PitchBook

EMERGING TECH RESEARCH

Mobility Tech Industry Spotlight

Electric Vehicles

This spotlight covers the electric vehicles segment, which is featured in the **2Q 2019 Mobility Tech** report. The full-length report can be purchased through the PitchBook Platform.

Contact

Asad Hussain
Analyst, Emerging Technology
asad.hussain@pitchbook.com
206.480.1378

Executive summary

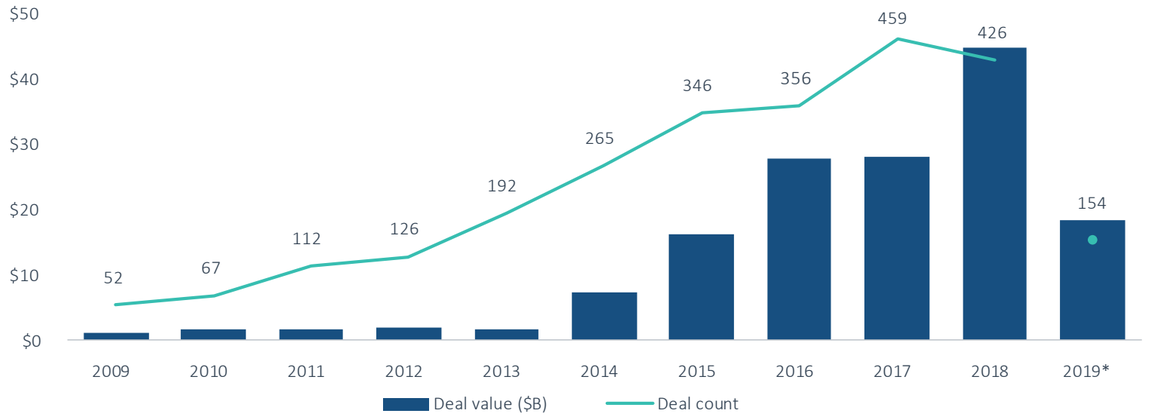
Consumer transportation is a massive global industry. In the US alone, households spent roughly $1.1 trillion annually for “on-road” transportation services, which includes the purchase, operation and maintenance of personal vehicles.[1] Despite the size and maturity of this market, however, it is rife with inefficiencies. Vehicles are often underutilized while large incumbent auto manufacturers and taxi service providers remain stagnant. This stagnation is reflected in the market capitalizations of the world’s largest auto companies which, for the past decade, have been relatively unchanged and have dramatically underperformed the broader stock market. While automakers have gone a long way in integrating automation technologies to extract more efficiencies from existing processes, these changes have not had a transformational impact on the industry. At the same time, the consistent rise in auto loans[2] underscores the increasing reliance consumers place on their cars even as the average automobile sits parked for 95% or more of its usable life.[3]

The development of the digital economy and mobile connectivity has altered this paradigm, giving rise to new technologies and business models that cater to what we see as strong underlying demand for low-cost, convenient and efficient mobility solutions. We believe this emerging industry of alternative mobility has helped bridge the divide between legacy methods of transportation and emerging methods of digital communication. This industry has given rise to several disruptive products and services including ridesharing and delivery platforms, micromobility scooter and bike services, commercial-scale fleet management tools and emerging autonomous vehicle technology. As the world becomes increasingly connected, we believe demand for mobility tech—or the intersection of transportation and technology—is higher than ever.

Venture funding has been key to fueling the growth of mobility tech. Since 2010, venture investors have invested $148.4 billion into mobility technology, with $44.7 billion invested across 426 deals in 2018. This sustained ability to finance capex-heavy private mobility startups helped fuel the rise Uber and Lyft, two companies revolutionizing and disrupting traditional methods of consumer—and increasingly commercial—transportation. We believe autonomous vehicles may represent the next phase of disruptive mobility technology, with startups including **Zoox** and **TuSimple** poised to usher in a new era. This report provides an overview of the mobility tech landscape and the products and services of the venture-backed startups in the space.

Figure 1.

