VOLKSWAGEN

GROUP OF AMERICA

National ZEV Investment Plan: Cycle 1

Public version

April 9, 2017

Contents

1. Executive Summary

As required by Appendix C to the 2.0-Liter Partial Consent Decree entered by the U.S. District Court for the Northern District of California on October 25, 2016, Volkswagen Group of America is investing $1.2 billion over the next 10 years in zero emission vehicle (ZEV) infrastructure, education, and access outside California to support the increased adoption of ZEV technology in the United States, representing the largest commitment of its kind to date. Based on figures from the Council of Economic Advisors and U.S. Department of Transportation related to highway and transit investments, the $1.2 billion being spent here is estimated to support up to 15,000 jobs throughout the United States over the 10 year course of the investment *[Dept. of Transportation, Council of Economic Advisors]*.[1] The first cycle of a separate investment of $800 million in California is the subject of the California ZEV Investment Plan, which was submitted to the California Air Resources Board on March 8.

Volkswagen Group of America has created Electrify America LLC, a wholly-owned subsidiary headquartered in Reston, Virginia, to fulfill its Appendix C commitments.

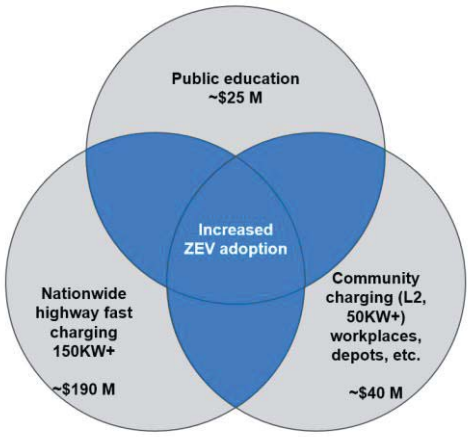
The investment: The $1.2 billion commitment will be spent in $300 million increments over four 30-month cycles. This report describes the $300 million in investments that will be made in the first 30-month cycle, which runs from Q1 2017 through Q2 2019, to meet this goal.

Cycle 1 (Q1 2017 – Q2 2019)	Cycle 2 (Q3 2019 - Q4 2021)	Cycle 3 (Q1 2022 – Q2 2024)	Cycle 4 (Q3 2024 – Q4 2026)	Full 10 years
$300M	**$300M**	**$300M**	**$300M**	**$1,200M**

This investment will make it easier for millions of Americans to charge their electric vehicles. In addition, Electrify America will broadly promote the benefits of ZEVs to consumers through education campaigns.

[1] The Council of Economic Advisors estimates that every $1 billion in federal highway and transit investment would support 13,000 jobs. This total count includes direct, indirect, and induced jobs. Note that the estimate here is for the number of jobs across the entire 10-year, $1.2 billion investment, and not just the first investment cycle, and assumes that spend on charging infrastructure will create a similar number of job-hours per dollar spent as highway and transit investments.

The Cycle 1 plan: In the first ZEV investment cycle, Electrify America will focus on three activities aimed at increasing the use of ZEVs and showing more Americans that going electric is possible and beneficial today. (1) Installing charging infrastructure (approximately $250 million), (2) Public Education initiatives (approximately $25 million), (3) ZEV access initiatives (under development), and an additional approximately $25 million spent on the operational costs of running Electrify America (e.g., personnel, other business expenses).



Overview of Cycle 1 National Investment Plan

INSTALLING CHARGING INFRASTRUCTURE (~$250 million)

Electrify America plans to build charging infrastructure that will primarily consist of (1) community charging and (2) a long distance highway network. In addition, other use cases/technologies are also under consideration including targeted battery storage to manage peak demand and ease grid loads, etc.

A series of guiding principles were applied to identify appropriate infrastructure investments:

- Focus on accessible locations where utilization is expected to be high for ZEV drivers
- Focus on a variety of use cases based on the anticipated charging behaviors of ZEV drivers
- Incorporate anticipated changes in the ZEV industry to maximize usefulness of stations in the medium-to-long term
- Consideration for long term sustainability of the network

Charging stations will be located first in the areas with the highest anticipated ZEV demand; this is based on the forecast penetration rates of ZEVs in each region and the estimated gap between the supply and demand of charging infrastructure in those regions. In aggregate, the Electrify America first cycle investment will aim to establish a network of approximately 2500+ non-proprietary chargers across 450+ individual stations. Note that, in addition to the capital spend numbers shared below, there is an additional approximately $20 million associated with creditable station operating expenses (e.g., fixed costs).

Electrify America stations will be designed to provide access by supporting multiple non-proprietary and interoperable charging technologies to meet different needs. Level 2 AC charging (L2) with universally accepted J1772 connectors will serve charging at long dwell-time locations. 50+ kW Direct Current (DC) fast charging will serve ZEV needs in shorter dwell time situations and along highway corridors, utilizing non-proprietary charging standards (CCS and CHAdeMO). Electrify America will also support open protocols including Open Charge Point Protocol (OCPP) that allow more standardized communication between different chargers and networks.

To simplify the consumer experience, Electrify America will seek access agreements with owners of other charging networks to make it easy for as many ZEV drivers as possible to move more seamlessly between different charging networks.

Community charging (approximately $40 million in capex)

The National Academy of Sciences' 2015 comprehensive report on overcoming barriers to ZEV deployment endorsed a strategy focused on specific geographies, or "beachheads," stating that a strong strategy to increase ZEV adoption "logically would focus on key geographic regions or regional corridors where momentum has already been established; infrastructure is more readily available; [and] word-of-mouth between neighbors, friends, and co-workers can occur more readily" [*NAS, 2015*]. Through the National Outreach Plan process, Electrify America received approximately 50 proposals from cities for concentrated ZEV infrastructure investments in specific metropolitan areas, and many additional recommendations from states, local governments and other stakeholders expressing support for concentrating investment in metropolitan areas.

Electrify America has selected 11 metropolitan areas for Cycle 1 investment: New York City, Washington D.C., Chicago, Portland (OR), Boston, Seattle, Philadelphia, Denver, Houston, Miami, and Raleigh. Government agencies from ten of these metro areas submitted proposals to Electrify America, some of which were the most comprehensive proposals received. Electrify America notes that it was not able to select every metropolitan area that submitted a strong proposal, but it intends to expand its Community Charging investments into metro areas with supportive government policies and strong utility integration in future investment cycles.

Within selected metros, Electrify America plans to build 300+ stations across five major use cases (multi-family homes, workplace, commercial/retail, community, and municipal lots/garages). In order to maximize the effectiveness of the network, it is important to focus on a variety of use cases. According to an NREL report from Jan. 2017, workplace and public charging have both been shown to significantly increase fleet-wide electric vehicle miles traveled *[Wood et al., 2017]*, consistent with the overall goals of Electrify America. A deployment mix of AC L2, DC 50 kW, and DC 150+ kW chargers will be offered across these use

cases to help best meet the anticipated needs of ZEV drivers. Reasoning behind the metro area selection is provided in Section 2.2.1.2.1.

A high-speed highway network (approximately $190 million in capex)

In recent years, a consensus around the value of a national network of extremely high speed ZEV charging equipment along our nation's highways has been emerging. In 2013, western states coordinated with industry to establish the West Coast Electric Highway, which has "successfully enabled significant range extension" for ZEVs and led to "a considerable amount of long distance travel" by ZEV drivers according to Idaho National Laboratory research [*INL 2015b*].

