

Global and U.S. electric vehicle trends

....

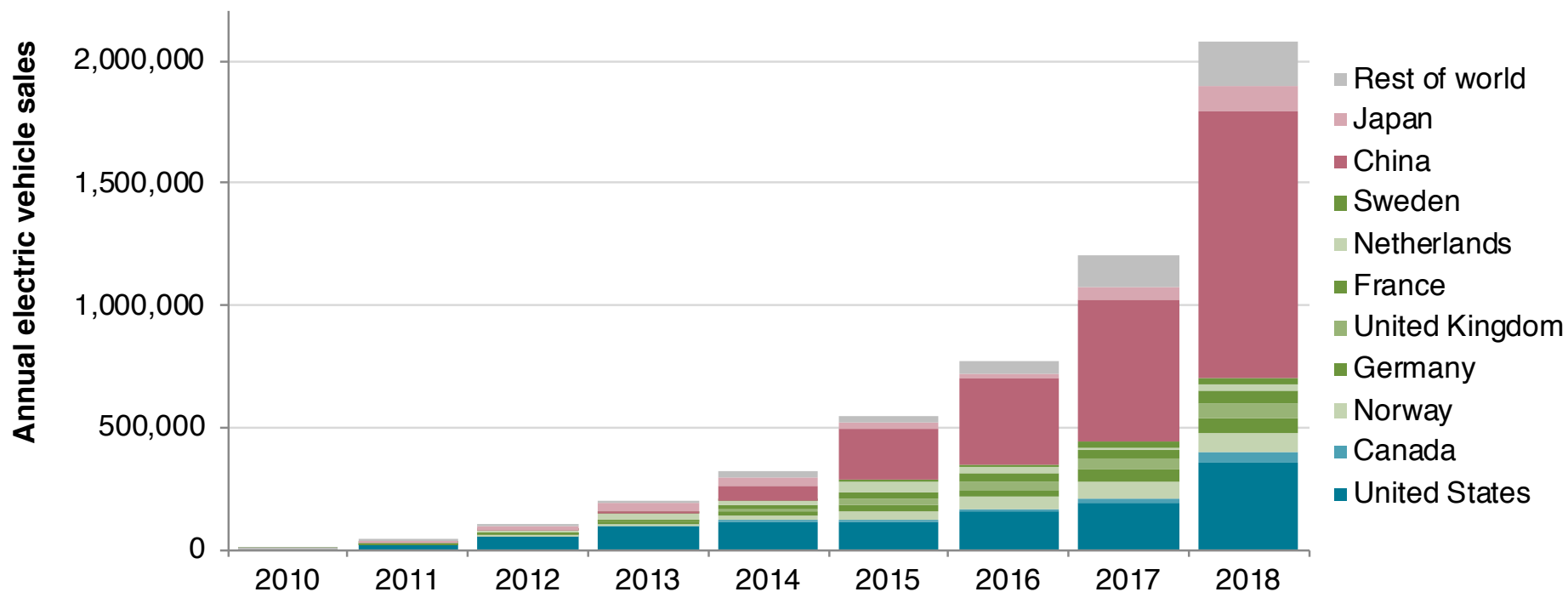
....

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

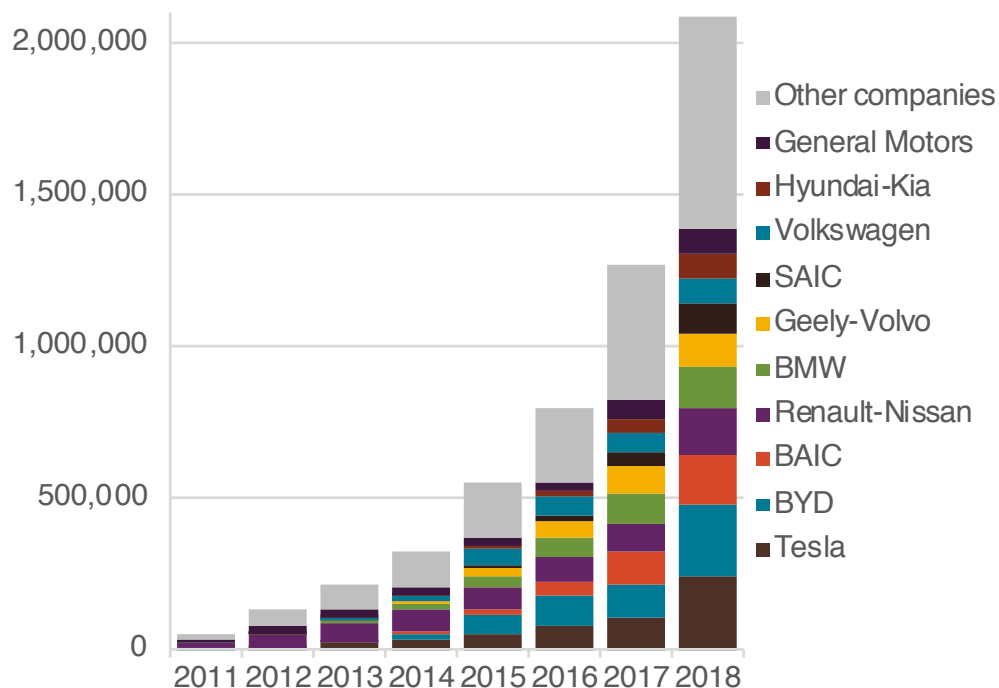
- Annual global EV sales surpassed 2 million/year in 2018 (5 million cumulative)
- Mostly the sales are in China, Europe, and the U.S.
 - These markets have policy, incentives, charging infrastructure, local action