Mobility tech VC deal activity



*Source: PitchBook | Geography: Global | *As of June 30, 2019*

1: “TET 2018–Chapter 6–Household Spending on Transportation,” Bureau of Transportation Statistics, United States Department of Transportation, n.d.
2: “The Rise in US Auto Loan Debt Shows No Signs of Slowing Down,” Forbes, Niall McCarthy, January 3, 2019
3: “‘Cars Are Parked 95% of the Time’. Let’s Check!” Reinventing Parking, Paul Barter, February 22, 2013

Mobility market map

Autonomous software

- Perception
- Full stack
- Localization/mapping
- Simulation & development tools

Autonomous hardware

- Lidar
- Radar
- V2X

Shared mobility

- Ridesharing
- Smart transit
- Micromobility
- Carsharing

Transportation logistics

- Freight
- Delivery

Charging & battery tech

- northvolt
- chargepoint
- Liotech
- QuantumScape

Electric vehicles

Electric vehicle makers

- Weltmeister
- Rivian
- BAIC BJEV
- XPENG
- Youxia
- Singulato
- 车和家 CHJ-Automotive
- Byton
- Leapmotor
- Novatr 天际
- Hozon 合众汽车
- Aiways
- Proterra
- Nikola
- Zero Motorcycles
- Iconiq

Car connectivity

- Connectivity & data management
- Fleet management
- Cybersecurity
- Parking

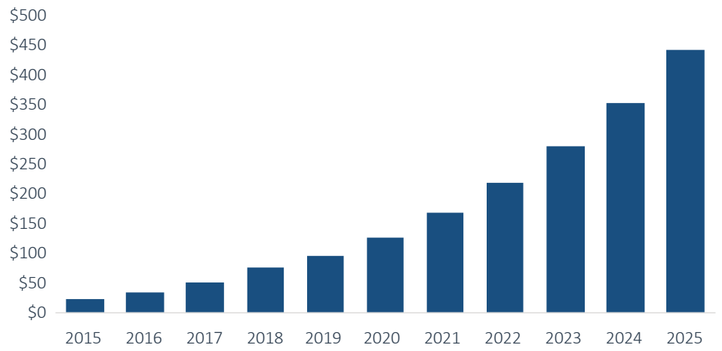
Companies included are VC-backed, segmented by primary use case and sorted by total capital raised as of June 30, 2019.

SEGMENT DEEP DIVE

Electric vehicles

ELECTRIC VEHICLES

Figure 33. MARKET SIZE ($B)



Source: Bloomberg, internal PitchBook estimates
Global Electric Vehicles Revenue

BUSINESS MODEL

Companies within this segment manufacture electric vehicles, powertrains and components, battery technology and charging networks, all of which enable wider adoption of electric vehicles. Electrification startups primarily compete with incumbent automakers and suppliers.

KPIS

- MSRP relative to ICE vehicles
- Vehicle performance (range, BHP, torque)
- Battery performance (cycle life, efficiency, energy density)
- Utilization of charging infrastructure

KEY PROVIDERS

Tesla, Nissan, GM, Bosch, Denso, BorgWarner, Rivian, Nikola, SAIC Motor, Proterra, BYD, BAIC BJEV, NIO, Geely, Karma, electrify america, chargepoint, Byton, OLA, SILA Nanotechnologies, Zero Motorcycles

KEY INVESTORS

Kleiner Perkins, GGVCapital, Innovate UK, Oak Investment Partners, VENTURES, tao capital partners, Next47 powered by Siemens, California Energy Commission, Daimler, Tencent 腾讯, DFJ, BMW i Ventures

NOTABLE DEALS

RIVIAN

April 2019 (announced)
$500.0M corporate round

Investor:
Ford

NIO

September 2018
$1.0B IPO

$8.5B valuation

INDUSTRY DRIVERS

- Demand from fleet operators for cost-effective vehicles less reliant on fuel
- Regulation mandating fuel efficiency and electrification, especially in urban areas, as well as government subsidies lowering the cost of electric vehicles
- Consumer shift toward climate-friendly forms of transportation
- Downward trend in lithium and battery costs driving adoption

