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**The Impact of Global Electric Vehicle Market Growth on Tire Development Webinar**

*Additional submitted attachment is included below.*



[\*Click here\*](#) for a full audio recording of the webinar

# The Impact of Global Electric Vehicle Market Growth on Tire Development

Webinar

Bruce Lambillotte

November 14, 2019



# Today's Presenters

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Bruce Lambillotte  
Presenter  
Vice President of Technical Consulting



Maggie Olson  
Moderator  
Marketing Specialist

# Agenda

- Growth of Electric Vehicle Markets
  - Drivers and Inhibitors of Growth
  - Total Global Demand to YR2028 and Demand by EV Type; Market Area
  - China Market
  - Potential disruptors: An Example
- Tire Technology Impacts
  - Key Vehicle Attributes
  - Key Tire Attributes Needed
- Electric Vehicle Tire Market Forecast
- Closing Comments

# Premise

Smithers believes, based upon our surveys, that electrification of vehicle propulsion over the next ten years and beyond is one of three key mega-trends that are driving development in the automotive industry and in turn... tire development and the tire supply chain evolution:

- **electrification**
- autonomous vehicle technology
- ride sharing

# Definitions

- EVs: electric vehicles
  - HEV: hybrid electric vehicle; motor can fully power vehicle; cannot be plugged in and recharged
  - Mild HEV: mild hybrid electric vehicle; motor assists engine
  - PHEV: plug-in hybrid electric vehicle
  - FCEV: fuel cell electric vehicle; electric only motor powered with hydrogen fuel cell
  - BEV: battery electric (full electric) vehicle; runs exclusively with onboard batteries
  - LSEV: low speed electric vehicles
- ICE: internal combustion engine





# Growth of Electric Vehicle Markets



# Electric Vehicle Markets: Growth

## Electric cars exceed 1m in Europe as sales soar by more than 40%

Milestone reached nearly a year after China but ahead of the US



## ELECTRIC VEHICLES

## US Electric Vehicle Sales Increased by 81% in 2018

Tesla had a banner year. But it's not all good news for the U.S. EV market.

JULIA PYPER | JANUARY 07, 2019



## Tenfold improvement in liquid batteries mean electric car refuelling could take minutes

17 September 2018, by Jon Cartwright

## VW vows to build massive electric car charging network across US

It hopes to rival Tesla in scope

By Andrew J. Hawkins | @andyjayhawk | Apr 18, 2018, 12:03pm EDT

## Millions of EV Charging Points Planned for U.S., Europe by 2025

By Mark Chediak

September 14, 2018, 1:01 AM EDT

## Tesla turns another profit, ramps up production – as competitors flood market with electric vehicles. Potential for 'pile-up of epic proportions'

- Automakers from Acura to Zotye are plugging into electric vehicles.
- Industry analysts expecting to see nearly a dozen new all-electric vehicles in U.S. showrooms by the end of 2019, with dozens more coming to market in 2020.
- Jaguar, Mercedes and Volkswagen are making a direct run for Tesla's customer base, recently debuting several all-electric luxury models.

Paul A. Eisenstein | @DetroitBureau

Published 1 Hour Ago | Updated 1 Hour Ago



## China powers up electric car market

By Tim McDonald  
BBC News, Singapore

11 January 2019



# Electric Vehicle Markets: Growth

- Vehicle market share growth to date has been gradual
- Even in YR2028, parc will still be limited despite high CAGR from the small base
- Growth is primarily light vehicle tires: PC and LCV
- Hybrids will predominate during this period
- China will be exception (BEVs)



# Electric Vehicle Markets: Drivers of Growth

- Urbanization
  - Over 50% of global population projected to be in cities by 2030
- Pollution / congestion pushing more aggressive regulatory approaches
  - Incentives for purchase
  - Reduced CO<sub>2</sub>/NO<sub>x</sub> and fuel efficiency goals
  - Noise reduction
- Infrastructure development: charging stations being added
- Battery technology range improvements
- Available assortment of vehicles (variety of offerings)