In 2015, Congress required the Federal government to designate national electric vehicle charging corridors and established an aspirational goal of deploying charging infrastructure along the full nationwide network by 2020 [*FAST Act*]. In 2016, the Department of Energy and the Department of Transportation agreed to jointly develop a 2020 vision for that network incorporating DC fast charging at power levels up to 350 kW. Upon designation of the corridors in 2016, 28 states, utilities, vehicle manufactures, and suppliers – such as New York, General Motors, and General Electric – committed to help accelerate ZEV charging infrastructure deployment along these corridors [*Laign*].

The comments, recommendations and proposals submitted to Electrify America through the National Outreach Plan process articulated overwhelming support for investment in a nationwide network of high speed ZEV charging infrastructure along our nation's highways. More than 100 comments and proposals called for investment in DC fast charging corridors, and approximately 20 specifically called for deploying a network with faster, higher-powered charging than is available today. For example, nine states listed DC fast charging corridors as their number one investment priority.

Electrify America will build a long distance high speed highway network consisting of charging stations along high-traffic corridors between metropolitan areas and across the country, with an initial target of approximately 240 highway sites installed or under development by the end of the first cycle, more than 150 of which are expected to be completed. These highway sites will be present in 39 U.S. states with higher anticipated ZEV average annual daily traffic (AADT, a Department of Transportation measure of road traffic density on an annual basis) by 2020. The sites will be located on prominent U.S. interstates and highways, and they have high correlation with the recently-announced EV Charging Corridors [*Alternative Fuels Corridors 2017*]. Sites will be, on average, about 66 miles apart, with no more than 120 miles between stations, meaning many shorter range ZEVs available today will be able to use this network. Also, note that we accounted for existing infrastructure on targeted

highways in our methodology to ensure that the network will supplement, not duplicate, investments already made (see Section 2.2.1.2.2.).

More than 25 comments to Electrify America – especially from ZEV drivers – emphasized the importance of placing stations in locations with sufficient amenities and proper signage. A "user-centric experience" along EV charging corridors is also an aspirational goal established by the Department of Transportation [*FHWA, 2017*]. Electrify America's goal is to locate the charging sites within easy access of the interstate in locations that provide ample parking spaces for charging, ensure customer safety, and offer access to retail and service establishments like restaurants, coffee houses, and retail and convenience stores that provide customers with options during the typical charging time period of up to 30 minutes. The average station will be able to charge five vehicles at once, with station capacity ranging from no less than four and up to ten vehicles charging at a time.

In order to accommodate the call for faster charging reflected in public comments, the chargers deployed will represent state-of-the-art technology with the fastest charging speeds available. Stations will focus on 150 kW and some 320 kW DC fast chargers, which will also be capable of charging 50 kW capable vehicles at a lower power level.[2] Most currently installed non-proprietary DC fast chargers are in the 25-50 kW range; a 50 kW charger can supply about 3 miles of ZEV range per minute of charging. Electrify America's 150 kW DC fast charging stations will provide about 9 miles of ZEV range per minute of charging, while 320 kW DC fast chargers will provide about 19 miles of range per minute. These faster charging speeds are necessary to refuel the next generation of larger battery capacity ZEVs with all-electric ranges above 200 miles. According to Navigant Research projections, these vehicles will represent 84 percent of battery-electric vehicle sales by 2020. By 2025, 39 different models of 200+ mile battery-electric vehicles are projected to represent 87 percent of sales [*Navigant, 2016b*]. Electrify America's network is being designed to charge this next generation of ZEVs.

Industry input received during the Outreach Plan provides Electrify America with confidence that one or more vehicle manufacturers plan to sell 320 kW capable ZEVs by 2020. Electrify America will carefully evaluate the ratio of 150/320 kW chargers at these sites for maximum customer convenience and optimal budgeting, but it plans to "future proof" these investments by designing most stations to be cost-effectively converted from 150 kW to 320 kW charging by the end of the 4th cycle (e.g., by installing appropriately-powered utility connections capable of handling 320 kW chargers), as recommended by Idaho National Lab. Electrify America will also maintain open discussions with OEMs to track progress towards 320

[2] Idaho National Lab, DOE, and DOT refer to power levels of 350 kW because the limit of the standard is currently 350 amps multiplied by 1000 volts, or 350kW. However, comments from OEMs and experts during the Outreach Plan process have led Electrify America to believe that the next generation of vehicles will be designed to go up to 920V, not 1000V. Electrify America refers to 320 kW charging to reflect the result of 350A x 920V."

kW-capable vehicles, understanding that there are still technical, cost, and code and standard setting challenges associated with this new technology [*Carson, 2016*].

Building the infrastructure

In constructing and operating a charging network, Electrify America, which is headquartered in Reston, Virginia, will rely on an extensive group of third-party suppliers and vendors in the charging infrastructure space, most of whom are based in the United States. As such, these partnerships will mean that jobs are created and many existing companies will grow as a result of Electrify America's $250 million Cycle 1 investment across the nation and its additional $120 million investment in California. Electrify America has already begun formal discussions with suppliers, through both a Request for Information (RFI) sent to potential suppliers in December 2016 and through the formal issuance of Requests for Proposals (RFPs), the first of which was issues in March 2017. Over 80% of the suppliers issued the RFI were companies based in the United States.

Preliminary milestones for the network construction progress are shown in Table 1. Site development for the first Electrify America stations will begin in Q2 2017, with development initiated for all stations by Q2 2018. These first stations are expected to be completed and operational for local community charging in Q3 2017 and for highway charging in Q2 2018. Given long lead times in terms of site acquisition and permitting processes, the majority of the stations are expected to be completed near the end of the 30 month cycle, from fewer than approximately 150-200 operational stations in Q2 2018 to 450+ stations by the end of Q2 2019.

	National ZEV infrastructure		
	Pre-site selection	**In development**	**Operational**
Q2 2017	350-400	100-150	0
Q4 2017	150-200	200-250	50-100
Q2 2018	0-50	300-350	150-200
Q4 2018	0	150-200	250-300
Q2 2019	0	0-50	450+

TABLE 1: PRELIMINARY MILESTONES FOR NETWORK CONSTRUCTION FOR THE NATIONAL INFRASTRUCTURE PLAN

Much of this proposed schedule is determined by the lead times associated with various pre-installation tasks, including finding and acquiring sites, permitting, and securing available hardware (especially for new high-speed charging systems), each of which can vary considerably based on local factors. Much of the uncertainty around timelines is associated with (1) the site acquisition and design process, which requires contract negotiations with property owners/developers, customization of engineering drawings for specific sites, and the need to identify approximately five sites for each final location due to uncertainties through the implementation cycle; and (2) the permitting/approval process, which can take anywhere from

3 to 9 months depending on the permits required at the various levels of government (e.g., local vs. state).

BRAND-NEUTRAL PUBLIC EDUCATION AND AWARENESS ACTIVITIES ($25 million)

Electrify America received nearly 150 submissions through the National Outreach Plan process that expressed support for investments that will increase public awareness of ZEVs' attributes and benefits. As one Western state explained, "Without a significant investment in highway corridor charging infrastructure, paired with a dynamic advertising and marketing campaign to spread the awareness of the emerging technology and associated infrastructure available to travelers, the ability of the EV market to expand eastward across the country will be stymied." Likewise, a Northeastern state commented: "A major brand-neutral marketing campaign would have the potential to raise awareness and acceptance of EVs broadly."

