What Are The Different Transportation Markets and What Helps Make Them Succeed?

Webinar Series on Transportation Electrification Sponsored by Edison Electric Institute and the U.S. Department of Energy

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About the Webinar Series

- Edison Electric Institute (EEI) and U.S. Department of Energy (DOE) are sponsoring a series of monthly webinars designed to:
  - Help electric companies learn about transportation electrification (TE);
  - Provide a "how to" on developing, launching, and sustaining an electric company TE program in its region; and
  - Provide a forum for discussions, best practices, and lessons learned.

Special thanks to Clean Cities U.S. Department of Energy for supporting this initiative

Ways to Get Involved With DOE

Join the Workplace Charging Challenge

- Visit: http://energy.gov/eere/vehicles/ev-everywhere-workplace-charging-challenge
- Contact Acting Coordinator, Nick Bleich at Nicholas.Bleich@ee.doe.gov

Request an EV Everywhere decal for your vehicle and EVSE

- http://www.afdc.energy.gov/decals

Raise awareness about PEVs with Best.Drive.EVer. Campaign

- Request materials from Robert.Graham@ee.doe.gov

Connect with your local Clean Cities Coordinator

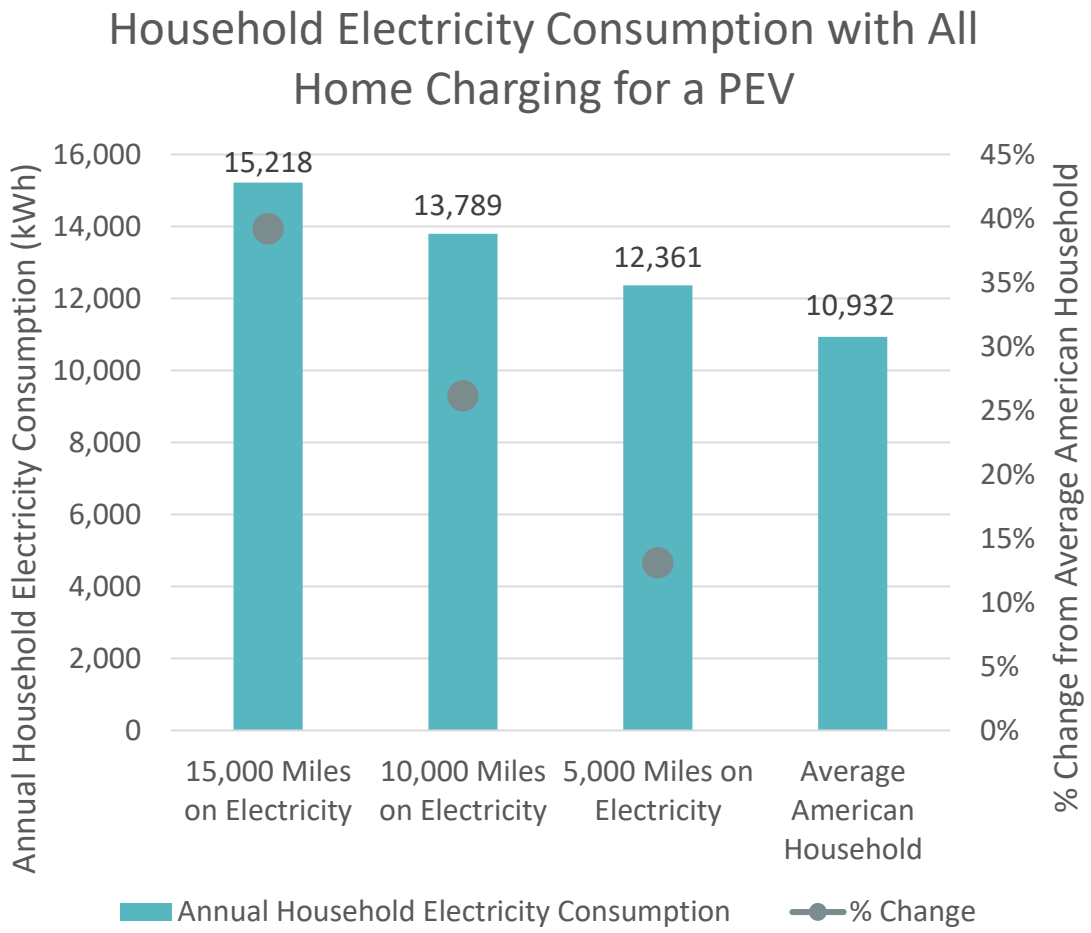
- Contact Linda.Bluestein@ee.doe.gov for more information

Ways to Get Involved With EEI

- Join EEI's ***CEO Transportation Taskforce*** and benefit from other electric company experiences
- Join EEI's ***Fleet Electrification Initiative*** and the new ***Employee PEV Engagement initiative***
- Connect to EEI's TheElectricGeneration.org website

Restating Electric Company Motivation To Help Accelerate Transportation Electrification

- Stagnant load growth and decreasing revenues due to changing customer behavior
  - Energy efficiency and distributed energy resources
- Meanwhile grid modernization investments are putting upward pressure on rates
- Transportation electrification (TE) “at scale” could help offset impacts of declining system utilization and rising cost-of-service
- Existing grid can accommodate wide scale TE
  - Pacific Northwest National Lab (2007) found 73% of passenger vehicles could be charged at night by U.S. grid (about 158 million) without building one new power plant
  - Demand from 7m PEVs would be about 1% of grid capacity (source: Raymond James)



Source: Atlas Public Policy Analysis

What Are The Different Transportation Markets and What Helps Make Them Succeed?

- Key Subjects we'll cover today
  - What are transportation electrification markets and where are they going?
  - What helps make transportation electrification markets succeed?
  - Electric company examples of successful transportation electrification programs

Section 1: Overview Of Transportation Electrification Markets and Projected Growth

TE Opportunities: More Than Just PEVs

Demonstration Stage (Few Suppliers)

Heavy-Duty Trucks

Trash Trucks

Delivery Vans

Emerging Availability (Few Suppliers)

Utility Fleet PHEV Trucks

Electric Buses

Commercial Availability (Multiple Suppliers)

