Looking ahead: Electric drive

Health Effects Institute
2017 Annual Conference
April 30, 2017

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Outline

- State of the electric vehicle market
  - Global growth, annual production volume
  - Where is U.S. market uptake highest?
- Opportunities and challenges
  - Prospects for continued cost reduction
  - Incentives, regulatory policy, infrastructure
- Reflections
In January 2017, cumulative global electric vehicle sales passed 2 million.

Most of the sales are in China, U.S., and Europe.
Most major autos are now in the game: 15 autos at 20k+ annual sales

- Global annual 2015 to 2016 electric vehicle growth ~40%
- Battery production more concentrated (5 companies make up 3/4 of production)

Where is electric vehicle uptake highest?

- Top cities tend to have more available public charging, models, incentives, local actions

See: [http://www.theicct.org/leading-us-city-electric-vehicle-2016](http://www.theicct.org/leading-us-city-electric-vehicle-2016)

Updated report to be published in summer 2017, 2016 vehicle registration data from IHS Automotive
Supplier competition, innovation, and volume → costs are dropping

- Battery pack costs expected to drop from $200-$300/kWh in 2016 to ~$150/kWh in 2020-2025
- Short- (100 mi) and medium-range (150 mi) electric vehicles will become cost competitive
- **Challenge**: Sustain consumer incentives through 2020 while costs drop
Opportunity: Long-term regulatory policy

- Due to all the battery pack cost reductions, incremental performance standards for 2025+ timeframe push electric vehicles into the market
  - \textit{Challenge}: Bigger investments need stable regulatory environment, longer lead time

Assumes adopted 2025 standards and hypothetical 2026-2030 standards at 4%-6% lower CO$_2$/year
Opportunity: Progress in cities

- These 14 markets account for a third of global electric vehicle sales
  - The sales leaders have 10,000 to 40,000 new electric vehicle sales per year
  - The sales share leaders have electric vehicle shares of 10-27% of new vehicle sales

What are the key features of the high electric vehicle uptake markets?

- Comprehensive city, state, and national policy, including fiscal incentives, local perks, public charging infrastructure programs, and awareness campaigns

### Electric vehicle capitals promotion actions

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<th>Country</th>
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The challenge: Transition to electric drive

- Major governments have signaled the need to fully transition to electric drive in the 2025 to 2050 timeframe to achieve climate, air quality, and energy goals
  - National: Germany, India, Netherlands, Norway, United Kingdom
  - States/Provinces: British Columbia., California, Connecticut, Maryland, Massachusetts, New York, Oregon, Québec, Rhode Island, Vermont
  - Cities: Many registration and circulation restrictions, low emission zones, discussions of bans

ZEV Alliance COP21 announcement: http://zevalliance.org/content/cop21-2050-announcement
Reflections

- **Electric vehicle technology prospects**
  - More models across vehicle types by all automakers
  - Innovation, volume → lower cost and higher range electric vehicles for mainstream buyers

- **Select markets show what it takes to launch the market**
  - Many policies help address market barriers of cost, convenience, consumer info
  - National and state: Consumer incentives, long-term CO₂ performance standards
  - Utility: Charging infrastructure (home, workplace, public)
  - Cities likely to be key drivers (restrictions, bans, access)
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ICCT electric vehicle page: http://theicct.org/electric-vehicles
EV world capitals report: http://www.theicct.org/EV-capitals-of-the-world
ZEV Alliance: http://www.zevalliance.org

Acknowledgements
Analysis by Peter Slowik, Dale Hall, Marissa Moultak, Nic Lutsey
Supported by ZEV Alliance governments, The 11th Hour Project of the Schmidt Family Foundation, ClimateWorks Foundation, Mark Heising and Elizabeth Simons
EV uptake and underlying factors by metro area

- Leading markets tend to have more public charging, more available electric vehicle models, consumer incentives, and local promotion actions.
Opportunity: Benefits greatly exceed cost

- Electric vehicles reduce energy costs (and have major benefits)
  - Benefits are nearly many times higher than costs
  - *Challenge*: Transition will take time, prolonged policy support will be key


Slowik et al (2016). Evolution of incentives to sustain the transition to a global electric vehicle fleet. [http://www.theicct.org/evolution-incentives-electric-transition](http://www.theicct.org/evolution-incentives-electric-transition)