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<b>Docketed Date:</b>	8/5/2019

# Electric Vehicle Outlook 2019.

**BloombergNEF**

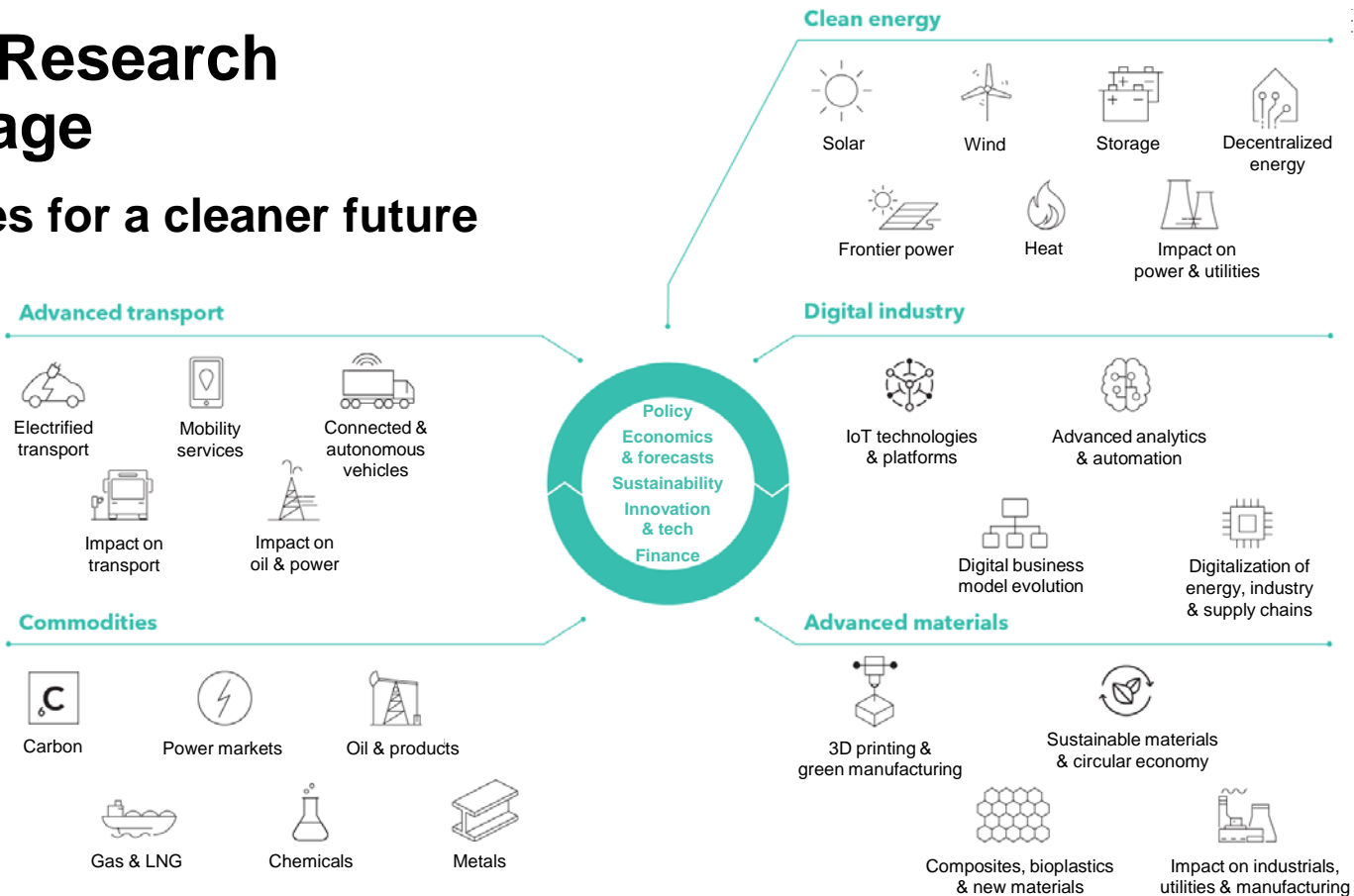
**Nick Albanese**  
**Nikolas Soulopoulos**  
August 5, 2019

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# BNEF Research Coverage

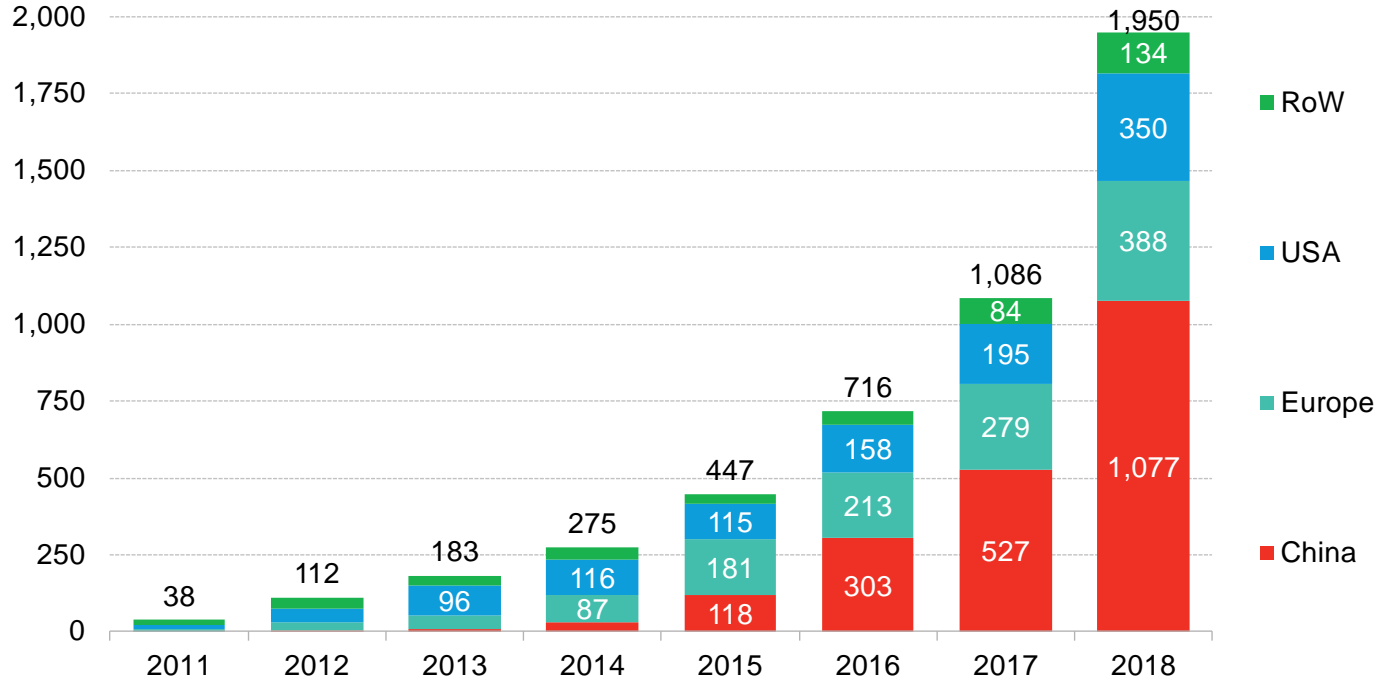
## Strategies for a cleaner future



Source: BloombergNEF.

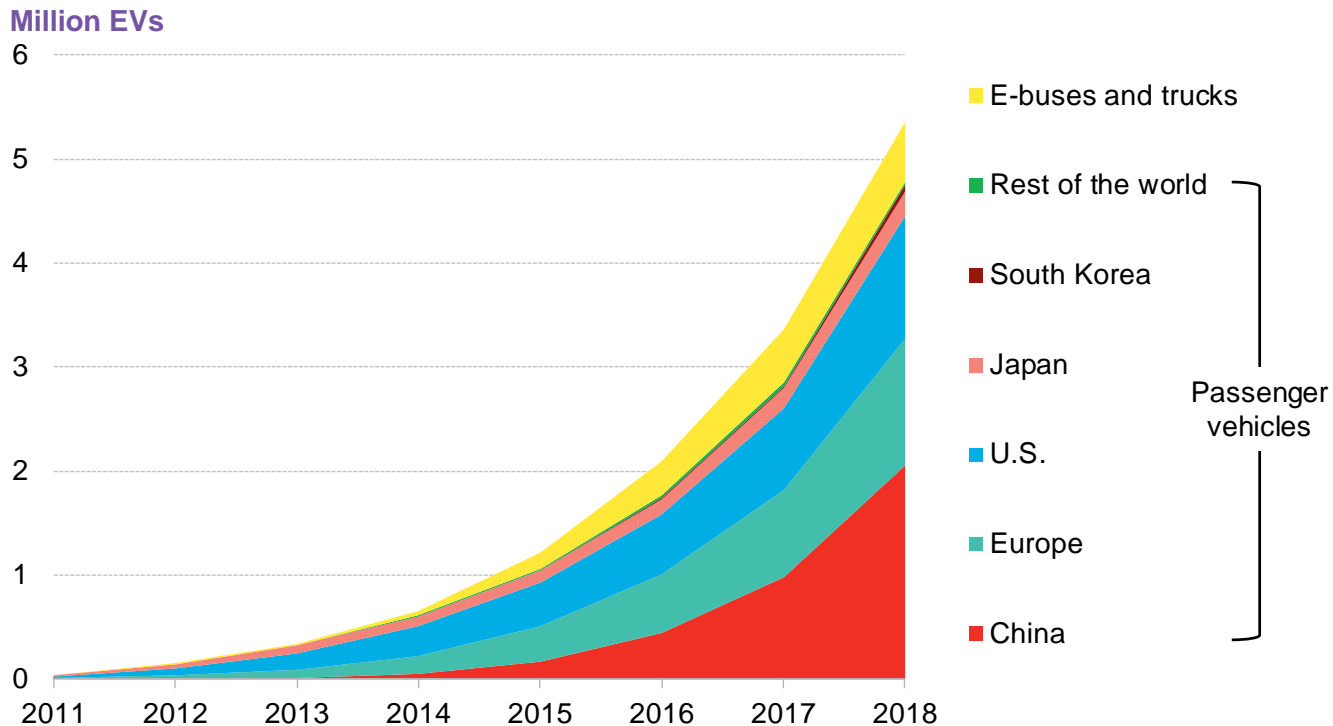
# Annual passenger EV sales continue to increase each year

Thousand EVs



Source: BloombergNEF, Marklines.