Light-Duty PEVs

Electric forklifts

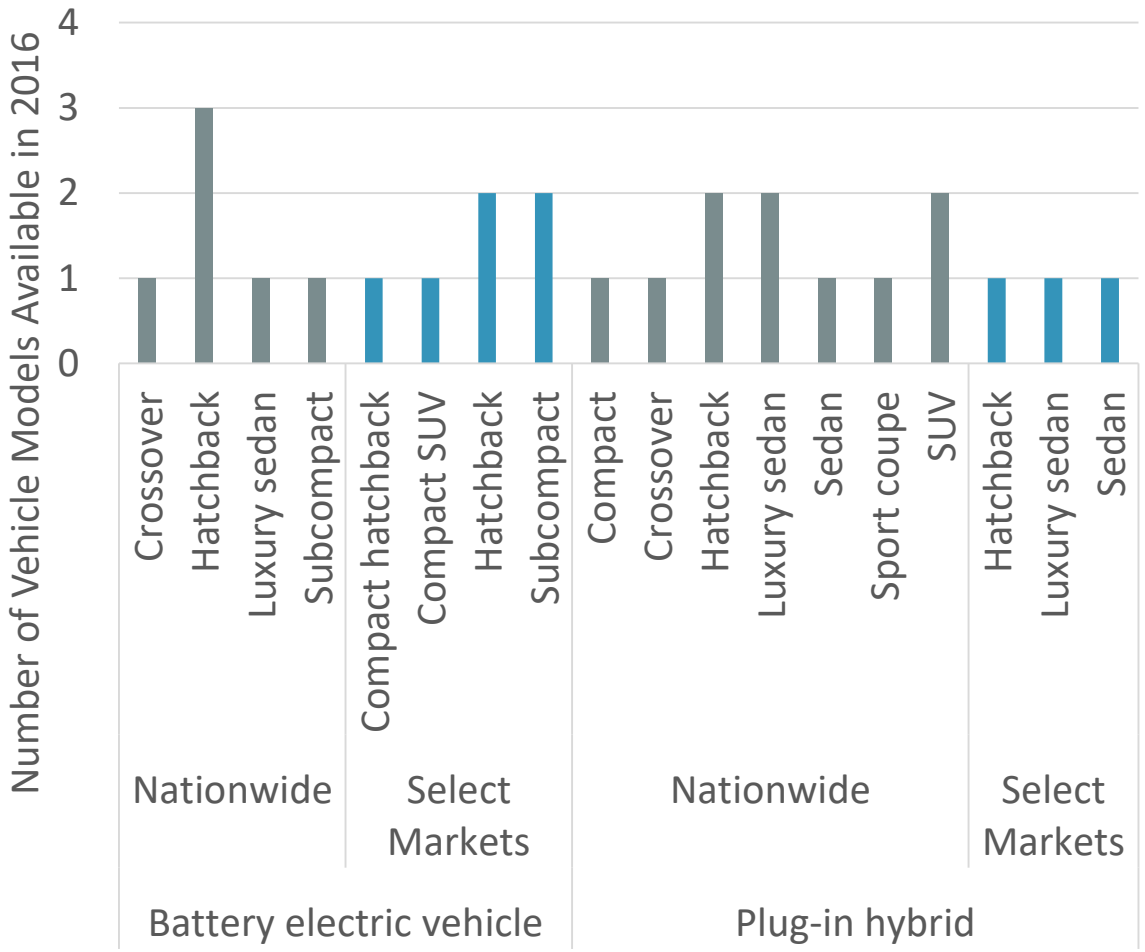
Electric Airport GSE

Port Electrification

To be covered in more detail

Commercially Available: Light-Duty PEVs

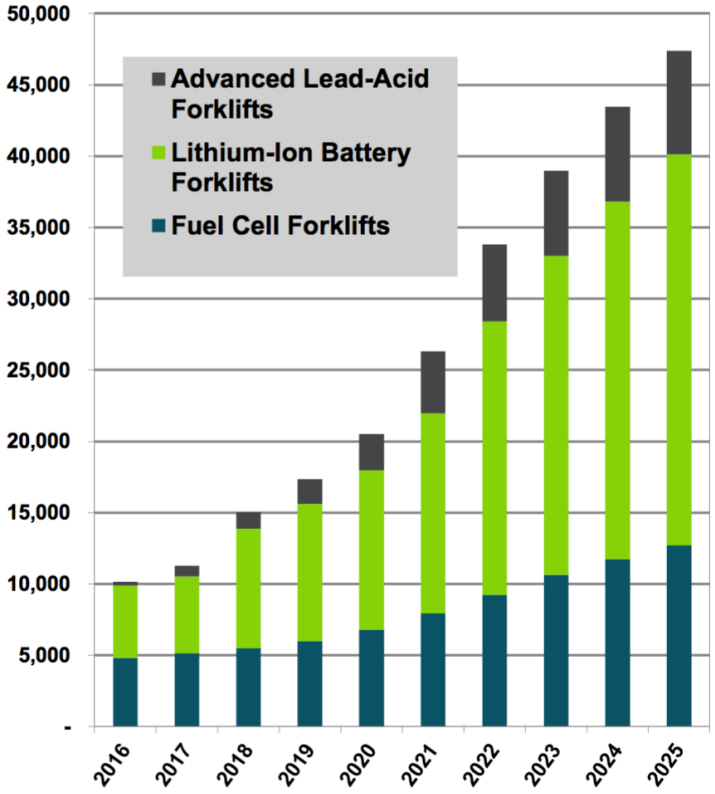
- *Electrifying passenger vehicles likely to result in sizeable new electric load in many regions*
  - Each PEV needs 1,500-5,000 kWh annually
  - Almost 500,000 PEVs on road today
  - Could approach 10-15% of new vehicles sales by 2025
  - Wildcards exist like success of Tesla Model 3 and larger plug-in hybrids
- Increasing availability
  - 16 makes and models available nationally today
  - With an additional 9 vehicle models available regionally
  - An additional 16-18 makes and models available by 2020
- Key factors
  - State policy (e.g., ZEV program, incentives)
  - Oil price and market volatility



Source: EPRI

Commercially Available but Evolving: E-Forklifts

Advanced Electric Forklift Sales by Technology, North America: 2016-2025



- Lift truck market sales are at an all-time high totaling over 225,534 units in 2015 (e-forklift sales were 141,846 or 63% of all sales)
- While conventional lead-acid e-forklifts are mature they have limitations (e.g. charge time, runtime, low cycle life, charging room, maintenance, etc.)
- Advanced solutions generally have higher upfront costs but lower operating costs by addressing the above challenges
- Navigant expects sales of advanced e-forklifts to grow from 10,000 units annually today to over 47,000 units by 2025