Opportunities

Secular trends driving consumer adoption: Consumers are drawn to the electric vehicle story, which provides low-cost transportation with less harmful impact to the environment. Electric powertrains provide many benefits to consumers relative to traditional internal combustion engines, including lower long-term running and maintenance costs (i.e. no fuel and fewer moving parts) and improved performance from a more responsive and linear torque curve leading to better throttle response and a lower center of gravity resulting in better handling. Major automakers such as GM, Nissan and Toyota have debuted their own electric vehicles, and the success of Tesla's Model S and Model 3 demonstrate that electric vehicles have mass appeal and can be commercialized successfully by new entrants. Key venture-backed companies building electric vehicles include **Rivian**, **Weltmeister**, BAIC Group, **XPeng**, **CHJ Automotive**, **Nikola**, **Byton** and **Leapmotor**.

Market could quadruple by mid-2020s: We expect the total market for plug-in hybrid and battery powered electric vehicles to exceed $440 billion in 2025, up from $95 billion through 1H 2019. This would result in an increase in electric vehicle market penetration to roughly 11% of new car sales in 2025 from about 2% through 1H 2019. We expect this to be driven by a continuation in declining battery manufacturing costs increasing affordability. The development of charging infrastructure and the entrance of major automakers into the market will in turn increase consumer awareness and drive electric vehicle adoption.

The electric vehicle as a platform: Unlike internal combustion engines, electric powertrains are small, have few moving pieces and can be easily integrated into platforms that underpin multiple car designs, reducing the per-vehicle cost of manufacturing. For example, electric vehicle makers Tesla and **Rivian** have developed their own proprietary "skateboard" platforms, each of which consists of a skateboard-shaped chassis housing battery packs, motors, driveline and suspension components, wheels and braking systems—all the building blocks for driving. Toyota and Subaru also recently announced that they will collaborate on a shared all-wheel drive electric vehicle platform. **AEV Robotics** has gone a step further and created a modular vehicle system designed specifically for flexibility and vehicle shapes beyond passenger vehicles. Longer term, we expect the utility of these platforms to increase as they are used to build numerous products such as ridesharing shuttles, food delivery pods and logistics machinery.

Growing China opportunity: A significant number of key electric vehicle manufacturers including **Weltmeister**, Nio (which went public in late 2018), **Byton**, Seres and Lucid Motors are based in China or China-backed. China represents a huge market for electric vehicles. J.P. Morgan expects the country to account for 55% of global electric vehicle sales by 2025, driven by increased affordability, rapid deployment of charging facilities and additional subsidies and policies encouraging electric vehicle adoption.[23] The Chinese government is seeking to curb emissions by aggressively funding electrification startups in the region. According to Chinese government data, approximately 330 electric vehicle firms are registered for subsidies. Manufacturing in China allows avoidance of import tariffs and represents a key cost advantage for electric vehicle manufacturers attempting to break into the market.

23: "Driving into 2025: The Future of Electric Vehicles," J.P. Morgan, October 10, 2018

ELECTRIC VEHICLES

Favorable regulation: An increasing number of countries, regions and municipalities are adopting stringent targets to curb emissions from gasoline and diesel-powered vehicles. With zero emissions output, electric vehicles present a compelling alternative, and many countries offer subsidies to encourage electric vehicle sales. Major governments around the world are pushing increasingly stringent targets for the hybridization and electrification of vehicles. A multitude of countries including China, Denmark, France, India, Israel, Norway, the UK and Sweden have made soft commitments to phasing out new gasoline and diesel vehicle sales by the 2030-2040 timeframe. Municipalities are moving more quickly, with cities including Amsterdam, Brussels, Los Angeles, London, Madrid, Paris, Rome and Vancouver making soft commitments to phase out gasoline and diesel vehicles by the 2025-2030 timeframe. Some cities are seeking to aggressively curb emissions in the near term. In June 2019, Paris banned diesel car models preceding 2006 from the city; and in late 2018, Madrid banned gas and diesel-powered vehicles from its city center.

Electrification of buses: Although passenger vehicles are commonly thought of when referring to electrification, electric bus powertrains can yield greater emissions reductions given their relatively higher utilizations and per-vehicle contributions to emissions. Just as China is one of the largest markets for electric vehicles, it has become the leader in the electrification of buses. According to a Bloomberg report, of the nearly 425,000 electric buses in the world, 421,000 are in China.[24] Electrifying buses, which operate in dense urban locations with much higher utilizations compared to passenger vehicles, has an outsized impact in the reduction of greenhouse gas emissions and noise pollution. Key companies operating in the space include BYD Company, **Proterra** and **Vantage Power**.

