Global and U.S. electric vehicle trends
Overview

- Global electric vehicle (EV) trends
  - Sales, EV production volume growth, EV cost parity timing
  - Top global EV markets
  - Automaker announcements
  - EV industrial competitiveness by country
  - Canada EV sales - top

- U.S. trends
  - Policy developments
  - National and leading EV markets

- Zero-emission heavy-duty commercial freight vehicles
  - More complex technology, policy space
Global electric vehicle growth

- Annual global EV sales surpassed 2 million/year in 2018 (5 million cumulative)
- Mostly the sales are in China, Europe, and the U.S.
  - These markets have policy, incentives, charging infrastructure, local action

Source: www.EV-volumes.com
Global electric vehicle growth

- Annual global EV production surpassed 2 million/year in 2018
- There are now 10 automaker groups selling over 80,000 EVs per year
  - Battery production: 5 companies supplying batteries over 200,000 EVs per year

Electric vehicle sales by automaker

Electric vehicle sales by battery supplier

Volume and innovation drive EV costs down

- Battery cost reductions enable electric vehicle cost parity
  - Parity points shown below for cars: 2024-2029 for 150-300-mile electric range
  - Parity points for crossovers and SUVs tend to be several years later

44% of world’s EVs are in just 25 markets in China, Europe, Japan, US
- Each market benefits from regulations, incentives, infrastructure, model availability
- These areas are striving to overcome all the prevailing electric vehicle barriers

Based on total electric vehicles sales through 2017
Automakers increasingly share all-electric vision

- Automaker announcements by 2025:
  - Hundreds of new EV models, over $200b in investments, and 15m EVs/year
  - Vehicle deployment would lead to higher volume than required by regulations

Based on company announcements for plug-in vehicles
Industrial competitiveness

Canada EV sales in global context, top EV models, vehicle sales and production statistics
Canada is the 8th largest EV market, with over 40,000 sales in 2018. Annual EV sales growth rate for Canada over 2014-2018 has increased each year.
Canada and U.S. electric vehicle sales

- Canada’s EV market largely depends on imports
  - 97% of Canada EV sales were imports (53% from U.S.)
  - 70% of U.S. EV sales were made in the U.S.
  - Fifteen top-selling EV models in Canada and U.S. (90% of EV sales)

### Canada sales

<table>
<thead>
<tr>
<th>Rank</th>
<th>Model</th>
<th>Sales</th>
<th>Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tesla Model 3</td>
<td>6,300</td>
<td>U.S.</td>
</tr>
<tr>
<td>2</td>
<td>Nissan Leaf</td>
<td>5,700</td>
<td>U.S.</td>
</tr>
<tr>
<td>3</td>
<td>Mitsubishi Outlander*</td>
<td>5,300</td>
<td>Japan</td>
</tr>
<tr>
<td>4</td>
<td>Chevrolet Volt*</td>
<td>4,300</td>
<td>U.S.</td>
</tr>
<tr>
<td>5</td>
<td>Toyota Prius Prime*</td>
<td>3,500</td>
<td>Japan</td>
</tr>
<tr>
<td>6</td>
<td>Chevrolet Bolt</td>
<td>2,500</td>
<td>U.S.</td>
</tr>
<tr>
<td>7</td>
<td>Ford Fusion Energi*</td>
<td>1,900</td>
<td>Mexico</td>
</tr>
<tr>
<td>8</td>
<td>Tesla Model X</td>
<td>1,600</td>
<td>U.S.</td>
</tr>
<tr>
<td>9</td>
<td>Chrysler Pacifica*</td>
<td>1,400</td>
<td>Canada</td>
</tr>
<tr>
<td>10</td>
<td>Hyundai Ioniq PHEV*</td>
<td>1,400</td>
<td>S. Korea</td>
</tr>
<tr>
<td>11</td>
<td>Volkswagen e-Golf</td>
<td>1,200</td>
<td>Germany</td>
</tr>
<tr>
<td>12</td>
<td>Tesla Model S</td>
<td>1,100</td>
<td>U.S.</td>
</tr>
<tr>
<td>13</td>
<td>Kia Soul</td>
<td>1,100</td>
<td>S. Korea</td>
</tr>
<tr>
<td>14</td>
<td>Honda Clarity PHEV*</td>
<td>800</td>
<td>Japan</td>
</tr>
<tr>
<td>15</td>
<td>Hyundai Ioniq BEV</td>
<td>500</td>
<td>S. Korea</td>
</tr>
</tbody>
</table>