Source: Navigant

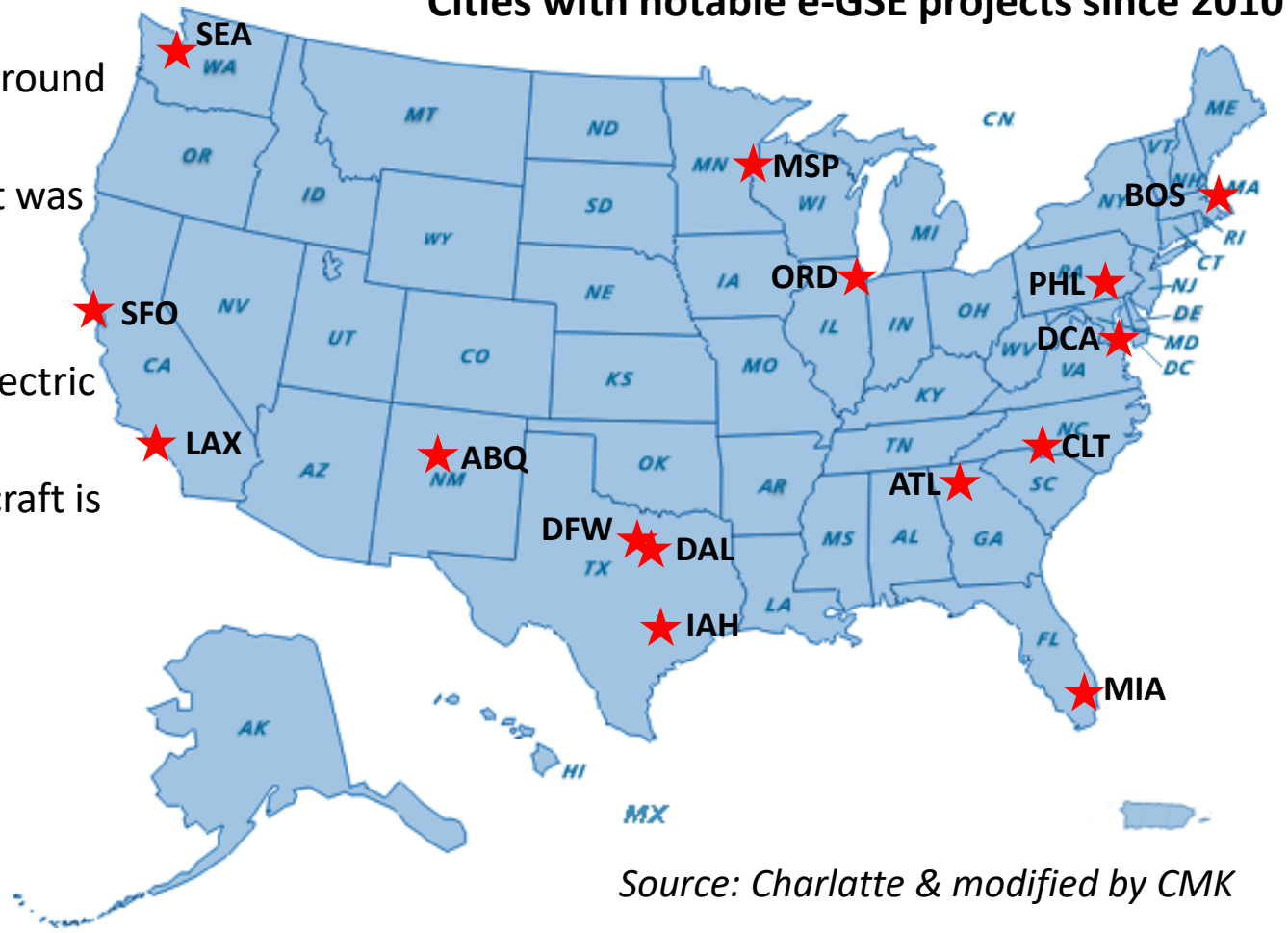
A typically forklift consumes about 13,000-26,000 kWhs/yr depending on # of shifts and charging

Commercially Available: E-Airport Ground Support

- Airport authorities moving away from fuel-burning ground movements to electric propulsion wherever feasible
  - North America Ground Handling system market was estimated at approx. $12B in 2016
  - Projected to grow to approx. $19.4B by 2021
- Ground Handling service providers are developing electric and biogas fuel-powered towing vehicles for aircraft
  - Allows engines to remain powered off until aircraft is at runway's head

Typical annual electric load:
- Tow tractor: 32,000 kWh
- Container loader: 29,000 kWh
- Belt loader: 5,000 kWh
- GPU: 262,000 kWh
- AC unit 693,000 kWh

Cities with notable e-GSE projects since 2010

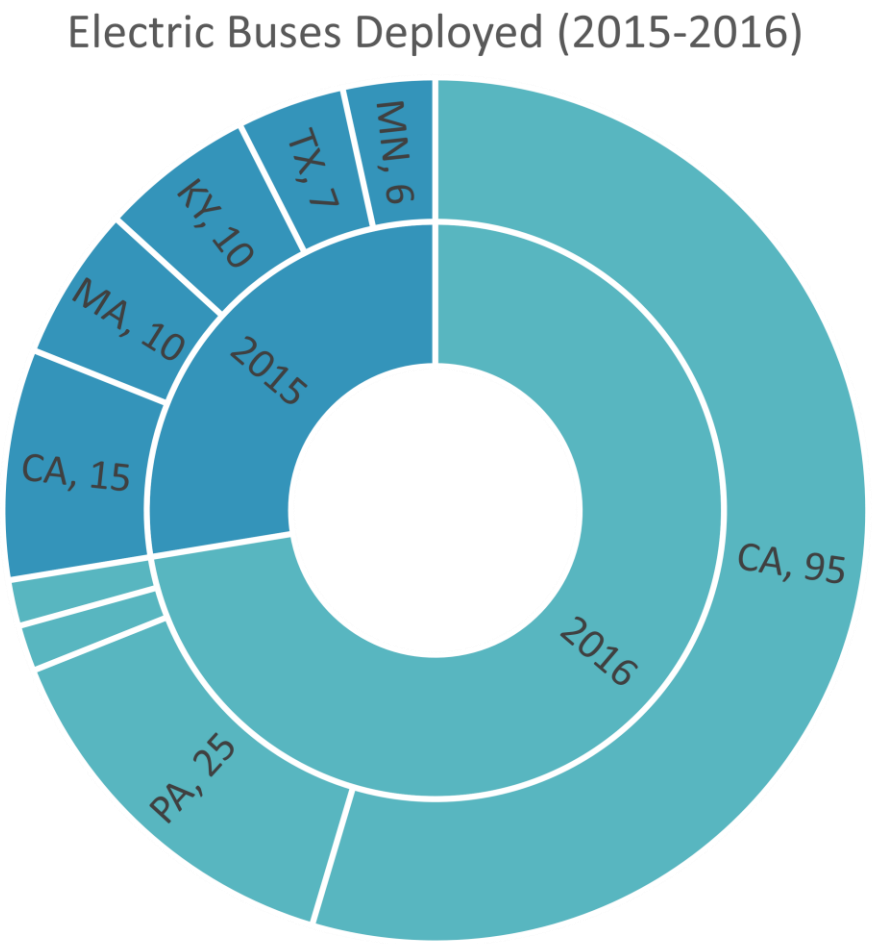


Source: Charlatte & modified by CMK

Emerging Availability: E-Transit Buses

- 6 OEMs with 8 models available today
  - Sales dominated by Proterra and BYD
- ZEV buses are expected to double in 2016 and account for 20% of transit bus market by 2030
- Federal incentives driving interest
  - $55 million annual program targeting ZEV buses
- Potential lower total cost of ownership
  - Higher upfront cost with lower fuel and maintenance costs

A typical bus consumes about 50,000-100,000 kWh/year depending on battery size and duty cycle



Source: Atlas Public Policy Analysis

Emerging Availability: Utility Electrified Fleets

EEI Fleet Electrification Initiative

- More than 70 utilities have committed to invest at least 5% of annual fleet budgets for PEVs

EPRI PHEV Medium-Duty Program

- Class 2 through 8
- 296 trucks deployed in 64 fleets in 23 States
- Also includes VIA Motors pickup trucks and vans and Odyne Systems class 6 through 8
- Chassis Manufacturers include Freightliner, Ford and Kenworth
- All vehicles have data acquisition technology to assess vehicle performance and use

Section 2: What Makes TE Markets Succeed?

