



The Edison Foundation

INSTITUTE for
ELECTRIC INNOVATION

IEI Report

Plug-in Electric Vehicle Forecast: 2016-2025

Interim Report
March 2017

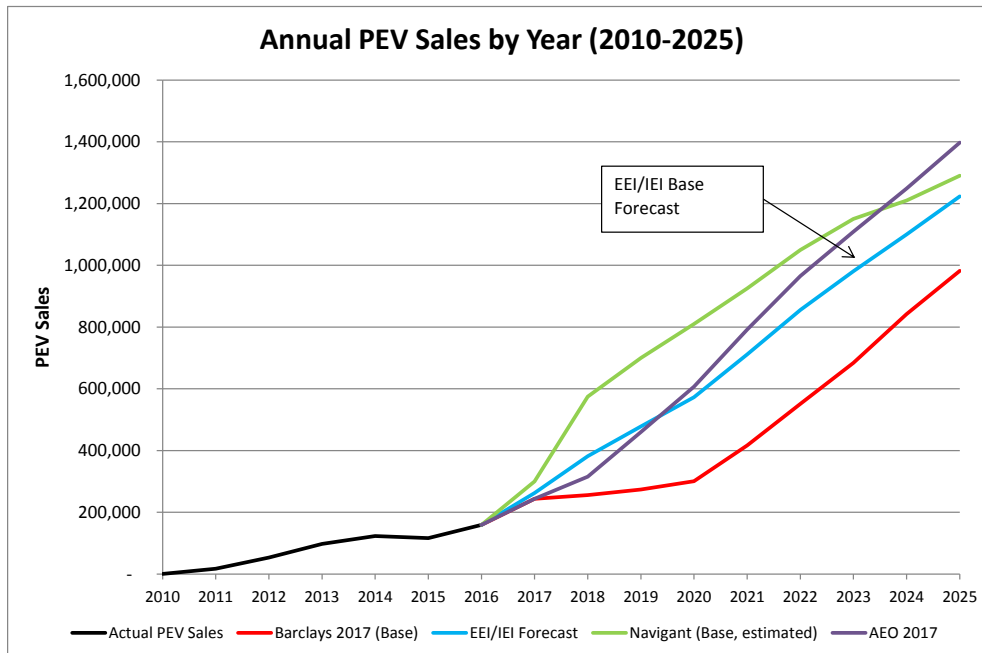
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EEI/IEI PEV FORECAST: 2016-2025

Given the growing interest in electrification of transportation, the Edison Electric Institute and the Institute for Electric Innovation (EEI/IEI) developed its first plug-in electric vehicle (PEV) forecast including both plug-in hybrid EVs (PHEVs) and battery EVs (BEVs). The EEI/IEI forecast shows the following:

- **Annual sales of PEVs** will exceed 1 million vehicles in 2023, reaching over 7 percent of annual vehicle sales by 2025.
- The **stock of PEVs** will reach 7 million by 2025, up from 567,000 today.
- The **BEV share is expected to increase** from 52 percent of annual PEV sales in 2016 to more than 60 percent in 2025. This impacts EV charging infrastructure needs.
- Both corporate average fuel economy (CAFE) standards and declining battery costs are major drivers of PEV sales.
- Continued decline in battery costs will result in **increased cost competitiveness** of PEVs with internal combustion engine (ICE) vehicles by 2025.
- Current CAFE targets are 54.5 MPG by 2025. A relaxing of CAFE/GHG regulations would put downward pressure on PEV sales.
- Automakers' announced PEV sales targets suggest that the EEI/IEI forecast is reasonable.

Figure 1: EEI/IEI Forecast Compared to Selected Forecasts



The EEI/IEI forecast also shows that:

- Annual PEV sales are expected to grow from 0.9 percent in 2016 to 7.3% in 2025 (see Figure 2).
- The PEV stock is expected to grow from 567,000 vehicles in 2016 to over 7 million vehicles in 2025 (see Figure 3). Note: There were 238 million vehicles (cars and light trucks) registered in the U.S. in 2015. This is expected to increase to 258 million vehicles by 2025.