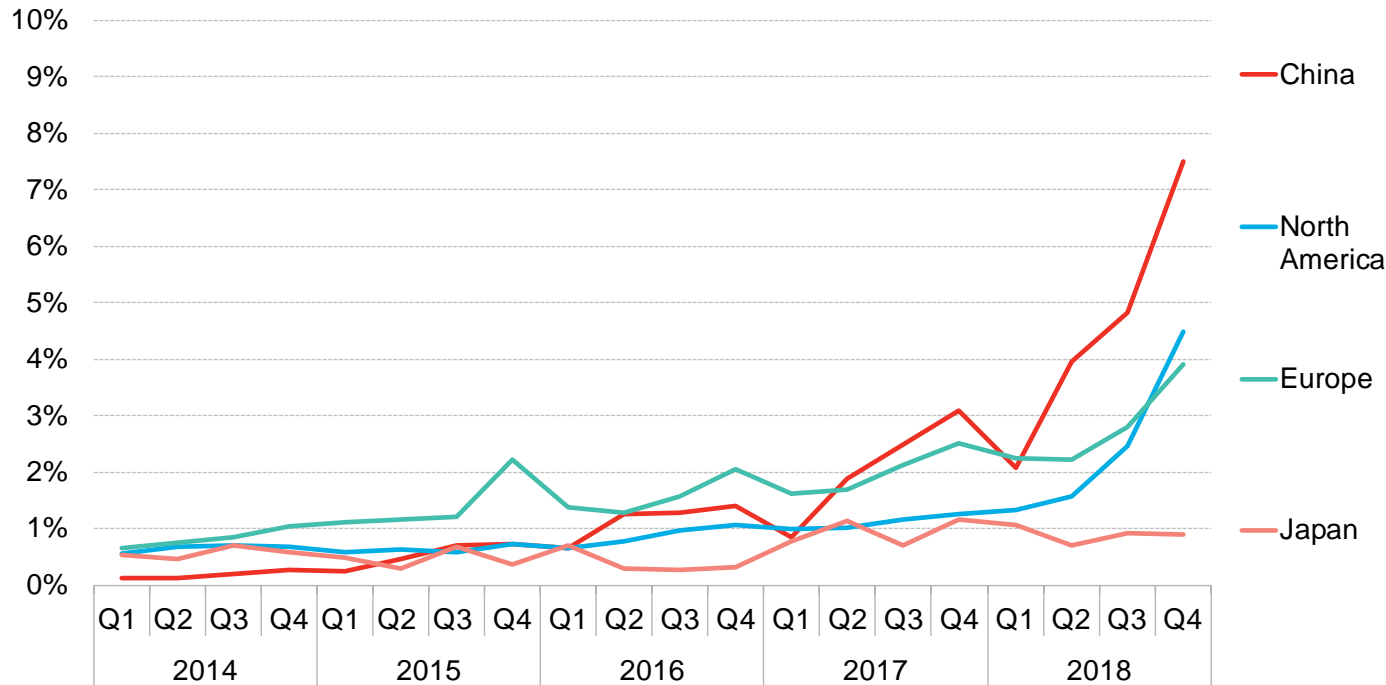
# There are now around 5 million passenger EVs on the road



Source: BloombergNEF, Marklines.