Most Successful TE Markets Have A Combination Of The Following

Political Leadership

- A proactive governor or local mayor
- An engaged state legislature
- A supportive public utility commission

An Active Stakeholder Network

- Organized partnerships and coalitions including automakers and infrastructure providers
- An active utility facilitating infrastructure deployment and customer education

A Clear Strategy and Policy Framework

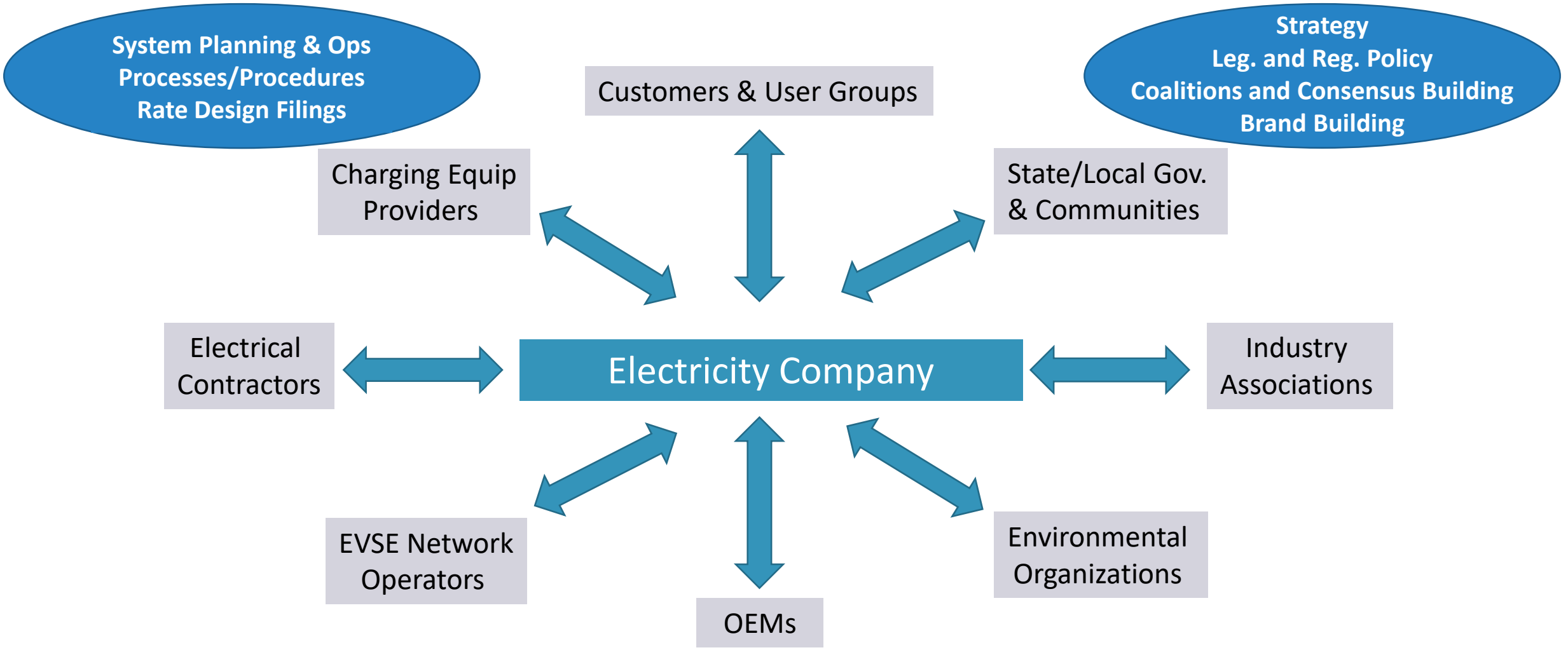
- A market implementation plan or roadmap
- Consistent PEV policies and incentives
- Sustained market education and promotions

Whitehouse Announces “Unprecedented Set Of Actions” To Accelerate Infrastructure Deployment

- $4.5B in Federal Load Guarantees eligible to support *commercial scale deployment of innovative EV charging infrastructure*
- A new framework for collaboration between automakers, utilities, charging companies, and states to accelerate charging infrastructure deployment and EV adoption
- The collaboration, centered on a set of *Guiding Principles to Promote Electric Vehicles and Charging Infrastructure* has nearly 50 organizations committed to date

“In the past eight years,” the White House says, “the number of plug-in electric vehicle models increased from one to more than 20, battery costs have decreased 70%, and we have increased the number of electric vehicle charging stations from less than 500 in 2008 to more than 16,000 today – a 40-fold increase.”

Electric Company Can Be Key Actor In TE Ecosystem (Applies to PEVs, Goods Movement and Transit)



