

Electric Vehicle Market and Policy Overview

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Advanced Energy Economy Institute

EPRI Climate & Energy Panel

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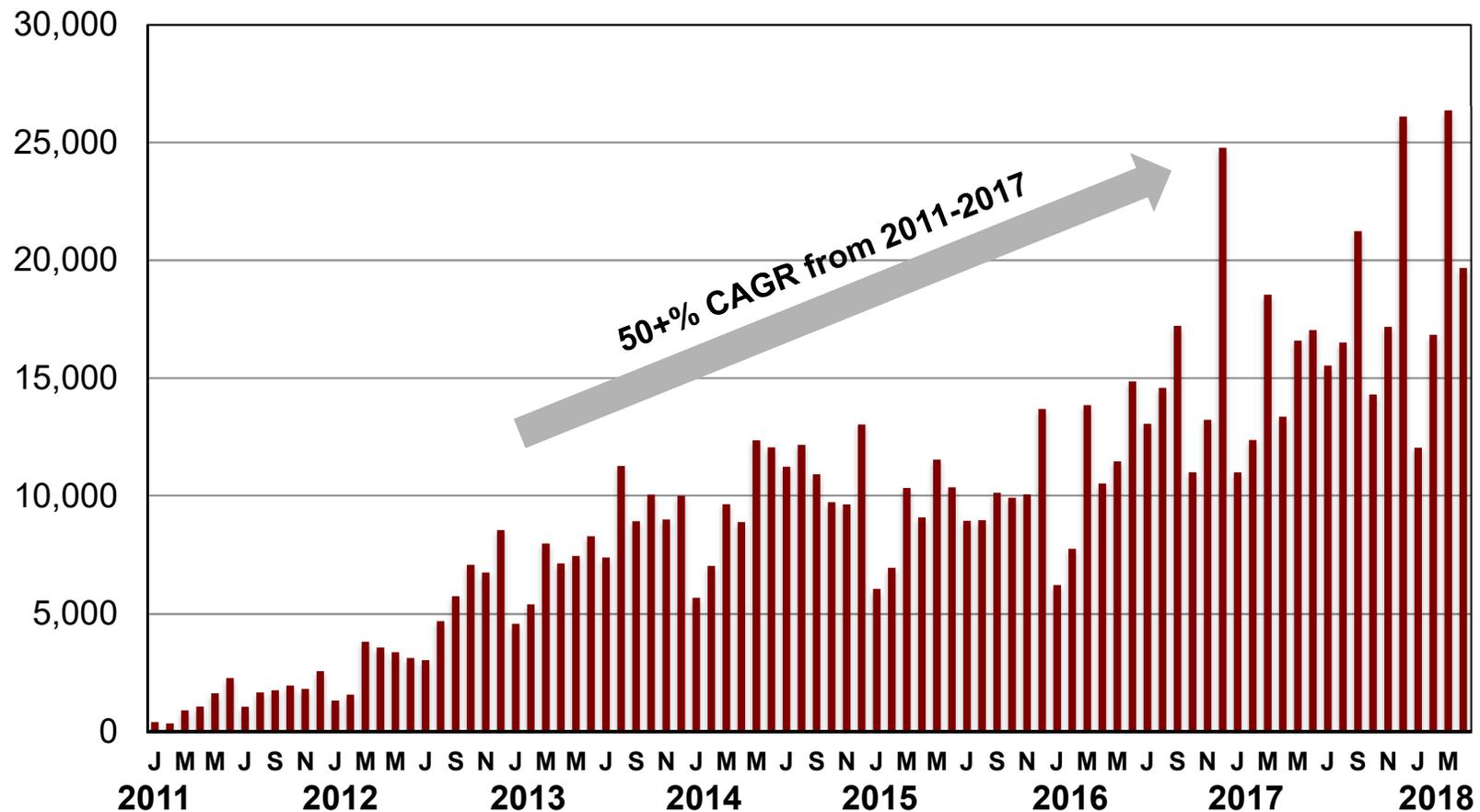


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Light duty EV sales have grown 50% per year since 2011

U.S. LDV Plug-in Electric Vehicle Sales (units)



Note: April of 2018 made it 31 straight months of year-over-year monthly growth.