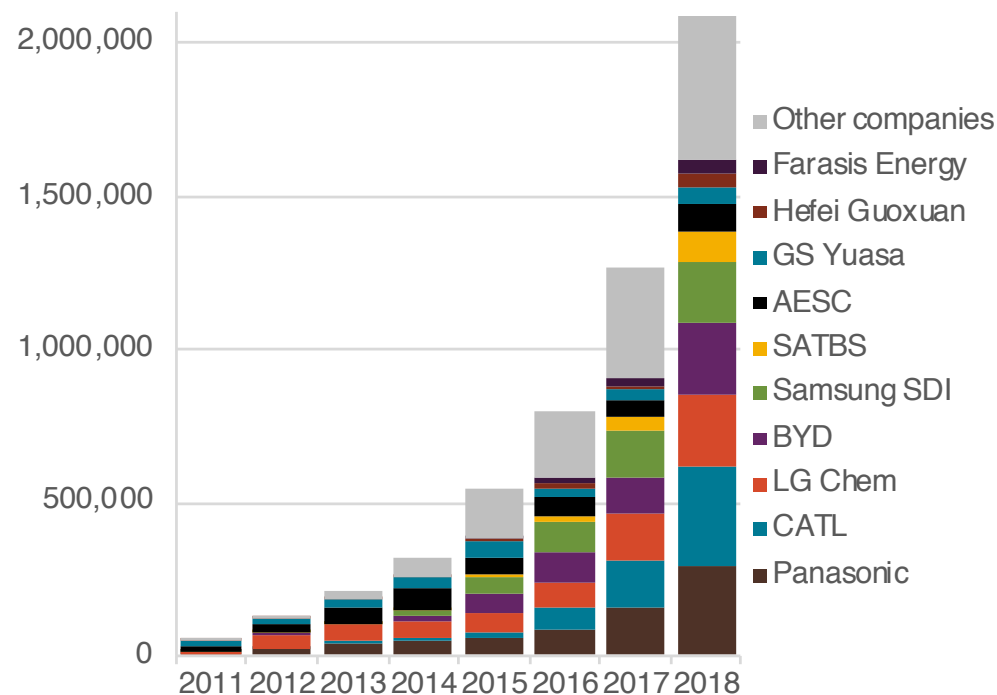
Global electric vehicle growth

- 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

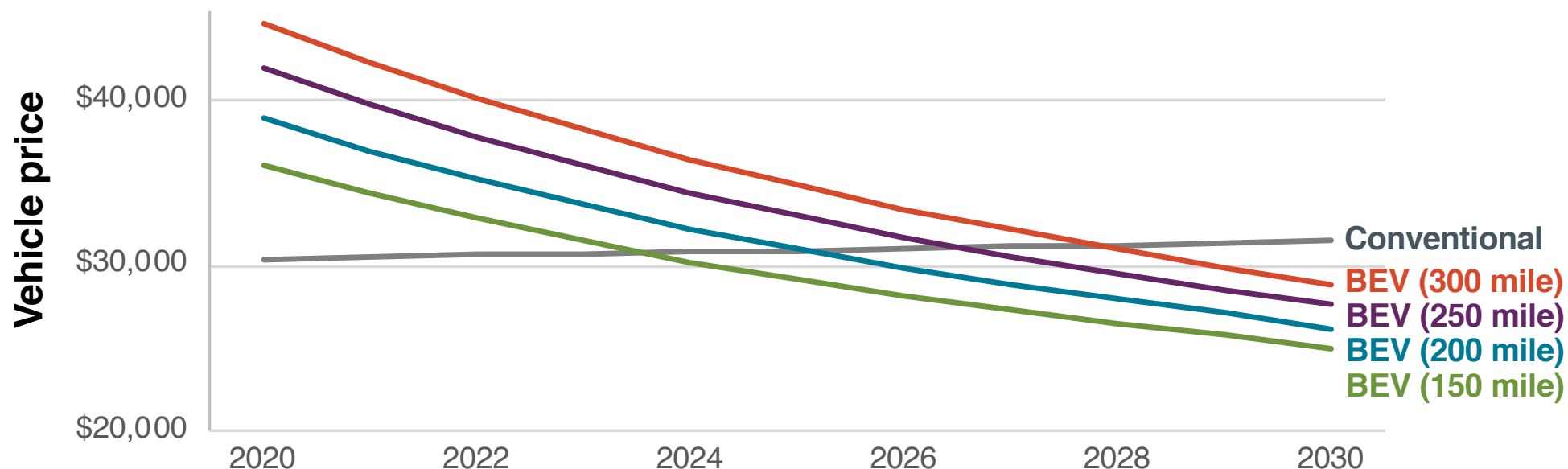


Electric vehicle sales by battery supplier



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