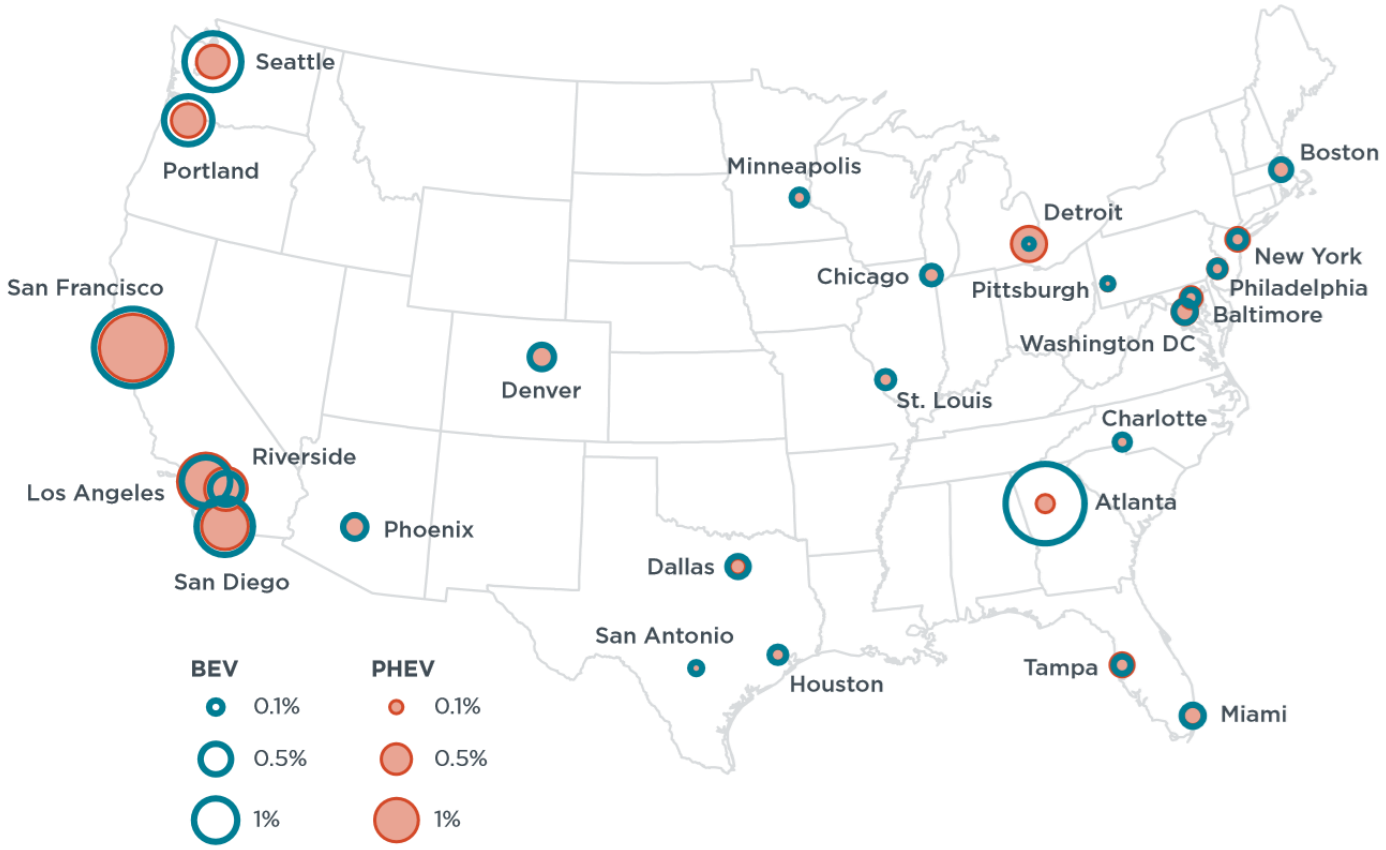
Encouraging State/Local Plans Builds Strong Partnerships and Helps Establish Priorities

Common themes amongst these plans:

- Establishing policy and incentive positions
- Developing strategies to prioritize/simplify infrastructure deployment
- Creating market education and outreach programs
- Encouraging public/private fleet PEV deployment
- Developing PEV signage standards
- Building coalitions and ongoing dialog

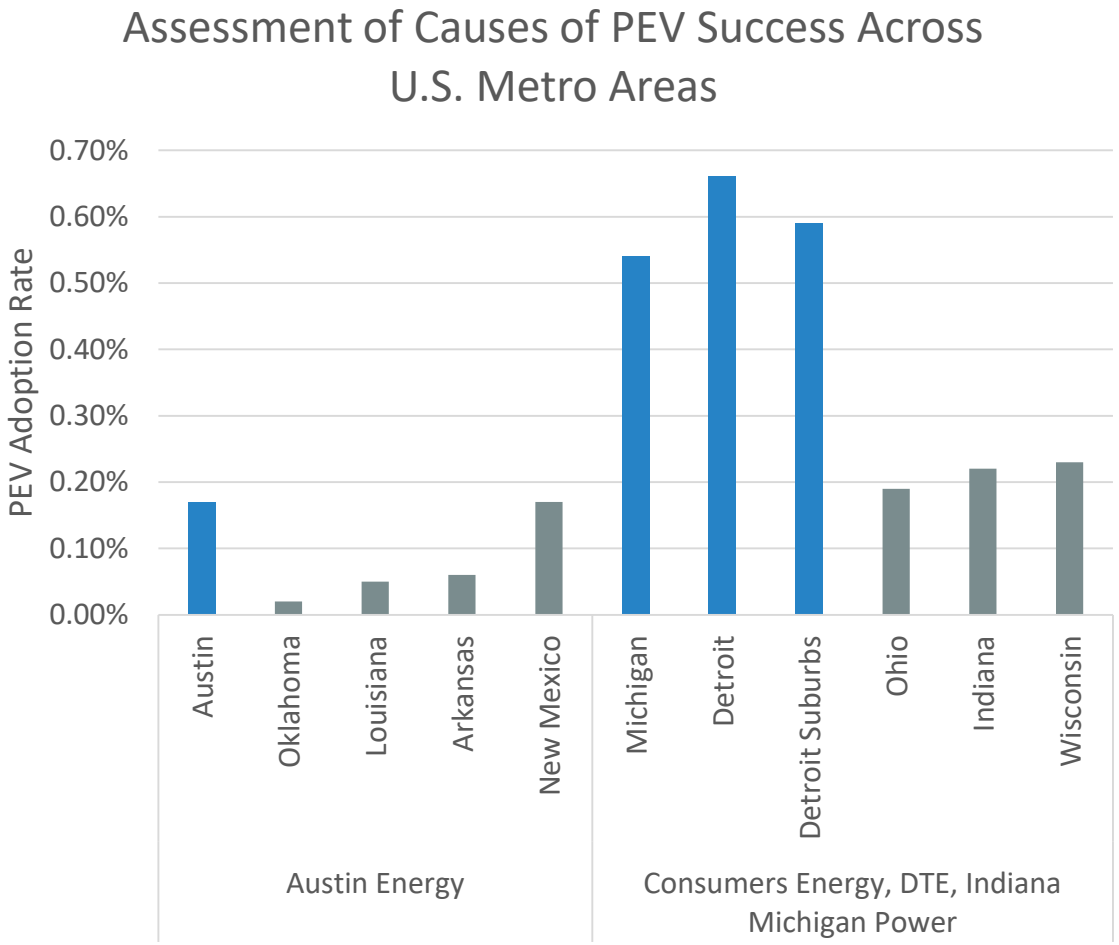
Ongoing Efforts to Identify Effective PEV Strategies and Policy Frameworks

- State policies and activities are driving greatest adoption of PEVs
  - States with more adoption had more policies and promotional activities
  - Vehicle financial incentives, HOV access, public charging availability, fee exemptions
- Metro and City actions also matter
- Challenging to identify the right mix
  - Evaluations of political/financial strategies ongoing by NGOs. Technical strategy evaluations ongoing by National Labs
  - Likely need a different mix of policies and strategies depending on climate (CARB, Argonne National Lab)