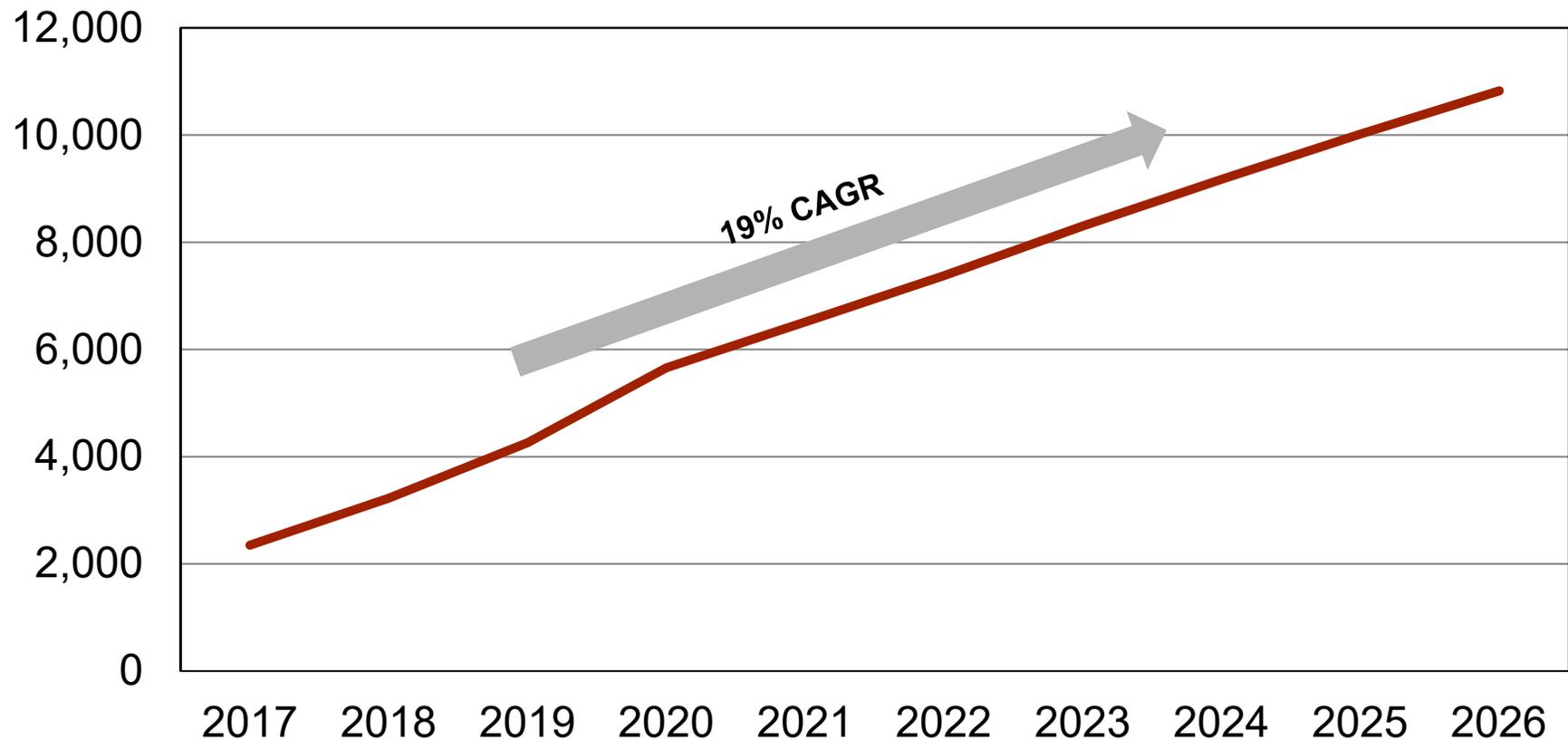
Note: PEVs includes all-electric battery electric vehicles (BEVs) and plug-in hybrid vehicles (PHEVs).