Electrification of freight: We believe the use of medium-size and heavy electric trucks could see a 15x increase by 2025 as favorable operating economics drive adoption. In addition to reduced fuel costs, electric powertrains also have lower maintenance costs given fewer moving parts relative to internal combustion engines. Service and maintenance costs for electric fleets could run 20% less than diesel fleets.[25] Whereas diesel trucks require specialized equipment and highly trained mechanics, electric truck servicing requires less specialized equipment and labor. Electric trucks also have the potential to last longer than combustion engine trucks. While typical diesel trucks may have an average lifespan of roughly 10 years, electric battery warranties can last up to 12 years, and the vehicles are estimated to last up to 20 years. Moreover, as battery costs continue to decline, payback periods could fall significantly for these vehicles. Key companies developing truck electrification technology include Tesla, **Nikola**, **Wrightspeed Powertrains**, **VIA** and **XOS Trucks** (formally Thor Trucks).

Charging infrastructure benefits from fleet electrification: We see fleet electrification as a key growth driver for electric vehicle charging companies over the next 10 years. Today, the vast majority of charging systems in the US serve personally-owned passenger vehicles as opposed to commercially-owned fleet vehicles, but we expect this may change as more electric trucks enter usage. We expect a 15x increase in the global number of medium and heavy electric trucks on the road by 2025. Since basic charging services are generally commoditized with little differentiation among providers, we believe that full-service turnkey solutions that can provide integration with fleet management and telematics software present a relatively more competitive product to provide in the current mobility ecosystem.

24: "China Set to Dominate Electric Vehicle Battleground for Decades," Bloomberg, with assistance by Ying Tian and Adrian Leung, May 15, 2019
25: Ian Gardner, CEO at Royale EV., Panel at Sustain SoCal Driving Mobility Conference, June 25, 2019

ELECTRIC VEHICLES

Key companies providing electric vehicle charging solutions include **ChargePoint**, ABB, Siemens, Electrify America (a subsidiary of VW), **EVgo** (acquired by Vision Ridge Partners through a $120.0 million LBO in 2016), **Greenlots** (acquired by Shell in early 2019), **BTCPower** (acquired by Innogy in 2018), **Blink** and Efacec. This is a competitive market, with large incumbents General Electric and Schneider Electric forced to exit the market. We believe partnerships between various players in the ecosystem will be key to streamlining the consumer experience and increasing electric vehicle adoption. In an example of this, two of the largest players in this space, **ChargePoint** and Electrify America, recently announced a partnership to allow cross-charging across networks.

Autonomy to drive adoption of electric vehicles: The eventual rise of autonomous vehicle fleets could further catalyze the adoption of electric vehicles. Fully electric vehicles have inherent computing advantages that may be more suited to autonomous vehicles relative to combustion engines. In addition to fuel savings and maintenance advantages, the ability to wire the mechanics of a car directly to a computer could help facilitate the deployment of autonomous driving software relative to retrofitting such systems to work with traditional internal combustion powertrains.

Opportunities in battery production: The growth of electric vehicles will drive opportunities to invest in the powering and charging ecosystem. Key players in this space include **Enevate** and **HyperStrong**. We expect increased demand for electric vehicle batteries will drive lithium demand over the next decade. We expect global demand for lithium to grow at a double-digit annual rate through 2025, with lithium suppliers Albemarle and SQM well positioned to benefit primarily from volume growth. Another company in the space, **Sila Nanotechnologies**, seeks to disrupt the lithium ecosystem by developing an alternative-energy dense material based on silicon. In June 2019, **Northvolt**, a Swedish battery startup, announced a $1.0 billion equity capital raise led by VW and Goldman Sachs to build a battery gigafactory in Sweden as well as a separate joint venture with BMW to build a gigafactory in Germany. We believe companies such as Tesla and **Northvolt** are well poised to significantly drive down the cost of battery production, which could in turn disrupt incumbent fossil fuel industries to the extent this drives electric vehicle adoption.