Figure 2. Annual PEV Sales Percent of Total Vehicle Sales (EEI/IEI Forecast)

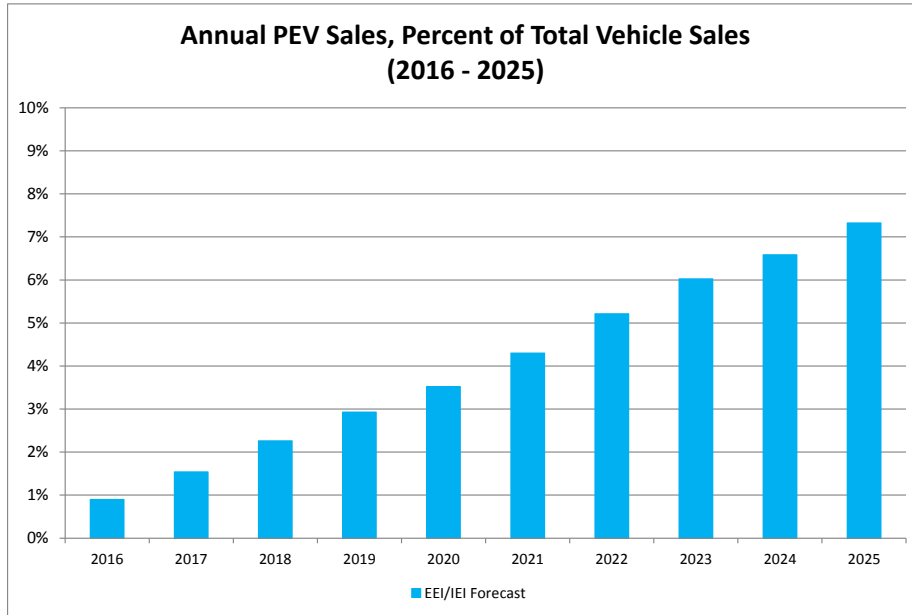
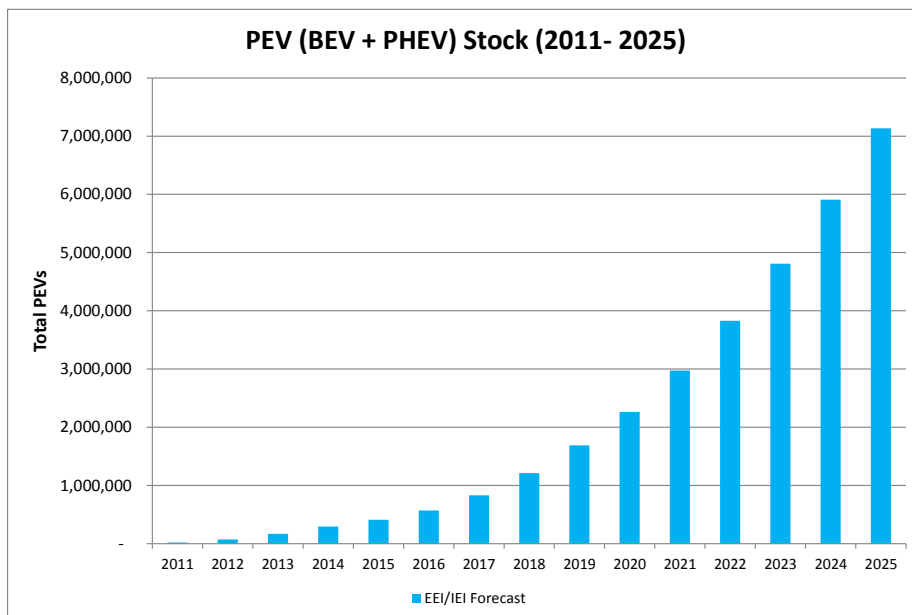