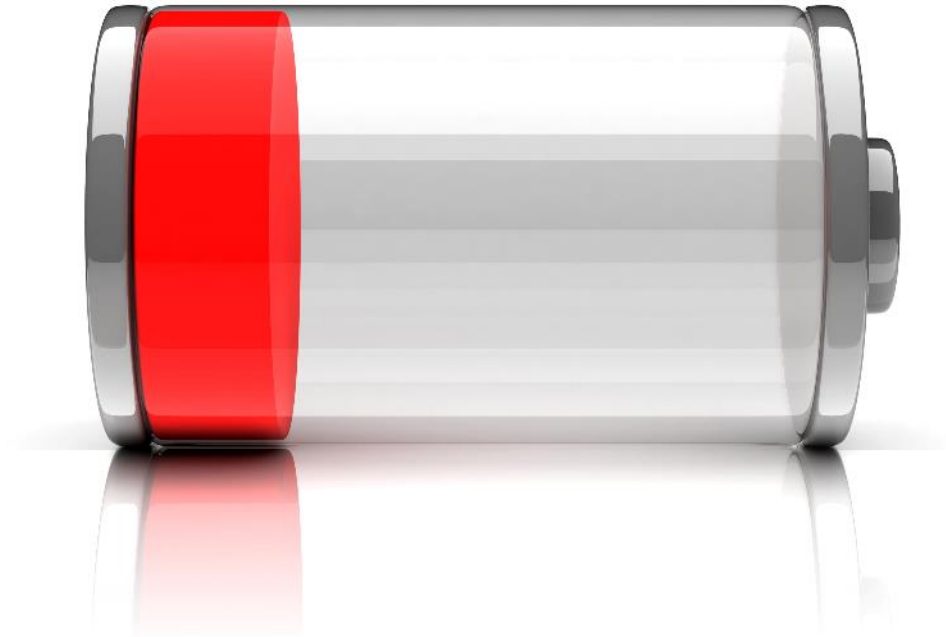
# Electric Vehicle Markets: Inhibitors of Growth

## Technology Challenges

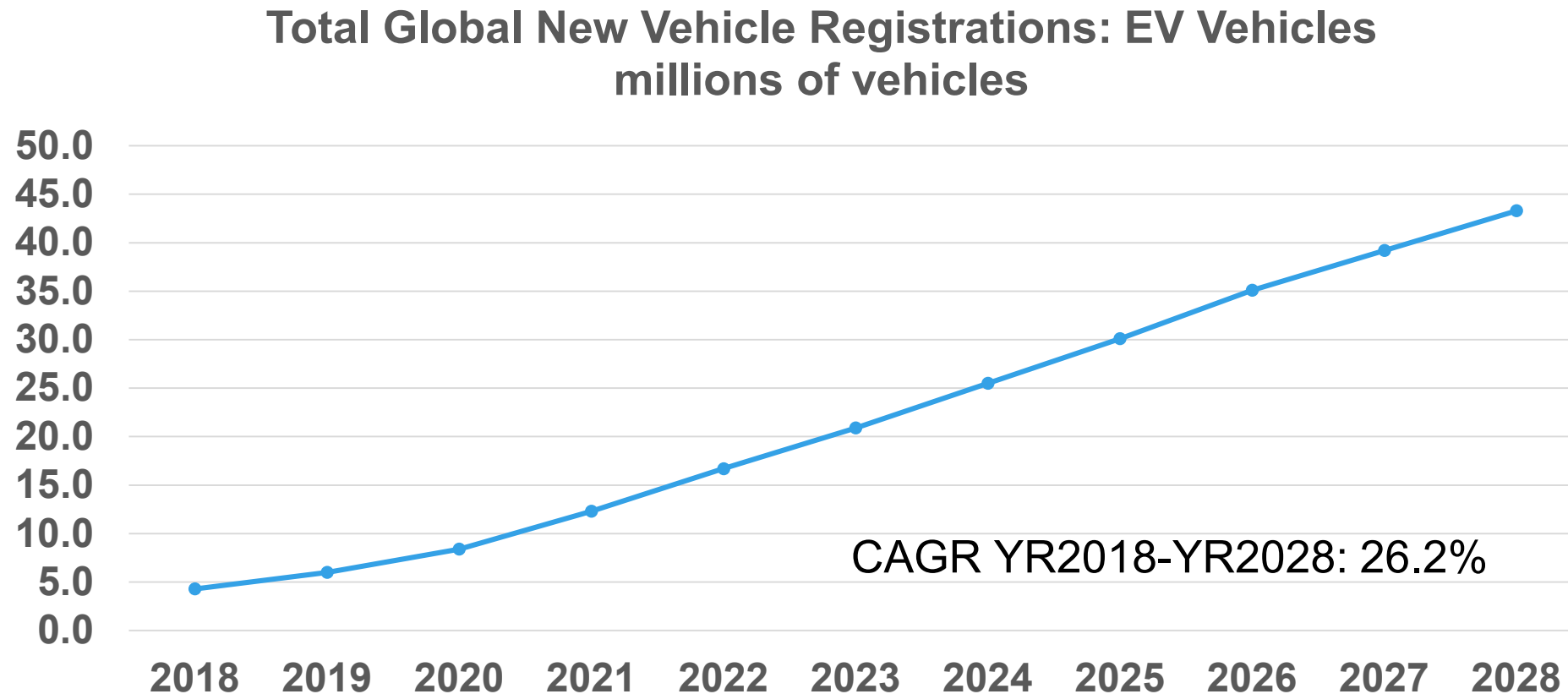
- Range per charge (km)
- Cold environment performance concerns
- Speed of recharging

