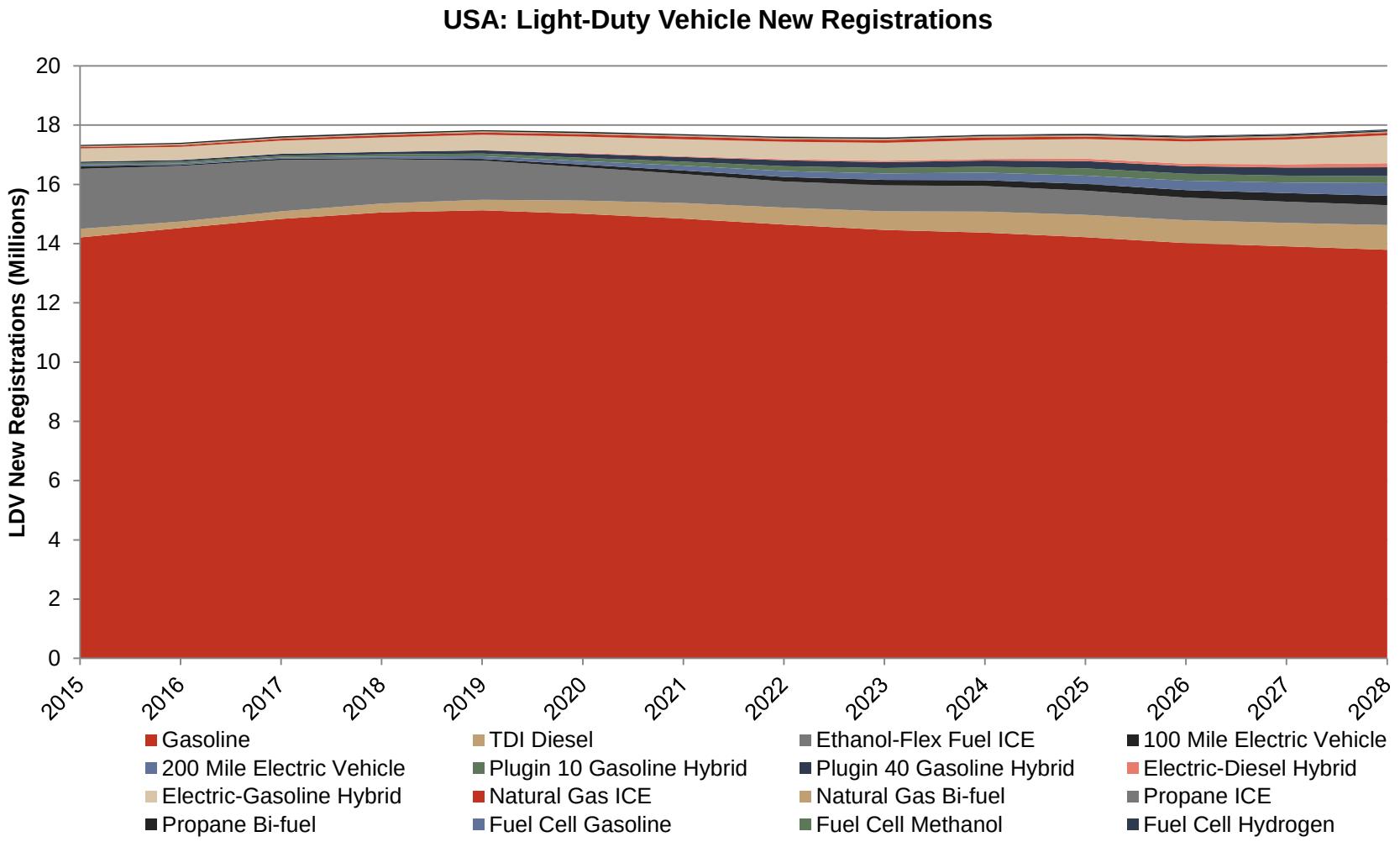
USA LDV New Registrations (2018-2028)

The USA Light-Vehicle Fleet is projected to have steady, if slower, growth through 2028