Figure 3. PEV Stock Based on EEI/IEI Forecast



Background

EEI/IEI developed a consensus forecast of PEV sales projections from 2016-2025 based on three independent forecasts:

- U.S. Energy Information Administration (EIA) Annual Energy Outlook 2017 Reference Case
- Barclays Equity Research Note – Together in Electric Dreams (January 2017)
- Navigant Research – Electric Vehicle Geographic Forecasts (June 2016)

These forecasts were selected because they included three key factors: consumer preference models that determine interest in PEVs; declining battery cost curves that influence PEV cost competitiveness with ICE vehicles and manufacturer profitability; and fuel efficiency standards and environmental regulations.

Declining battery costs and growing consumer interest in PEVs act as an accelerant to PEV sales. Fuel efficiency standards and environmental regulations (CAFE and GHG) act as a floor for PEV sales (i.e., minimum compliance). Cost reductions in battery packs enable longer range PEVs, increase cost competitiveness with ICE vehicles, and result in automobile manufacturers producing a wider variety of PEVs across more vehicle segments to better meet consumer demand.

- Between 2010 and 2016, battery pack costs (\$/kWh) declined by about 20 percent per year. The U.S. Department of Energy estimated battery pack costs in 2016 at \$245/kWh.
- Barclay projects that battery pack costs at \$100/kWh will create price parity with ICE vehicles.

Based on automaker public announcements by BMW, Mercedes, Volvo, VW, and Tesla and conservative estimates for other manufacturers, annual PEV sales are expected to exceed 1 million in 2025. Figure 4 shows the percent of PEV sales in 2016, the percent expected in 2025, and the likely number of PEV sales in 2025 by manufacturer. Given this, the EEI/IEI forecast of over 1 million in annual PEV sales expected by 2025 is reasonable and likely conservative.

Figure 4. Annual PEV Sales in 2025 Projected by Vehicle Manufacturer

Annual PEV Sales in 2025 Projected by Vehicle Manufacturer														
Manufacturer	2025 Public Announcements						2025 Estimates Only							
	Tesla	VW	Mercedes	BMW	Volvo	Total	Ford	GM	Fiat-Chrysler	Nissan	Toyota	Hyundai-Kia	Honda	Total
% PEV Sales in 2016 (Actual)	100	1.9	0.6	4.4	2.4	--	1	0.9	0.2	0.9	0.1	0.3	0	--
All Vehicle Sales Expected in the U.S. in 2025	200,000	600,000	380,000	370,000	80,000	--	2,600,000	3,000,000	2,200,000	1,750,000	2,400,000	1,400,000	1,500,000	--
% PEV Sales Expected in 2025	100	25	20	20	20	--	7	5	5	6	3	5	3	--
Estimated PEV Sales in 2025	200,000	150,000	76,000	74,000	16,000	516,000	182,000	150,000	110,000	105,000	72,000	70,000	45,000	734,000

CAFE/GHG Compliance Issues

CAFE standards are a primary driver for the 31 PEV models available in the U.S. from 17 automakers today. To comply with CAFE standards, automakers have had to both: (1) advance technologically via improved vehicle aerodynamics, light-weight materials, turbo-charged engines, continuously variable transmissions, and stop-start technologies; and (2) offer a range of PEVs.