Source: <http://insideevs.com/monthly-plug-in-sales-scorecard/>



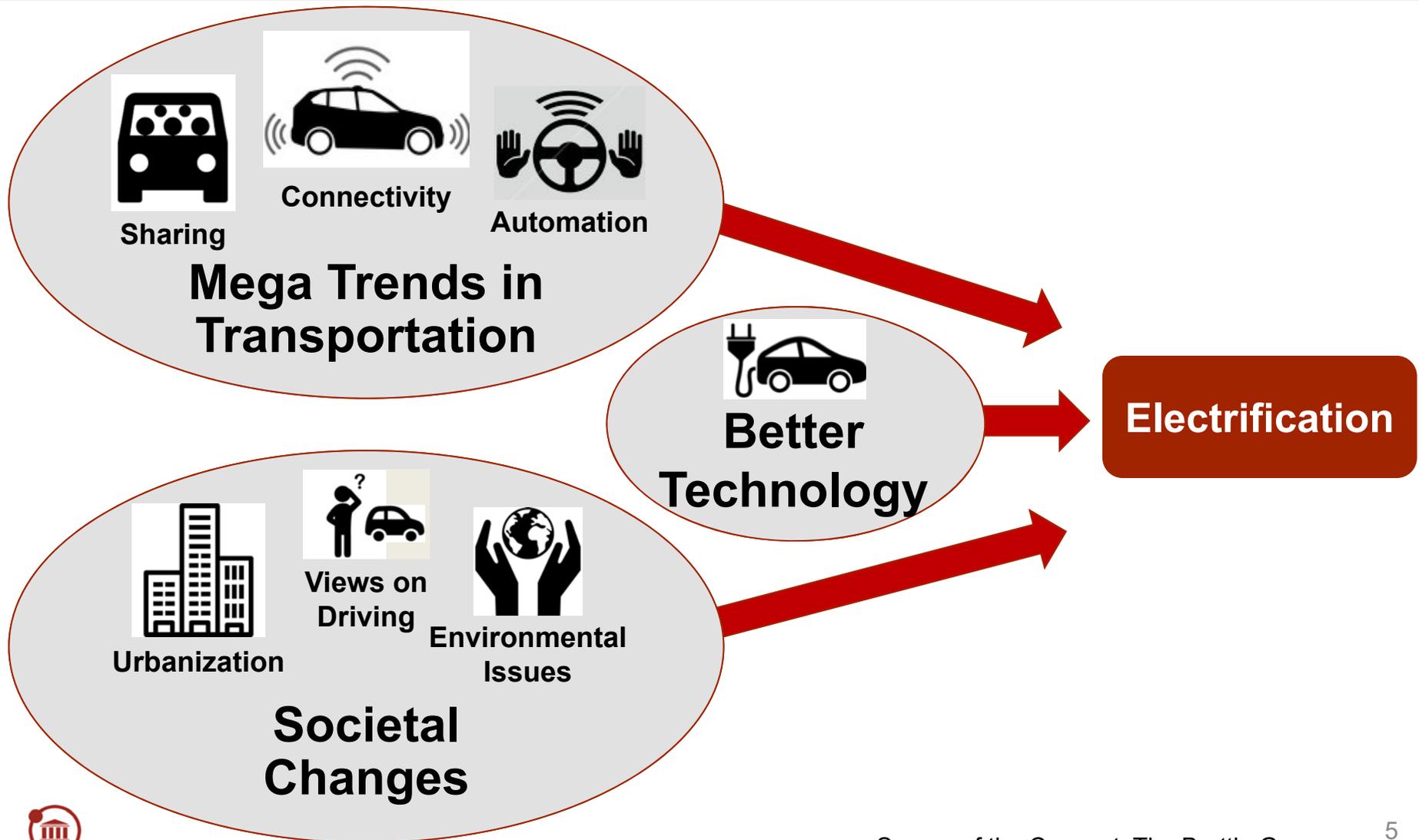
And its not just about cars...

Projected U.S. Medium/Heavy Duty PEV Sales



Source: Navigant Vehicle Grid Integration Report, Published Q4 2017.

A multitude of factors are driving the change



So its no surprise that most autos have announced 200+ mile range EV models



Source: Navigant Research.

With the markets taking off...

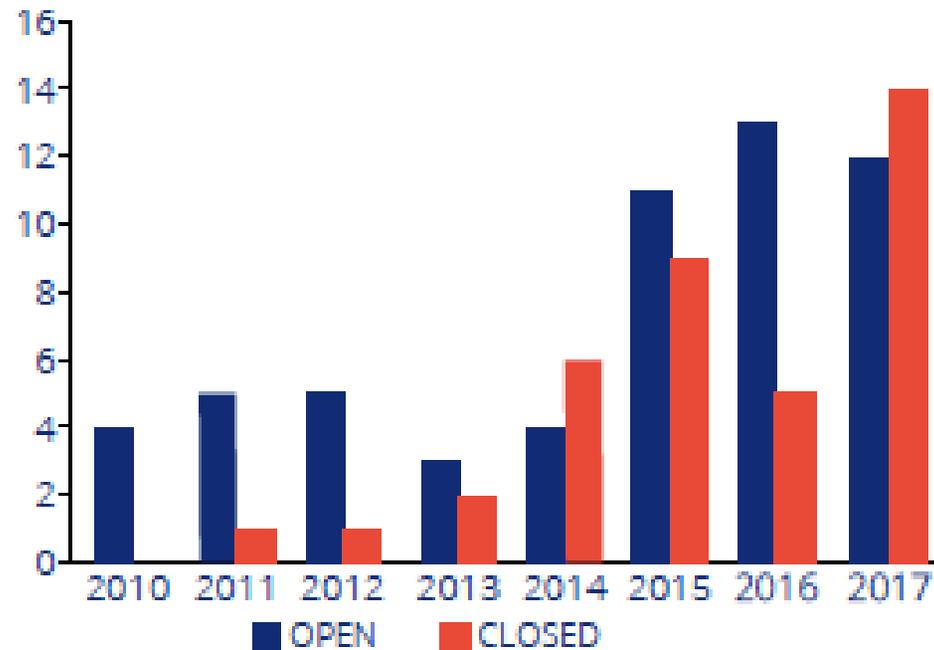


Policymakers are playing catch up



EV regulatory dockets are on the rise...