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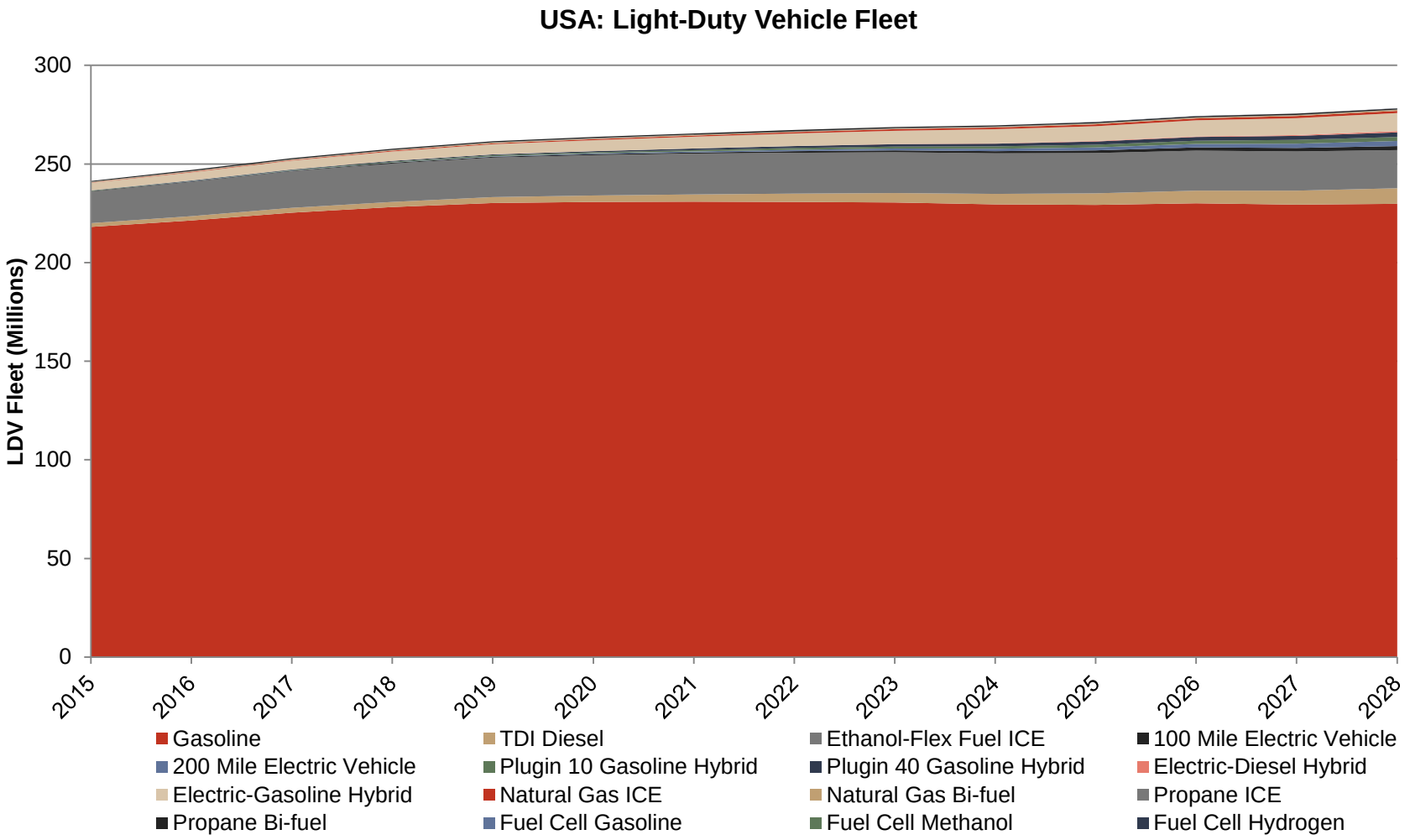