Source: *Assessment of Leading EV Promotion Activities in U.S. Cities*

Electric Companies With Supportive Policymakers Help PEV Markets Succeed

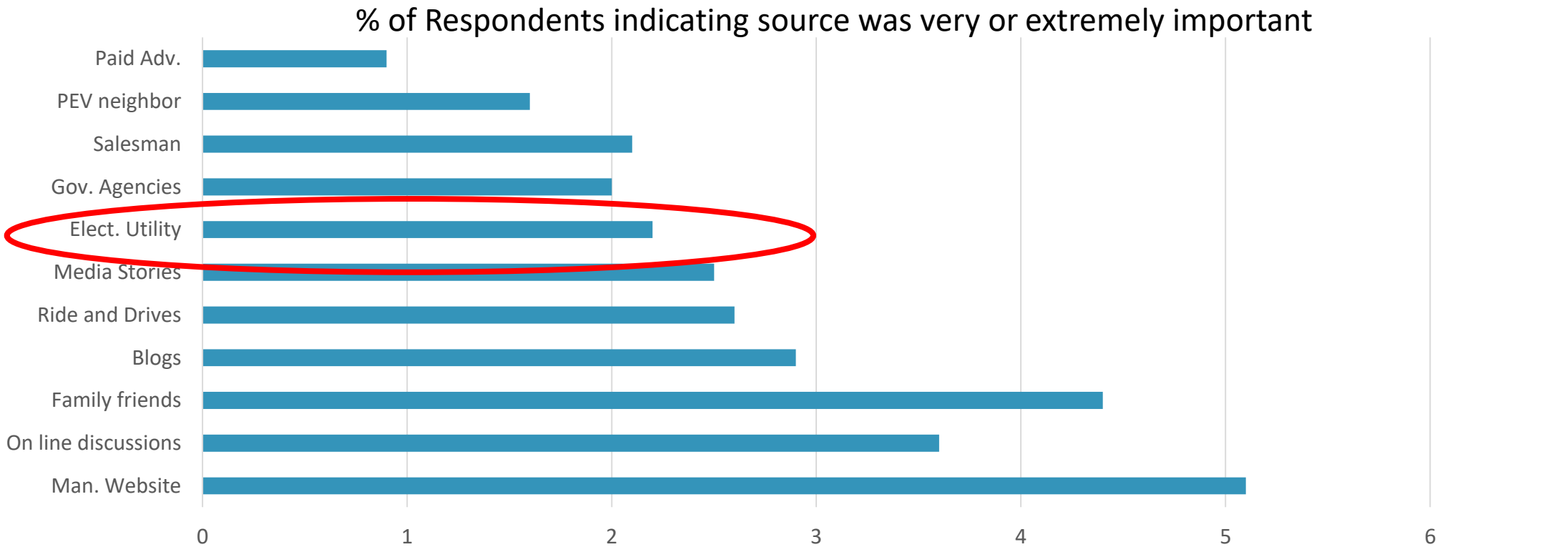


Examples:

- Austin Energy
  - Up to $1,500 for residential charging station
  - PEV submeter
  - Reduced PEV off-peak rates
  - New EV 360™ rate is $30 per month for all residential and public charging
- Consumers Energy, DTE, Indiana Michigan Power
  - Michigan Public Service Commission approved TOU rates
  - Flat rates
  - Up to $1500 for residential charging station

Source: Argonne National Laboratory

Education Is An Importation Electric Company Role

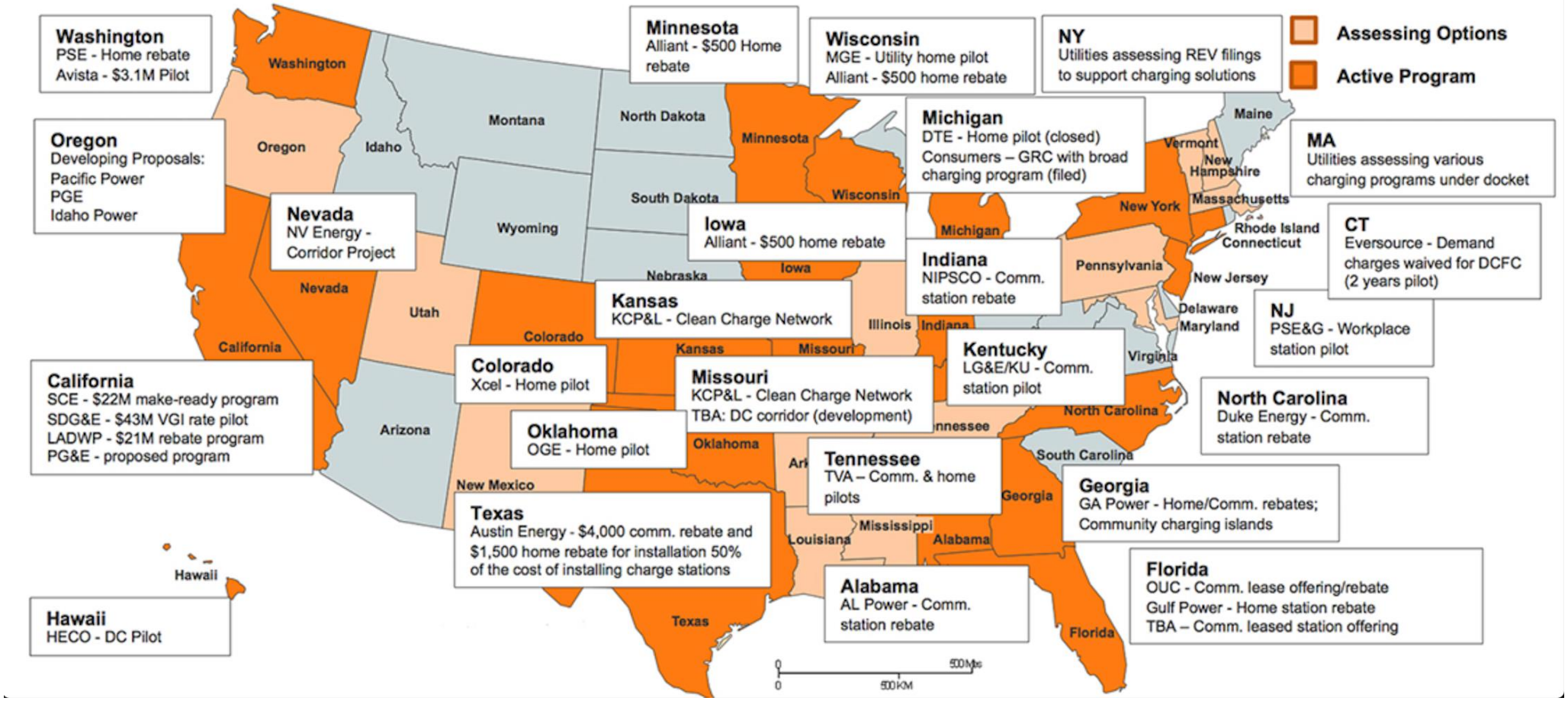


Source: CSE Clean Vehicle Rebate Dashboard Jan, 2015-May, 2016. Approx. 11,300 PEV sales