Considerations

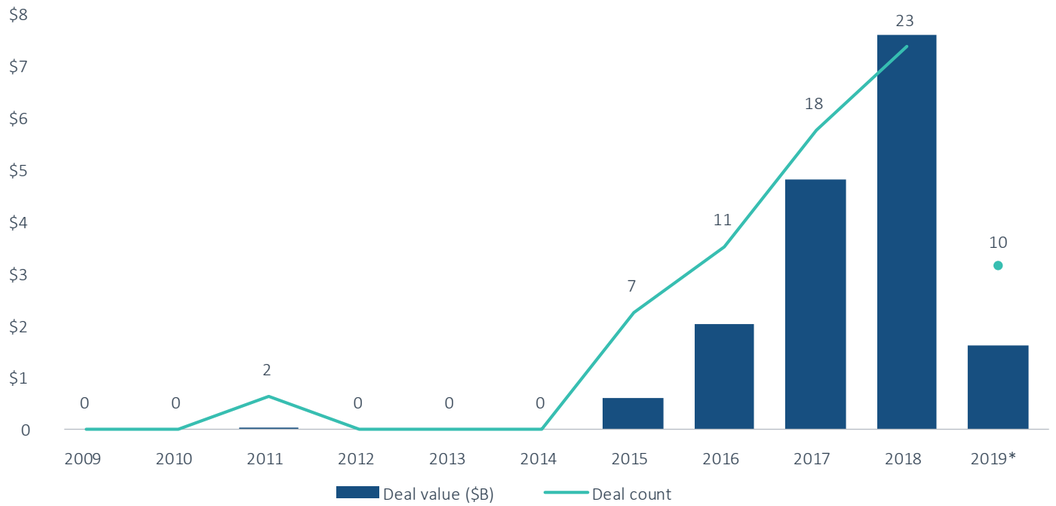
Complications of fleet electrification: Without the right technology and products, moving a fleet to electric can be a dauntingly complicated process, and this may slow adoption. The back-end logistics of scheduling and routing vehicles to charge efficiently can be disruptive to daily operations and harm customer experience. We believe that integrated charging solutions (i.e. charging locations, software and other infrastructure) that can share information with existing fleet management software (i.e. routing, dispatch and telematics) represent a key point of differentiation. Moreover, as charging stations are often located within parking garages or parking lots, their ability to connect with a structure's electric grid can help optimize energy consumption. As this emerging industry develops, we believe fleet managers will increasingly seek full turnkey-managed charging services that can help them navigate the complications of developing and implementing charging infrastructure. We think companies such as **ChargePoint** that offer these bundled, integrated solutions are well positioned to benefit from fleet electrification.

High capital intensity and thin margins: Developing and manufacturing electric vehicles is a capital-intensive business model with thin margins even at scale. For example, Tesla reportedly came close to bankruptcy while ramping up production of the Model 3. Electric vehicle maker **Faraday Future**—which has yet to produce a product—has also reportedly faced significant financial and management problems this year, having received a $225 million bridge loan in April and support from a local government in Inner Mongolia. These firms' difficulties reflect challenges hindering success in the automotive industry, which is stacked with well-funded, entrenched incumbents.

Scrutiny from investors in an increasingly competitive space: Cracks in the electric vehicle story have emerged in the form of potentially diminished demand from consumers, especially in China. Sales of electric vehicles were up just 1.8% YoY, a sharp deceleration from the 126% growth rate seen last year.[26] Electric vehicle manufacturers such as Tesla and Nio have stumbled when it comes to hitting delivery targets and have suffered issues such as car fires, leading to sharp declines in their share prices.

Figure 34.

Chinese electric vehicle VC deal activity



*Source: PitchBook | Geography: China | *As of June 30, 2019*

26: "A Year Ago, China's Electric Vehicle Sales Grew 126%. Now They're at 2%" Quartz, Echo Huang, June 12, 2019

ELECTRIC VEHICLES

Funding availability: So far this year, startups developing electric vehicles have raised just $2.3 billion in venture funding, well below the $10.9 billion raised last year. We believe this shortfall may reflect growing skepticism of early-stage companies in the industry and more caution among investors.[27] This shortfall is particularly pronounced in China, where government subsidies promoting electrification have recently been limited and qualification requirements have become stricter. Venture funding toward China-based electric vehicle firms totaled $1.6 billion in the first two quarters of 2019, putting the full year on pace to fall short of the previous year's peak of $7.6 billion.