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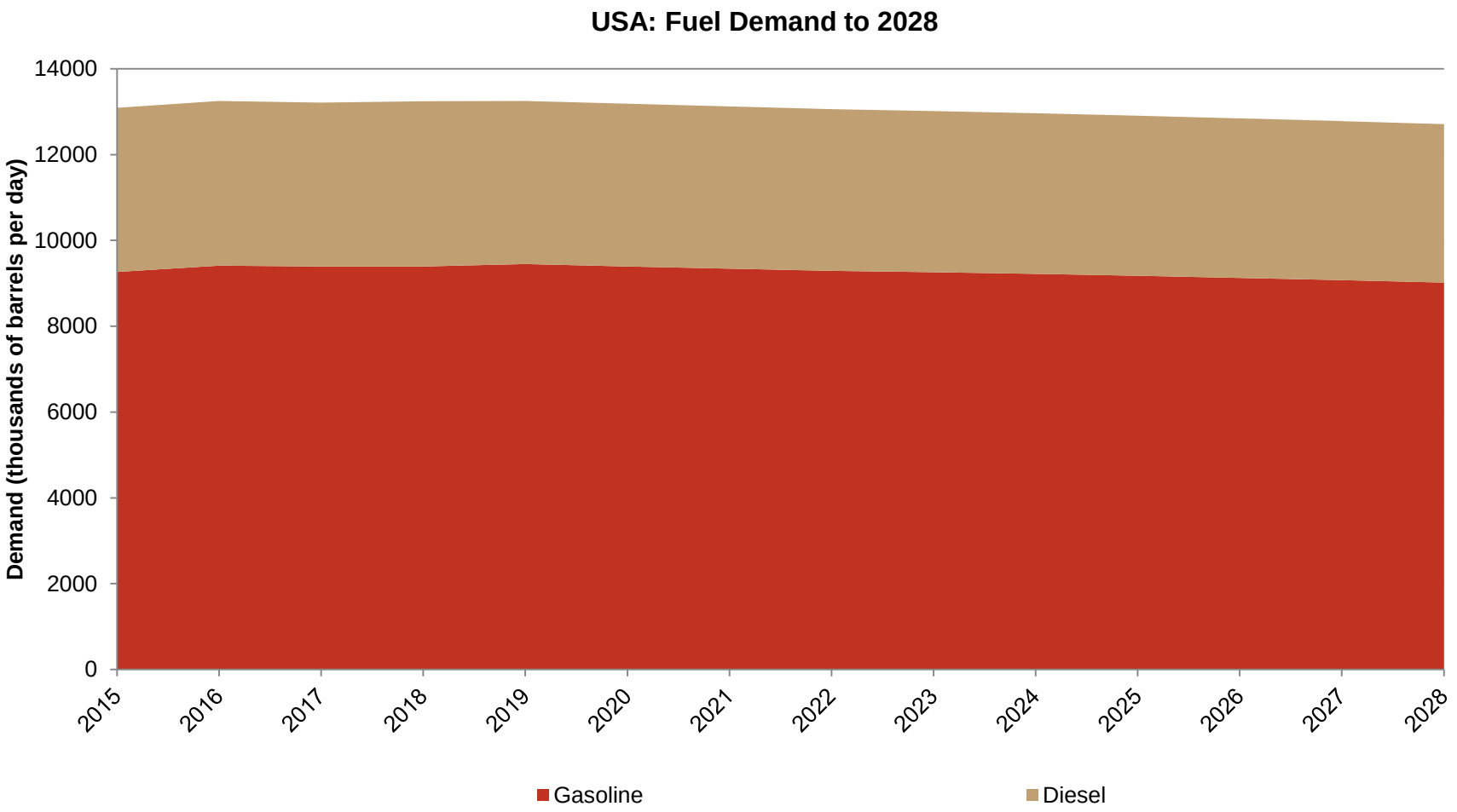

