

## DOCKETED

<b>Docket Number:</b>	17-IEPR-07
<b>Project Title:</b>	Integrated Resource Planning
<b>TN #:</b>	217105
<b>Document Title:</b>	SCENARIOS FOR FUTURE PENETRATION OF ZEVS
<b>Description:</b>	4.18.17 Presentation by Derek Jones of Navigant
<b>Filer:</b>	Raquel Kravitz
<b>Organization:</b>	Navigant
<b>Submitter Role:</b>	Public
<b>Submission Date:</b>	4/17/2017 2:59:32 PM
<b>Docketed Date:</b>	4/17/2017

# SCENARIOS FOR FUTURE PENETRATION OF ZEVS

---

APRIL 18, 2017

CALIFORNIA ENERGY COMMISSION

# DISCLAIMER

## **Notice Regarding Presentation**

This presentation was prepared by Navigant Research (Navigant) for informational purposes only. Navigant makes no claim to any government data and other data obtained from public sources found in this publication (whether or not the owners of such data are noted in this publication).

Navigant does not make any express or implied warranty or representation concerning the information contained in this presentation, or as to merchantability or fitness for a particular purpose or function. This presentation is incomplete without reference to, and should be viewed solely in conjunction with the oral briefing provided by Navigant. No part of it may be circulated, quoted, or reproduced for distribution without prior written approval from Navigant.

# NAVIGANT RESEARCH PRESENTER



**Derek Jones** is an Associate Director with Navigant's Energy Practice with more than 10 years of experience in distributed energy resource technology evaluation, program, and policy planning. While at Pacific Gas & Electric Co. (PG&E), he managed regulatory compliance reporting estimating load impacts and adoption forecasts for solar PV and plug-in electric vehicle (PEV) technologies. He co-led California investor owned utilities (IOU) reporting activities providing load impacts from the IOU's respective PEV rate schedules, PEV penetration forecasts, and cost tracking for distribution and service upgrades. Prior to PG&E, he worked for Mitsubishi Corporation's government relations office in Washington DC where he monitored and advised the trading company's worldwide leadership on US and global auto industry market, policy, and technology developments.

# NAVIGANT TRANSPORTATION EFFICIENCIES RESEARCH

## *Transportation Efficiencies Research Service*

Navigant has researched, analyzed, and advised stakeholders within the plug-in electric vehicle (PEV) market ecosystem since 2009, the beginning of the modern electric vehicle era.

Navigant maintains a deep connection to all electric transportation market ecosystems through our ongoing interviews of the full supply chain.