FIGURE 8: UTILITY REGULATORY DOCKET ACTIVITY BY YEAR (2010-2017)

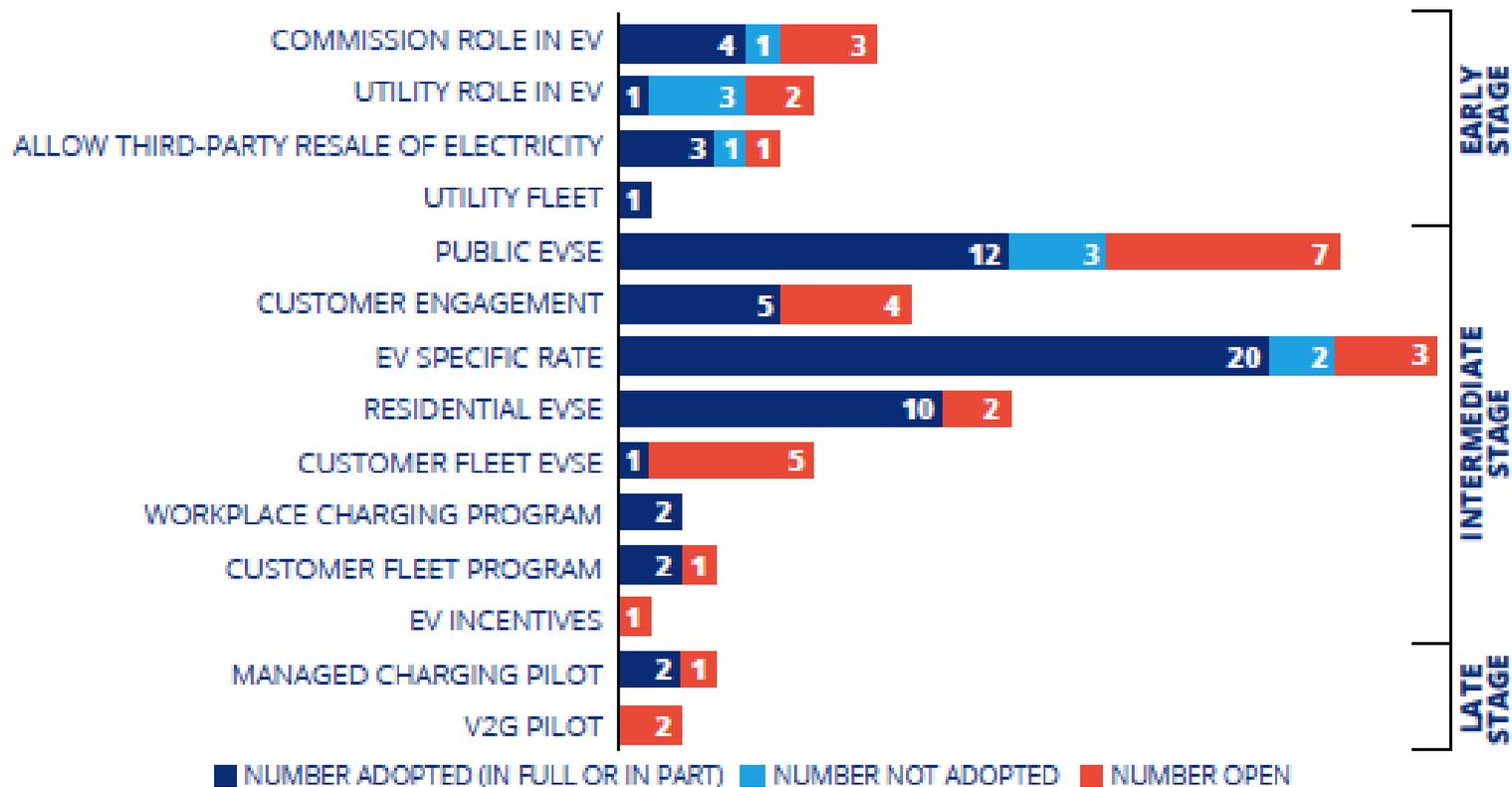


Source: Smart Electric Power Alliance, 2017.
Note: Dockets identified through AEE PowerSuite (<https://powersuite.aee.net>) search of relevant EV dockets between November-December 2017.



And the dockets are taking on more issues

FIGURE 9: UTILITY EV REGULATORY DOCKETS BY PROGRAM/ACTIVITY TYPE, BY STAGE, AND BY STATUS



Source: Smart Electric Power Alliance, 2017. Note: Dockets identified through AEE PowerSuite (<https://powersuite.aee.net>) search of relevant EV dockets between November-December 2017. SEPA categorized by program and/or activity. Some dockets include more than one type of program or activity so the total number is higher than the actual number of dockets.