Customers seek information from their trusted energy provider including: how to prepare their homes and businesses for EV fueling, cost of electricity fuel, and the most cost effective ways to fuel

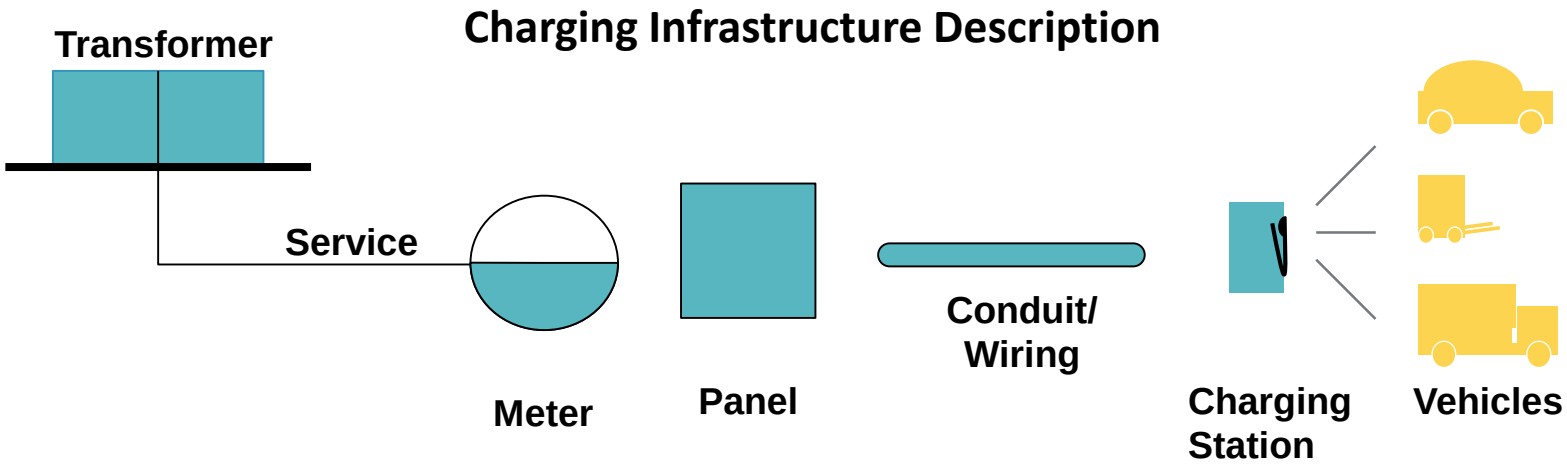
Electric Company Infrastructure Support Programs Are Growing

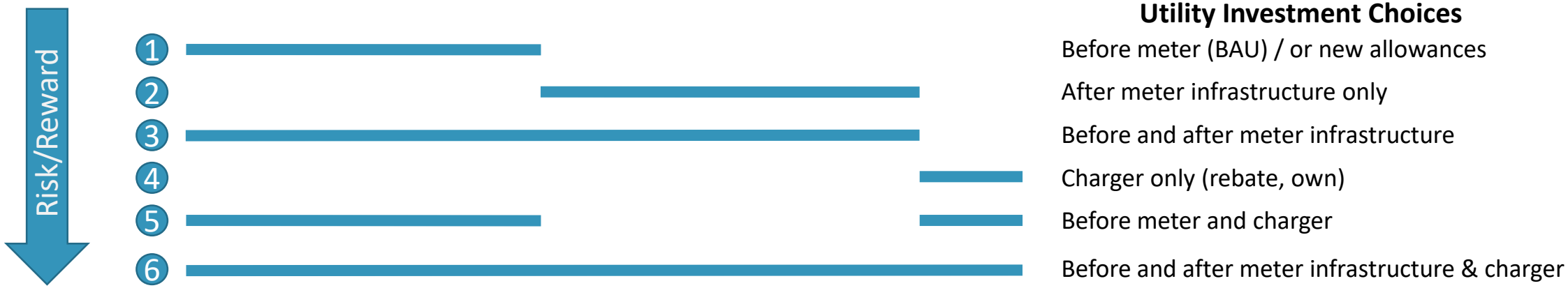
Source: ChargePoint



7 utility programs for infrastructure deployment have been approved (about 11,000 stations with 30 DC Fast Chargers). 4 more programs are in process (9,400 stations with 225 DC Fast Chargers).

Different Electric Company Investment Options (Goods & People Movement and Transit)





Considerations: Competition vs. monopoly, grid benefits vs. ratepayer costs, investment type vs. stranded asset risk

Section 3: Electric Company Examples of Successful TE Programs

- ✓ Four electric companies provide examples of TE leadership covering: PEV Readiness, Workplace Charging, Forklift Fuel Switching, and E-Fleet Deployment
- ✓ Each speaker will describe their TE program followed by Q&A

SDG&E: PEV Readiness & Grid-Integration

- In 2009 SDG&E set a goal to **efficiently integrate EV charging loads with the grid** in meeting CA state goals. Exploration led to favoring a time-variant rate with enabling technology. **Impact:** grid optimization, and reduced market barriers to EV adoption through infrastructure investment
- Customer and employee pilot studies validated this approach, which led to **Power Your Drive**, approved by CPUC in 2016
- **Focus:** Multi-family and workplace settings create net benefits for customers, fills void
- **Lessons:** Learn-by-doing, stakeholder coalitions are critical, sharing data helps inform state policy, and experiential education has strongest impact

Centerpoint: Workplace Charging and Employee Education

- **WPC Pilot-** learning through experience, helps reps engage with customers, generates data for future programs
- **Surveying employees** regularly to determine future PEV quantity. Projecting up to 100 electric vehicles in next 5 years
- CapEx **funded through facilities budget** with **free charging** offered today (value - $5/mo. per employee)
- **Employee education** program primarily through public website, employee communications and **Ride & Drives** (i.e. National Drive Electric Week)
- Participating in **EEI's Employee PEV Engagement Initiative**

Southern Company "Fuel Switching" Program

- Resulted in **enhanced customer relationship/satisfaction** and **increased system utilization**
- Required effective **external engagement** (relationships with equipment dealers) **and internal training** (consultative skills)
- Began with **a pilot and engagement** with stakeholders and regulators 15 years ago
- Easily **meets PUC cost effectiveness tests** and is widely supported
- **Migrated** program structure and lessons learned to **other TE markets** (mining, airport ground service equipment, etc.)

