Electric Vehicles – Global Scenario
November 2017
How do you balance the pace of innovation with regulations?

It’s not a marathon, it’s a **sprint**.
The marathon is over. Companies now need to sprint to keep up with the industry’s pace of change…

Our analysis finds the automotive C-suite is not prepared to respond to disruptive competition, increasing regulations and heightened scrutiny.
...in an increasingly complicated and emerging market

<table>
<thead>
<tr>
<th>Ride Hailing</th>
<th>Ride Sharing</th>
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<td><img src="image" alt="Taxi" /></td>
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Not a complete list!
What’s driving the need for speed: regulation and disruptive innovation driven by entrepreneurs + tech innovators

1. Regulations and regulators are now looking to lead as opposed to follow

2. Global EV sales to reach over 30m by 2026, driven by China, Europe and North America

3. Automakers expediting the shift towards EVs through a multi-pronged strategy involving customer engagement, portfolio restructuring and wider collaboration

4. Adoption of EVs will alter the supply chain, offering opportunities for growth and innovation in the short and medium-term
Regulations, new entrants and evolving consumer preferences are:

- Forcing investment
- Speeding introduction
- Constraining adoption

Cities will become the economic units for future mobility adoption.
Regulations around vehicle emissions are getting stringent and converging across nations...

- Emission targets of US, EU, China, India, Japan and South Korea are converging near 100-120 gCO2/km by 2020

- Moving towards Zero Emissions, complete ban on ICE
  - Norway, Netherlands allow only EV sales starting 2025
  - India aims for 100% EV sales by 2030
  - France and UK to ban ICEs by 2040

- Cities lead the charge, setting up more aggressive targets
  - Stuttgart likely to ban diesel starting 2018, another 6 cities expected to ban by 2025
  - ~70% states in the US have individual climate policies, California has the most stringent target of reducing GHG emissions to 1990s level by 2020

Source: International Council for Clean Transportation, European Parliamentary Research Service and EY analysis
...forcing the industry to set aggressive EV targets, reduce focus on diesel and adapt fuel efficient technologies

<table>
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<tr>
<th>Industry is setting aggressive alternate fuel vehicle targets:</th>
<th>Powertrain mix to shift towards alternate fuel vehicles:</th>
<th>Diesel global market share contracting by 2/3\textsuperscript{rd}:</th>
<th>Cost of ICEVs to increase with new engine &amp; transmission technologies:</th>
</tr>
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<tbody>
<tr>
<td>OEMs announcing EV model launch plans, shift to 100% EVs</td>
<td>~31% by 2026 from 3.5% in 2016</td>
<td>4% in 2026 from 13.5% in 2016</td>
<td>Advance transmissions to increase cost by US$25-250</td>
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</tbody>
</table>

Source: EPA, LMC Automotive, International Council for Clean Transportation, Company websites and EY analysis

AFVs include Battery EVs, Fuel Cell EVs, Plug-in Hybrids, Mild Hybrids (48V) and Full Hybrids
Global EV adoption is likely to be varied across geographies with Europe, China and North America leading the drive towards e-mobility.

**Europe**
- 2016 vol: 0.5m
- CAGR 2016-26f: 36%
- BEV volumes are likely to grow rapidly driven by stringent regulations, focus on RDE and NOx emissions.

**China**
- 2016 vol: 0.4m
- CAGR 2016-26f: 39%
- Recent regulation around NEV quotas to spur demand and position the country at the centre of EV universe.

**North America**
- 2016 vol: 0.5m
- CAGR 2016-26f: 20%
- Government incentives and CAFE norms to drive sales, uptake remains contingent on Trump administration’s policy on emission norms.

Source: EY analysis, LMC Automotive, Analyst reports

Note: Both BEVs and hybrids included; In 2016, Japan contributed 1.15 m sales (primarily hybrids)
Automakers are expediting the shift towards EVs through a multi-pronged strategy involving customer engagement, portfolio restructuring and wider collaboration.

<table>
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<tr>
<th>Customer engagement</th>
<th>Product portfolio development</th>
<th>Expand charging infrastructure</th>
<th>Manufacturing and alliances</th>
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<tbody>
<tr>
<td>- EV specific services including apps and complimentary charging</td>
<td>- Launching EV specific brands</td>
<td>Collaborations with:</td>
<td>- Battery R&amp;D and innovation – In-house versus outsourcing</td>
</tr>
<tr>
<td>- Dedicated sales personnel</td>
<td>- SUV / crossover based EVs</td>
<td>- P&amp;U companies as well as other OEMs</td>
<td>- Securing raw material access</td>
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<tr>
<td>- Specialized financing options including subscription based vehicles on demand</td>
<td>- Cross-OEM platform sharing</td>
<td>- Startups on new technologies such as wireless charging</td>
<td>- Tier 0.5 / Contract manufacturing model lines</td>
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<td></td>
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<td>- Retail, hospitality and city authorities</td>
<td>- Crowd sourcing – for mass customization</td>
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India, too, has recently stepped-up the transition to EVs, the government’s e-mobility vision presents a unique set of opportunities and challenges

Opportunities

• 2Ws, 3Ws and intra-city buses offer early deployment opportunities
• While TCO for car fleets favors ICES today, post BS6 to shift in favor of EVs
• Reduction in import bill
• Urgency to improve air quality

Challenges

• Insufficient incentives to make the switch: Limited models, vehicle range
• EV vs ICE price premium in CVs and PV (private users)
• Absence of EV supply chain
• Inadequate charging and energy infrastructure

80% of India’s oil needs are met through imports

4 Indian cities in top 10 most polluted globally

200 Public charging points in India compared to over 1,50,000 in China

Source: EY analysis, Analyst reports
Adoption of EVs will alter the supply chain, offering opportunities for growth and innovation in the short and medium-term

New sources of value creation will need to be discovered and the pecking order of the industry participants will get redrawn

- Supply chains to be retooled, opening up opportunities for battery makers, cell component makers, and their suppliers
- Along with the automotive value chain, EVs will also create a significant opportunity for new entrants and infrastructure providers
- There is a risk of major components getting commoditized once EVs achieve scale

Source: EY analysis
Light weighting in EVs: A supply chain opportunity
Manufacturers are focussing on using plastics across non-moving components without compromising performance

Engine cover | Rear air diffusers | Carbon laminated body
---|---|---
Truck liners | Rear view mirror casting | Energy recovery devices
Seat structure | Wire and cable | Cooling pipes, pumps
Roof elements | | Bumper

Asia is estimated to dominate EV plastics market by 2021 with Chinese government trying to make the country a hub for EV manufacturing

Source: EY analysis
It’s all about urgency to develop an approach to retain or gain competitive advantage

Challenge innovation process for products and business models

► Challenge the type of innovation portfolio required — optimizing How to Win versus Where to Play
► Consider alternate business models that decouple ownership (vehicle, battery) vs access

Balance investments in progressive and disruptive innovation

► Assess the “Return on Innovation Investment” as a key measure of success in managing the innovation portfolio

Collaborate across traditional industry boundaries to create a competitive ecosystem

► Create an ecosystem including energy players, entrepreneurs and tech companies
► Work closely with ‘City as a customer’ – to deliver consumer experience
► Collaborate closely with policy makers on pilot programs to demonstrate viability
If everything seems under control, you're not going fast enough.

— Mario Andretti
Thank you for your attention!