Source: SEPA *Utilities and Electric Vehicles*. March 2018

Upcoming AEE Issue Brief – Guide for State Regulators on America’s EV Future

- Lays foundation for understanding EV market – the emerging market, the use cases for EVs and associated charging infrastructure – and addresses array of emerging regulatory issues.
- **Key Take Away - Planning is critical.**
 - High levels of EV deployment can benefit all ratepayers if charging is smart, yet congestion can arise even at lower levels if charging is dumb.
 - Regulatory framework will determine how to maximize the value of EVs as it relates to utility planning and operations, rate design and financing.
- Issue Brief anticipated in June 2018



Macro Implication of EVs on Grid: Significant Potential Load Growth

Brattle's Estimates of POTENTIAL Electricity Demand with Electrification (TWh) (including EVs and Heating)

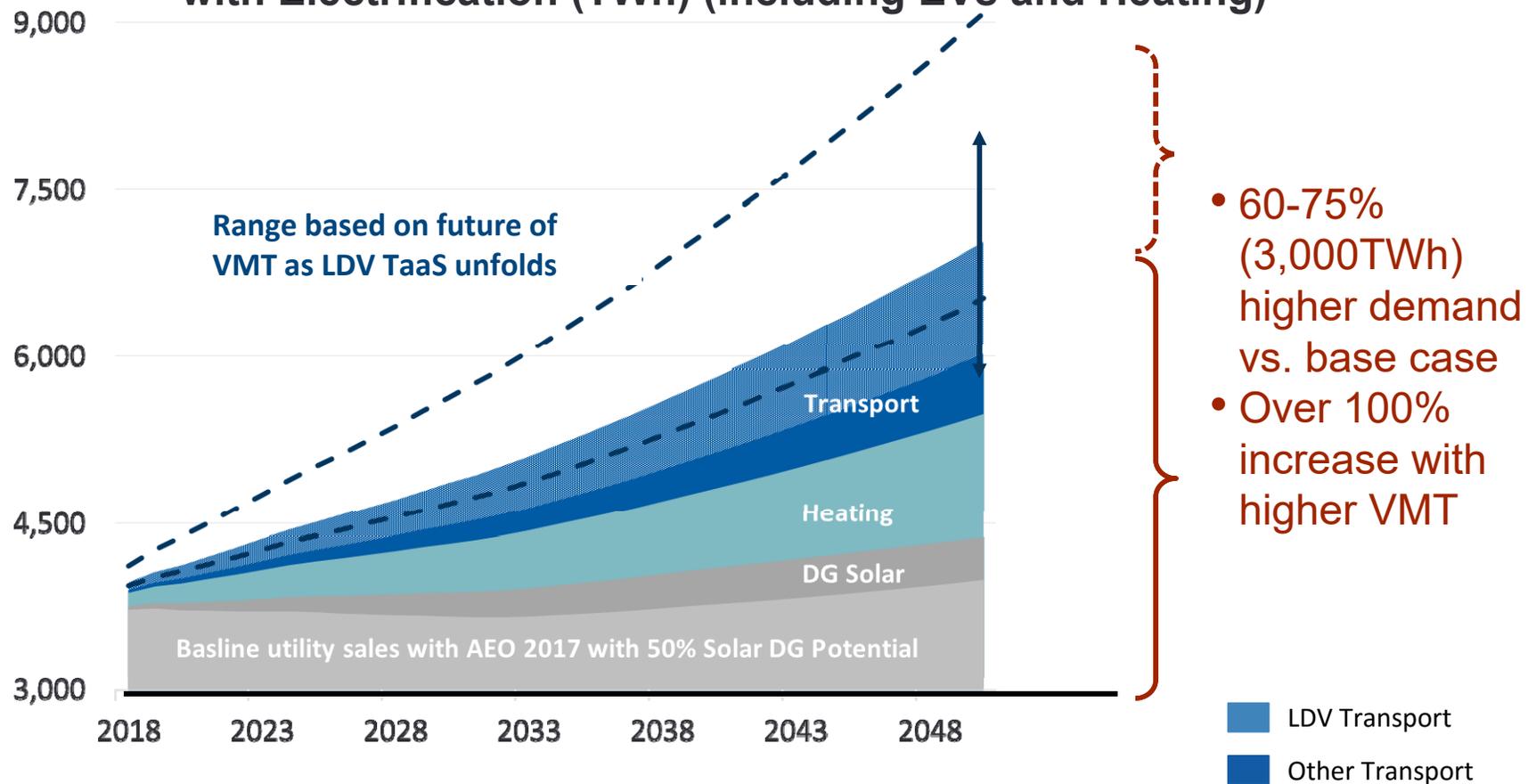


Chart Credit: The Brattle Group

Key Question for Utility Planners: How Fast?

- Will EV adoption follow path of cars and electricity or look more consumer electronics?