Figure 5. PEV Sales: EEI/IEI Forecast vs Minimum Compliance with Current CAFE

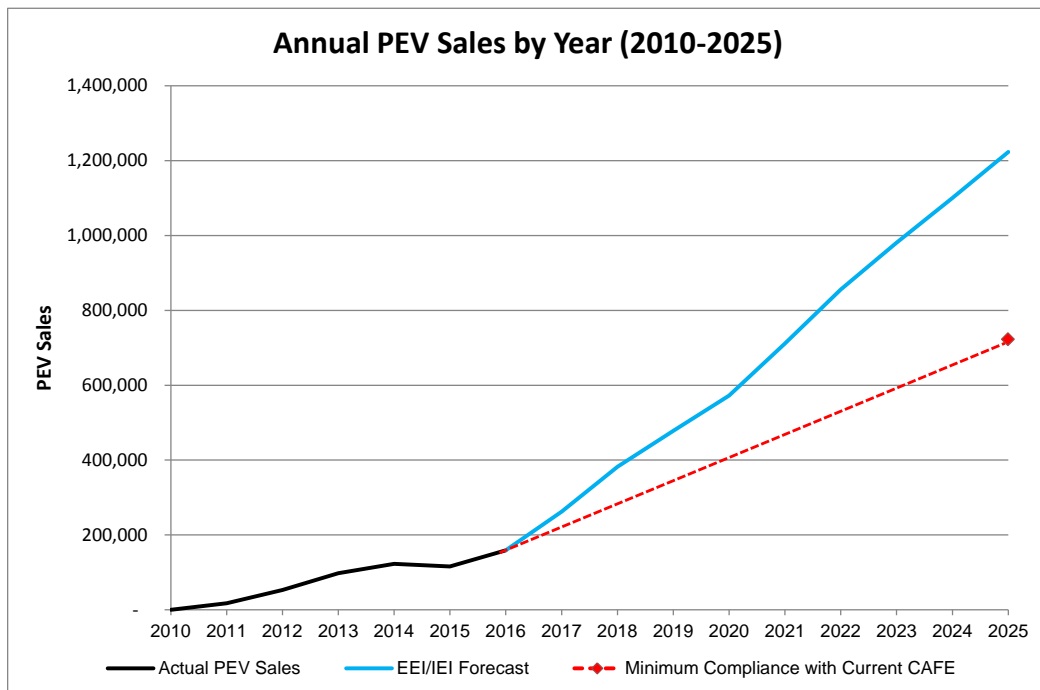


Figure 5 shows a comparison of the EEI/IEI forecast relative to PEV sales under minimum compliance with CAFE as projected by EPA, NHTSA, and CARB under the current rulemaking. Minimum compliance with CAFE is a floor for PEV sales and any reduction in current CAFE standards will likely depress PEV sales.

As part of the rulemaking that established model year (MY) 2017-2025 standards, EPA and NHTSA made a regulatory commitment to conduct a midterm evaluation of the standards for MY 2022-2025 which increase fuel economy from 46.8 MPG to 54.5 MPG. Recently, EPA Administrator Pruitt and DOT Secretary Chao announced that EPA and NHTSA intends to reconsider the appropriateness of the MY 2022-2025 standards no later than April 1, 2018.

About the Institute for Electric Innovation

The Institute for Electric Innovation focuses on advancing the adoption and application of new technologies that will strengthen and transform the energy grid. IEI's members are the investor-owned electric companies that represent about 70 percent of the U.S. electric power industry. The membership is committed to an affordable, reliable, secure, and clean energy future.

IEI promotes the sharing of information, ideas, and experiences among regulators, policy makers, technology companies, thought leaders, and the electric power industry. IEI also identifies policies that support the business case for the adoption of cost-effective technologies.

IEI is governed by a Management Committee of electric industry Chief Executive Officers. In addition, IEI has a Strategy Committee made up of senior electric industry executives and a select group of technology companies on its Technology Partner Roundtable.

About the Edison Foundation

The Edison Foundation is a 501(c)(3) charitable organization dedicated to bringing the benefits of electricity to families, businesses, and industries worldwide. Furthering Thomas Alva Edison's spirit of invention, the Foundation works to encourage a greater understanding of the production, delivery, and use of electric power to foster economic progress; to ensure a safe and clean environment; and to improve the quality of life for all people. The Edison Foundation provides knowledge, insight, and leadership to achieve its goals through research, conferences, grants, and other outreach activities.



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