# EVs are still only 2-4% of sales in most markets on an annual basis

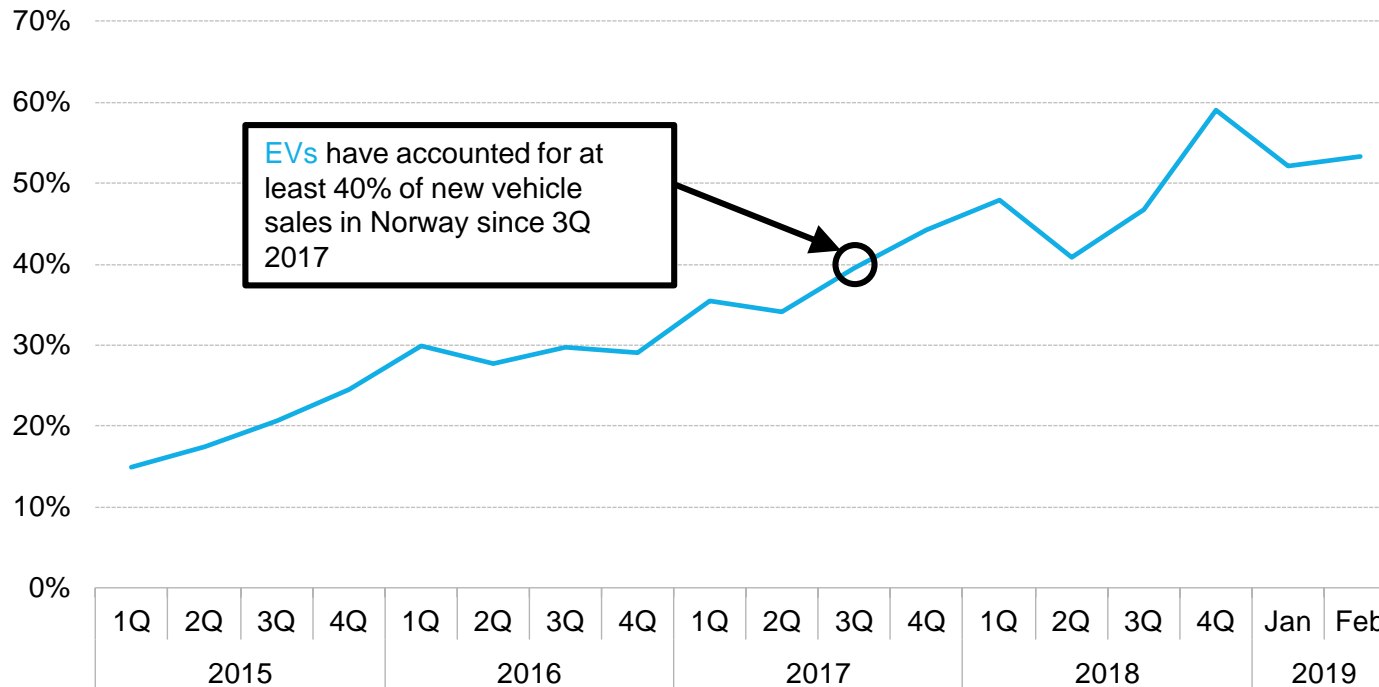
Quarterly EV sales share



# Some markets are much further ahead



Quarterly EV sales share in Norway

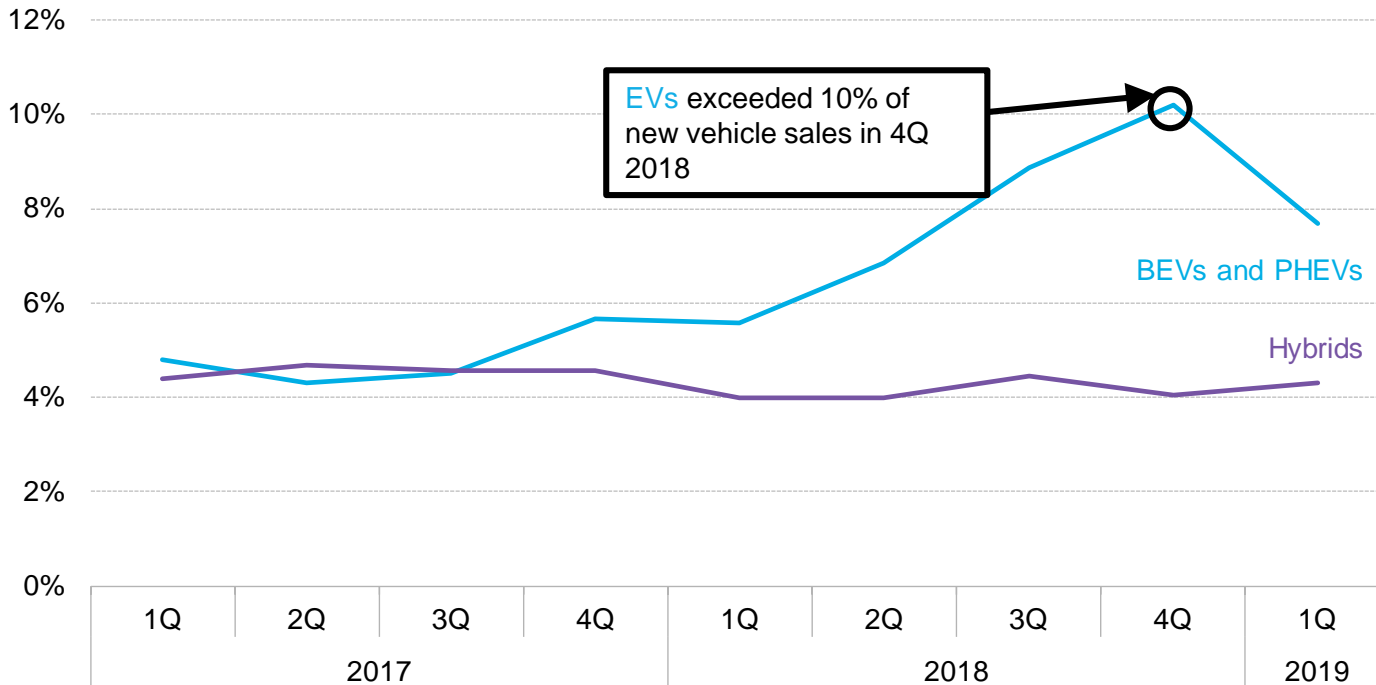


5 Source: BloombergNEF, Norwegian Road Traffic Information Office, InsideEVs, automakers. @BloombergNEF

# Some markets are much further ahead



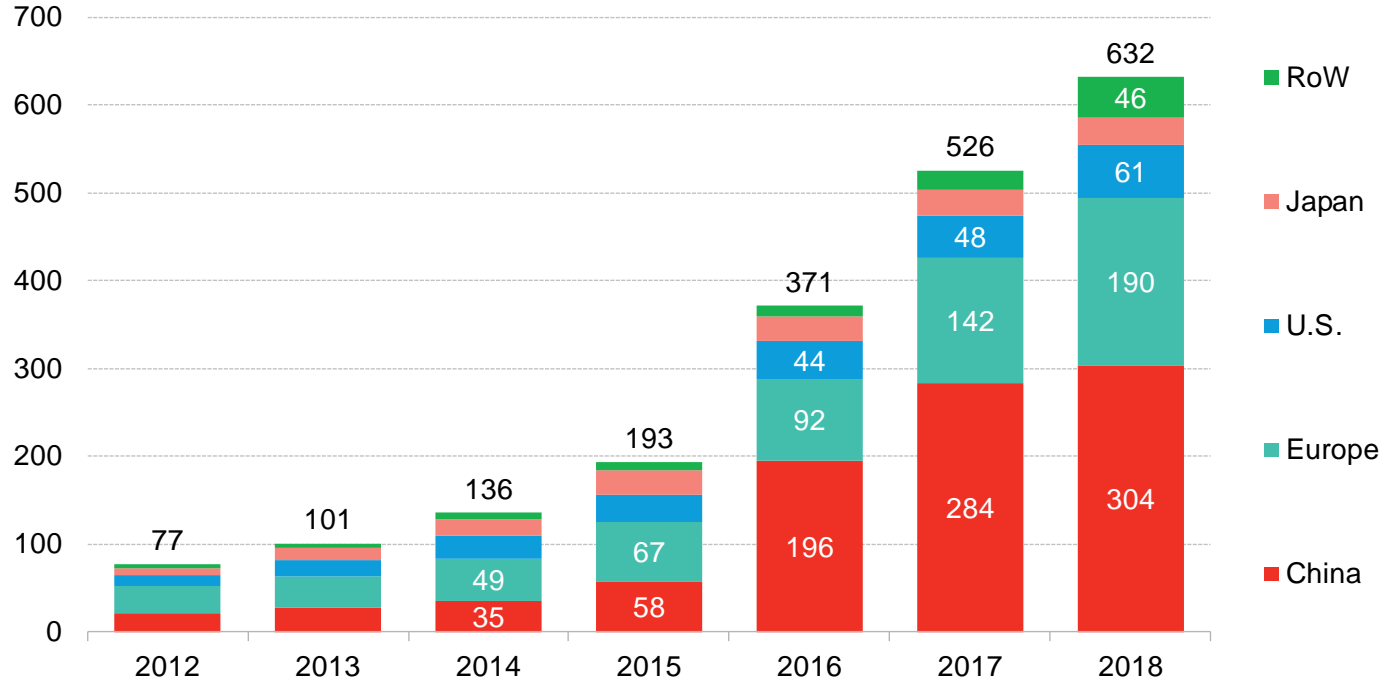
Quarterly EV sales share in California





# Public charging infrastructure grew 20% in 2018

Thousand charging points

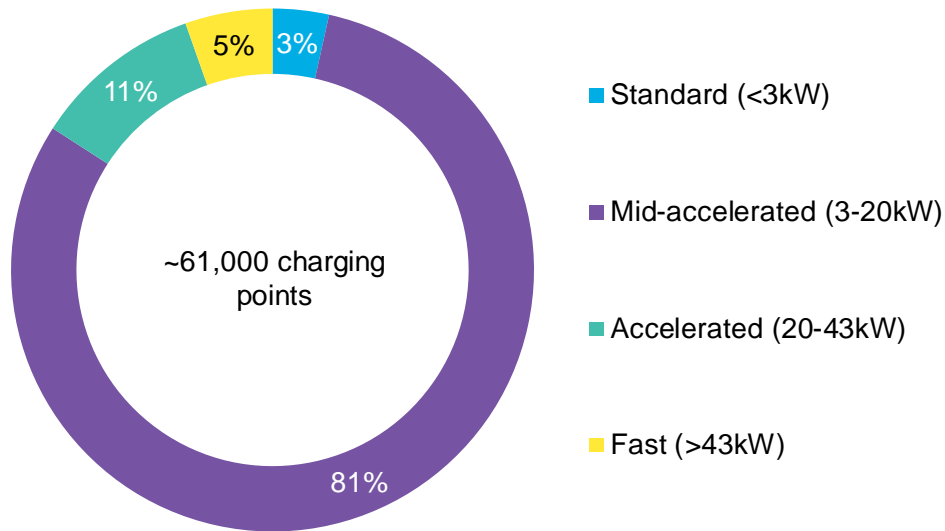


7 Source: BloombergNEF. Note: Values rounded and approximate. Data as of 2018.

# Breakdown of public U.S. charging points

Charging point type breakdown

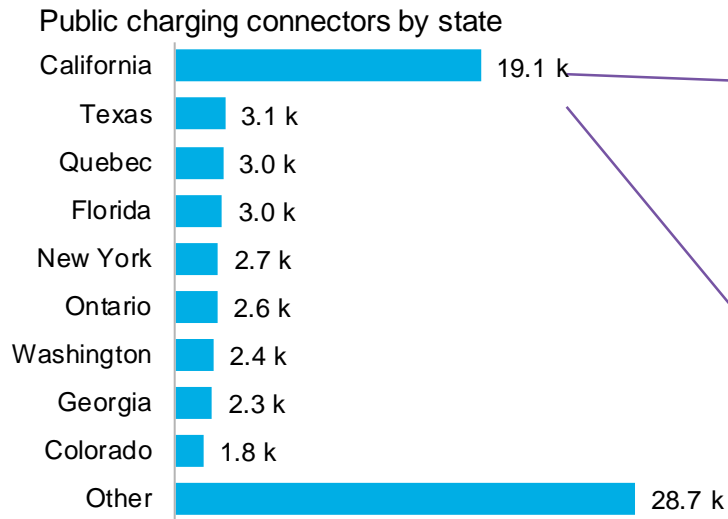
%



Source: BloombergNEF. Note: Values approximate. Data as of 2018.

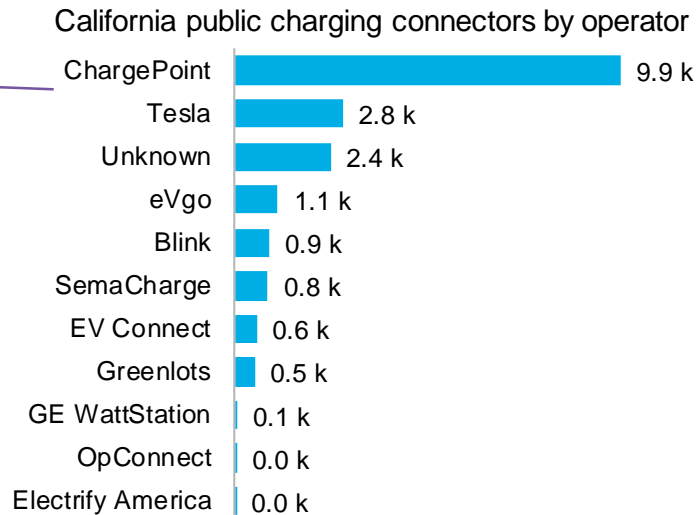
# Public charging infrastructure installations are rising

## Public charging connectors – U.S.



Source: BloombergNEF. Note: Data as of 2Q 2019

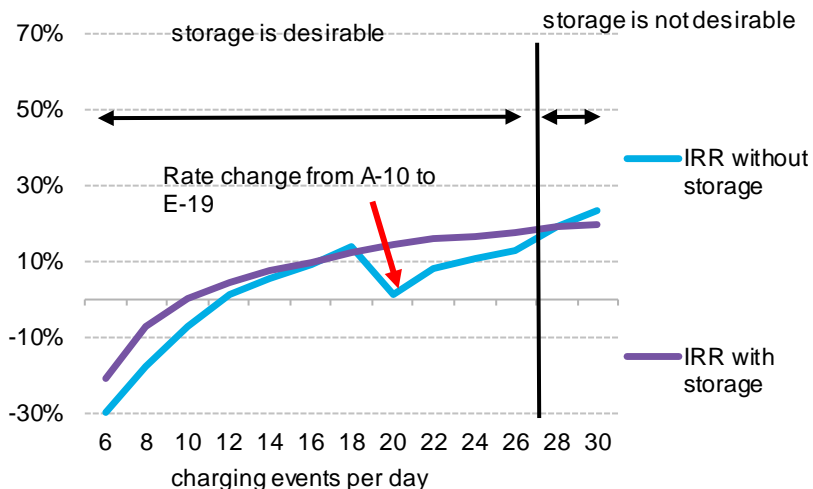
## Public charging connectors – California