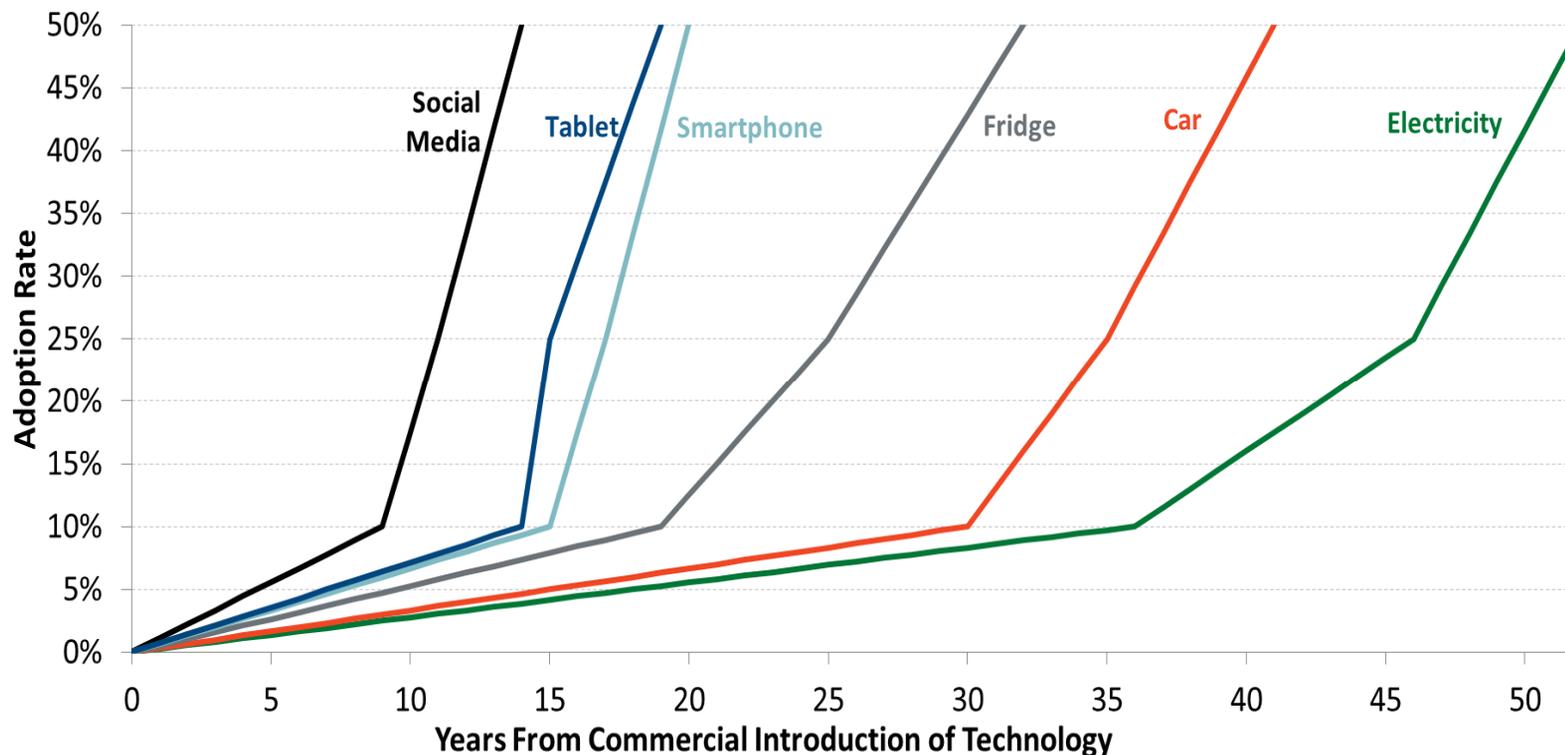


Chart Credit: The Brattle Group

Other Implications of EVs on Grid

- Potential to improve utilization of existing assets
 - Would require proper rate design to encourage off-peak charging (such as smart chargers to enable time varying or time of use rates)
 - Can extend useful life of existing infrastructure and reduce costs for all ratepayers
- Vehicle to Grid offers reliability, resiliency benefits
 - While still at early stages, V2G offers potential to enhance grid reliability and resiliency by aggregating potential of batteries distributed throughout grid.
- EVs may be gateway for greater customer engagement



Challenges of EVs on Grid

- Need to avoid exacerbating peaks
 - Time varying rates can help mitigate
- Underscores need for distribution grid planning
 - EV adoption – particularly during early phase – higher in affluent neighborhoods, creating distribution challenges.
 - Already cheaper to operate, EVs are expected to have lower sticker prices by 2025, so broader distribution system assessments will be needed.
- Rapidly changing technologies pose new challenges
 - While EVs can help with load balancing, EV charging infrastructure is evolving quickly so on-going regulatory engagement will be necessary (eg, 1 MW chargers, etc)



Questions re Role of the Utility

- Facilitator: provides nondiscriminatory electric service but not engaging directly in charging infrastructure.
- Manager: In addition to providing electricity, utility manages the charging operation and grid integration.
- Provider (includes Manager role): provides electric service and charging equipment for cost-based payments.
- Exclusive Provider: Vendors other than utilities are prohibited from providing charging services (under laws precluding the resale of electric service).



Thank You!