In order to inform the public education campaign, Electrify America has performed a segmentation analysis of the general car-buying population to evaluate the penetration of ZEVs in various car-buying population segments and regions, the positioning of zero-emission vehicles relative to competition, the barriers to adoption of ZEVs by population segment, and the key messages to communicate to the general population in order to improve penetration of ZEVs. Based on this analysis and analysis of consumer media consumption habits, Electrify America is developing a comprehensive educational campaign that will simultaneously communicate the benefits of ZEVs (performance, acceleration, quietness, comfort, and the overall enjoyment of the ride) and address barriers to adoption (range anxiety, "golf cart" misperception, charger availability).

Media will be used to put ZEVs on the "big stage" in order to help consumers understand that ZEVs not only meet the majority of their needs today, but even more so as the charging infrastructure network grows. The messaging will be split across traditional advertising channels such as television and targeted digital (including digital radio and social media). In order to quickly maximize messaging presence, a coordinated national/local media strategy was developed. This allows for quick ramp-up across the country, followed by sustained messaging in top, high-potential ZEV markets.

The nearly 150 comments received by Electrify America made it clear that extensive ZEV Education and Outreach efforts are ongoing, and Electrify America intends its investment to leverage and reinforce these ongoing efforts. Through the National Outreach Plan process, we have already begun conversations with a number of potential partners on educational initiatives, including ZEV advocacy organizations, school education curriculum developers, OEMs, and state agencies. We will continue to provide updates on these activities as they develop.

Electrify America's creative agency continues to refine the creative content based on the segmentation analysis (highlighting the most impactful benefits of ZEVs), and creative concepts should be finalized in Q2 of 2017, followed by finalization of media planning by summer. Media will begin towards the end of Q3 of 2017.

ZEV ACCESS INITIATIVES

Numerous government agencies and other stakeholders proposed ZEV access programs in their comments to Electrify America. A program of experiential initiatives like ride-and-drive events are being developed to help increase ZEV access and exposure for as many Americans as possible.[3] The purpose of these activities is to increase the public's awareness of and access to ZEVs and allow them to experience ZEVs without having to purchase a vehicle.

[3] Electrify America will seek written approval for access programs or projects from EPA before Electrify America makes these investments, as required by Appendix C.

1.2 Summary of Public Comments and Other Input

1.2.1. Summary of public comments

As part of the National Outreach Plan, Electrify America solicited proposals and recommendations from outside parties to help substantiate and improve this plan. Electrify America notified stakeholders identified in Appendix C (i.e., states, municipal governments, federally-recognized Indian tribes, and federal agencies) of the proposal submission period, which was open from December 9, 2016 to January 16, 2017. Further detail on outreach efforts can be found in the National Outreach Plan submitted to EPA on November 9, 2016. Electrify America will continue to consider input from stakeholders over the 10-year life of Appendix C.

For the first 30-month investment cycle, Electrify America allowed a 3-week grace period and considered submissions received through February 6, 2017. A total of 484 submissions were received as of February 6, 2017. Figure 1 provides an overview of the proposals by topic and by type of submitter.

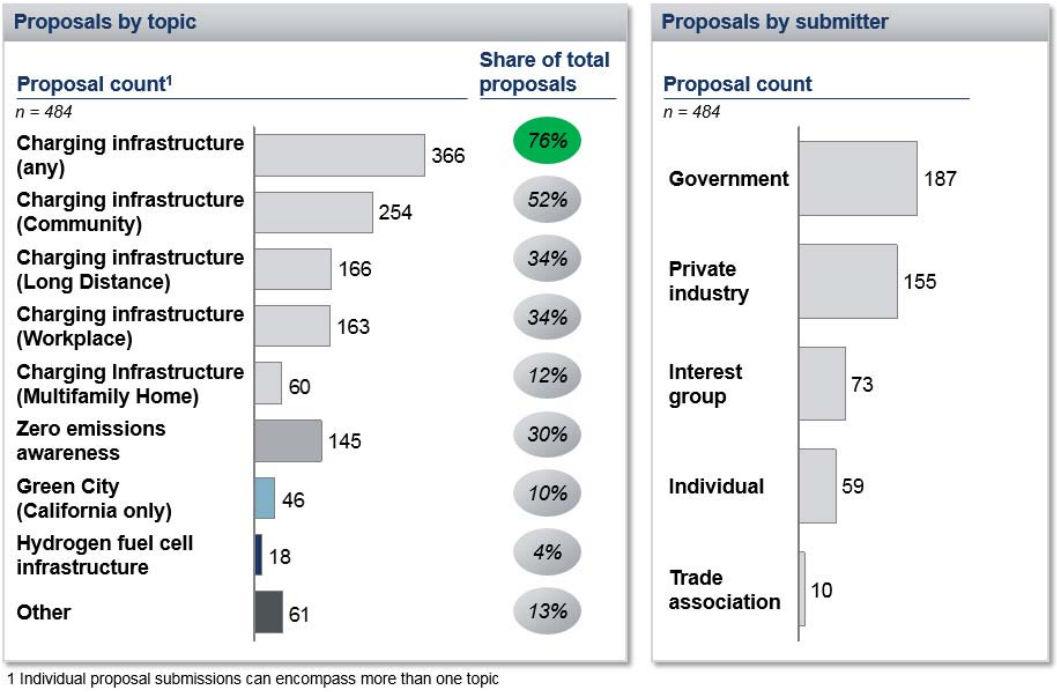


FIGURE 1: SUBMISSIONS BY TOPIC AND SOURCE, OTHER METRICS

Submissions were received from entities in all but four states, and two Native American tribes submitted proposals. The largest number of submissions originated from California (194 submissions), while 49 proposals and recommendations were received from representatives of a city, county, coalition, transit organization or air quality association outside of California.

About 29,000 unique visitors viewed the website, and 121,000 total website hits were recorded by February 6, 2017.

1.2.2. Consideration of comments

Proposals were initially evaluated across a variety of factors including, but not limited to, submission source, speed of implementation, likely charger utilization, and development synergies. Following the initial evaluation, proposals are being categorized based on action-ability and sent for thorough professional review and sorting to the appropriate internal working teams at Electrify America. Starting March 13, working teams began to follow up with proposal and recommendation submitters to clarify submissions, discuss specific ideas, and incorporate some or all of the ideas into Electrify America's plans. There is high likelihood that Electrify America will act on proposals that overlap with or optimize priorities identified by Electrify America in the first cycle. Note that *Electrify America intends to respond to everyone who submitted a proposal*. An overview of this process is shown in Figure 2.