### United States sales

<table>
<thead>
<tr>
<th>Rank</th>
<th>Model</th>
<th>Sales</th>
<th>Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tesla Model 3</td>
<td>139,700</td>
<td>U.S.</td>
</tr>
<tr>
<td>2</td>
<td>Toyota Prius Prime*</td>
<td>27,600</td>
<td>Japan</td>
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<tr>
<td>3</td>
<td>Tesla Model X</td>
<td>24,700</td>
<td>U.S.</td>
</tr>
<tr>
<td>4</td>
<td>Tesla Model S</td>
<td>24,500</td>
<td>U.S.</td>
</tr>
<tr>
<td>5</td>
<td>Chevrolet Volt*</td>
<td>18,300</td>
<td>U.S.</td>
</tr>
<tr>
<td>6</td>
<td>Honda Clarity PHEV*</td>
<td>18,200</td>
<td>Japan</td>
</tr>
<tr>
<td>7</td>
<td>Chevrolet Bolt</td>
<td>18,000</td>
<td>U.S.</td>
</tr>
<tr>
<td>8</td>
<td>Nissan Leaf</td>
<td>14,700</td>
<td>U.S.</td>
</tr>
<tr>
<td>9</td>
<td>Ford Fusion Energi*</td>
<td>8,100</td>
<td>Mexico</td>
</tr>
<tr>
<td>10</td>
<td>Chrysler Pacifica*</td>
<td>7,100</td>
<td>Canada</td>
</tr>
<tr>
<td>11</td>
<td>BMW i3*</td>
<td>6,100</td>
<td>Germany</td>
</tr>
<tr>
<td>12</td>
<td>BMW X5*</td>
<td>4,400</td>
<td>U.S.</td>
</tr>
<tr>
<td>13</td>
<td>BMW 530e*</td>
<td>4,300</td>
<td>Germany</td>
</tr>
<tr>
<td>14</td>
<td>Mitsubishi Outlander*</td>
<td>4,200</td>
<td>Japan</td>
</tr>
<tr>
<td>15</td>
<td>Kia Niro*</td>
<td>3,400</td>
<td>S. Korea</td>
</tr>
</tbody>
</table>

* denotes plug-in hybrid; Data are calendar year 2018 sales

Sources: ICCT; EV-Volumes [http://www.ev-volumes.com/datacenter/]
Canada’s role in the long-term EV transition is unclear

- Canada is a global auto manufacturing leader and a top auto market
  - 2 million vehicles produced, $50+ billion in annual auto and supplier exports in 2018
  - Canada’s limited EV production puts its auto industry at risk in a global EV transition

<table>
<thead>
<tr>
<th>Rank</th>
<th>Industry metrics: 2018 production and exports</th>
<th>Market metrics</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Vehicle production</td>
<td>Vehicle export value</td>
</tr>
<tr>
<td>1</td>
<td>China (25.5 m)</td>
<td>Germany ($167 b)</td>
</tr>
<tr>
<td>2</td>
<td>U.S. (11 m)</td>
<td>Japan ($108 b)</td>
</tr>
<tr>
<td>3</td>
<td>Japan (9.2 m)</td>
<td>Mexico ($74 b)</td>
</tr>
<tr>
<td>4</td>
<td>Germany (5.1 m)</td>
<td>U.S. ($67 b)</td>
</tr>
<tr>
<td>5</td>
<td>India (4.7 m)</td>
<td>Canada ($45 b)</td>
</tr>
<tr>
<td>6</td>
<td>S. Korea (4 m)</td>
<td>U.K. ($44 b)</td>
</tr>
<tr>
<td>7</td>
<td>Mexico (3.9 m)</td>
<td>Spain ($42 b)</td>
</tr>
<tr>
<td>8</td>
<td>Spain (2.8 m)</td>
<td>S. Korea ($40 b)</td>
</tr>
<tr>
<td>9</td>
<td>Brazil (2.7 m)</td>
<td>Belgium ($38 b)</td>
</tr>
<tr>
<td>10</td>
<td>France (2.3 m)</td>
<td>France ($34 b)</td>
</tr>
<tr>
<td>11</td>
<td>Thailand (2.2 m)</td>
<td>Italy ($23 b)</td>
</tr>
<tr>
<td>12</td>
<td>Canada (2 m)</td>
<td>Slovakia ($22 b)</td>
</tr>
<tr>
<td>13</td>
<td>Russia (1.7 m)</td>
<td>Thailand ($19 b)</td>
</tr>
<tr>
<td>14</td>
<td>U.K. (1.6 m)</td>
<td>Turkey ($18 b)</td>
</tr>
<tr>
<td>15</td>
<td>Iran (1.5 m)</td>
<td>Sweden ($14 b)</td>
</tr>
<tr>
<td>Global</td>
<td>91.6 million</td>
<td>$1,730 billion</td>
</tr>
<tr>
<td>Canada share</td>
<td>2.2%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