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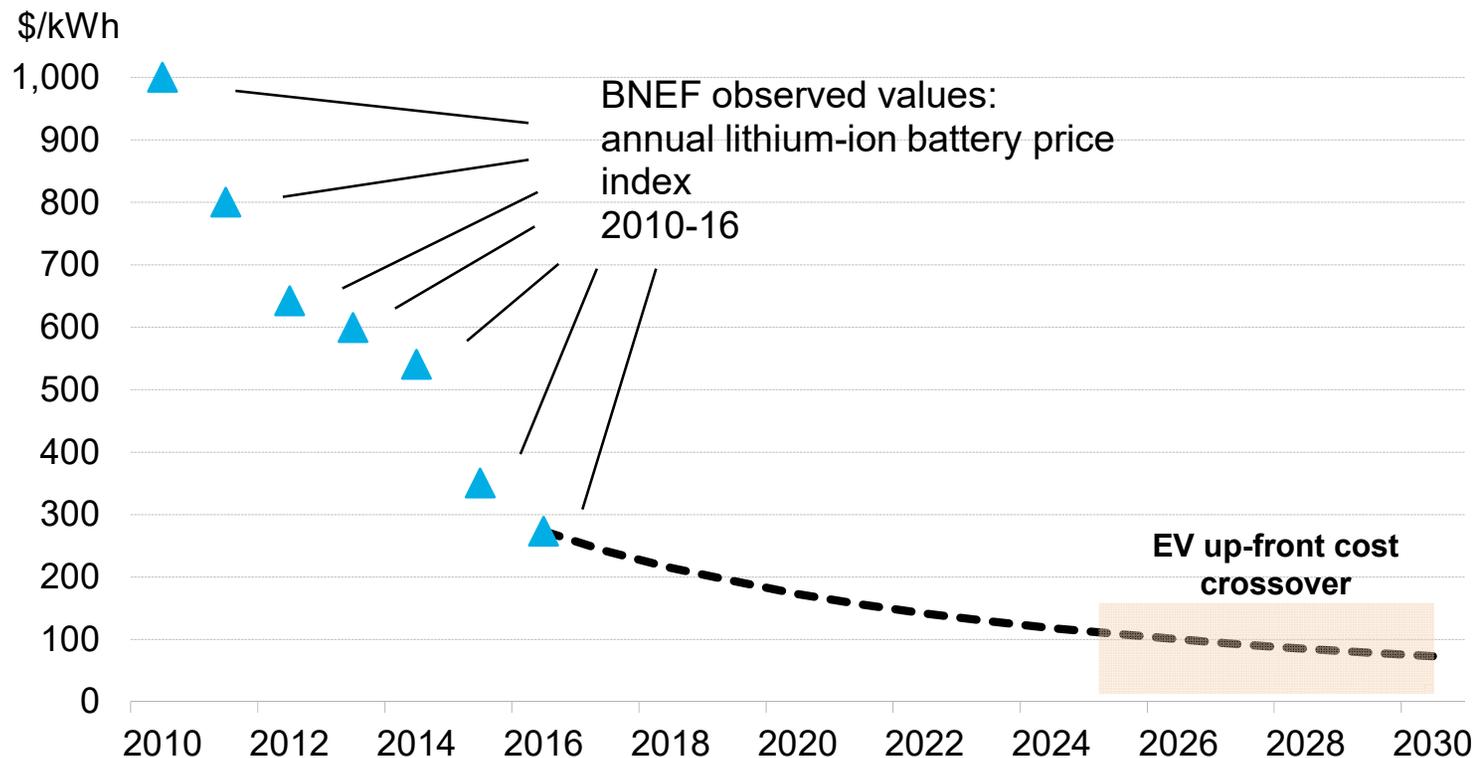
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Key to the technological improvements has been declining battery costs

Lithium-ion Battery Prices



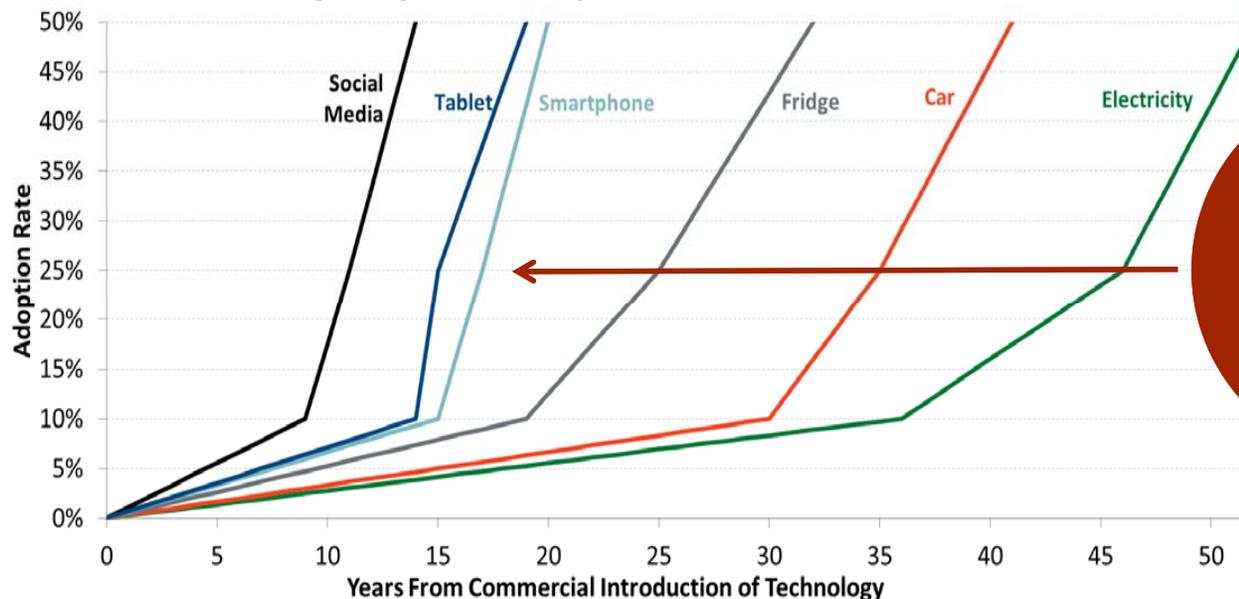
Source: Bloomberg New Energy Finance.