## Market Challenges\*

- Low fuel prices reduce payback on higher initial cost
  - Potential rollback of US CAFE requirements
  - ICE vehicles have become significantly more fuel efficient
- Faster depreciation than ICE vehicles causing lower resale value
- Not yet available in a wide range of styles and sizes
- Limited recharging infrastructure

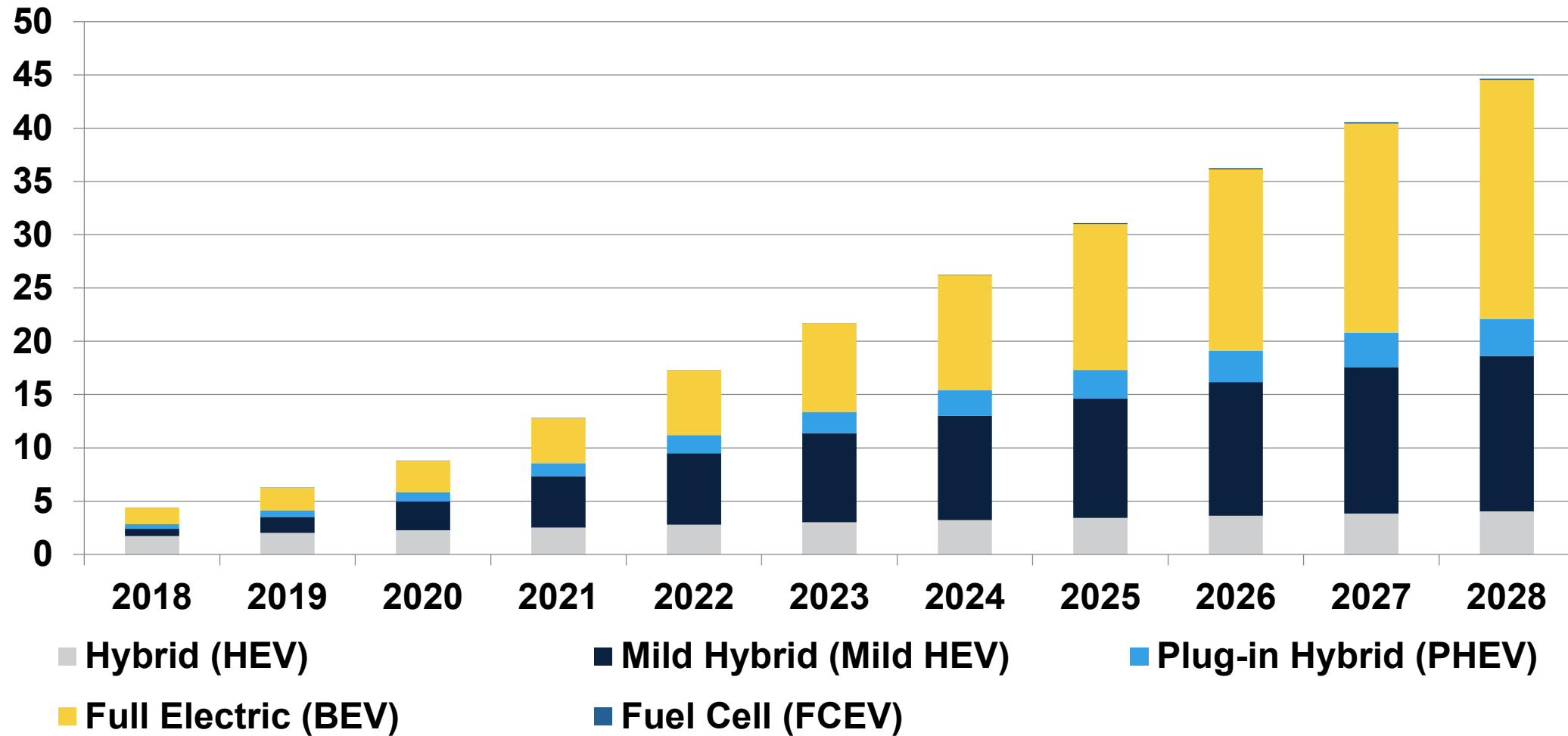


# Electric Vehicles: Global Forecast

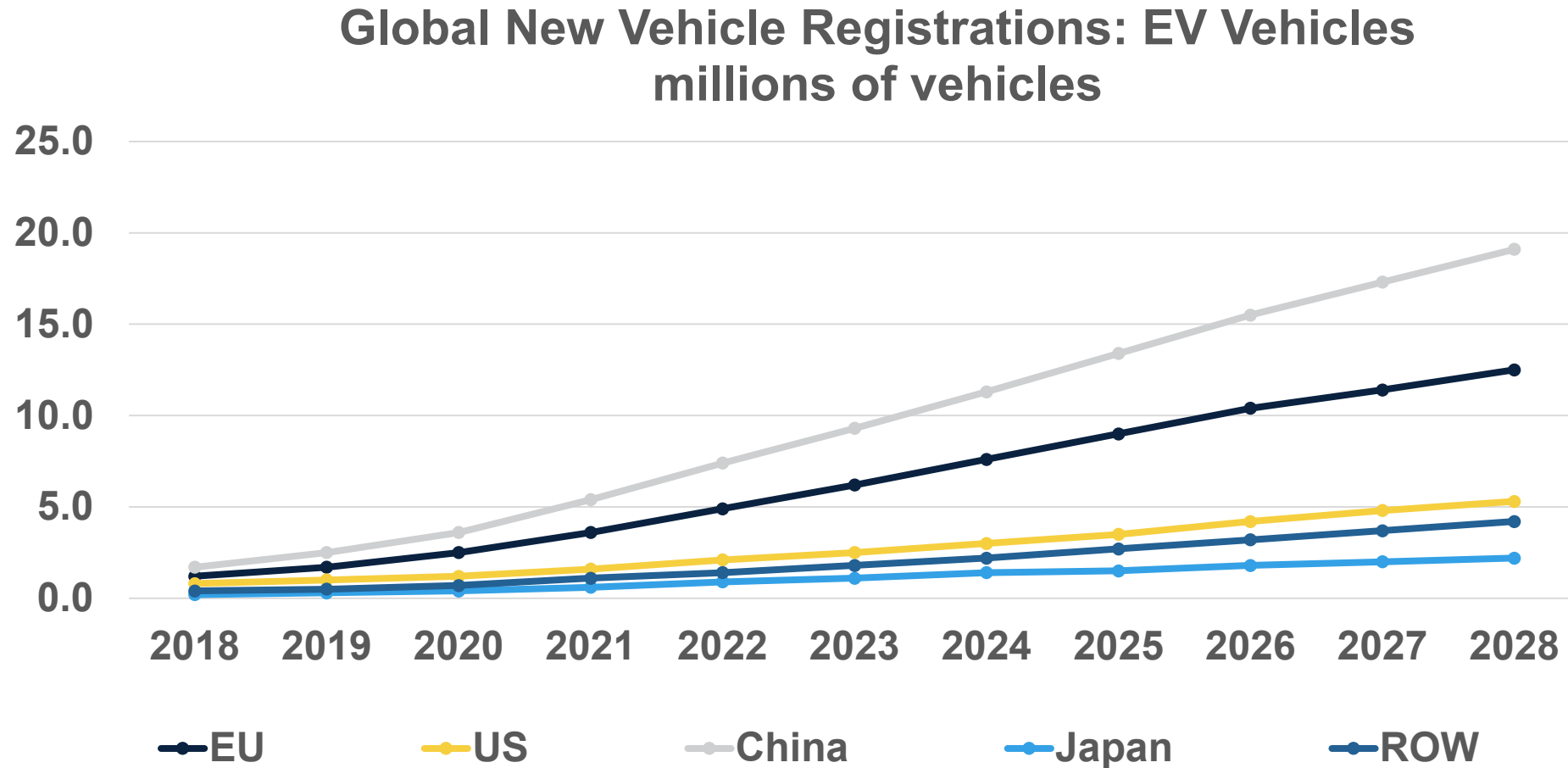




# Electric Vehicles: Forecast by Vehicle Type



# Electric Vehicles: Forecast by Market Areas



# Electric Vehicles: China



- The top market: China EV PC vehicle parc (“New Energy Vehicles”) projected to grow fastest
  - Surpassed US in YR2016 with 649K EV PC vehicles; 1/3 of global EV PC parc
  - Cumulative sales thru YR2018: approximately 3 million
- Drivers:
  - Reduced pollution in cities
  - Reduced dependence upon imported oil
  - China has ~25% share of global supply of lithium-ion batteries
- BEVs dominate; thru YR2018: 79% BEV/21% PHEV
- Goal to reduce oil imports: government is and will continue to will facilitate charging infrastructure
- Bus market will become predominately BEV; >30% of new bus sales in YR2016