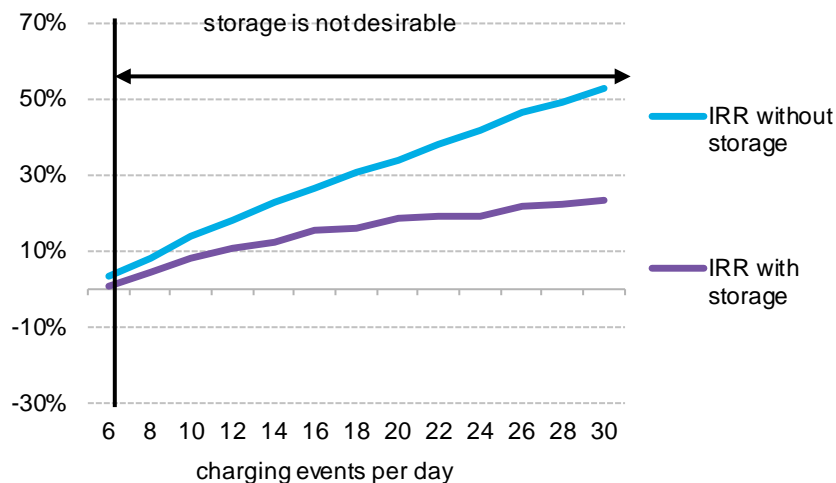
Source: BloombergNEF. Note: Data as of 2Q 2019

# The economics of public fast chargers are challenging

Fast charging IRR with and without storage in PG&E's service territory



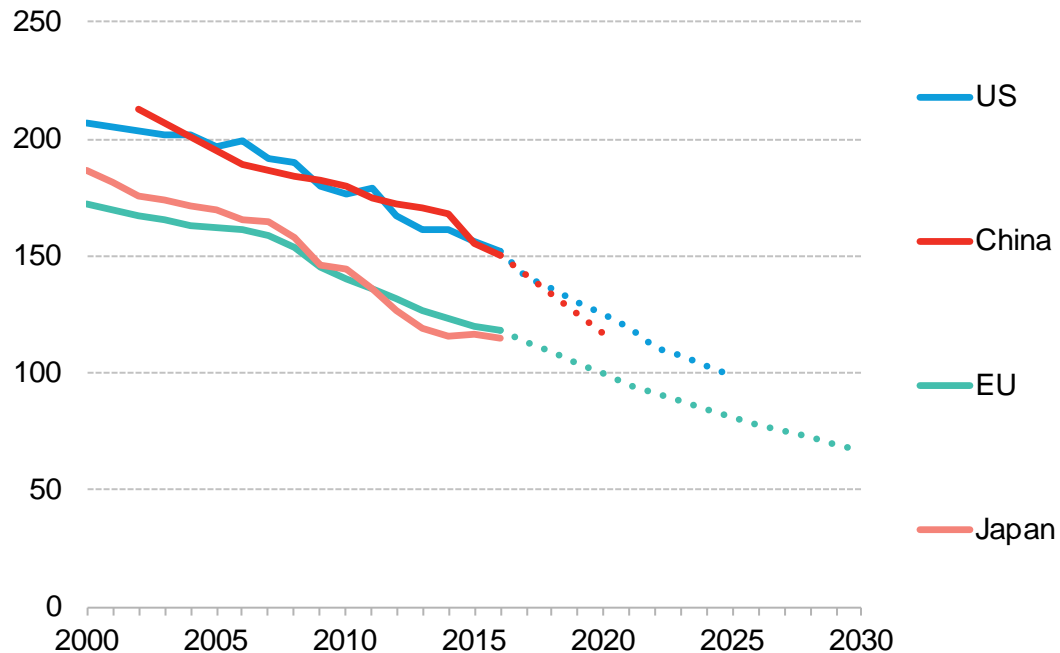
Fast charging IRR with and without storage in SCE's service territory under proposed charging tariffs







Source: BloombergNEF, PG&E, SCE Note: Storage is sized to cap grid demand at 150 kW; results as of October 2018.

# Fuel economy regulations globally

gCO<sub>2</sub>/km



## Regulated vehicle emissions targets

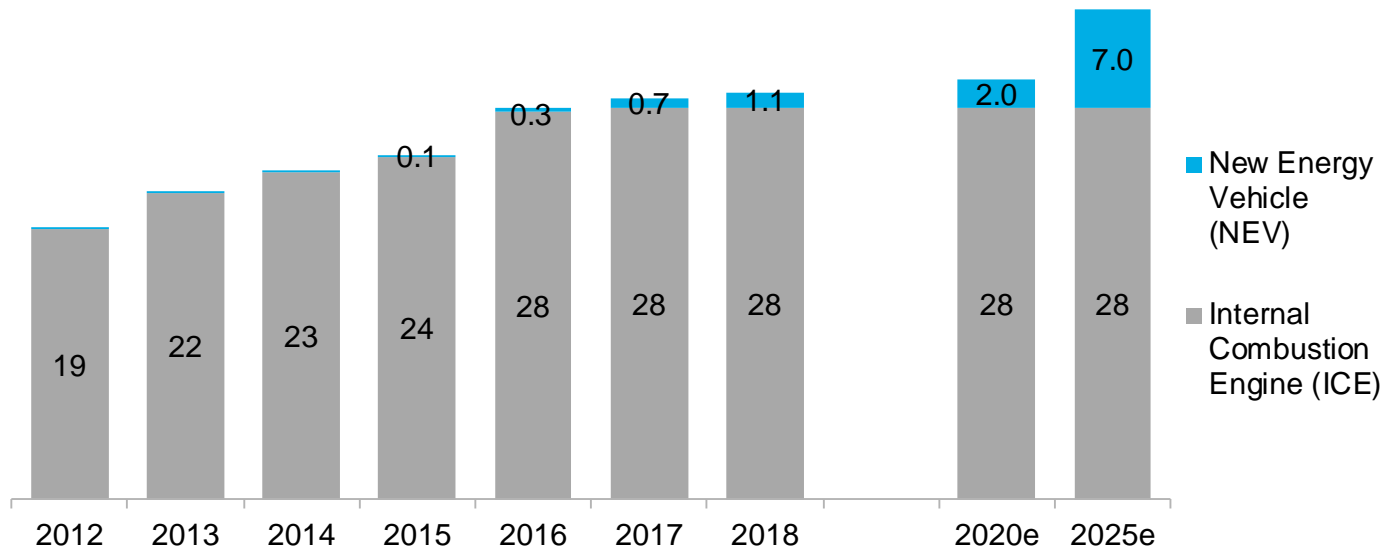
Country/Region	Time frame	Reduction in CO <sub>2</sub>
EU 	2021-2030	-37.5%
U.S. 	2017-2025	-30%
China 	2017-2020	-18%
Japan 	2020-2030	-44%

Source: ICCT, BloombergNEF. Note: Historical data and future targets are converted to the NEDC testing cycle. U.S. target are for passenger cars only and correspond to the targets as originally written before the conclusion of the mid-term review.

# China vehicle sales targets in the 2025 auto plan



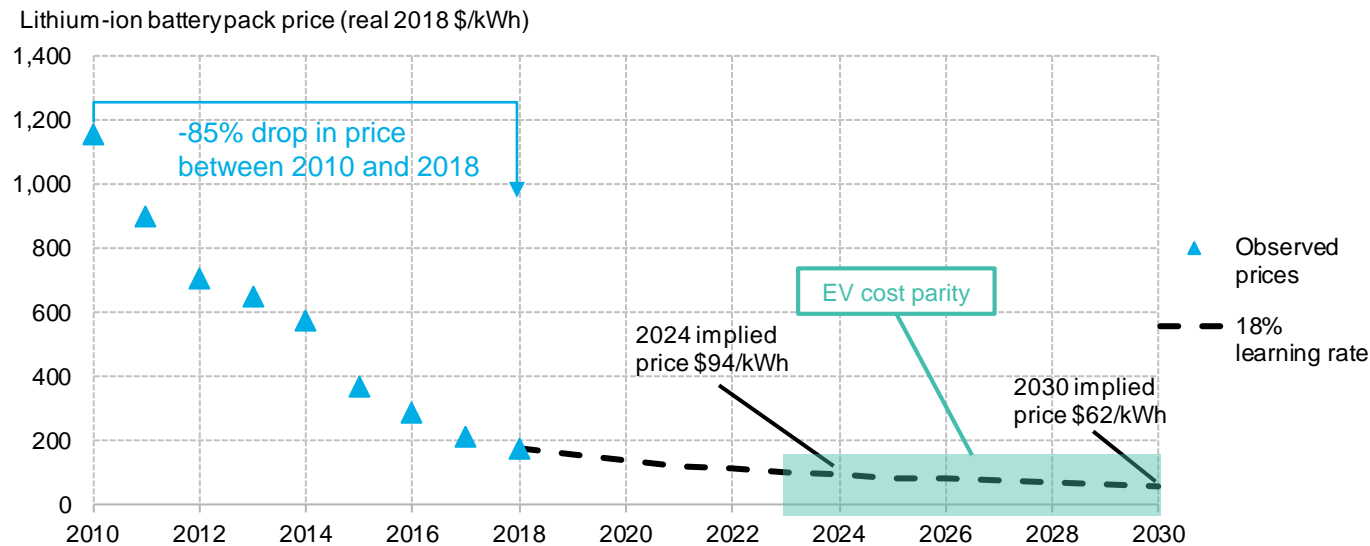
Sales in millions



Source: MIIT, NDRC. Note: NEV target includes both passenger and commercial vehicles.