FP&L: Electric Fleet Deployment

- **Over a decade of leadership** deploying electrified fleet vehicles (light/medium/heavy duty) when technology solutions meet mission needs (cost, benefit, safety, reliability)
- Acquisition costs generally higher for PEVs, **but TCO costs generally lower**. Program funded as part of normal fleet acquisition and operations
- Over 570 HEVs/PHEVs/EVs with almost 160 Level 1 and Level 2 stations (300 charge ports) supporting both fleet and employee vehicles
  - **Leverages shared use" charging"**
- **Partners with EPRI** and other utilities to cost effectively evaluate new technologies

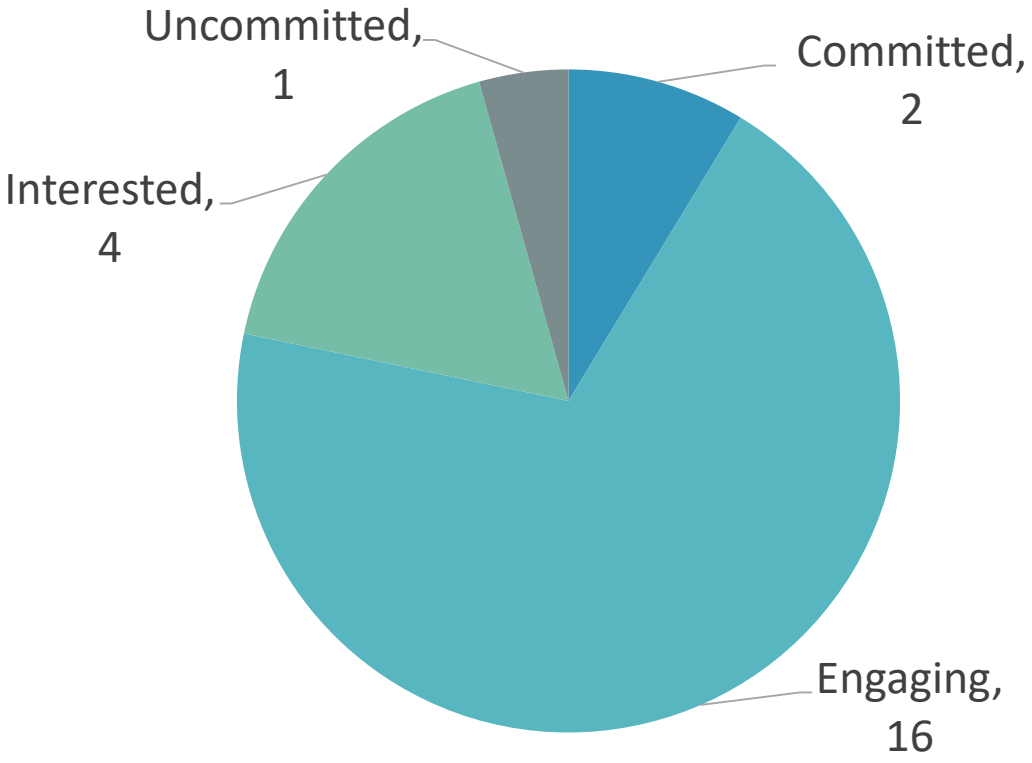
Section 4: Summary and Next Steps

Webinar Summary

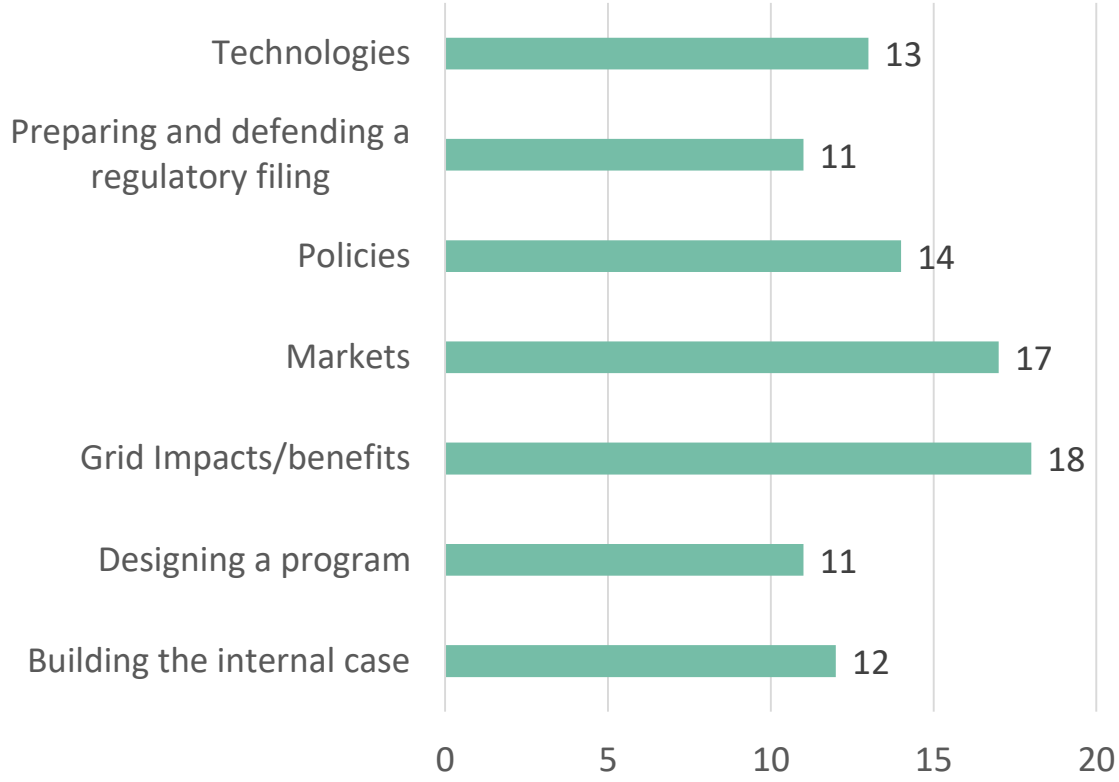
- TE Markets are more than passenger vehicles and growing steadily
- Future scale that TE represents to electric companies could help offset impacts of declining system utilization, rising cost-of-service and provide new business models
- Making TE markets succeed takes coordinated political leadership, active stakeholder networks, and a clear strategy and policy framework regionally
- Market studies, academia and key stakeholders strongly endorse need for an *active* electric company to help TE markets succeed through market education, incentives and rates, advocacy, and infrastructure investments
- As electric companies consider new TE programs there is significant evidence and experience to be leveraged and EEI, DOE, and other stakeholders are here to help

What You Told Us You Were Interested In Going Forward

What stage are you at in your interest in transportation electrification?



What areas are you most interested in regarding transportation electrification?



(23 Electric Companies Responded)

What To Expect In Future TE Webinars

- Understanding the grid impacts and benefits of transportation electrification
- What are the different roles an electric company could play and why?
- What could a transportation electrification filing look like?
- How does the electric company get started on a transportation electrification program and filing?

In the meantime, we encourage you to share your feedback on these webinars and appreciate any input that enhances the effectiveness of this effort

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