# Electric Vehicles: Technical Considerations

	Tesla 3	Honda Accord	Toyota Camry	Chevy Malibu
Curb Mass (kg)	1847	1525	1495	1537
Range (km)	499	785	875	763
Recharge / Refuel Time (minutes)	30 (supercharger) up to 516 (wall)	5	5	5

*Source: Data from Company Websites & fueleconomy.gov*

- Vehicle range
- Overall weight and distribution of weight differs from typical ICE vehicles
- Starting torque is much higher than typical ICE vehicle



# Needs by Vehicle Type

- Challenges for various electric propulsion systems

Challenge	FCEV	HEV	PHEV	BEV
Range (fuel efficiency)	Minor	Minor	Medium	Major
Torque issues	Major	Minor	Medium	Major
Noise reduction	Major	Minor	Major	Major



# Electric Vehicles: Key Vehicle Attributes

- High energy efficiency
- Low noise generation
- Higher torque (BEVs)
- Higher weight & different distribution of vehicle weight
- Low emissions generation (CO<sub>2</sub>, NO<sub>x</sub> particulates)





# Example Disruptor to Forecasts



# Disruptor Example: Low Speed Electric Vehicles

- LSEVs: a disruptor to the conventional EV passenger car market
- Small: typically less than 2.5 m length
- Park two cars in one parking space
- Primarily 2-passenger; low cost
- May be powered with lead-acid battery
- Low weight: ~450kg or less
- Reduced speed: ~40-70 km/h
- Estimated >3 million in use in China



Photo credit: Dennis Zuev

# Disruptor Example: Low Speed EV Tires

- Small sizes; proliferation
- Not necessarily radial in construction
- Significant reduction in load-carrying capacity requirements
- Significant reduction in speed capability requirements: ~40-70 km/hr
- Tire cost and durability would become key issues







# EV Tire Technology Impacts



# Tires for Electric Vehicles: Key Attributes Needed

- Fuel efficiency
- Noise reduction
- Traction: handle higher torque requirements
- Capability of handling higher vehicle weight; handling differently distributed vehicle weight
- Treadwear
- Vehicle-matched tire specifications



# Key Tire Attributes Needed

- Fuel efficiency
  - Most pertinent to BEVs
  - Increased service range is a priority goal
  - May be #1 - #2 among OE performance criteria, depending upon vehicle manufacturer
  - Not limited to RR; tire aerodynamics also could lead to reduced tire width and further increases in outside diameter