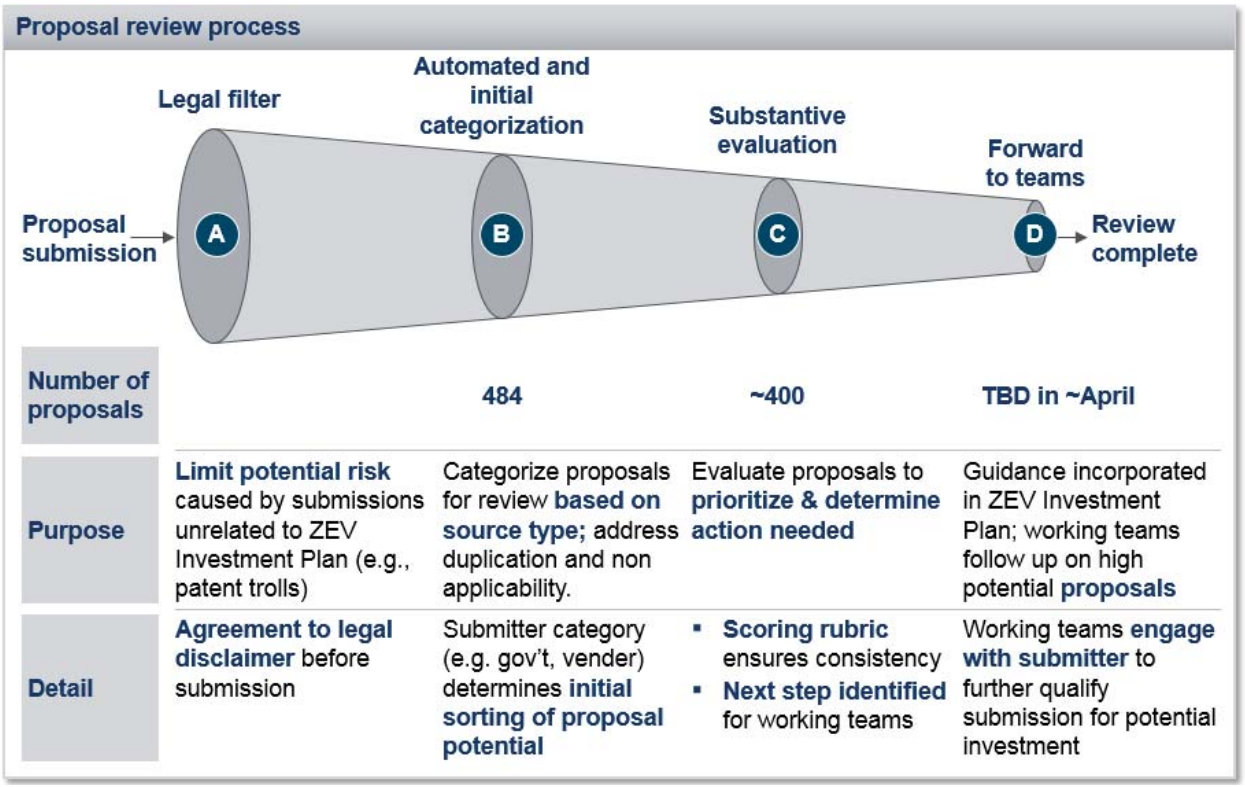


FIGURE 2: OVERVIEW OF PROCESS FOR CONSIDERATION OF PUBLIC COMMENTS

1.2.3. Samples of submitted proposals and recommendations

The submissions provided Electrify America with information on the level of public support for this plan's investment strategies, and it also provided specific project ideas. A selection of submitted recommendations and proposals includes the following:

- **Charging Infrastructure Needs:** The overwhelming majority of comments supported and, in many cases, prioritized, ZEV charging infrastructure deployment investments. This was true across the full spectrum of commenters, from comprehensive proposals from State governments to requests from small towns and 'mom-and-pop' stores for a single charger. Commenters highlighted that charging infrastructure investments meet an identified need and a recognized ZEV deployment barrier. Consistent with this feedback, Electrify America is maximizing infrastructure investment in this plan in ways consistent with the requirements of Appendix C.
- **DC Fast Charging along Highway Corridors:** More than 100 comments and proposals focused on the importance of and execution of a highway network, and nine states and numerous other submissions explicitly urged Electrify America to prioritize investment in highway charging as its highest investment priority. Electrify America intends to focus nearly two-thirds of its national investment in this area, consistent with this recommendation.
- **ZEV charging depots**: Numerous submissions, especially from cities, proposed charging depots in urban centers, consistent with our strategy to incorporate this use case in metro areas. For example, in one Northeastern city, a consortium of parties including the local utility is seeking to install a 100% renewables-powered charging hub in its downtown.
- **Coordinated Planning with State and Regional Government**: Many submissions, especially from state agencies and regional coordinating entities, emphasized the benefits of coordinating infrastructure investments with ongoing state activities. For example, two Western states submitted a consolidated proposal to increase charging infrastructure through workplace charging, park-and-ride transit hub charging, and charging along key interstate corridors. These submissions have highlighted the value of coordinating with state agencies, and Electrify America has already initiated coordination as part of its outreach effort, as described below.
- **Workplace Charging**: Electrify America received more than 150 submissions supporting investment in workplace charging, which is an additional validation of the importance of this use case. Many comments from businesses and government agencies recommended specific sites. Electrify America will closely consider each site identified in a target metro area.

- **Multifamily Dwellings**: More than 50 submissions proposed investment in the multifamily and residential use case, affirming the importance of this use case.
- **Destination Charging**: A small number of commenters suggested that Electrify America invest in destination charging. This use case will receive more consideration from Electrify America given that some proposals had this focus, including some compelling destinations, such as national parks and monuments.
- **Airports**: Submissions from 20 airports and federal agencies proposed charging infrastructure investment at airports. These proposals are being evaluated and may be a further extension of longer dwell time parking applications. The fact that these typically preferentially-located chargers would be seen by non-EV drivers using those airports may help further build charging infrastructure awareness.
- **Experiential Projects**: Electrify America received more than 50 suggestions and proposals to provide experiential access to ZEVs, including ride and drives, ZEV taxis and car sharing, and brand-neutral ZEV showrooms. Electrify America plans to explore some of these concepts in its California Green City.
- **Other Recommendations Out of Scope**: Electrify America also received comments and proposals that it is not able to act upon in Cycle 1, either due to restrictions on investment in Appendix C, or because the investments would be outside of this investment plan's focus on foundational infrastructure to serve ZEV driver needs. For example, some cities and other entities requested that Electrify America supply them with ZEVs of various size classes, which would not qualify as a priority investment at this time. Additional proposals also recommended Electrify America investment in Level 1 charging, bicycle programs, and research and development projects, which are not creditable cost investments under Appendix C. While these submissions did not fit within the scope or timetable of the Cycle 1 ZEV Investment Plan, promising creditable ZEV initiatives will be considered in later investment cycles.

1.2.4. Other Input

Throughout development of this plan, Electrify America consulted knowledgeable experts in the ZEV space with extensive automaker, utility, infrastructure, policy, communications, technology, and consumer advocacy backgrounds.

Electrify America met with a number of utilities and utility groups to explore utility infrastructure investment approaches and synergies. We also spoke with state level officials and their associations to understand state-level infrastructure priorities, charging site opportunities, and potential partnership plans.

Electrify America met with Federal agency experts, who provided detailed information on the Federal government's Smart City effort, their process for designating EV charging

corridors along highways under the FAST Act, lessons learned from the EV Project and the Workplace Charging Challenge, and ongoing work to support deployment of non-proprietary DC fast charging at power levels up to 350 kW.

Additionally, major automotive original equipment manufacturers (OEMs) were consulted to understand their interest and expectations about a new, comprehensive charging network that would best suit future ZEV customers. Consumer, environmental, and EV driver groups were also consulted to gain their public interest viewpoints.