Why think about regs now?

At 1% of LDV sales, it is early days, but:

- **Planning is key:** High levels of EV deployment can benefit all ratepayers if charging is smart, but congestion can arise even at lower levels if charging is dumb

➤ Growth is highly likely and could be explosive



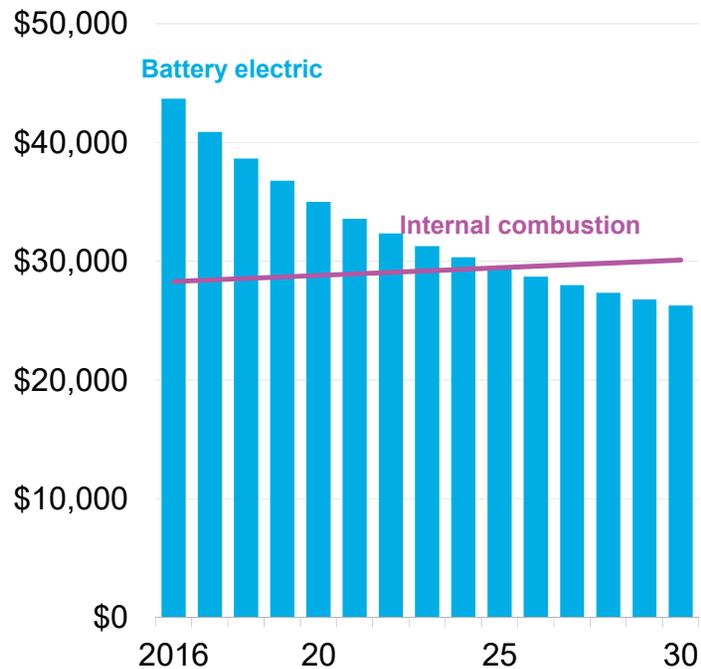
Will EVs have tech like adoption?



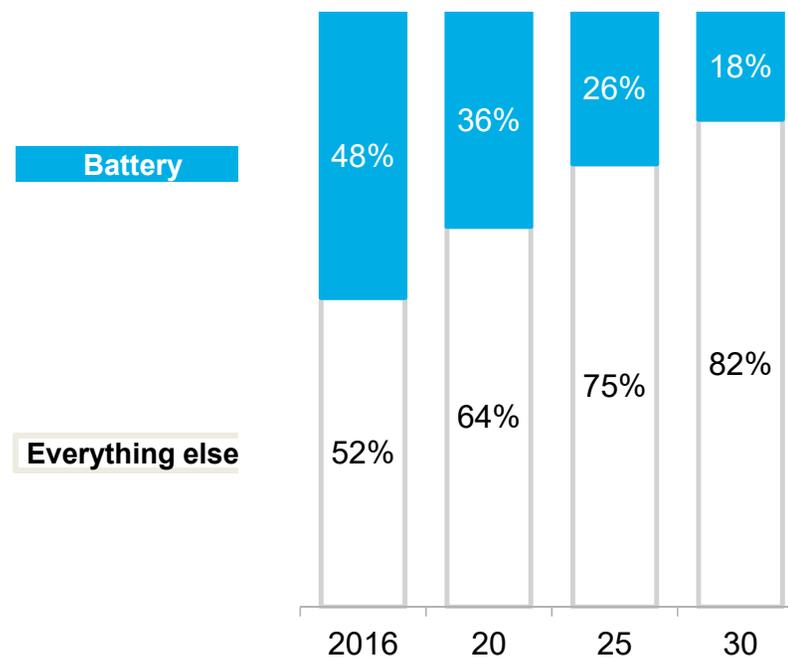
Chart Credit: The Brattle Group

EVs already cost less to operate, and by 2025, their sticker price will be lower too

Vehicle Prices



Battery Electric Vehicle Cost Breakdown



Source: Bloomberg New Energy Finance.