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Future of Electric Vehicles

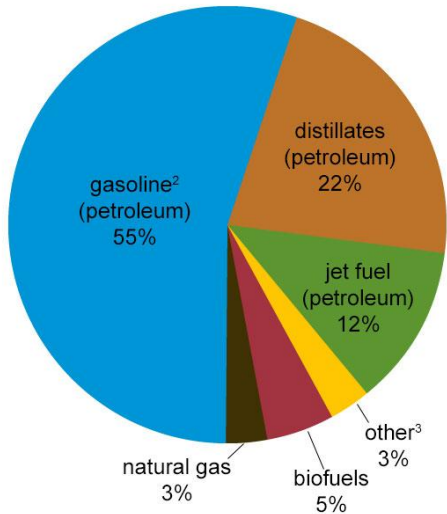
November 12, 2018
Emma Young, Bob Zhang



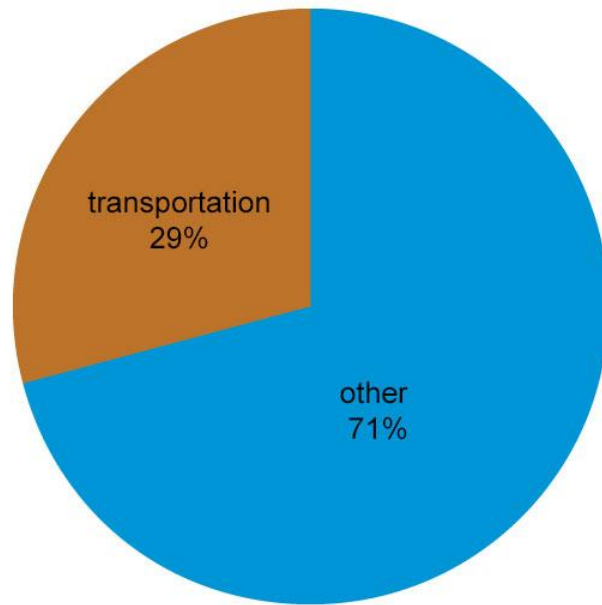
Where We Stand Today

- Petroleum products accounted for about 92% of the total U.S. transportation sector energy use.

U.S. transportation energy sources/fuels, 2017¹



Share of total U.S. energy used for transportation, 2017



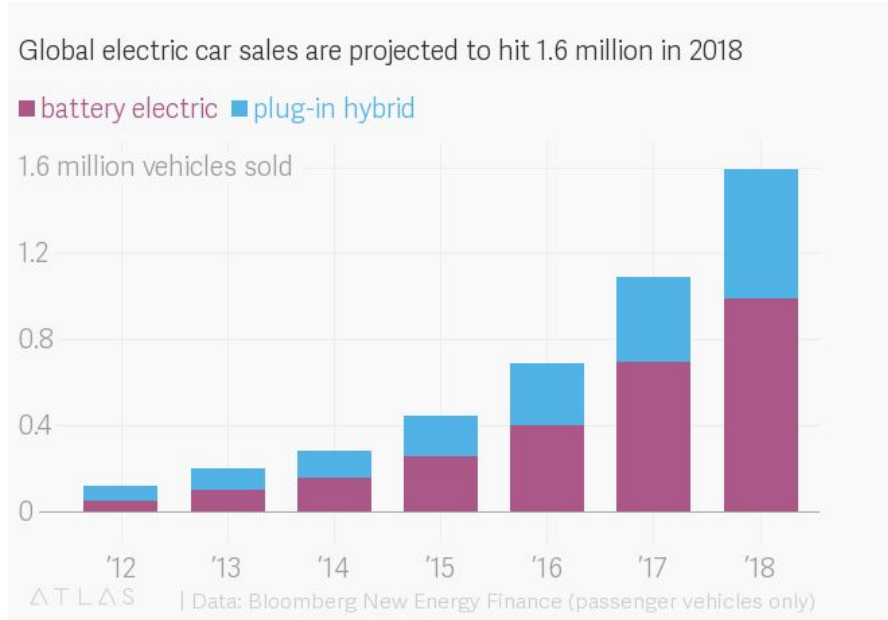
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 2.1, April 2018, preliminary data