2. National ZEV Investment Plan

2.1. Overview

Over the course of the first 30-month investment cycle, Electrify America will invest $300 million nationwide (excluding California, which is detailed in the California ZEV Investment Plan) across three primary areas:

1. ZEV charging infrastructure
2. ZEV public education campaign
3. ZEV access initiatives (under development)

Approximately $250 million will be spent on charging infrastructure, at least $25 million on public education investments, and the remainder (approximately $25 million) on other operational expenses for Electrify America. Spend related to ZEV access initiatives has not yet been estimated. Note that all numbers and activities referenced in this investment plan refer to National spend (i.e., excludes spend under the California ZEV Investment Plan) unless otherwise indicated.

Figure 3 provides an overview of these planned costs.

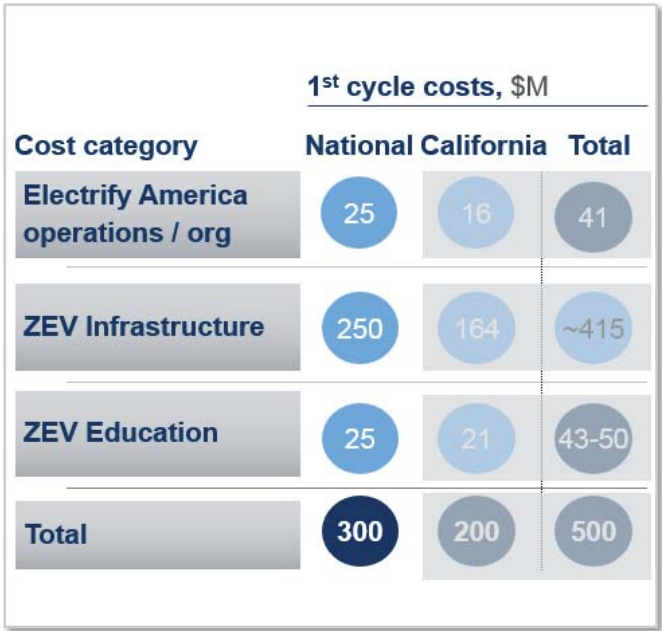


FIGURE 3: OVERVIEW OF COSTS ACROSS CATEGORIES

An overview of the three main investment categories is provided below:

1. **ZEV charging infrastructure**: Electrify America will focus on two primary areas for infrastructure investment: long-distance highway chargers and community-based metropolitan chargers. An overview of these investments is provided in Table 2.

	Long-distance highway network	Community-based metro network
Number of stations	240*	300+
Primary technologies	320 kW and 150 kW	150 kW, 50 kW, and L2
Number of highways/metros	~35 highways across the US	11 metro areas across the US
Approximate spend	$190 million	$40 million

*Stations built or under development.

TABLE 2: OVERVIEW OF LONG-DISTANCE HIGHWAY AND COMMUNITY-BASED LOCAL NETWORKS (EXCLUDING CALIFORNIA)

In developing this plan, we drew on a number of sources from academia, industry, and government (see Section 2.6. Supporting literature) to ensure investments are focused on high-priority areas where there is clear need for investment in ZEV infrastructure and where likelihood of utilization is highest. Details of the station location methodology is described in the following sections of this plan. Note that approximate spend on the highway network is $190 million, the community-based network is $40 million, and there are an additional $15-20 million in creditable expenses associated with station operations (e.g. fixed costs around maintenance and networking).

2. **Public education campaigns**: The purpose of these campaigns is to develop a portfolio of brand-neutral media that increases the number of people aware of and willing to consider ZEVs.
3. **ZEV access initiatives**: Various experiential initiatives like ride and drive events are being considered to further increase ZEV access.

Overhead and other costs are expected to account for approximately $25 million of Electrify America's spend in the first 30-month investment cycle. The majority of this spend (approximately $20 million) will be attributable to operating the business (e.g., personnel).

2.2. Investment types and descriptions

2.2.1. Infrastructure

2.2.1.1. Guiding principles

Electrify America's mission is to establish one of the largest, most technically advanced and customer-friendly charging networks in the U.S. to promote and support the increased adoption of ZEVs. Key guiding principles used to design the network include the following:

- **Focus on locations where access and utilization is expected to be highest**: investments target highways and metropolitan areas with high current and projected concentrations of ZEV drivers to maximize potential network utilization.
- **Focus on a variety of use cases based on anticipated charging behaviors of ZEV drivers**: Electrify America will build chargers to cater to drivers on highways, in public areas (commercial/retail locations, parking garages), in workplaces and multi-family dwellings, and in other viable use cases where appropriate.
- **Incorporate anticipated changes in the ZEV industry by 'future-proofing' stations to maximize their usefulness in the medium-to-long term**: investment will include the latest technology (from L2s up to 320 kW DC fast charging) and operate across different charging standards (CCS and CHAdeMO) to maximize access and help ensure future compatibility in a rapidly evolving industry. Electrify America will also continually look for new technologies, including wireless charging, and work to incorporate them in future investment cycles. Wireless charging will likely occur no earlier than cycle 2 as even the most credible wireless charging proposal we received acknowledged that the bulk of wireless charging investment might not be viable until after 2020. By focusing on open standards and cross-platform compatibility in the first 30-month cycle, Electrify America will be well positioned to adopt new technologies.
- **Focus on a sustainable business model**: the Electrify America network is being designed to ensure that the network is economically viable and can be operated and maintained for the long term.
- **Focus on interoperability and suitable signage**: the Electrify America network will represent an advanced business-to-business (B2B) platform to support other stakeholders who wish to manage the customer relationship themselves as well as business-to-consumer (B2C) capabilities for customer management by Electrify America. Where possible, agreements will be created with the owners/operators of other charging networks to simplify and improve ZEV charging for all drivers on multiple networks. Both Electrify America and available state and federal signage resources will

be used to the extent possible to further resolve consumer lack of awareness of existing charging infrastructure (Figure 4) *[Singer 2016]*.

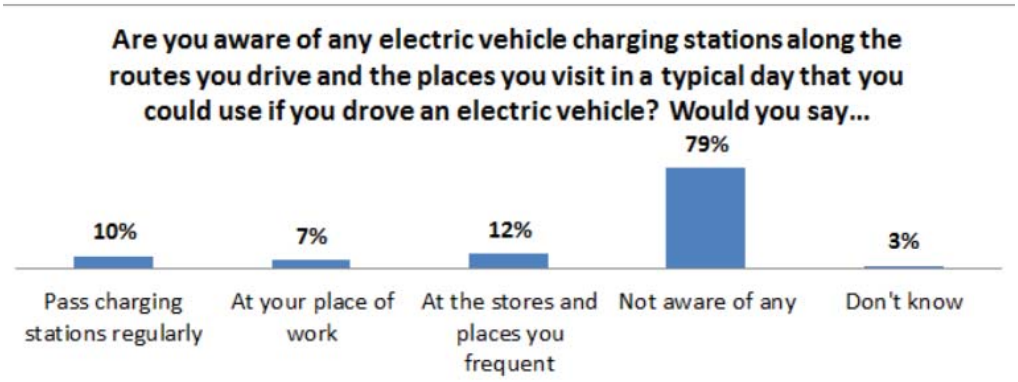


FIGURE 4: CONSUMER VIEWS ON PLUG-IN ELECTRIC VEHICLES

2.2.1.2. Investment selection methodology

The ZEV infrastructure investment plan includes two key components: (1) community-based charging stations in 11 major metropolitan areas and (2) a high-speed nationwide network to facilitate highway travel between major metropolitan areas and across the country with higher and faster DC charging power to reduce waiting times. For both components, the following three factors were used to determine the required investment: (a) locations with the highest ZEV demand; (b) the gap between the existing charging infrastructure supply and projected demand at each location; and (c) the charger count and type needed to meet the excess charging demand at each location. By adopting this methodology, Electrify America is well positioned to install charging stations where they are most needed, as Appendix C requires, and most likely to be used. Note that, throughout this process, Electrify America utilized academic, government, and industry reports on ZEV charging infrastructure investment, advertising, and projections to develop this plan. Electrify America used peer-reviewed reports to the extent they were available. The reports reviewed are reflected in the sources listed at the conclusion of this report.