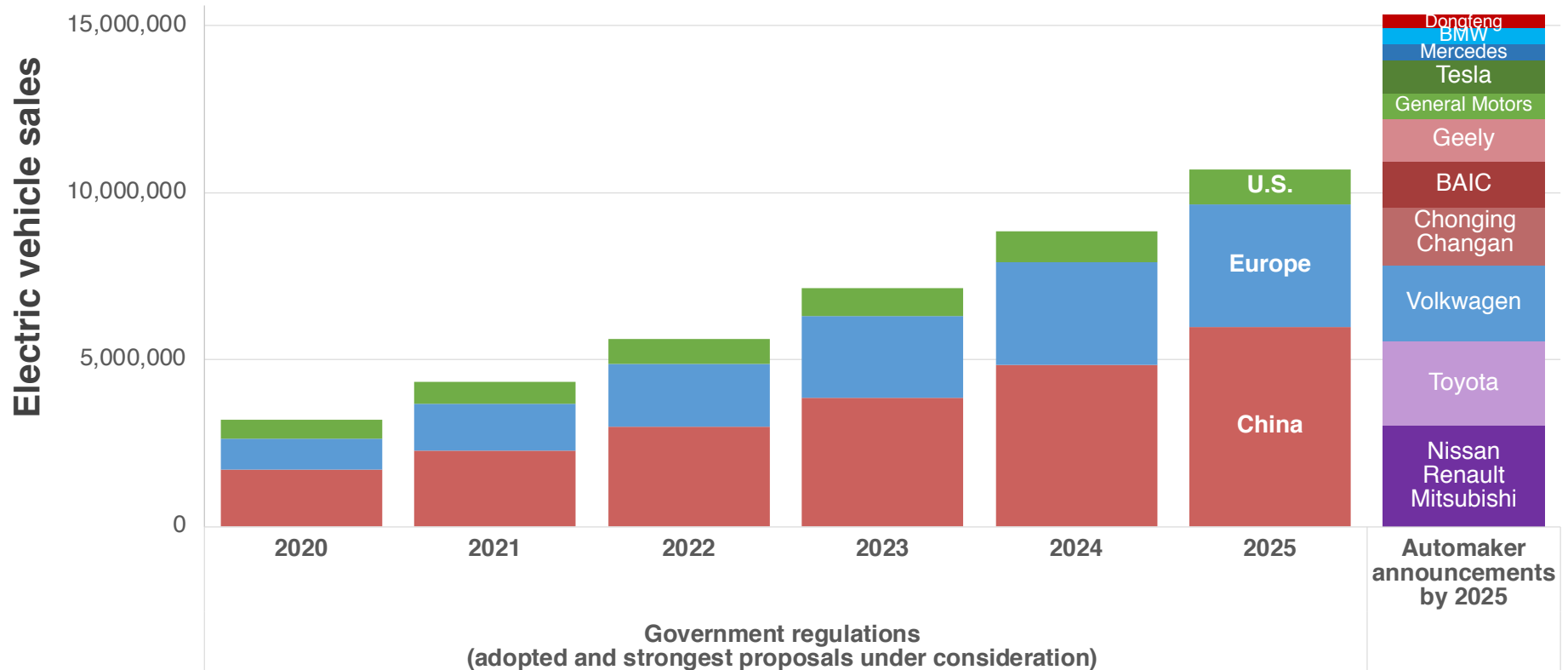
Top EV markets have a complete policy package

- 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



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

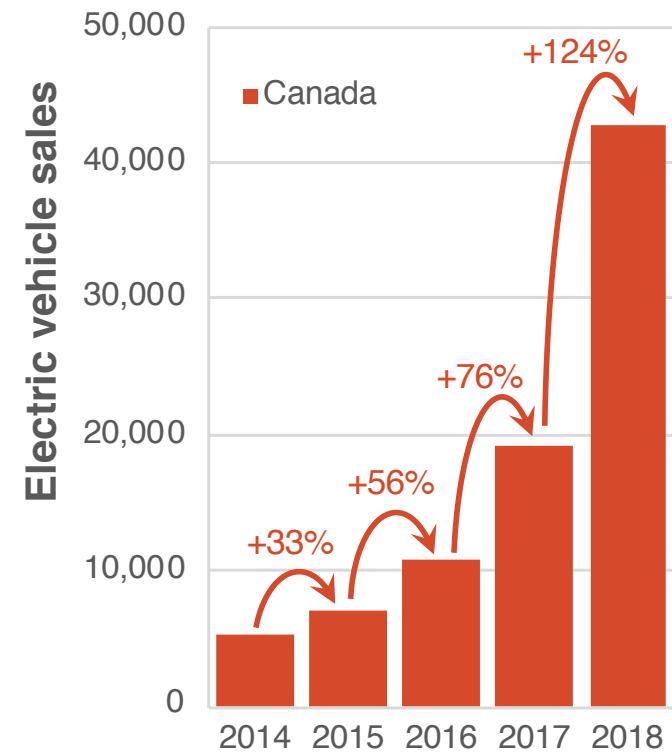
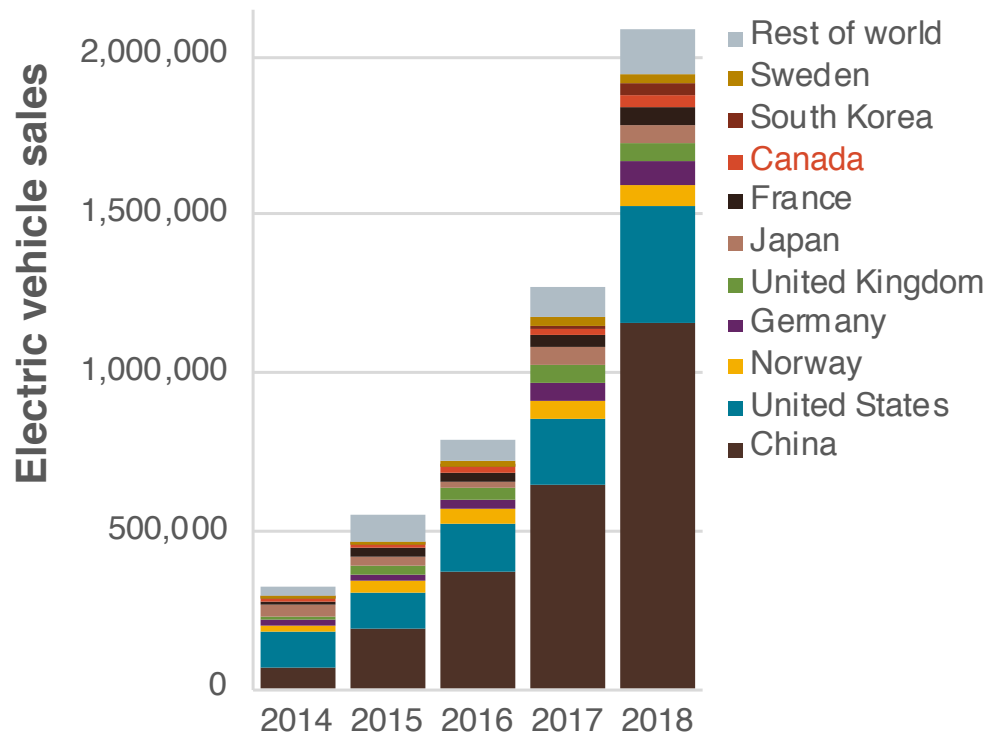