# Lithium-ion battery prices keep falling and are key to EV affordability

Volume-weighted battery pack prices have been falling

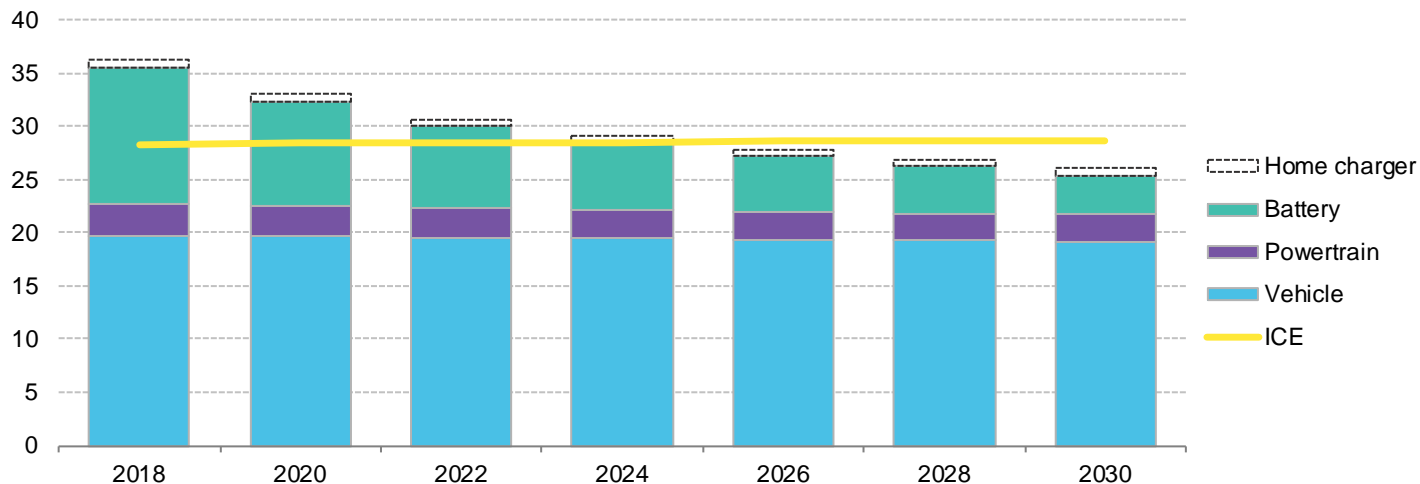


Source: BloombergNEF. Note: Prices have been changed to real 2018 dollars.

# Passenger electric vehicles reach price parity in the mid 2020s

## U.S. pre-tax retail price for a medium ICE and BEV with the addition of home charger cost

real 2018 thousand dollars

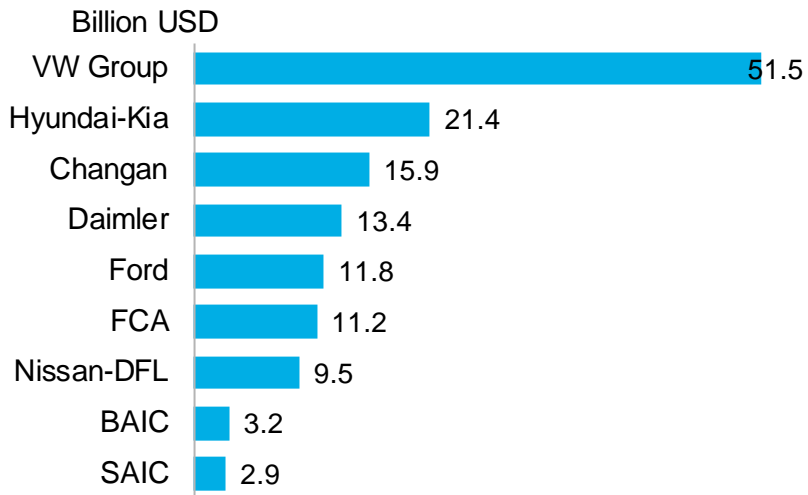


Source: BloombergNEF. Note: We assumed the same real world driving range for EVs globally; small=200 miles, medium=250 miles, large, SUVs=300 miles.

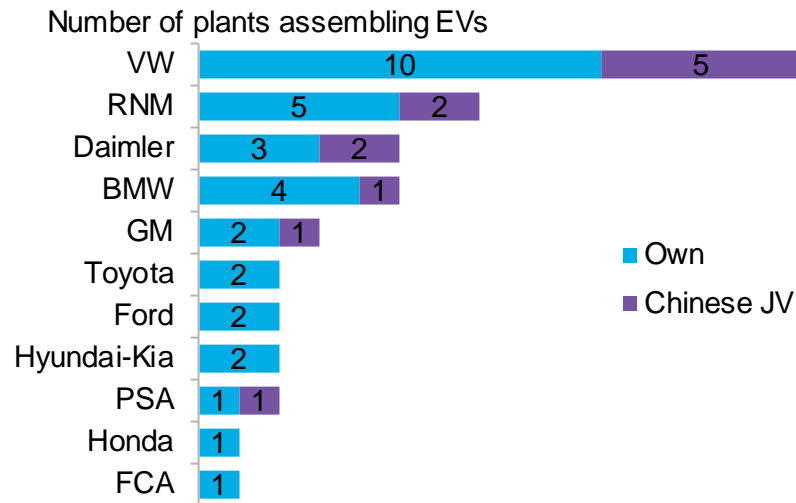


# Major automakers are ramping up EV investments

## Announced electrification investments (as of 1H 2018)

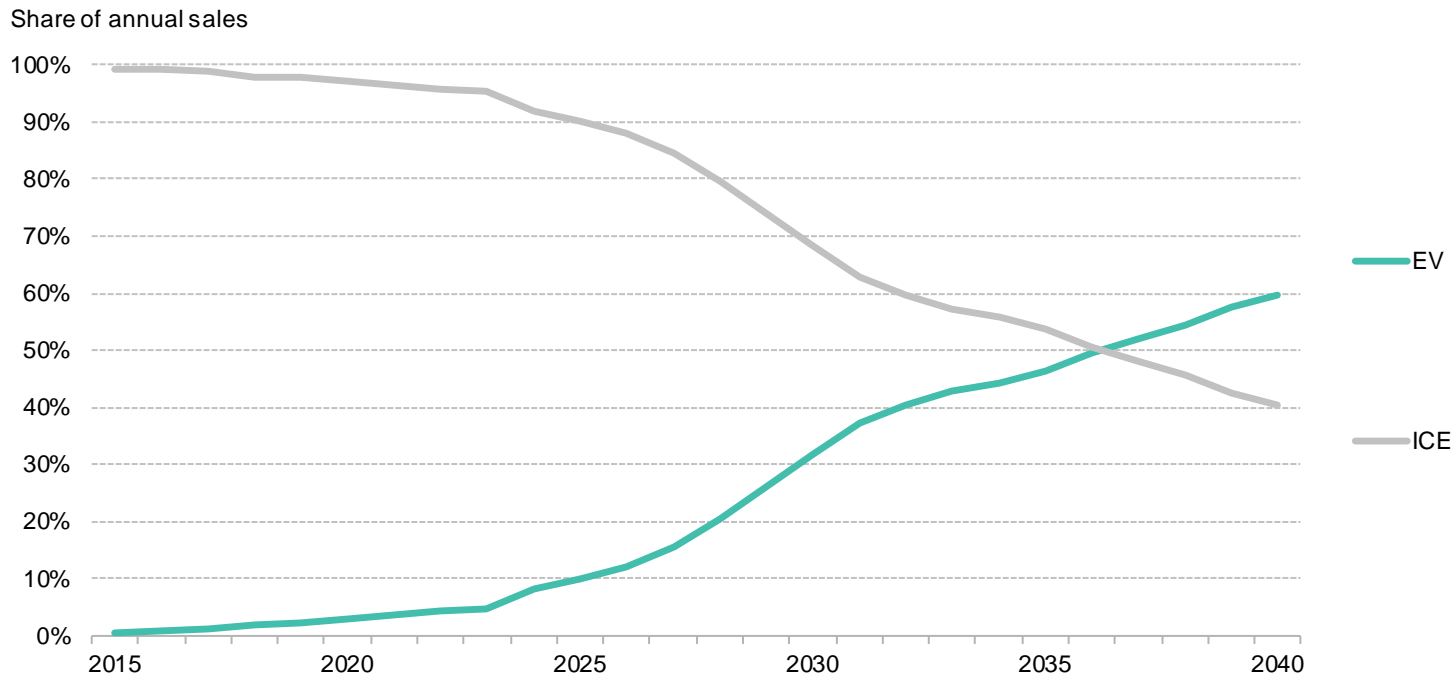


## Number of plants assembling EVs (as of 4Q 2017)



Source: BloombergNEF, MarkLines, company press releases.