2.2.1.2.1. Community-based local network investment selection methodology

The first step in the selection process was to determine the list of metropolitan areas to prioritize for investment. An overview of the process can be seen in Figure 5 and comprised two key steps:

1. Narrowing down the list from approximately 100 metropolitan areas to 25 based on key demographic factors and current hybrid and forecast ZEV sales.

2. Further prioritizing this list to 11 metropolitan areas based on the extent of local government interest, incentives, and regulation; local awareness of ZEVs; feedback from utilities and other stakeholders; and quality of fit with the long-distance highway plan.

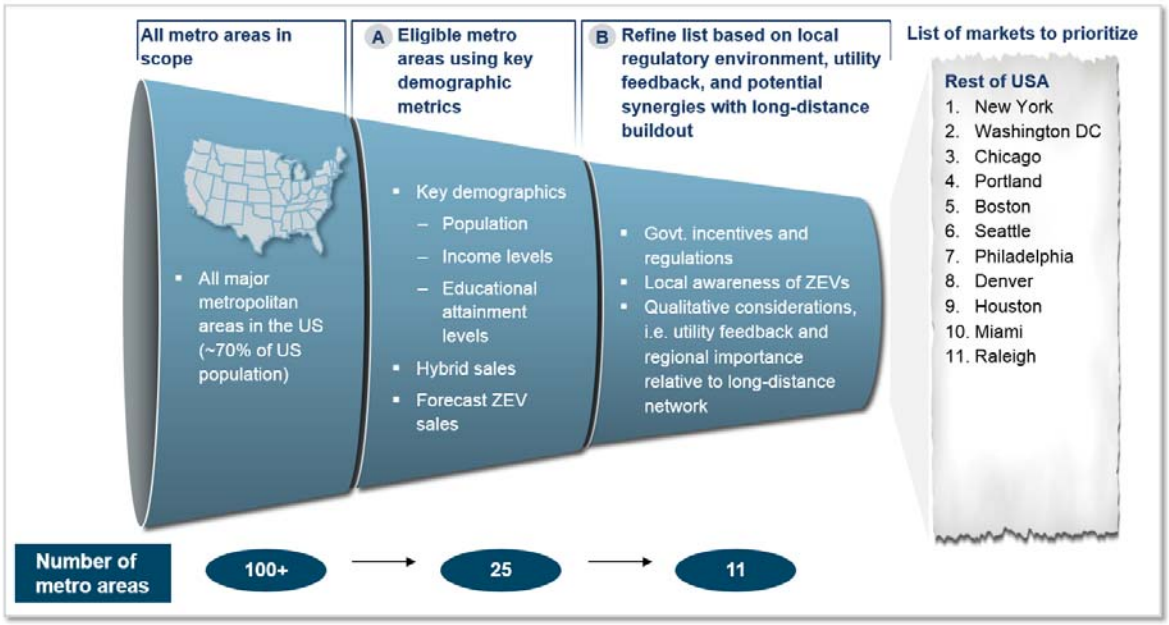


FIGURE 5: OVERVIEW OF METROPOLITAN AREA SELECTION METHODOLOGY

By adopting the methodology shown in Figure 5, a shortlist of priority National metros was developed: New York City, Washington D.C., Chicago, Portland, Boston, Seattle, Philadelphia, Denver, Houston, Miami, and Raleigh. Electrify America notes that it was not able to select every metropolitan area that submitted a strong proposal, but it intends to expand its Community Charging investments into metro areas with supportive government policies and strong utility integration in future investment cycles, and Electrify America will continue to refine its methodology as the industry develops.

Within each priority metro area identified, Electrify America calculated the gap between projected demand for charging power needed from future infrastructure to support projected higher EV market share and the power delivered from infrastructure today. Specifically, infrastructure demand outside the residence was estimated based on a calculation of the projected total ZEV vehicle miles traveled (VMT) in each of the metropolitan areas in 2020. ZEV VMT represents the anticipated ZEV drivers' commuting behavior and is the product of the average commute length [*Kneebone and Holmes*], the number of commuting vehicles, and the ZEV penetration rate [*Navigant Research, 2016*]. Calculated ZEV VMT (in miles) is converted to an expected energy demand using an average energy efficiency of 0.35 kWh/mile. This calculation generates the expected energy demand (in kWh) for charging infrastructure outside the residence within particular metropolitan areas.

Electrify America's approximately $40 million investment in local community-based charging is estimated to fill approximately 10-15% of the projected supply-demand gap in these metropolitan areas through the construction of 300+ stations built in the first 30-month investment cycle. Accordingly, Electrify America investment in infrastructure is only a starting point to closing these considerable charging power gaps; as such, other private and public investment will continue to be needed, especially from utilities who are increasingly acting to provide more charging infrastructure in their service areas.

2.2.1.2.2. Long-distance highway network investment selection methodology

In recent years, consensus around the need for a national network of extremely high speed ZEV charging equipment along our nation's highways has been emerging. In 2015, Congress required the Department of Transportation to designate national electric vehicle charging corridors, and established an aspirational goal of deploying charging infrastructure along the nationwide network by 2020 [*FAST Act*]. In 2016, the Department of Energy and the Department of Transportation agreed to jointly develop a 2020 vision for that network incorporating DC fast charging at power levels up to 350 kW. And when the Department of Transportation designated specific EV charging corridors later that year, a coalition of 28 states, utilities, vehicle manufactures, and other stakeholders committed to help accelerate the deployment of electric vehicle charging infrastructure along the identified routes [*Laign*].

The comments, recommendations, and proposals submitted to Electrify America through the National Outreach Plan also supported investment in a nationwide network of high speed ZEV charging infrastructure along our nation's highways. More than 100 comments and proposals called for investment in fast charging corridors, and approximately 20 specifically called for deploying a network with faster, higher-powered charging than is available today. Commenters – especially EV drivers – also emphasized the importance of placing stations in locations with sufficient amenities and proper signage.

Electrify America has designed a nationwide highway network to place high-speed charging stations along the long-distance routes with the highest estimated ZEV traffic as well as to link prioritized metro areas from the prior section in order to form a cohesive nationwide network. At a high level, ZEV traffic was estimated along every major route in the U.S., and, after taking into account existing charging infrastructure supply along those routes to assure that new investment supplements existing investment, the estimated 'supply-demand gap' for charging stations along each route was calculated using an approach similar to what was used to determine the metropolitan area charging supply-demand gap, but which relied on average annual daily traffic data from the Federal Highway Administration to establish demand. This allowed us to determine which routes have the highest need for new infrastructure investment.