Where We Stand Today

- In 2017, estimated 3.1 million electric vehicles in use
- 97 million vehicles were sold last year, and 2% of them were electric
- Around 1.2 million on the road in China
- Around 750,000 on the road in the United States





Role of Government

- Government policies are still seen as essential in increasing the uptake of EVs on the road
- Policies will make China and Europe biggest adopters of electric vehicles

Norway

- In 2017 **pure electric and hybrid cars accounted for 52% of all new car sales** in the country, covering almost 50,000 new cars, with fully electric cars making up 20.9% of new sales.
- Government has established a target for all new cars sold to be **zero emissions by 2025**. This has been spurred on by large tax breaks and incentives such as free parking, charging and toll exemption in some cities for electric car drivers.
- Now **6.4%** of the countries cars are powered by electric vehicles

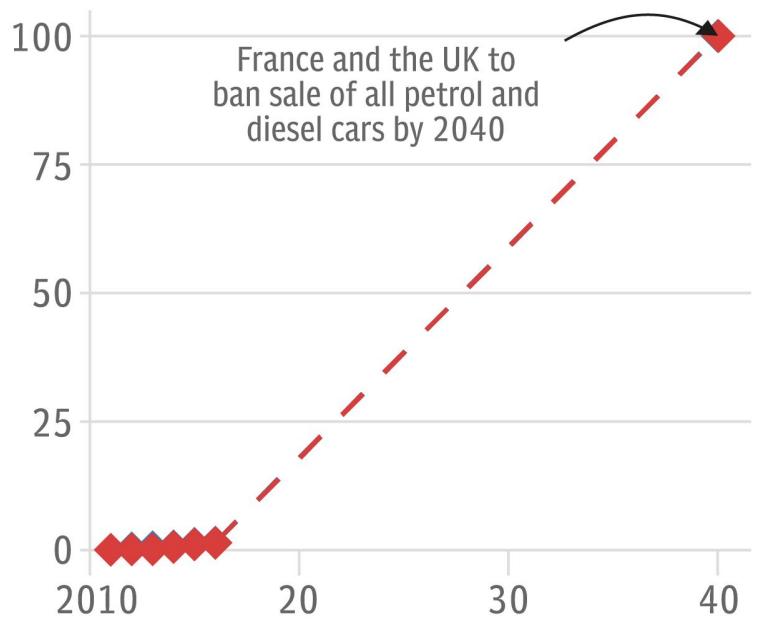
China

- Implementing New Energy Vehicle Mandate Policy
- Modified version of California's Zero Emission Vehicle Mandate
- Targets that increase the share of the automobile market by electric vehicles
- Predicted that by 2025, 19% of all passenger vehicle sales will be electric (compare to 14% in Europe and 11% in the US)

UK and France are targeting towards 100% electric car sale

Electric car market share (%)

◆ France ◆ UK

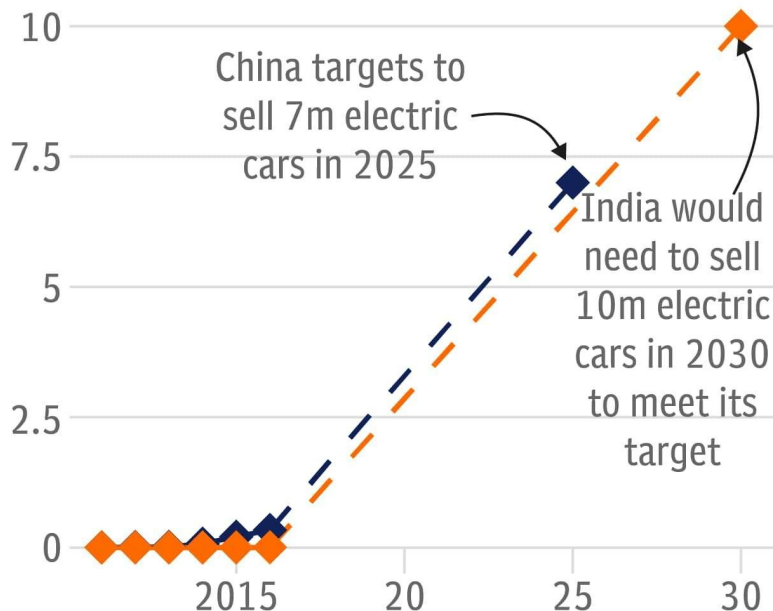


DATA: IEA, PRESS REPORTS

China and India's ambitious electric vehicle targets

Number of electric car sales (millions)