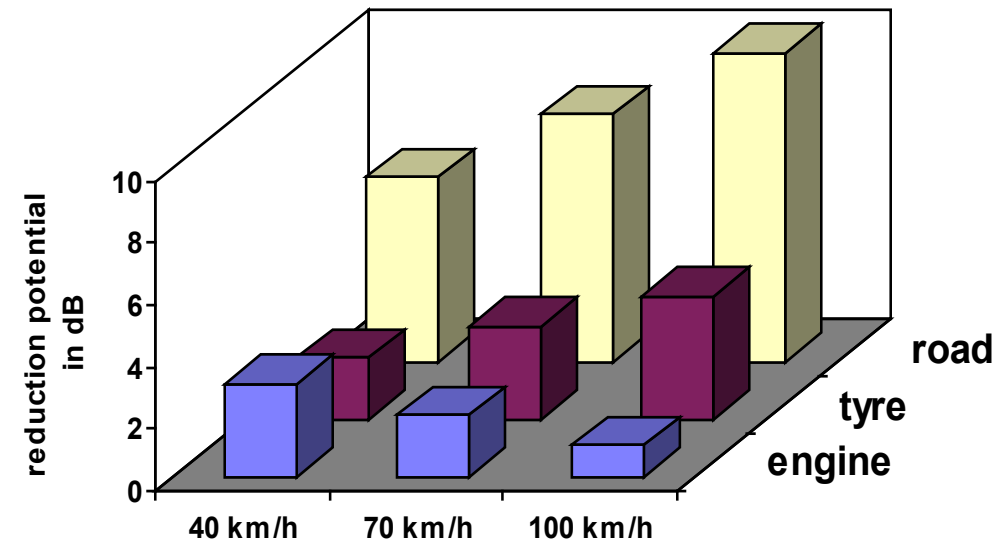
# Key Tire Attributes Needed

## *Fuel efficiency: why is rolling resistance so important for EVs?*

- The tire as a percentage of total vehicle energy consumption:
  - ICE: 20%
  - EV: 30%
- In addition to the battery, the tire impacts range; per YR2017 survey by ING
  - 28% of respondents considering a BEV would require at least 400-600 km range
  - 26% or respondents would require a minimum range of 600 km
- Tire manufacturer claim: “Rolling resistance may need to be reduced by 20% or more.”

# Key Tire Attributes Needed

- Noise (and vibration) reduction
  - Already a marketing tool for EV tires
  - Internal noise requires significantly more attention for EV tire applications
    - Noise may need to be reduced by as much as 30%
  - May be #1 - #3 among OE performance criteria



# Key Tire Attributes Needed

- Noise (and vibration) reduction (continued)
  - Ripe area for technical innovations in:
    - tire cavity redesign
    - noise canceling technology
    - tread pattern quieting





# Key Tire Attributes Needed

- Traction
  - Higher vehicle torque calls for higher traction capabilities in concert with electronic stability control
  - Design for higher tread tear resistance and reduced rim slip resistance
  - Solutions are largely existing technologies
  - May be #1 - #3 among OE performance criteria



# Key Tire Attributes Needed

- Load carrying capability
  - Especially for BEVs; hybrids have smaller batteries
  - EV vehicles weigh +20-30% compared to comparable ICE vehicles
  - Will increase percentage of tires with XL ratings in North America
  - May increase mean tire size Load Index
  - Solutions will use conventional technologies; many EVs will be relatively compact



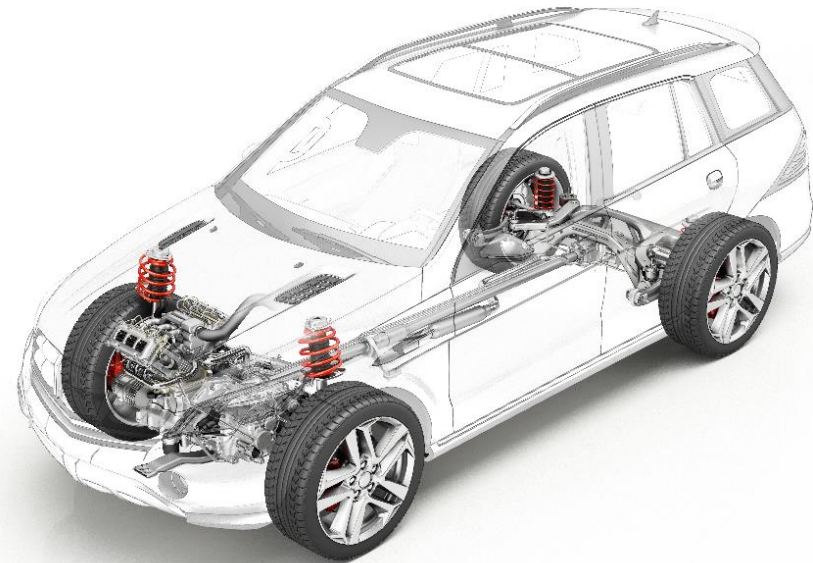
# Key Tire Attributes Needed

- Wear resistance
  - Higher vehicle torque and weight may call for higher tread abrasion resistance
  - Traditional tires may wear up to 30% faster on EVs
  - May be #3 - #5 among OE performance criteria
  - Need for wear resistance may be somewhat mitigated by motor management systems