Key sources of data used to complete this analysis include the following: ZEV penetration rates by census bureau statistical area (CBSA) *[Navigant, 2016; Experian]*, number of long-distance trips between metro areas from the FHWA Traveler Analysis Framework [*Federal Highway Administration framework*], and existing charging infrastructure levels *[EERE]*. An overview of targeted highways and estimated station counts is shown in Table 3.

Prioritized highway	Estimated station count
I-95	15+
I-75	10+
I-10	10+
I-80	10+
I-5	10+
I-90	5-9
I-70	5-9
I-40	5-9
I-15	5-9
I-30	5-9
I-85	5-9
I-44	5-9
I-35	5-9
I-65	5-9
I-45	2-4
I-91	2-4
I-84	2-4
I-25	2-4
I-81	2-4
I-20	2-4
I-24	2-4
I-94	2-4
I-87	<2
I-71	<2
I-64	<2
I-17	<2
I-39	<2
I-8	<2
I-26	<2
US-3	<2
US-1	<2
I-12	<2
I-295	<2
I-76	<2
I-55	<2

TABLE 3: OVERVIEW OF NATIONAL HIGHWAYS TARGETED FOR INVESTMENT IN FIRST 30-MONTH CYCLE (ONLY INCLUDING STATIONS EXPECTED TO BE COMPLETED IN FIRST CYCLE)

As described more fully in 2.2.1.3 below, in order to obtain rights to a particular charging site, Electrify America must identify suitable site locations and complete the process of negotiating with landowners, utilities, and other entities before any chargers can be installed.

Given the uncertainty inherent in this process, and the risks of premature disclosure of Electrify America's site selection, Electrify America will provide further detail concerning the location and type of charging infrastructure as those plans are finalized. At this time, Electrify America does not know the precise location of the chargers it will be installing during the first 30-month cycle.

2.2.1.3. Specific description of investments

This section provides an overview of: (1) the quantities and locations of charging stations, (2) the chargers and type/number of connectors per station, (3) the informational basis for calculating charger investment costs, and (4) Electrify America's plan to invest in the existing ZEV infrastructure industry's capabilities and expertise.

2.2.1.3.1. COMMUNITY-BASED LOCAL NETWORK

Five priority use cases will be supported in the local community-based network in the first investment cycle. In future investment cycles, Electrify America may increase the number of use cases supported. An overview of the major use cases and how charging behavior varies between them is shown in Figure 6.

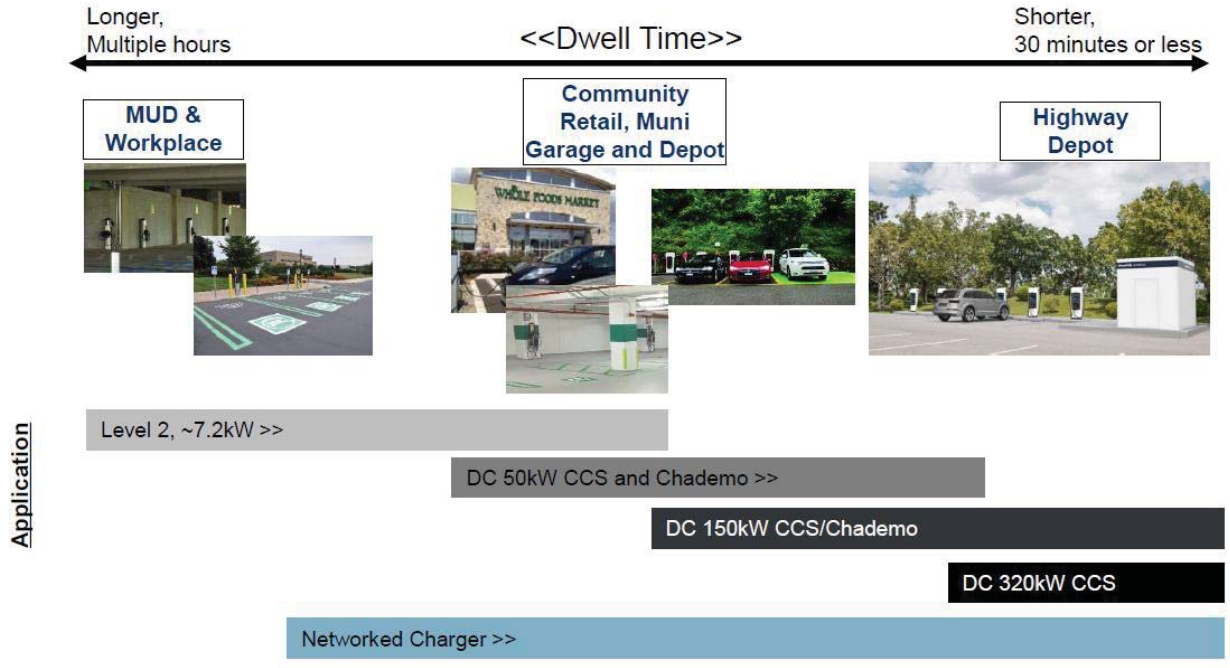


FIGURE 6: OVERVIEW OF MAJOR USE CASES TO BE PRIORITIZED IN FIRST CYCLE

At a high level, use cases with longer expected dwell times (e.g., workplace and multi-family homes), will have a higher ratio of L2 chargers, while use cases with shorter dwell times (e.g., commercial/retail) will have a higher ratio of DC 50+ kW chargers. This is consistent with expected driver behavior across the use cases, where, for example, drivers park their cars at home or work for 6-8+ hours at a time (allowing sufficient time for ~200 miles of charge to be added to the battery with an L2 charger), while drivers park at grocery stores or malls for considerably shorter periods of time (2-4 hours, where a 50 kW DCFC would be needed to add 200 miles of charge in that time period) *[Chehab 2017]*.

Across use cases, a majority of spend will be devoted to public use cases (commercial/retail centers, community depots, and municipal parking lots/garages), approximately one-third to workplaces, and the remainder to multi-family dwellings. However, considerations within individual metros, like corporate campus and multi-unit dwelling density, could alter these ratios. In addition to these use cases, there are other programs/technologies under consideration, including targeted battery storage.

2.2.1.3.2. LONG-DISTANCE HIGHWAY NETWORK

Electrify America will build a long distance high speed highway network consisting of charging stations along high-traffic corridors between metropolitan areas, with an initial target of approximately 240 highway sites installed or under development by the end of the first cycle, more than 150 of which are expected to be completed. Sites will be, on average, about 66 miles apart, with no more than 120 miles between stations, meaning many shorter range ZEVs available today will be able to use this network. An overview of the highway network is shown in Table 3 above.

Electrify America's goal is to locate the charging sites within easy access of the interstate in locations that provide ample parking spaces for charging, ensure customer safety, and offer access to retail and service establishments like restaurants, coffee houses, and retail and convenience stores to provide customers with options during the typical charging time period of up to 30 minutes. The average station will be able to charge five vehicles at once, with station capacity ranging from no less than four and up to ten vehicles charging at a time.

The chargers deployed will represent state-of-the-art technology with the fastest charging speeds available. Stations will focus on 150 kW and some 320 kW DC fast chargers, which will also be capable of charging 50 kW capable vehicles at a lower power level. Most currently installed non-proprietary DC fast chargers are in the 25-50 kW range; a 50 kW charger can supply about 3 miles of ZEV range per minute of charging. Electrify America's 150 kW DC fast charging stations will provide about 9 miles of ZEV range per minute of charging, while 320 kW DC fast chargers will provide about 19 miles of range per minute. These faster charging

speeds are necessary to refuel the next generation of larger battery capacity ZEVs with all-electric ranges above 200 miles.