◆ China ◆ India



DATA: IEA, PRESS REPORTS



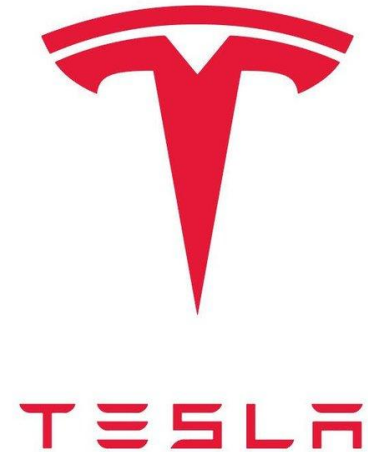
Examining the Market for Electric Vehicles

- In 2016, EVs cost about **\$15,000** more than conventional vehicles on average and are not expected to match the price of conventional vehicles until 2024.
- Projections that number of electric vehicles will grow from **3 million to 125 million** by 2030
- Number of EV's on the road grew **54% in 2017**
- Huge expansions in cell production is required
- The ability for automakers to produce these batteries is dependent on securing the necessary minerals, including **nickel, cobalt, and lithium**



Case Study 1: Tesla

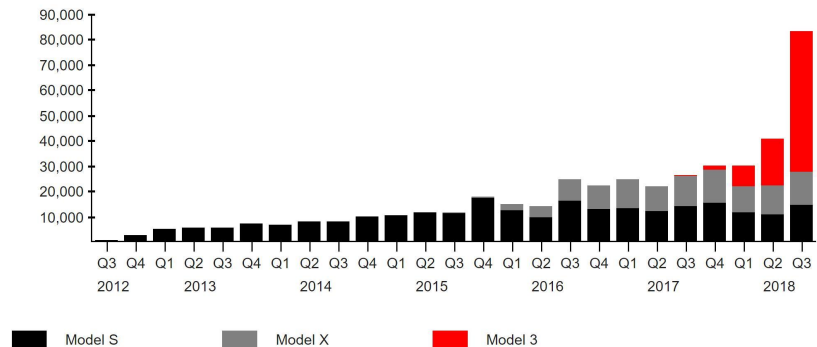
- Products and Technology
 - Model S (2012), Model X (2015), Model 3 (2016)
 - More than 60% Market Share in the US
 - Battery and Gigafactory
 - Autopilot





Tesla

- Future
 - Safety
 - Battery Technology
 - Production of batteries
 - Supercharger network
 - Market
 - New Gigafactory in Shanghai, China





Case Study 2: Volvo

- Branding
 - Knowledge, innovation, and **sustainability**
 - First premium automaker to have the entire portfolio to be electric





Volvo

- Into the new era
 - Strong performance in its current hybrid models
 - Market trend
 - Stricter carbon emissions regulations
 - Positive public image





Volvo

- Future
 - 50% fully electric and 1 million electric vehicles sold by 2025
 - Rapid growth in China
 - Example for other traditional automakers





Projections

- Huge market growth
 - In 2040, 55% of all new car sales and 33% of the global fleet will be electric.
- Government policies drive growth
 - China set to sell 7m EV by 2025 (19% of all passenger vehicle sales)
 - France and UK to ban petrol/diesel vehicles by 2040
- More competitive pricing for consumers
 - The upfront cost of EV will be competitive on an unsubsidized basis by 2024
- Corporations
 - More automakers will join Volvo in expediting into a fully electric portfolio



Trade-offs

- Increased cost to the consumer for the time being
- Current battery range and recharge limit
- Concerns with mining
 - Minerals like cobalt often in unstable, unregulated regions
 - Lack of investment in new capital and strategies by mining industries
- Battery recycling and disposal
- Is it truly helping reducing the carbon emissions?



Total Impact

- Positive impact in reducing greenhouse gas depends in part in where electric vehicles are being driven

Country	EVs (2015)	gCO2/kWh (2013)
United States	404,090	489.43
China	312,290	711.88
Japan	126,290	571.54
Netherlands	87,530	452.14
Norway	70,820	8.29



Thank you.





Sources

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