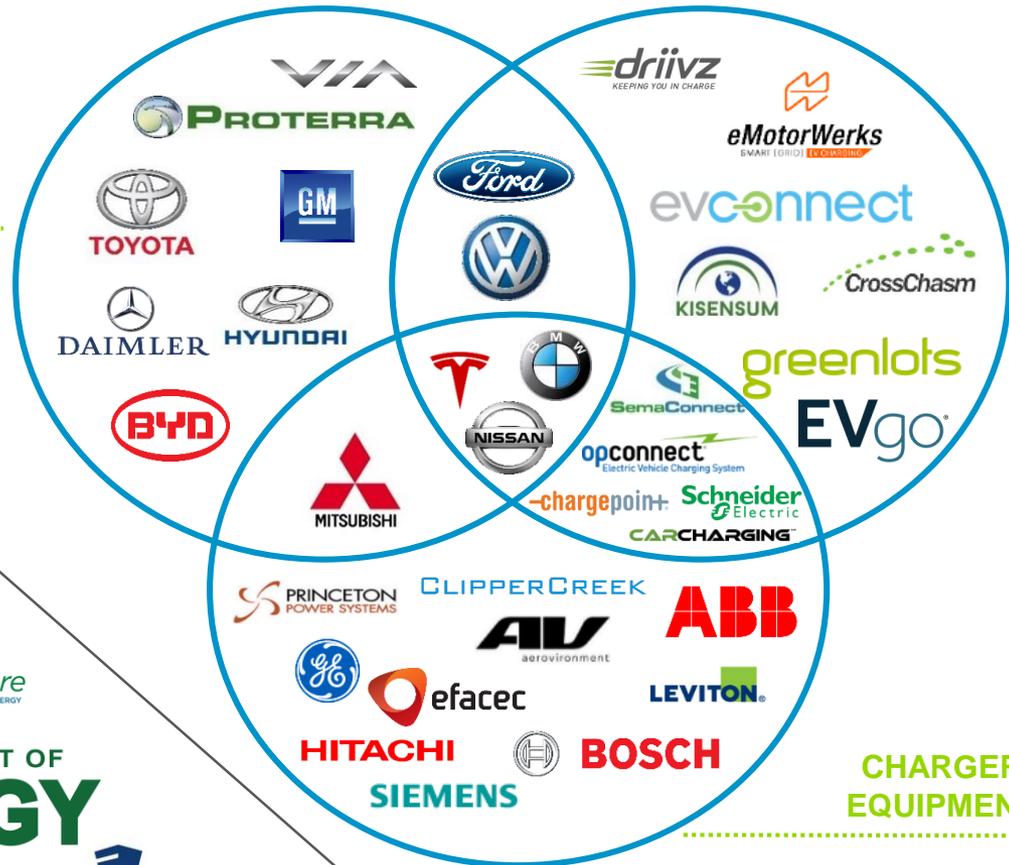
## **Example Topics Covered**

- Plug-In Hybrid Electric Vehicles
- Battery Electric Vehicles
- Hybrid Electric Vehicles
- Electrified Trucks and Buses
- Electric Bicycles, Motorcycles, and Scooters
- Electric Vehicle Battery Technologies
- Electric Vehicle Charging Infrastructure
- Consumer Attitudes, Preferences, and Behavior

# US PLUG-IN ELECTRIC VEHICLE MARKET ECOSYSTEM

## PEV Market Ecosystem

### VEHICLE OEM



### Government and NGO Actors



Union of Concerned Scientists



U.S. Department of Energy

California Environmental Protection Agency  
**Air Resources Board**



U.S. DEPARTMENT OF  
**ENERGY**



(Source: Navigant Research)

# EXPECTATIONS FOR THE PREVALENCE OF PEVS

---

MEDIUM-TERM AUTOMOTIVE SECTOR

# EXPECTATIONS FOR THE PREVALENCE OF PEVS

What are industry analysts' expectations for the prevalence of plug-in electric vehicles (PEV) in the medium-term automotive sector (2030)?

## Forecast

- By 2030 Navigant Research's base forecast puts global light PEV (plug-in hybrid & battery-only) sales at **12.5%** of global LDV market
- Vehicle population – equates to **5% (over 65 million)**

## Navigant Insights

- **Autonomous vehicle** uptake in early 2020s introduces uncertainty
  - PEV powertrains have a **potential advantage** over other vehicles
  - All electric components reduce maintenance costs
  - Wireless recharge ability minimizes refueling hassle factor

# 200-MILE RANGE BEVS TO BE THE NORM



**VOLVO**



**GAC MOTOR**

2016

2017

2018

2019

2020+



**JAGUAR**



**HYUNDAI**



**Audi**



**Mercedes-Benz**



**TOYOTA**

Battery Electric Vehicles = BEVs

# EXPECTATIONS FOR THE PREVALENCE OF PEVS

How does this compare with government, automotive industry, non-profit, or other forecasts?

## Forecast

- Overall figure **65 million** can be perceived as on the **conservative** side but our **12.5% figure** is actually **slightly more aggressive** than industry forecasts
- Navigant forecasts often slightly more conservative than other industry forecasts – though typically not as conservative as Energy Information Administration forecasts

## Navigant Insights

- By 2030 the impacts of **vehicle sharing / ride hailing** affect vehicle ownership rates, creating variations in forecasts on the vehicle fleet

# CRITICAL FACTORS DRIVING PEV FORECASTS

---

TOTAL COST OF OWNERSHIP AND CONSUMER TRADEOFFS

# CRITICAL FACTORS DRIVING PEV FORECASTS

What are the critical factors that drive forecasted penetrations of PEVs?

## Total Cost of Ownership

$$\text{TCO} = (\text{Purchase Cost} + \text{Operating Cost} - \text{Resale Value}) / (\text{Miles Traveled})$$

- Vehicle purchase costs a function of **battery prices** and **government subsidies**
- Comparative operating costs a function of **oil prices**

# CRITICAL FACTORS DRIVING PEV FORECASTS

What are the critical factors that derive forecasted penetrations of PEVs?