Industrial competitiveness

**Canada EV sales in global
context, top EV models, vehicle
sales and production statistics**

Annual EV growth: Worldwide and in Canada

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

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

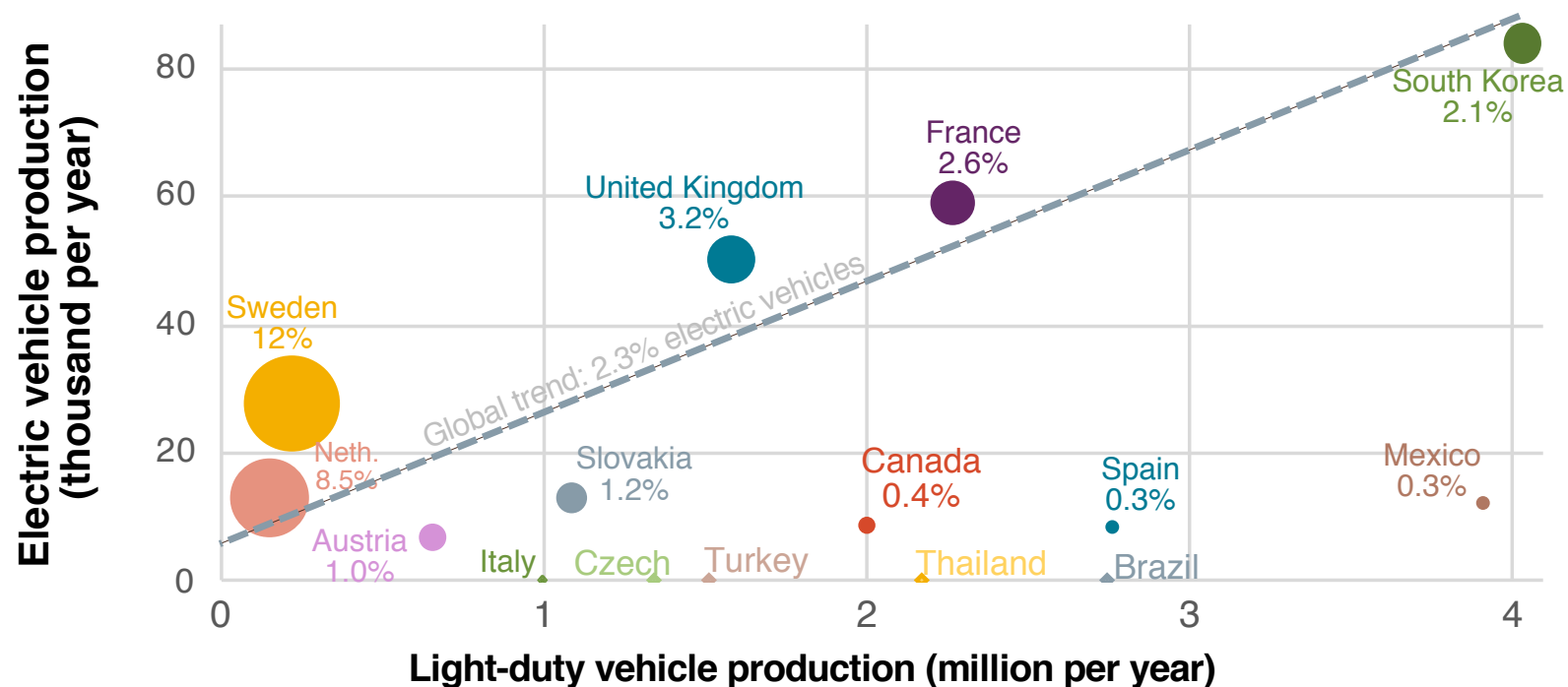
Canada's role in the long-term EV transition is unclear

- 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

Rank	Industry metrics: 2018 production and exports				Market metrics	
	Vehicle production	Vehicle export value	Automotive parts export value	Electric vehicle production	Vehicle sales	Electric vehicle sales
1	China (25.5 m)	Germany (\$167 b)	Germany (\$67 b)	China (1,078,000)	China (24.7 m)	China (1,104,000)
2	U.S. (11 m)	Japan (\$108 b)	U.S. (\$46 b)	U.S. (335,000)	U.S. (17.3 m)	U.S. (358,000)
3	Japan (9.2 m)	Mexico (\$74 b)	Japan (\$36 b)	Germany (205,000)	Japan (4.4 m)	Norway (73,000)
4	Germany (5.1 m)	U.S. (\$67 b)	China (\$35 b)	Japan (181,000)	Germany (3.4 m)	Germany (66,000)
5	India (4.7 m)	Canada (\$45 b)	Mexico (\$30 b)	S. Korea (84,000)	India (3.4 m)	U.K. (60,000)
6	S. Korea (4 m)	U.K. (\$44 b)	S. Korea (\$20 b)	France (59,000)	U.K. (2.4 m)	Japan (53,000)
7	Mexico (3.9 m)	Spain (\$42 b)	France (\$16 b)	U.K. (50,000)	France (2.2 m)	France (46,000)
8	Spain (2.8 m)	S. Korea (\$40 b)	Czech Rep. (\$15 b)	Sweden (28,000)	Brazil (2.1 m)	Canada (43,000)
9	Brazil (2.7 m)	Belgium (\$38 b)	Italy (\$15 b)	Nether. (13,000)	Canada (2 m)	S. Korea (32,000)
10	France (2.3 m)	France (\$34 b)	Poland (\$14 b)	Slovakia (13,000)	Russia (1.8 m)	Sweden (29,000)
11	Thailand (2.2 m)	Italy (\$23 b)	Spain (\$12 b)	Mexico (12,000)	S. Korea (1.6 m)	Nether. (27,000)
12	Canada (2 m)	Slovakia (\$22 b)	Canada (\$11 b)	Canada (9,000)	Spain (1.3 m)	Belgium (13,000)
13	Russia (1.7 m)	Thailand (\$19 b)	Thailand (\$9 b)	Spain (8,000)	Mexico (1.2 m)	Spain (12,000)
14	U.K. (1.6 m)	Turkey (\$18 b)	Romania (\$8 b)	Austria (7,000)	Australia (0.9 m)	Switzerland (9,000)
15	Iran (1.5 m)	Sweden (\$14 b)	U.K. (\$7 b)	India (1,000)	Indonesia (0.9 m)	Austria (9,000)
Global	91.6 million	\$1,730 billion	\$412 billion	2,090,000	91.6 million	2,090,000
Canada share	2.2%	2.6%	2.8%	0.4%	2.2%	2.0%