Success dependent on subsidies: According to Chinese government data, approximately 330 electric vehicle firms are registered for subsidies. However, China is moving toward reducing subsidies and raising qualification standards.[28] Electric vehicles with ranges under 155 miles have been disqualified, and many vehicles meeting this requirement will see their subsidies cut by as much as 60%. This is part of a broader effort by the Chinese government to focus its funding toward the best companies and push them to become self-sufficient, as opposed to propping up the unsustainable tail end of the industry.[29] This will likely have a significant impact on the operations of many Chinese electric vehicle companies. As funding dries up, these enterprises (many of whom are currently unprofitable) will find it more difficult to subsidize manufacturing and may pass higher costs on to consumers, potentially reducing sales.

Dependence on lithium deflation: Successful commercialization of electric vehicles will depend on the cost to produce them converging with the cost to produce internal combustion engine vehicles. While governments subsidies help, the continued price decline of lithium, a key component of electric vehicle batteries, will also be critical as we expect global demand for lithium to grow at a double-digit annual rate through 2025. While electric vehicle battery costs have been declining, a reversal of this trend could impede growth in the industry.

Branding key to penetrating market: We believe the untested nature of electric vehicle brands will be a key obstacle facing new entrants seeking to gain a foothold in the $440 billion auto market. We believe companies that can establish a well-known brand are best positioned to dominate this market in he future. Research shows that affinity to car brands is particularly robust, and consumers tend to stick to brands they know. According to a study by R.L. Polk Automotive, 48% of car purchasers in 2012 bought from the manufacturer of the car they were currently driving.[30] This dynamic intrinsically creates a barrier to entry for consumers wary of making a large investment of their capital into an untested and potentially unreliable new brand. In our view, manufacturers doing well at branding to set themselves apart include Tesla and **Rivian**, who are marketing themselves toward environmentally conscious, outdoorsy consumers that are enthusiastic about technology.[31]

27: "Electric Dreams in Danger as Funding Dwindles for China's Tesla challengers," Reuters Business News, Kane Wu, Yilei Sun, and Julie Zhu, June 18, 2019
28: Ibid.
29: "China's Electric Vehicle Sales Will Continue to Boom Despite Subsidy Costs, Fitch says," CNBC News, David Reid, April 8, 2019
30: "How Auto Makers Keep You Coming Back," The Wall Street Journal, Joseph B. White, January 22, 2013
31:"The CEO of Rivian Explains Why His Electric Vehicles Will Beat Audi, Mercedes Benz, and BMW with its First 2 Electric Vehicles," Business Insider, Mark Matousek, May 9, 2019

Outlook

Increasing adoption: Electric vehicle market penetration appears set to continue increasing over the long term, and we forecast electric vehicles will represent approximately 11% of all new car sales by 2025, up from 2% in 2018 (see Figure 35). We expect increased affordability to drive consumer adoption as providers scale, as lithium and battery pack costs decline and as regulatory subsidies persist.

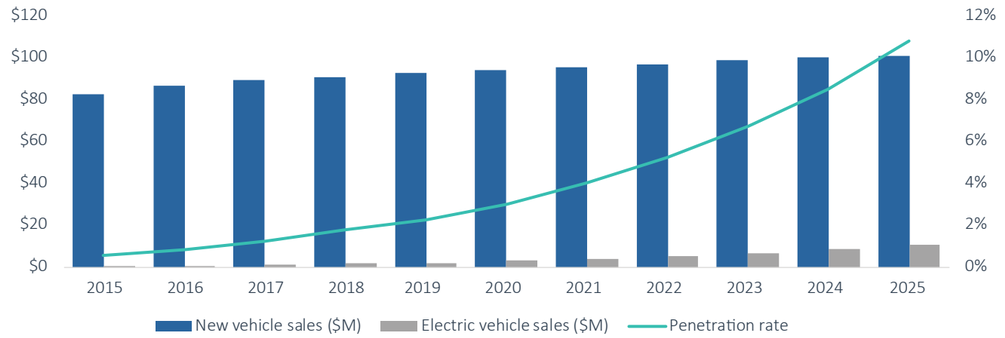
Acquisiton of electric vehicle platforms: We expect the electric vehicle industry to become more consolidated over the next few years as incumbent automakers seek to expand into the space. Attractive acquisition targets include companies such as **Rivian** and **AEV Robotics**, which provide electric vehicle platforms that could underpin several disparate use cases.