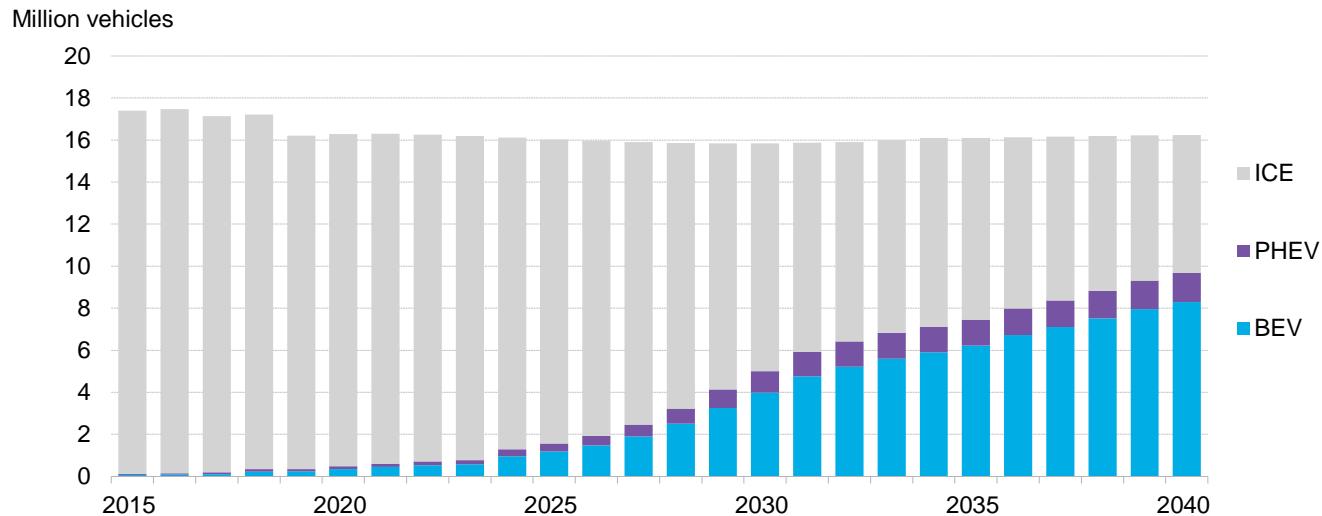
# Peak internal combustion?



Source: BloombergNEF. Note: U.S. results.

# Passenger EV sales approach 10 million in the U.S. by in 2040

### U.S. long-term passenger vehicle sales by drivetrain

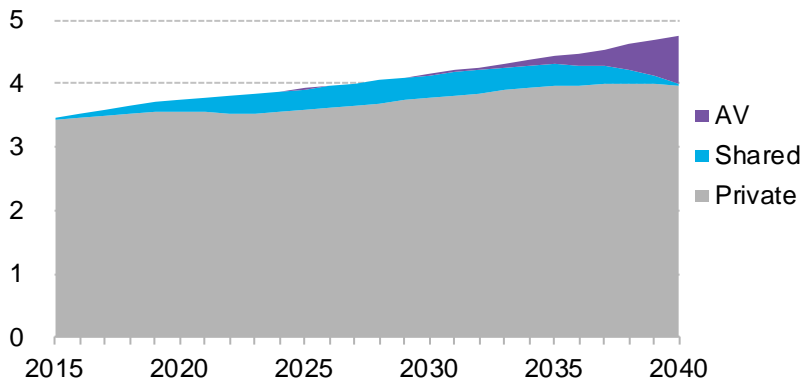


Source: BloombergNEF.

# Shared mobility takes a bite

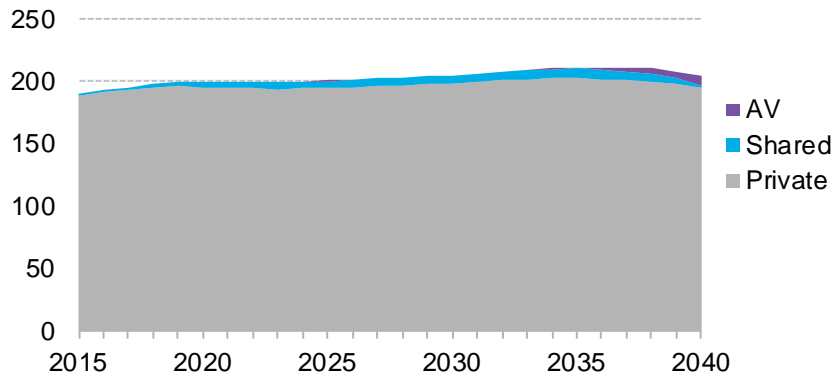
Annual kilometers travelled in the U.S.:  
**37% growth** between 2018-2040

Annual vehicle distance travelled (trillion km)



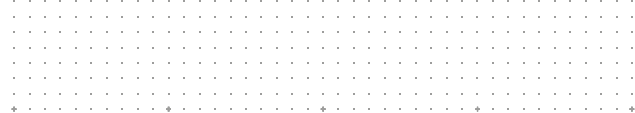
Passenger vehicle fleet size in the U.S.:  
**8% growth** between 2018-2040

Fleet size by type (million cars)

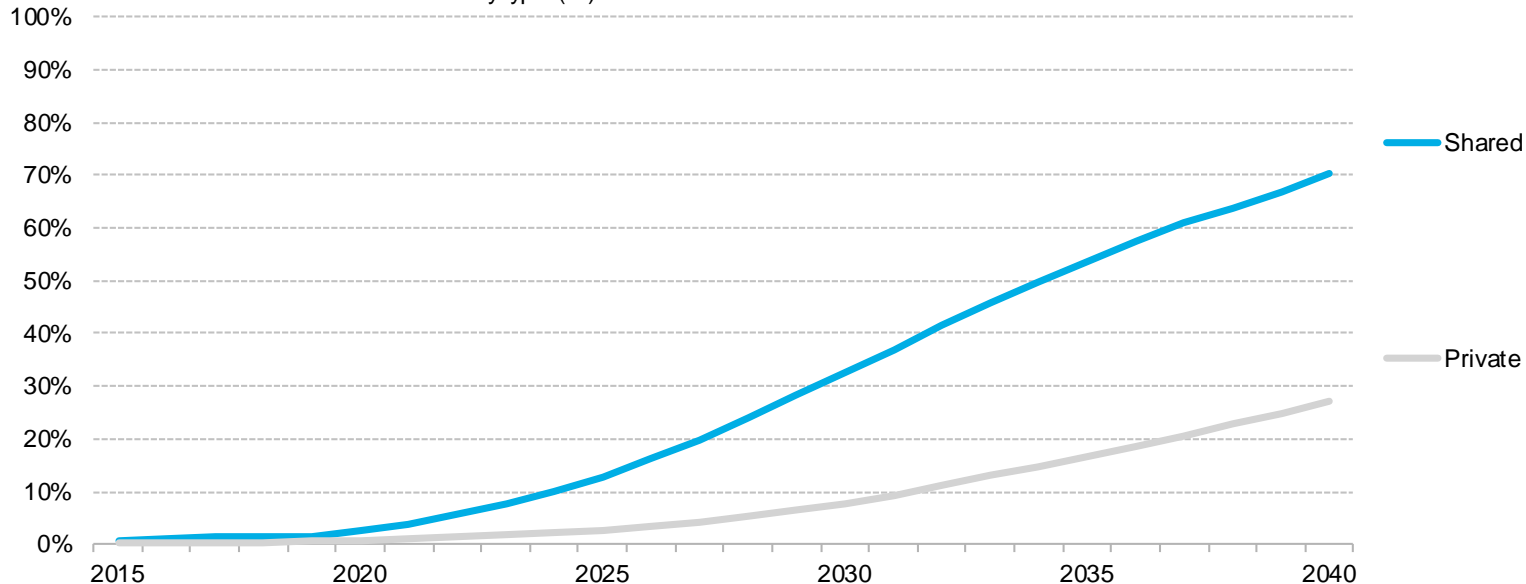


Source: BloombergNEF. Note: AV refers to Level-4 or higher autonomous vehicles used as robotaxis only. Shared includes taxis, ride-hailing and fleet-based car-sharing. Private refers to all other passenger vehicles.

# And shared mobility electrifies faster than personal cars



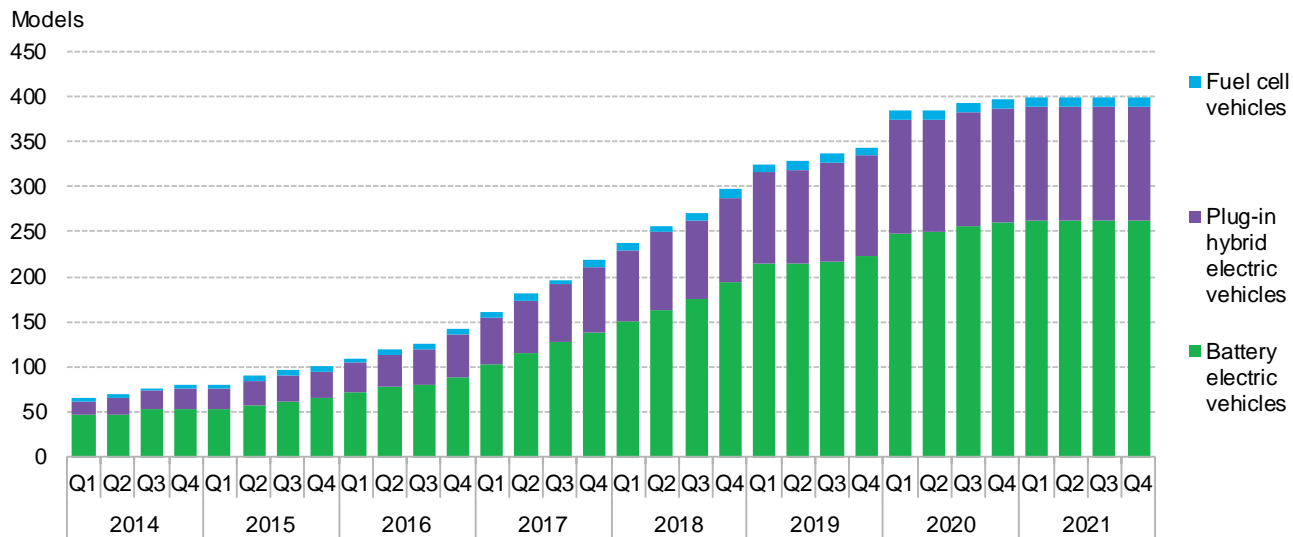
Electric share of annual distance travelled by type (%)



Source: BloombergNEF. Shared includes taxis, ride-hailing and fleet-based car-sharing. Private refers to all other passenger vehicles.