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

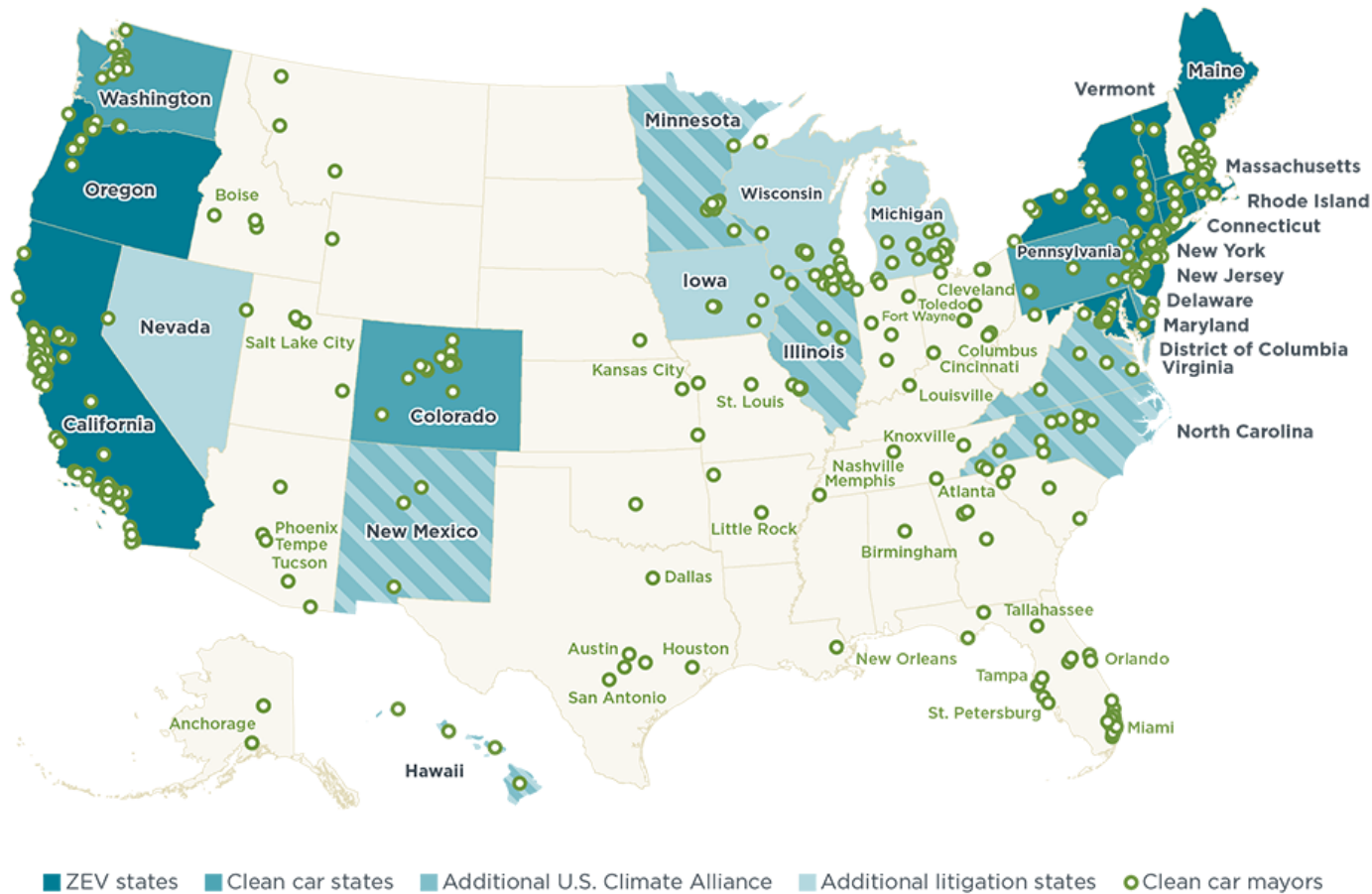


Trends in the U.S.

Overall federal/state policy developments, top EV markets, and underlying factors