Vehicles include passenger cars and light trucks
Sources: ICCT; EV-Volumes [http://www.ev-volumes.com/datacenter/]; International Trade Center; International Organization of Motor Vehicle Manufacturers
Canada’s EV production lags the global trend

- Canada’s limited EV production puts its auto industry at risk in a global EV transition
- Compared to 2.3% global EV share, Canada’s lags with 0.4% of auto production being electric
  - Canada’s EV production is from ~9,000 Chrysler Pacifica plug-in hybrids produced in 2018
  - Other major auto producing countries (S. Korea, UK, France) are keeping pace
  - Other non-major auto producing countries (Netherlands, Sweden) are becoming leaders

Sources: EV-Volumes [http://www.ev-volumes.com/datacenter/]; International Organization of Motor Vehicle Manufacturers; ICCT [https://www.theicct.org/publications/global-electric-vehicle-industry]; Larger manufacturing companies not shown: China, U.S., Germany, Japan
Trends in the U.S. Overall federal/state policy developments, top EV markets, and underlying factors
U.S. vehicle policy developments

- Federal government proposes revoking post-2020 CO₂ standards and state authority on emission standards
- 60% of the U.S. market is in states or cities that oppose federal rollback

U.S. electric vehicle sales: National

- Cumulative U.S. electric vehicle sales have passed 1 million

Source: [www.EV-volumes.com](http://www.EV-volumes.com)
Most EV sales are in markets with some combination of the following: ZEV regulation, incentives, extensive charging, city/utility promotions

Nearly two-thirds of EV sales are in ZEV regulation states (CA, OR, Northeast)
U.S. electric vehicle sales: Underlying factors

- Most EV sales are in markets with policy, incentives, charging, local action

Zero-emission commercial freight truck developments

- Very promising developments across major truck classes

### Gross vehicle weight class (U.S.)

- **Class 8 tractor trailer** (15+ tonnes)
  - BYD Day Cab
  - Kenworth T680
  - Eforce EF18 SZM
  - Nikola Two
  - Tesla Semi
  - Nikola One

- **Class 8 straight truck** (15+ tonnes)
  - emoss EMS 16 Series
  - Volvo VNR
  - Lion Lion8
  - Hyundai XCient
  - Eforce EV26

- **Class 7** (11.8 to 15 tonnes)
  - Cummins AEOS
  - MAN eTGM
  - Volvo FL Electric

- **Class 6** (8.8 to 11.8 tonnes)
  - emoss EMS 12 Series
  - Mercedes-Benz eActros
  - Peterbilt e220
  - BYD Class 6 Truck
  - Thor MDV
  - emoss EMS 10 Series

- **Class 5** (7.3 to 8.8 tonnes)
  - Mitsubishi FUSO eCanter
  - Freightliner eM2 106

- **Class 4** (6.3 to 7.3 tonnes)
  - Tevva eTruck
  - Volkswagen e-Delivery
  - Dongfeng Special Vehicle

[https://www.theicct.org/publications/transitioning-zero-emission-heavy-duty-freight-vehicles]
Zero-emission commercial freight tractor-trailers

- Very promising, but complex regulation, policy, infrastructure questions remain

Conclusions

- **Electric vehicle growth**
  - Growth: 60%+ annual growth rate, 2 million EVs per year and growing
  - Battery innovation and scale enables mainstream market in years ahead
  - Industry commitments showing order of magnitude higher scale is underway

- **Policies for the transition to electric vehicles**
  - Top EV markets around the world show us a complete policy package
  - Reducing CO$_2$ emissions at triple the historical rate needed to decarbonize transport
  - As EV cost parity is reached, policies including durable polluter-pay taxation, regulation, infrastructure support, and consumer campaigns remain critical
  - We could proceed with similar steps for zero-emission trucks in the years ahead
More info

ICCT electric vehicle page:
http://theicct.org/electric-vehicles

World electric vehicle capital report:

U.S. city electric vehicle report:
https://www.theicct.org/publications/continued-EV-transition-us-cities-2018

Update on electric vehicle costs in the United States through 2030:

Acknowledgements

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