I**ncreased competition from automakers:** We anticipate barriers to entry in the electric vehicle space to increase as automakers saturate the market. In the US, leading automakers in the electric vehicle industry include Tesla, GM and Nissan (see Figure 36). We expect competitive pressure from these incumbents to increase as they make broader pushes into electric vehicle sales. Ford plans to sell 40 electric models by 2025 as part of an $11 billion investment into electrification; Toyota plans to invest $13 billion into electrification technology over the next 10 years; and VW plans to sell 50 models by 2025 as part of a $40 billion investment into batteries and electrification technology.[32]

Corporate venture funding to fuel electric vehicle startups: Developing, manufacturing and bringing electric vehicles to market is a capital-intensive process, and we believe large corporations are well suited to fund this investment. We expect corporate VC

32: "World's 10 Biggest Automakers & Their EV Plans," CleanTechnica, Zachary Shahan, October 29, 2018

Figure 35. ELECTRIC VEHICLE UNIT SALES ESTIMATE



Source: Bloomberg, internal PitchBook estimates

Figure 36. TOP US ELECTRIC VEHICLE MANUFACTURERS

Electric vehicle manufacturer	Unit sales (#) since 2010
Tesla	409,465
GM	203,994
Nissan	134,392
Ford	106,195
Toyota	100,759
BMW	70,491
Flat	26,858
Honda	25,018
VW	14,941

Source: Visual Capitalist | Data as of May 2019

deal flows to electric vehicle companies to increase over the next few years. Examples of this include **Rivian**'s $700 million round led by Amazon in February 2019 and a $500 million corporate investment from Ford in April 2019. This trend has been particularly pronounced in China with electric vehicle makers such as Nio and **Weltmeister** receiving large investments from Chinese technology companies such as Alibaba and Baidu.

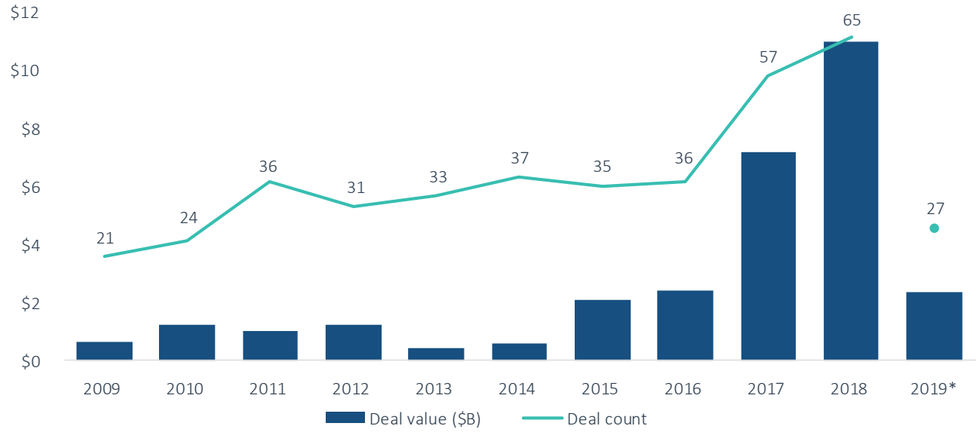
VC investment

Moderating venture investing: 2018 was a standout year for venture investing into electrification startups, with $11.0 billion deployed into the space across 65 deals. So far, 2019 is on pace to moderate from the highs of 2018 with fewer deals.

