# GRID IMPACTS AND INTEGRATION OF EVS

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## NAVIGANT RESEARCH INTRODUCTION

### NAVIGANT RESEARCH PROVIDES IN-DEPTH ANALYSIS OF GLOBAL CLEAN TECHNOLOGY MARKETS.

The team's research methodology combines supply-side industry analysis, end-user primary research and demand assessment, and deep examination of technology trends to provide a comprehensive view of the Energy Ecosystem.

### **RESEARCH PROGRAMS:**

Energy Technologies Utility Transformations Transportation Efficiencies Building Innovations RESEARCH OFFERINGS: Research Reports

Subscription Research Services

**Custom Market Research** 

- Custom Market Analysis
- Market Sizing and Forecasting
- Primary Research
- Go-to-Market Services

- Strategic Advisory
  Sessions
- Commercial Due Diligence

DATA SERVICES:

**Online Interactive Data** 

Technology Evaluation



### 200-MILE RANGE BEVS TO BE THE NORM





# PHEVS DIVERSIFYING INTO NEW SEGMENTS

- 20-40 mile EV 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 loniq PHEV: New sedan
- Kia Niro: New crossover
- Mini Countryman: New crossover
- Prius Prime: Revamped

### **Examples of PHEV models**



OEM Press Kit: Chrysler



OEM Press Kit: Toyota

Plug-in Hybrid Electric Vehicles = PHEVs



### ANNUAL PEV SALES EXPECTED TO GROW 333% BY 2025

### Expected PEV Adoption, 2016 - 2025





(Source: Navigant Research)



### PEV ENERGY CONSUMPTION TO INCREASE 6,000% BY 2035

- If managed by demand response (DR) and time-of-use (TOU) rate programs, PEVs can add load without expanding or extending peak
- Workplace charging can be timed to grid requirements and renewable generation



### Road Transportation Electricity Consumption, United States: 2016-2035

# 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 is needed to encourage ownership
  - Demonstration project similar to European EVA+ (Italy and Austria) and Ultra-E projects is needed
  - Future-proofing current EV supply equipment installations
    - Streamlining installation
  - Potential coordination between Combined Charging System (CCS) and CHAdeMO to reduce the cost of dual port equipment







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# DC CHARGING STATIONS ENABLE LONG-DISTANCE BEVS

#### Potential US DC Charging Map



(Source: Navigant Research)

### **National Alternative Fuel Corridors**



(Source: US Department of Transportation)

# DC fast-charging corridors can satisfy majority of intra-city travel



# UTILITIES EVALUATING MANY USE CASES FOR PEVS



(Source: Navigant Research)

### **GRID SERVICE USES**

- Real-time energy balancing
- Peak-shaving load shift
- Distribution peak capacity support
- TOU energy management
- Power quality
- Backup power
- Supply firming
- Frequency regulation

### SECONDARY BENEFITS

- Reduced fossil fuel use
- Power factor correction
- Overgeneration management
- Faster regulation
- Faster build time
- Locational flexibility
- Multisite aggregation
- Grid/communications reliability



# INTEGRATING EV LOADS BENEFITS OPERATIONS

- PEVs can be used in demand response with little upfront cost, no vehicle modification, and little-tono cost software or communication upgrades
- PEVs can be timed to charge during overproduction of solar, wind, or hydro, and they are located closer to these generation sources
- DCFC (50 kW today > 150 kW soon) can impact distribution assets, and may require changes in demand charge structure and bundling with storage
  - Partnerships with OEMs on second-life batteries for stationary storage could spur more PEV sales





Prepare for high PEV penetrations by reviewing demand response (DR) load management pilot and program options for V1G while VGI standard development continues to enable V2G

- Workplace charging popularity is soaring, potentially adding to late afternoon peak
  - Example: 50,000 vehicles charging at Level 2 would add 960 MW to peak load
- Early data shows opportunity to better control workplace charging load via timeof-use (TOU) rates and timers though could cause potential customer service issues
  - PEVs enrolled in DR with TOU rates could be overcompensated
- Opportunity to focus on public charging installations that are upgradable for easier retrofit when need for more communication and control arises



## THINK BEYOND TIME-OF-USE RATES

# TOU rates guide PEV charging away from system peak, but do not solve all issues, creating a new peak in the process

- Unlike solar PV, utilities are not automatically notified when or where a PEV connects to the grid, rendering those loads invisible to planners and operators charged with balancing the power system
- Significant market growth will require communications infrastructure, products, and services to dynamically manage DR from PEVs intelligently in high penetration areas

### Projected PEV Profile Without TOU Rates

### **TOU Rates Alone Do Not Solve the Issue**



# UTILITIES FACE UNCERTAINTY IN ADDRESSING PEV MARKET

- The recent regulatory trend has been against ratebasing EVSE investment
  - Michigan Consumer's Energy withdrew a proposal for installing charging stations due to the PSC's concern about impact on ratepayers
  - Missouri PSC stated it doesn't have jurisdiction over EV charging investment
- Utilities finding other ways to participate
  - Burlington Electric offering \$1,200 rebate on PEV purchase
  - SCE offering \$450 incentive for new or used PEV purchase
  - Nissan using utilities in Colorado, Hawaii, and other states as marketing channel for \$10,000 Leaf rebate



# VEHICLE GRID INTEGRATION (VGI) PRESENTS A COMPLICATED MATRIX OF STAKEHOLDERS







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