# Limited impact from plug-in hybrids and fuel cell passenger vehicles

Number of EV and fuel cell vehicle models available globally

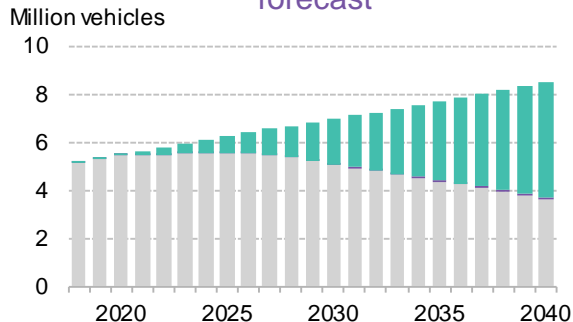


Source: BloombergNEF, automaker launch announcements.

# Light and medium commercial vehicles go electric, heavy vehicles are harder



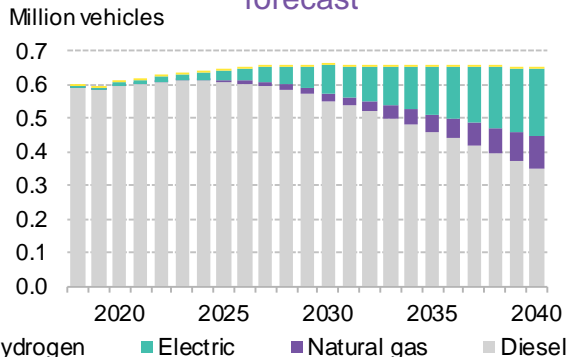
Light commercial vehicles forecast



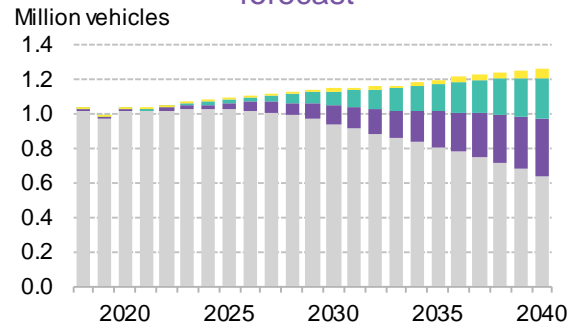
Source: BloombergNEF.



Medium commercial vehicles forecast



Heavy commercial vehicles forecast



# The municipal bus fleet is electrifying fast



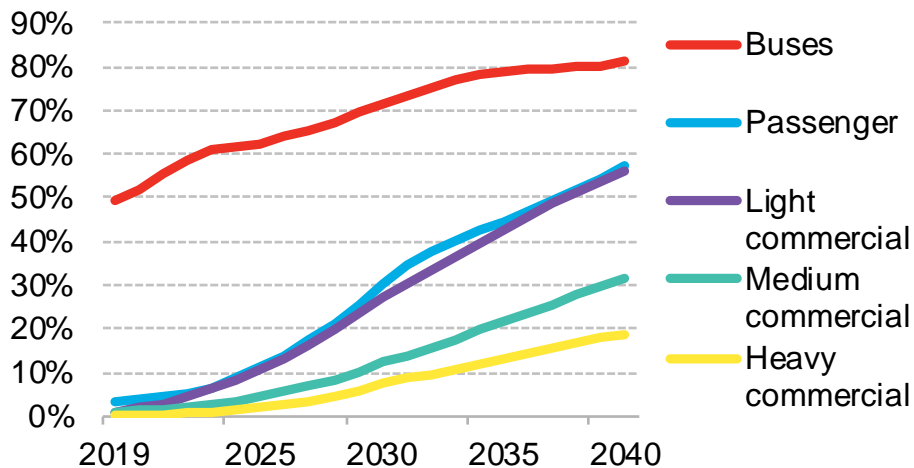
Image: BYD.



# Light and medium commercial vehicles go electric, heavy vehicles are harder

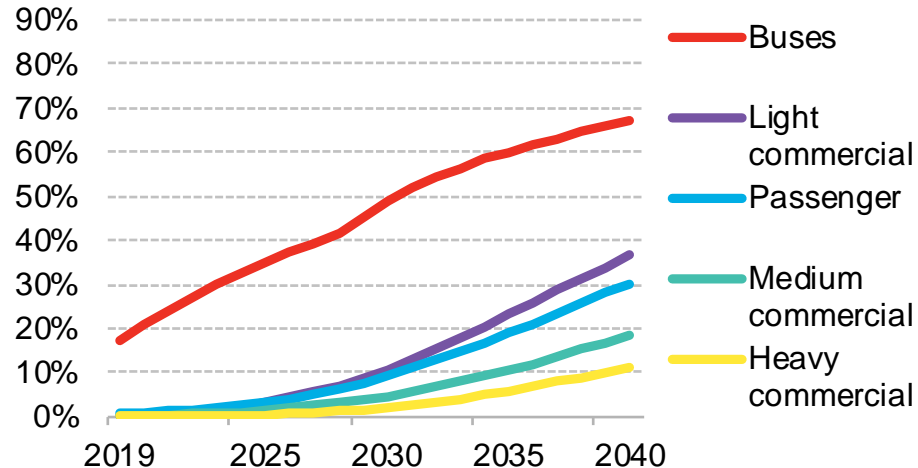
Share of annual sales

EV share of sales



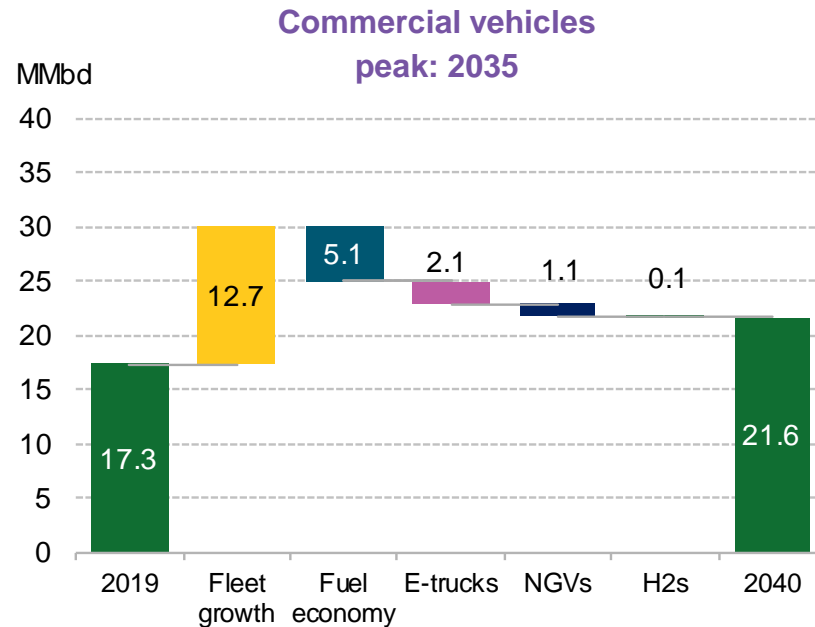
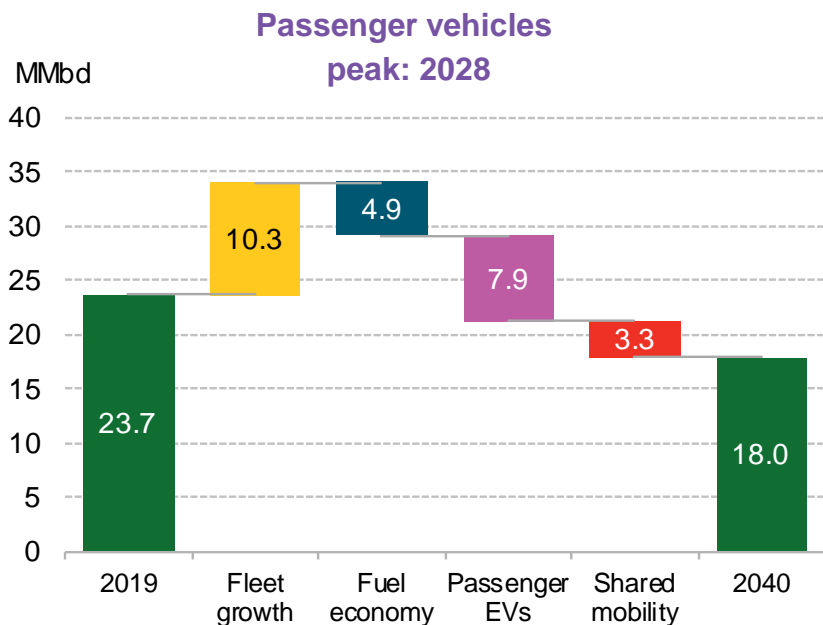
Share of fleet

EV Share of fleet



Source: BloombergNEF.