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Key Takeaways

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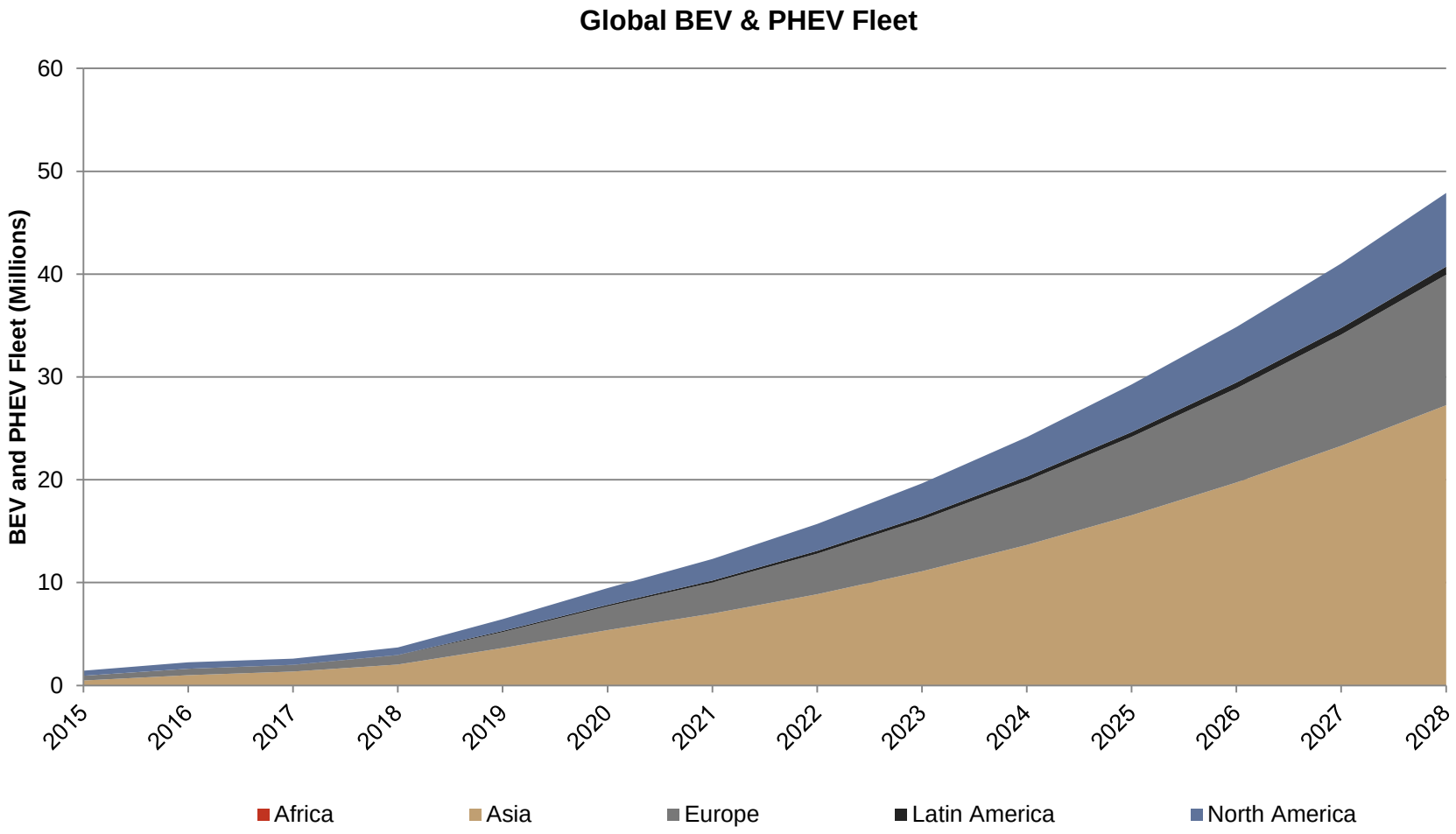
Global LDV BEV & PHEV Fleet (2018-2028)