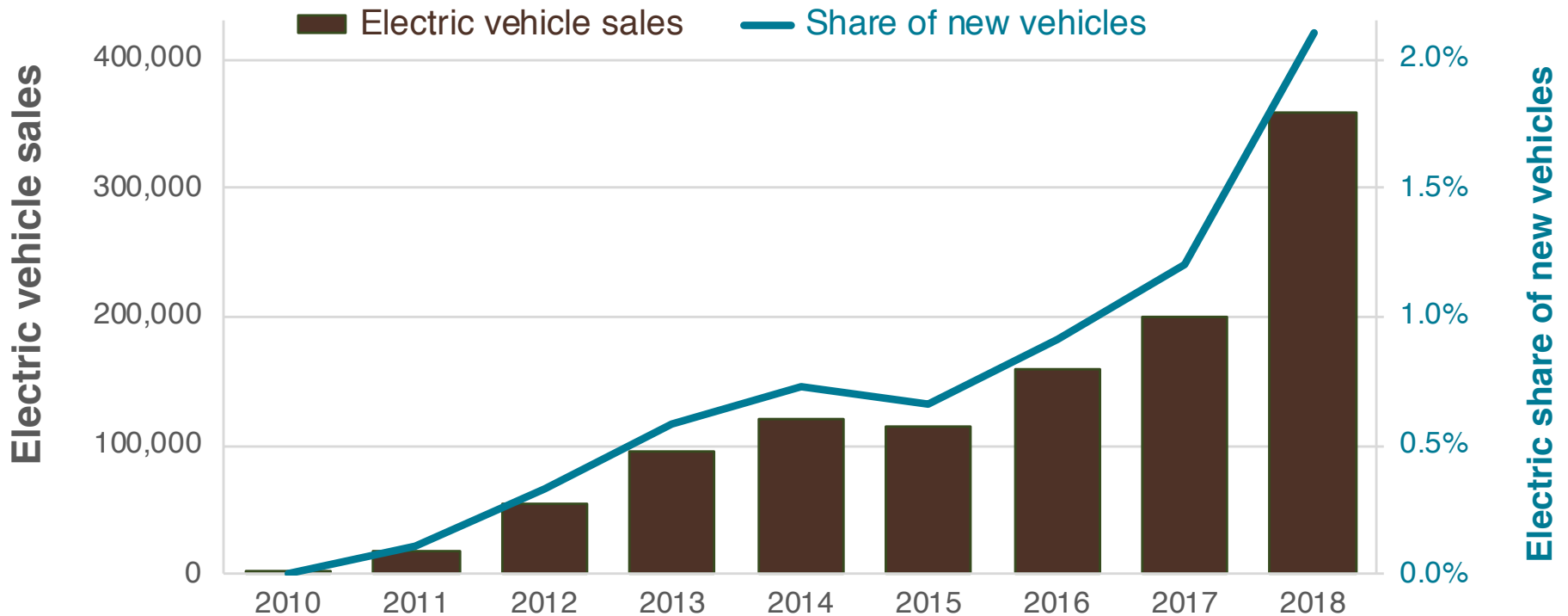
U.S. vehicle policy developments

- 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



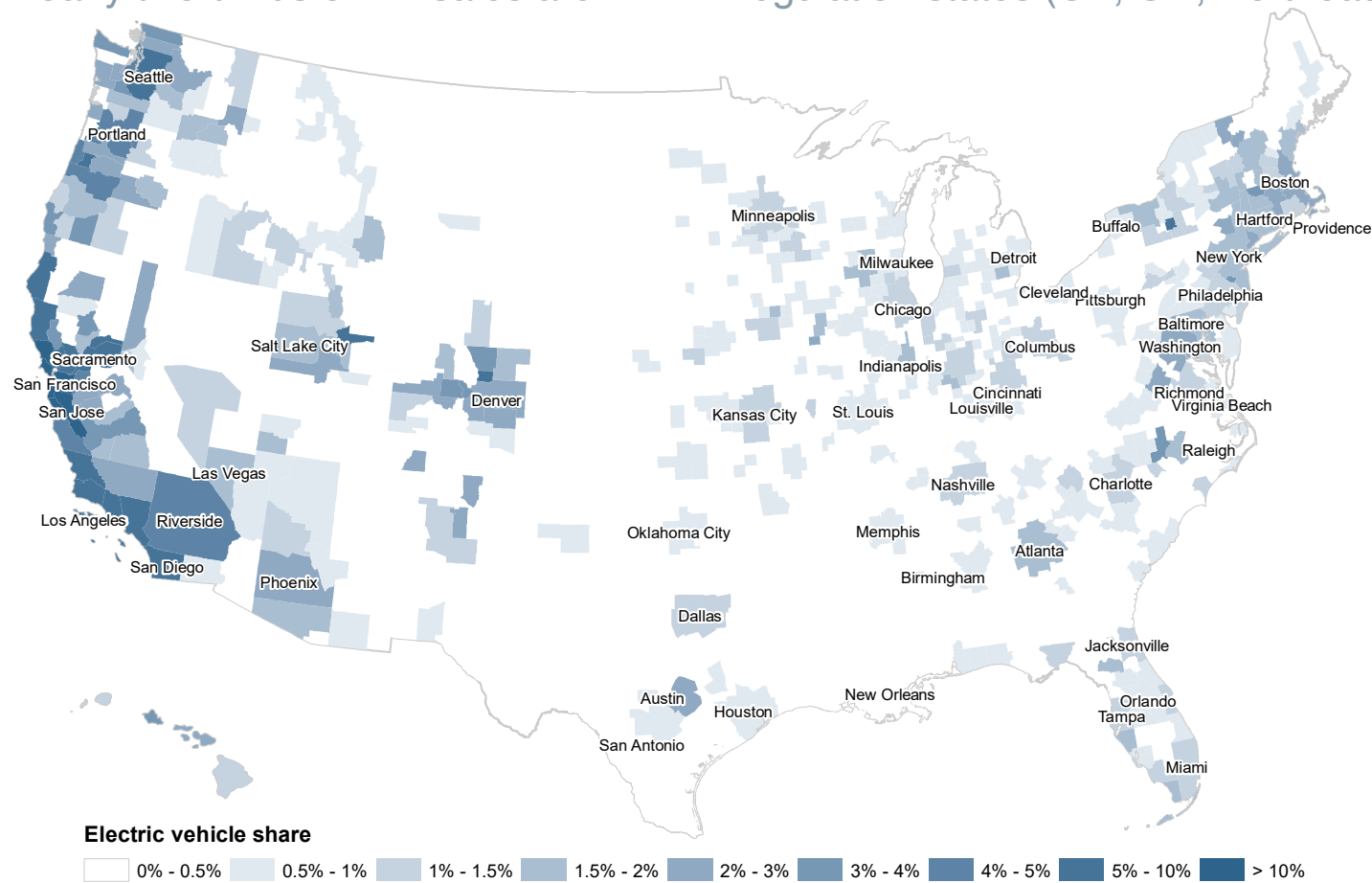