## Consumer Sacrifice

- Capability of the vehicle (**range**) relative to ICE vehicles
- Convenience (speed/ density) of recharging infrastructure (**charging stations**)

## Model Availability

- Available customer options (**model types by customer segment**)
- Impact of regulations / mandates (**emissions**)

# PLUG-IN HYBRID ELECTRIC VEHICLES (PHEV) DIVERSIFYING INTO NEW SEGMENTS

Models with 20-40 mile all-battery range, 10 kWh-20 kWh batteries

- **Audi Quattro:** New model
- **Audi Q8:** New model
- **BMW 530e:** New model
- **Cadillac CT6:** New luxury sedan
- **Chrysler Pacifica:** First minivan
- **Honda Clarity PHEV:** New model
- **Hyundai Ioniq PHEV:** New sedan
- **Kia Niro:** New crossover
- **Mini Countryman:** New crossover
- **Mitsubishi Outlander:** 4WD SUV
- **Prius Prime:** Revamped

## Examples of PHEV models



OEM Press Kit: Chrysler



OEM Press Kit: Toyota

# CRITICAL FACTORS DRIVING PEV FORECASTS

What will drive consumer demands?

## Same Core Market Drivers as Today

- Cost of customer **options** vs. customer's **personal priorities**

## Navigant Insights

- Modeling these drivers is a **complex and challenging** task, so simplifying assumptions are used
- Unknown and **evolving nature** of these key factors inherently limits potential model accuracy

# STIMULATING PRIVATE INVESTMENT IN CHARGING INFRASTRUCTURE

---

## KEY CONDITIONS

# STIMULATING PRIVATE INVESTMENT IN CHARGING INFRASTRUCTURE

What key conditions or circumstances are required to stimulate private investment in charging infrastructure?

## *Infrastructure Development*

- Model drivers: population of PEVs, then infrastructure, then PEVs

## *Diminishing Cost of Infrastructure Installation*

- Drive investment by accelerating payback from EV charging services
  - Accomplished through various policies such as:
  - Installation or equipment **subsidization**
  - Make ready building **codes**
  - Streamlined **permitting** and processing

# PREPARING FOR HIGHER POWER DC FAST CHARGING

## 350+ kW charging in development

- Much greater effect on host sites and local distribution grid
  - Demand charge relief
- Demonstration project similar to European EVA+ (Italy and Austria) and Ultra-E projects is needed
- Future-proofing current PEV supply equipment installations
  - Streamlining installation
- Potential coordination between Combined Charging System (CCS) and CHAdeMO to standardize electronics



DAIMLER



PORSCHE

# IMPACT OF INHERENT UNCERTAINTIES ON MARKET OUTLOOK

---

## KEY CONSIDERATIONS

# IMPACT OF INHERENT UNCERTAINTIES ON MARKET OUTLOOK

How do inherent uncertainties in electric vehicle markets (companies and models, valuations and profitability, charging technologies, autonomous/connected/shared cars) affect outlooks for deployment?

## Company / Model Availability

- **Near-term:** **Significant** impact
- **Long-term:** Global fuel efficiency standards (not just CAFÉ) **diminish** this uncertainty

## Automated Ride-Hailing / Car Sharing

- **Near-term:** **Minimal** impact as need for high vehicle utilization favors conventional vehicles
- **Long-term:** **Opportunity** for PHEV / BEV powertrains; greater reliability and lower maintenance/operating costs favor PEVs

# CALIFORNIA'S DECARBONIZATION AND TRANSPORTATION ELECTRIFICATION GOALS

---

## PEV MARKET STATUS AND OUTLOOK

# CALIFORNIA'S DECARBONIZATION AND TRANSPORTATION ELECTRIFICATION GOALS

Are market conditions and forces sufficiently established to achieve California's decarbonization and transportation electrification goals?

## More or Less

- Maintenance of the **status quo** (driven by the ZEV Program) and purchase **subsidies** will continue to bolster the PEV market and bring along **organic development** of various charging infrastructure forms

## Key Considerations

- Varied **model availability** across market segments
- Consumer **awareness** and education
- ZEV Program components will need to be **monitored and updated** throughout the 2020s to drive success towards goals

# CALIFORNIA'S DECARBONIZATION AND TRANSPORTATION ELECTRIFICATION GOALS

What further private and public intervention is needed to achieve the goals?

## *Additional Approaches*

- Workplace / Multi-family / End-of-Commute **infrastructure subsidization and utility investments in EV infrastructure**
  - Benefits both CA goals AND grid stability
- City programs for **low emission zones**
- Mandates for zero-emission driving automated systems
  - Post-R&D phase
- Subsidized carsharing programs with used PEVs
- Subsidies to encourage growing **ridehailing fleets use PEVs**
  - Benefits air quality and decarbonization goals

# THANK YOU

## **DEREK JONES**

Associate Director

+1. 415.356.7187

[derek.jones@navigant.com](mailto:derek.jones@navigant.com)

## **JOHN GARTNER**

Senior Research Director

+1. 303.493.0364

[john.gartner@navigant.com](mailto:john.gartner@navigant.com)