Global Light-Duty BEV & PHEV Stock from 2018 through 2028



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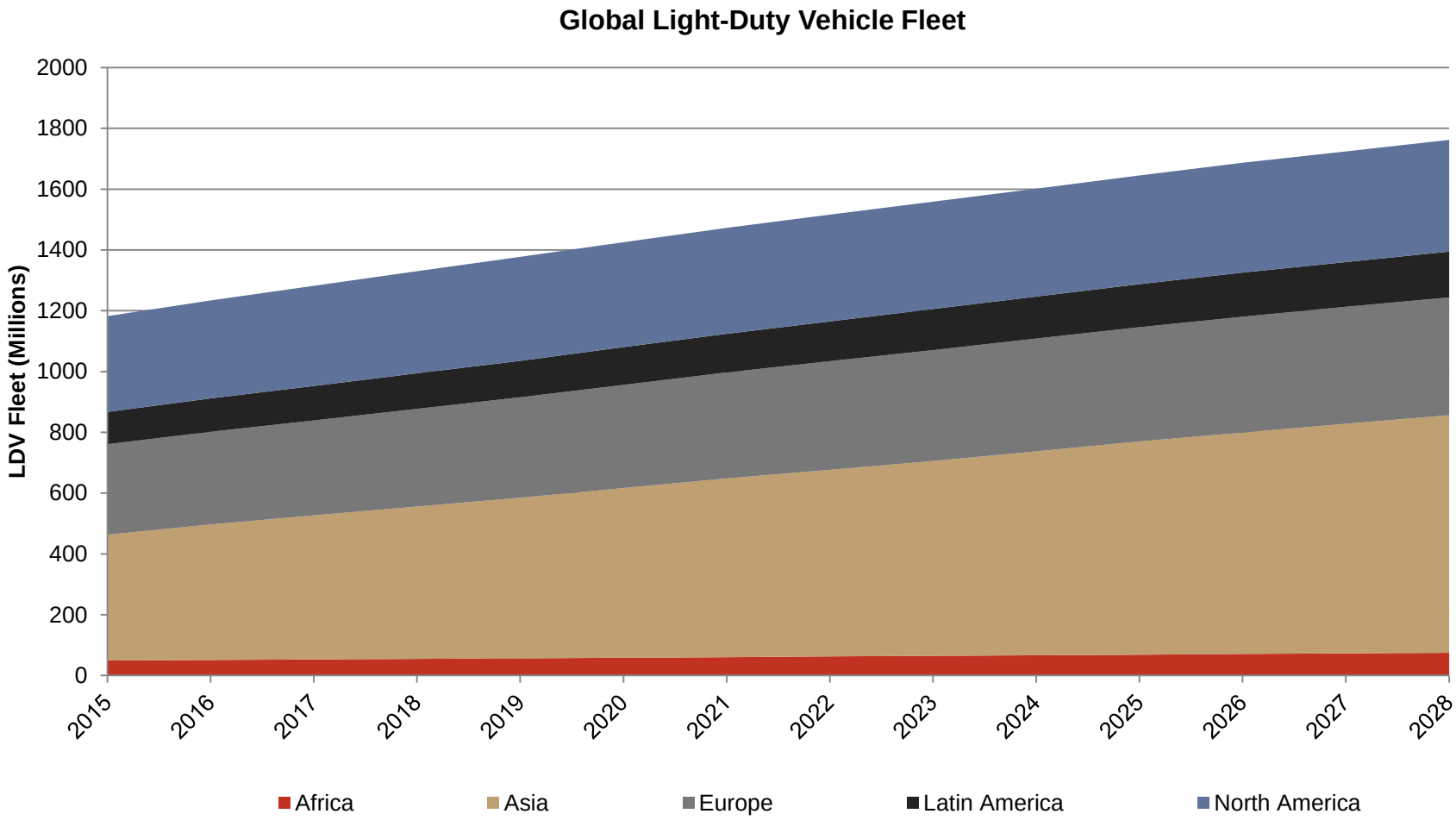
Global Light-Duty Vehicle Fleet (2018-2028)

Global Light-Duty Vehicle Stock From 2018 Through 2028



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Key Takeaways for Global Vehicles

Key Highlights and Outlook for the Global Market

Key Growth Markets

- China, India
- Asia leads global volume growth for vehicles and fuel demand

Global Fleet

- 2018 – 1.33 Billion
- 2028 – 1.77 Billion
- CAGR 2.9%

EVs will affect global demand, not erase it

- Accelerating demand for EVs globally
- Increasing importance of Chinese vehicle production and consumption
- Shift toward CUVs/SUVs in consumer fleets
- Geopolitical uncertainty
  - Trade
  - Environmental policy

+

Increased Fuel Efficiency

- Bigger threat to fuel demand than electric vehicles in next decade

Global EV Fleet

- 2018 – 4.8 Million
- 2028 – 52.1 Million
- CAGR 24.2%

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