U.S. electric vehicle sales: National

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



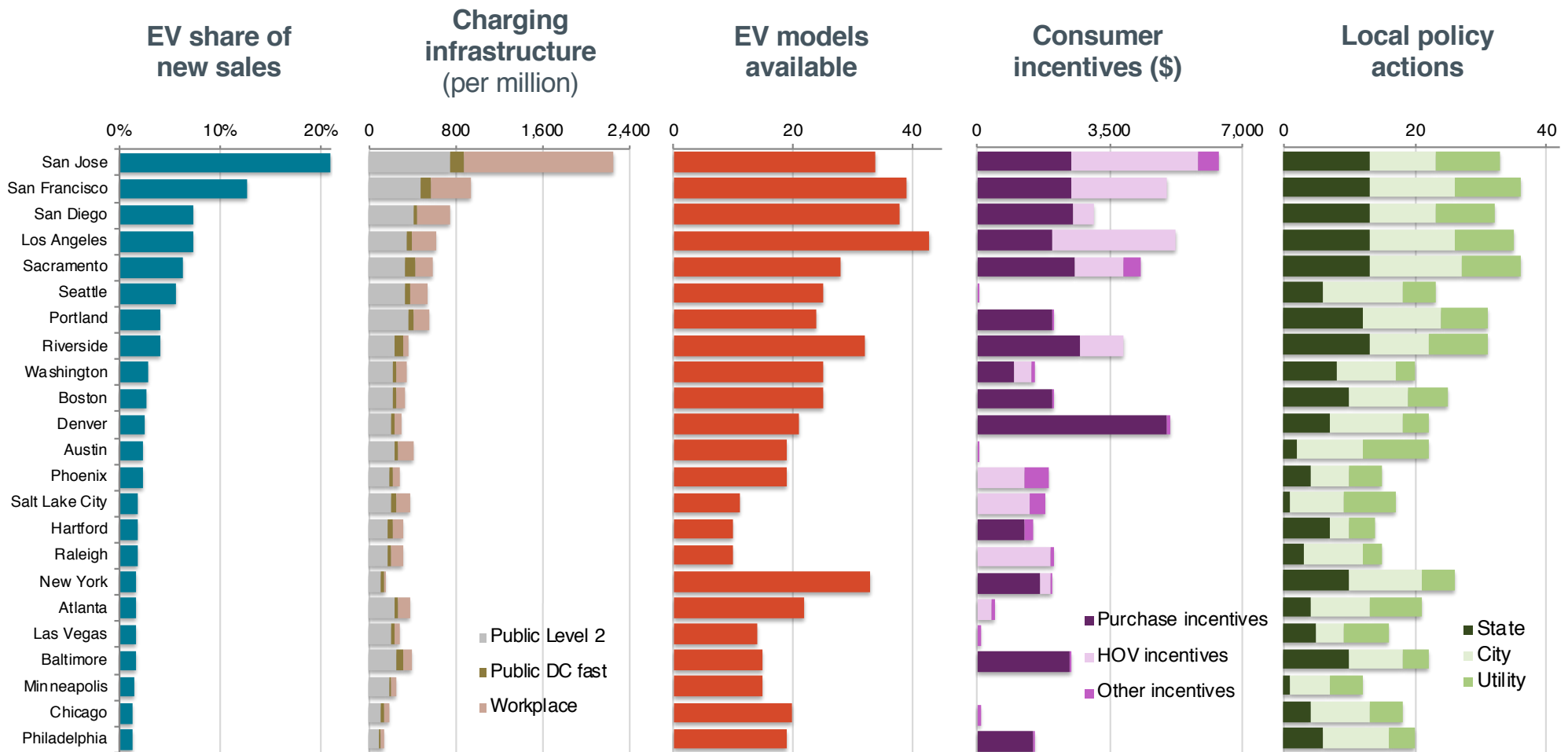
U.S. electric vehicle sales: Local markets