Early-stage deals: Since 2008, most venture funding in the electric vehicles space has gone to early-stage deals. Attracted by the significant disruption and addressable market opportunity of electric vehicles, venture investors have deployed over $15.5 billion to angel, seed and early-stage VC rounds since 2008.

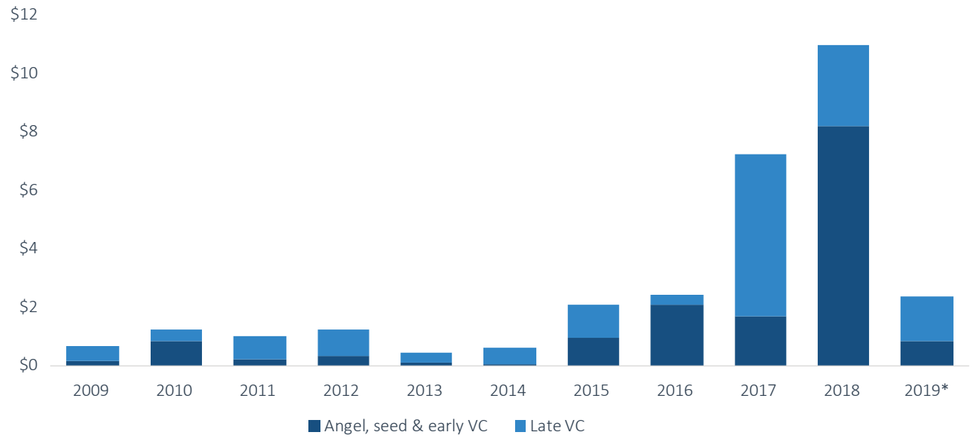
The dominance of China: We note that 13 out of the 15 top electrification venture deals since 2015 have been by Chinese companies, which include **Weltmeister**, **BAIC Group** and Nio (see Figure 39). Standout deals in 2019 so far include the $440 million (CNY 3 billion) Series B round in **Hozon Auto** from the Chinese government as well as another $448 million (CNY 3 billion) Series C round in **Weltmeister** led by Baidu.

Figure 37. ELECTRIC VEHICLES VC DEAL ACTIVITY



*Source: PitchBook | Geography: Global | *As of June 30, 2019*

Figure 38. ELECTRIC VEHICLES VC DEALS ($B) BY STAGE



*Source: PitchBook | Geography: Global | *As of June 30, 2019*

Figure 39.

Largest electric vehicle VC deals (2008-2Q 2019)

COMPANY	CLOSE DATE	DEAL SIZE ($M)	PRE-MONEY VALUATION ($M)	POST-MONEY VALUATION ($M)	DEAL TYPE	DEAL TYPE 2	HQ LOCATION
Weltmeister	April 16, 2018	$3,176			Early-stage VC		Shanghai, China
Faraday Future	June 25, 2018	$2,000		$4,444	Corporate	Series A	Los Angeles, United States
BAIC BJEV	August 15, 2017	$1,600	$2,600	$4,200	Late-stage VC	Series B	Beijing, China
Nio	November 8, 2017	$1,000	$4,000	$5,000	Late-stage VC	Series D	Shanghai, China
Weltmeister	August 8, 2016	$1,000			Early-stage VC	Series A	Shanghai, China
Youxia Motors	March 31, 2018	$791	$1,139	$1,929	Early-stage VC	Series B	Shanghai, China
Nio	March 1, 2017	$600	$2,600	$3,200	Late-stage VC	Series C	Shanghai, China
Singulato Motors	November 8, 2018	$600			Early-stage VC	Series B	Beijing, China
Xpeng	December 26, 2018	$584	$3,064	$3,648	Late-stage VC	Series B	Guangzhou, China
Nio	September 22, 2015	$500			Early-stage VC	Series B	Shanghai, China
Singulato Motors	April 26, 2018	$476			Late-stage VC	Series C	Beijing, China
CHJ Automotive	March 22, 2018	$474			Early-stage VC	Series B	Beijing, China
Byton	June 11, 2018	$463			Corporate	Series B	Nanjing, China
Liotech	January 1, 2010	$454			Early-stage VC		Novosibirsk, Russia
Weltmeister	March 8, 2019	$438			Late-stage VC	Series C	Shanghai, China

PitchBook