# Key Tire Attributes Needed

- Vehicle-matched tire specifications
  - Tire homologation
  - Status quo for OE market
  - Major change in the replacement marketplace
  - Positive development for on-line sales and subscription services
  - Negative development for SKU management in both plant and warehouse



# Insider Opinions: Questionnaire

Average rated impact of EV trends on EV tire market sectors over the next 10 years

*Source: Smithers online survey: “EV market trends and impact on tires to 2028”*

4 = very high, 3 = high, 2 = moderate, 1 = low				
EV tire market sector	Emissions, air and noise pollution	Advanced recharging infrastructure	Improving vehicle range	New regulations and government mandates
Tire materials	3.34	2.10	3.30	3.30
Tire manufacturing	2.93	2.00	2.80	3.04

# Perspective: Tires for EV vs. Tires for AV

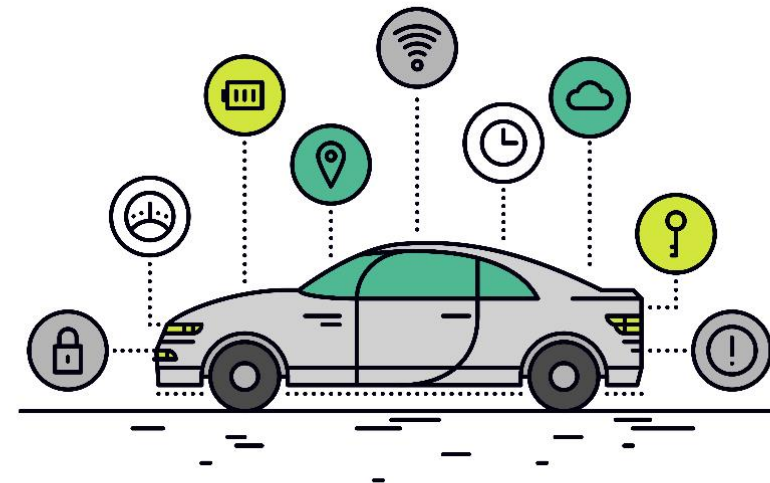
- EV and AV are different entities
- EV will add performance expectations and AV will add additional expectations
- AV tire development will not detract from EV development; especially for AV/EV vehicles
- AV technology will be applicable to all engine power types
  - *Source: Smithers online survey*





# Perspective: Tires for EV vs. Tires for AV

- Projections of autonomous vehicle tire needs:
  - Traction (wet/dry/snow/ice) for self-braking vehicles
  - Intelligent tires; real-time connected tires
  - Ride comfort: additional vibration and harshness emphasis
  - Possible reduced demands upon tire performance to achieve vehicle dynamics
    - example: reduced emphasis upon speed capabilities
  - Run-flat capabilities





# Growth of EV Tire Markets

# Growth of EV Tire Markets: Projected Demand

Global tire demand for EV segment 2018-2028 (OE + REP); million units

	2018	2028	CAGR
<b>EV light vehicles</b>	19.9	422.4	36%
<b>EV trucks</b>	0.2	2.6	29%
<b>EV buses</b>	1.2	6.8	19%
<b>Total</b>	21.4	431.7	35%

*Source: Smithers – The Impact of Electric Vehicles on Tires to 2028*







# Closing Comments

# Closing Comments

- Most of the needs for EV tires can be addressed with known technologies and do not require revolutionary change.
- Many tire performance characteristics needed for EV application will originate in ICE vehicle tire applications and transition to EVs (example: RR improvements).
- Some key performance characteristics developed for EV applications may transition to ICE vehicle applications (example: noise reduction).
- Every tire is a balanced compromise of attributes: many tire performance characteristics are interrelated and cannot be varied independently.
- EV and autonomous vehicle tire needs are not identical.

# Questions?

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