- 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



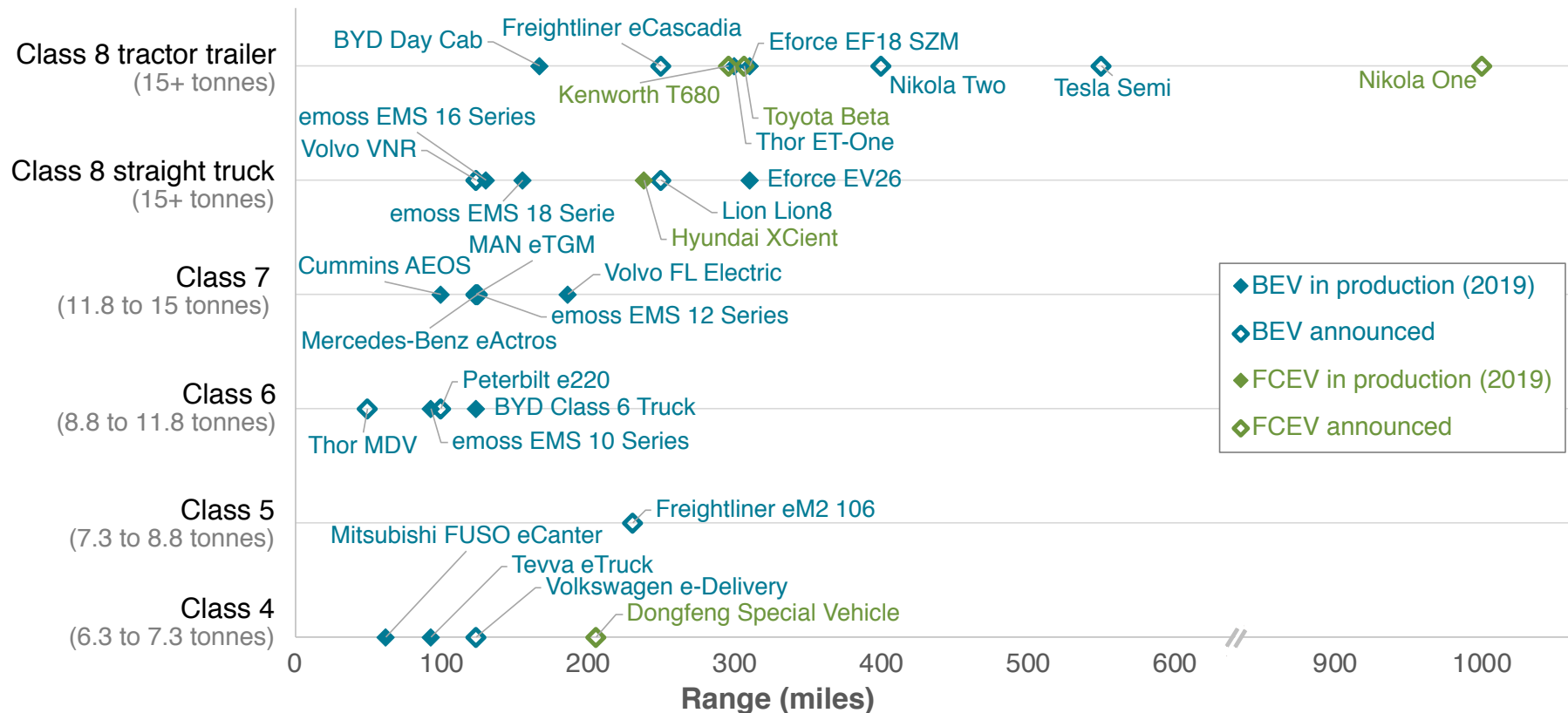
Zero-emission trucks

New electric and fuel cell trucks, cost analysis

Zero-emission commercial freight truck developments

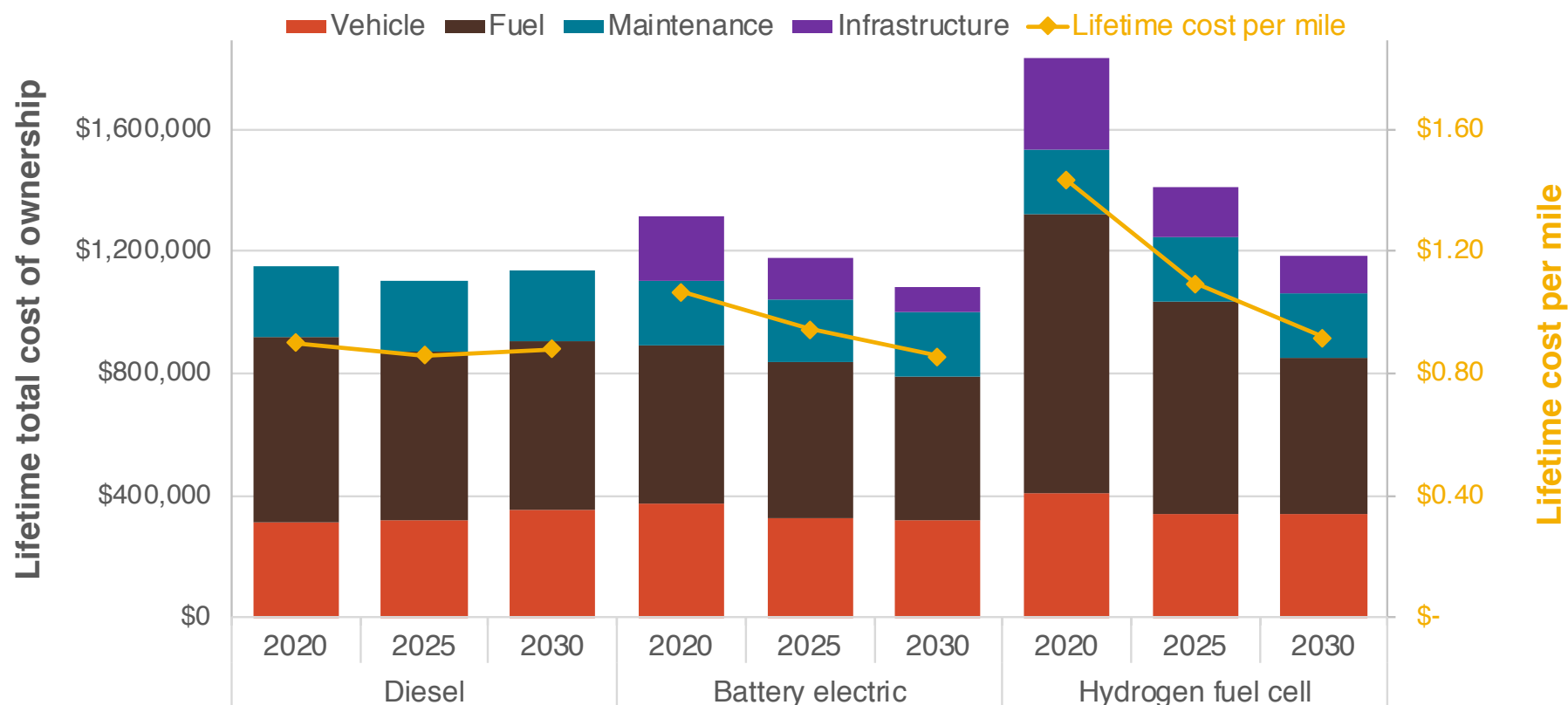
- Very promising developments across major truck classes

Gross vehicle weight class (U.S.)



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 CO₂ 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:

<http://www.theicct.org/publications/EV-capitals-of-the-world-2018>

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:

<https://www.theicct.org/publications/update-US-2030-electric-vehicle-cost>

Acknowledgements

Analysis and data collection by Pete Slowik, Dale Hall, Marissa Moultak, Hongyang Cui, Mikhail Grant, Sandra Wappelhorst, Huan Zhou, Mike Nicholas, Nic Lutsey