# Oil demand from road transport peaks in 2030

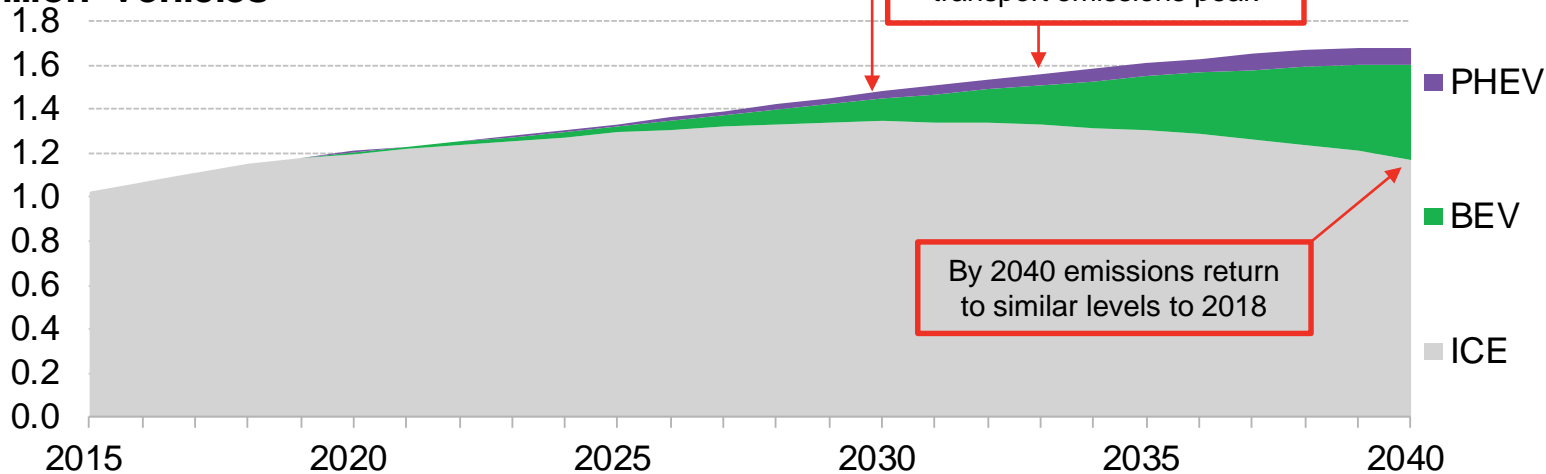


Source: BloombergNEF.

# Emissions rise for at least another decade

## Passenger vehicle fleet forecast

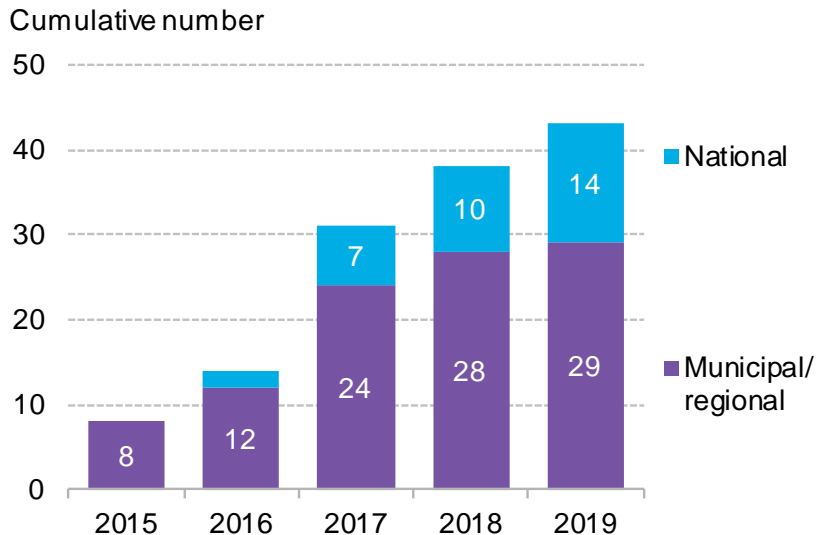
Billion vehicles



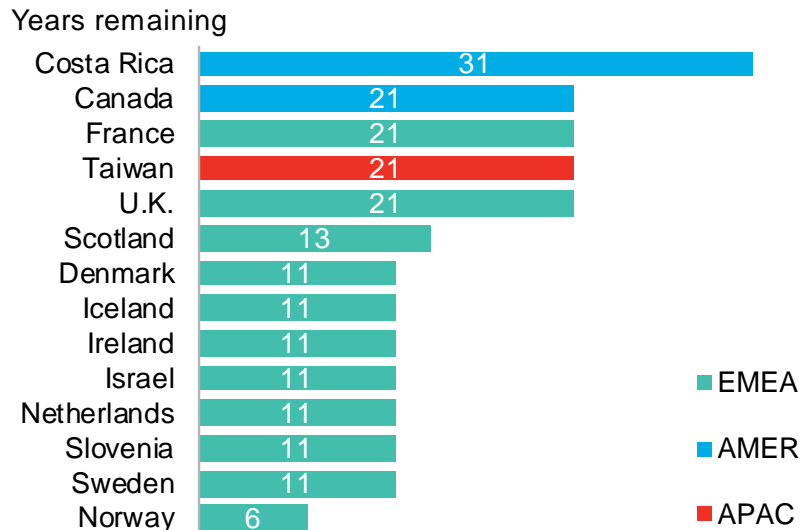
Source: BloombergNEF. Note: Emissions covers only passenger cars and trucks. Excludes 2 and 3 wheelers. Power sector emissions approximate.

# Policy pressure is rising

## Cumulative number of combustion vehicle phase-out targets announced



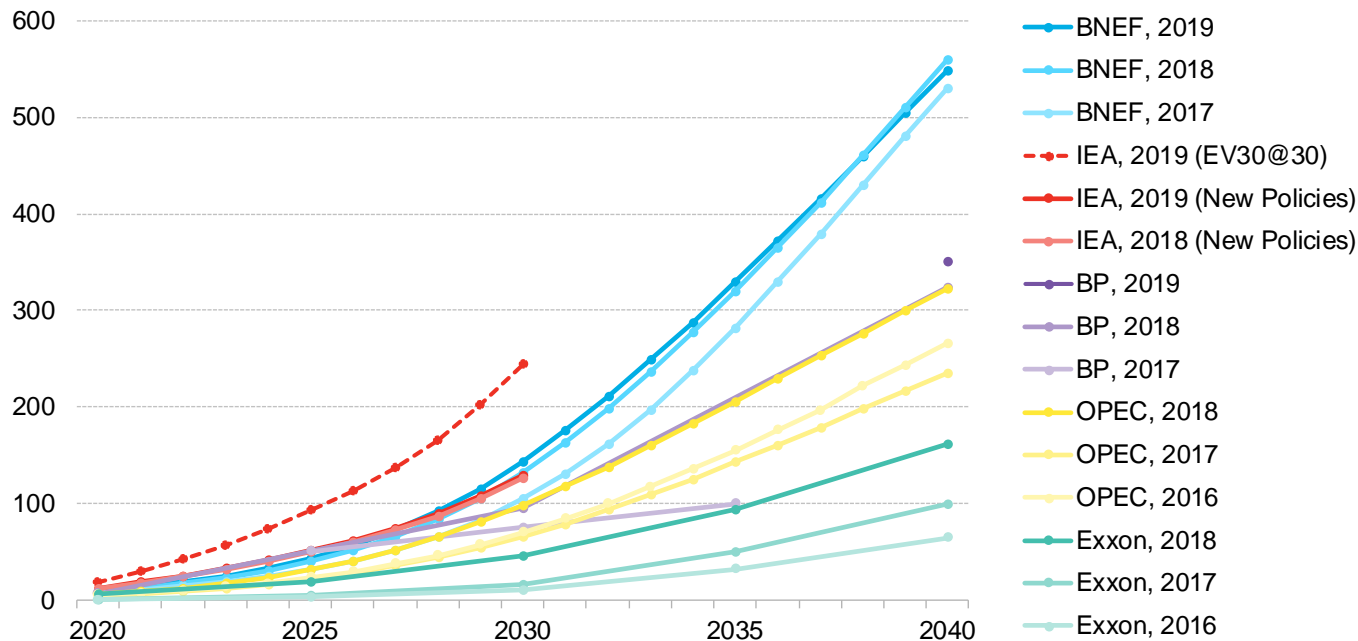
## Year remaining until combustion vehicle phase-out target years



Source: BloombergNEF, respective national policy announcements. Note: China stated in 2017 that it was considering a phase-out, but did not give any timeframe. India had previously stated a 2030 target, but this has been significantly reduced. (\*) Canada's target includes fuel cell vehicles.

# EV outlooks are all increasing

Million EVs on the road



Source: BloombergNEF, BP, OPEC, ExxonMobil, IEA. Notes: Some data points for BP, ExxonMobil and the IEA are BNEF estimates based on organization charts, reports and data (assuming linear growth between known data points). Assumptions, methodologies and included vehicle segments vary across outlooks. Latest BNEF, IEA, BP and OPEC outlooks include passenger and commercial EVs; previous BNEF and OPEC outlooks only included passenger EVs. BP only forecasted through 2035 in its 2016 and 2017 outlooks; the IEA only forecasts through 2030. OPEC's 2019 outlook not yet available; ExxonMobil's 2019 outlook not yet available; BP's 2019 outlook only provided an EV fleet size estimate for 2040. ExxonMobil and IEA outlooks prior to 2018 include BEVs, PHEVs and FCVs; all other outlooks include just BEVs and PHEVs. OPEC's reference case shown here. IEA's "Global EV Outlook 2019" shown here. Chart shows latest data available. See organization websites for authoritative viewpoints.

# Thank you

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## Electric Vehicle Outlook 2019

BNEF's annual forecast of electric vehicles,  
shared mobility and road transport to 2040.

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Source: BloombergNEF.

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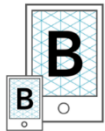
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