Precise address locations or GPS coordinates for these highway corridor stations will be developed during our site identification, validation, and acquisition stage that begins in the second quarter 2017. These target locations will be considered confidential business information to ensure optimal lease terms during site negotiations.

2.2.1.3.3. INFRASTRUCTURE INVESTMENT TIMELINE AND MILESTONES

The estimated development schedules for both the highway and local community networks are shown in Table 4. The end-to-end process from site development is a lengthy process with multiple steps and includes the following:

- Ordering equipment
- Development of new property leads
- Signing of lease agreements (or, where appropriate, purchasing property)
- Development of permitting/pre-construction packages
- Filing permits
- Warehousing equipment and Quality Assurance/Quality Control
- Permit approval
- Site preparation
- Equipment delivery to site
- Completion of site construction
- Landscaping
- Utility connection to the grid/inspection and any additional utility preparation including new transformers or upgraded substations
- Commissioning

The length of time needed to complete each step can vary considerably across use cases as well as across geographies (e.g., permit approval timelines can differ substantially from city-to-city and state-to-state). Electrify America has already begun engaging key stakeholders and partners to begin implementation planning. As these relationships develop further, Electrify America will be able to start identifying and acquiring specific locations for chargers.

Development of the first metro community station is expected to begin in Q2 2017, with the first local community and highway charging stations expected to be operational in Q3 2017 and Q2 2018, respectively. The process is expected to take longer for the highway charging stations due to the higher charging power hardware and more complex technical, real estate, and utility requirements involved. Interim milestones for each six month period for the pace of

network construction for both the highway and local community charging stations are shown in Table 4.

	Community-based local network			Long-distance highway network		
	Pre-site selection	In development	Operational	Pre-site selection	In development	Operational
Q2 2017	200-250	50-100	0	100-150	0-50	0
Q4 2017	100-150	150-200	50-100	50-100	50-100	0
Q2 2018	0	150-200	100-150	0-50	150+	0-50
Q4 2018	0	0-50	250-300	0	100-150	0-50
Q2 2019	0	0	300+	0	0-50	150+

TABLE 4: INTERIM INFRASTRUCTURE DEVELOPMENT MILESTONES (NUMBER OF STATIONS) DURING THE FIRST INVESTMENT CYCLE

2.2.1.3.4. CHARGING STATION COST ESTIMATES

To derive an accurate budget estimate for the cost to construct the community-based and long distance charging infrastructure proposed for cycle 1, including all land acquisition, equipment procurement, installation, network and maintenance costs, Electrify America relied on several sources. Published cost estimates, such as those published by the National Academy of Sciences, and competitive benchmarking reports, were reviewed [*NAS, 2015*]. Electrify America drew on previous experience and expertise with currently available charging hardware, network, installation and operating costs, as well as typical vendor costs in procuring sites. Finally, Electrify America engaged in robust dialogue with industry partners (described in section 2.2.1.3.5.) to understand the costs associated with building stations equipped with a new generation of 150 kW and 320 kW DC fast chargers.

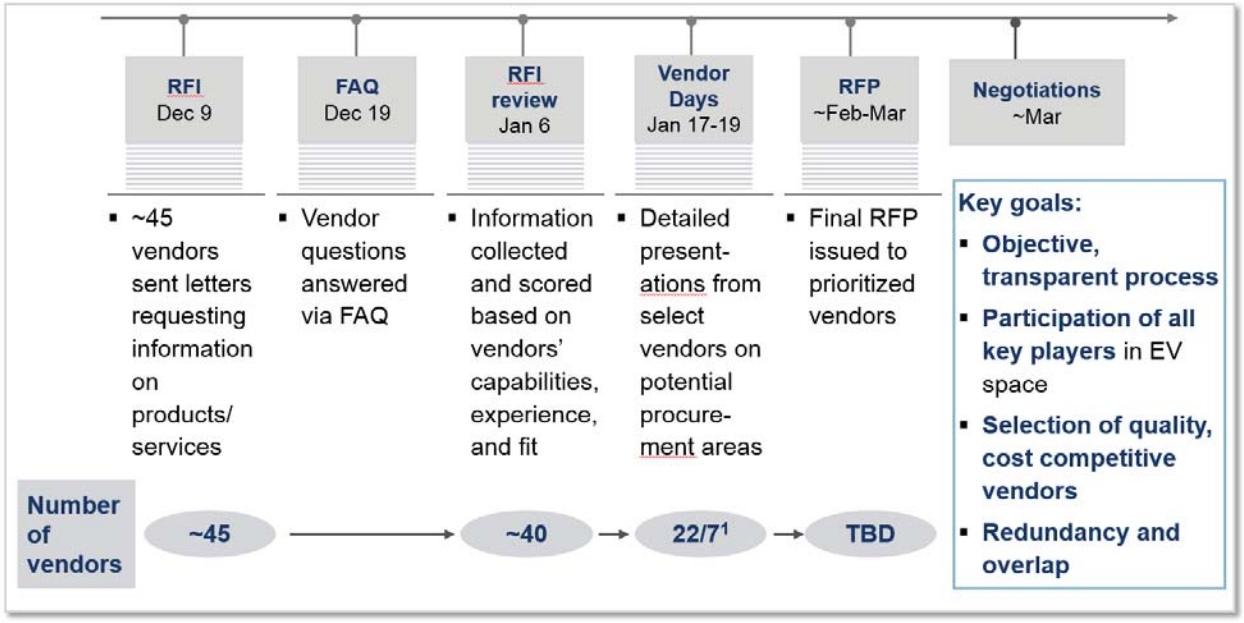
2.2.1.3.5. INDUSTRY PARTNERSHIP ENGAGEMENT

Electrify America will need the help of an extensive group of experienced suppliers in the charging infrastructure space to plan and implement this community and highway network, most of which are expected to be U.S. based firms. As such, Electrify America's $250M investment in infrastructure implementation and maintenance across the nation, and $120M investment in California, is expected to create opportunity for the existing American charging industry and employment in many American communities.

Electrify America has made significant progress in selecting vendors to meet these ambitious infrastructure build-out schedules. To date, Electrify America has solicited cost and technical information through an Request for Information (RFI), it has met with a large number of vendors across the charging space in a series of "Vendor Days," it has received numerous vender proposals through its National Outreach Plan Process, it has prioritized several vendors across key procurement categories from site identification and acquisition to site maintenance,

and it has initiated a series of Requests for Proposals (RFPs). Note that the RFI process is not limiting in that potential partners who did not participate in the RFI process may still be a part of the implementation moving forward when appropriate, and Electrify America will welcome such participation. An overview of the process is shown in Figure 7. Key steps included the following:

- **RFI issuance (Dec. 9th)**: 45+ vendors across the ZEV space (80+ percent U.S. based) sent letters requesting information (capabilities across the value chain, relevant experiences, and product/service offerings).
- **FAQ issuance (Dec. 19th)**: Vendor questions answered to clarify RFI where needed.
- **RFI response review (Jan. 6th)**:Information collected and scored based on vendors' capabilities, experience, and fit with Electrify America's overall mission. This process followed a rigorous, objective scoring methodology to best identify vendors positioned to help Electrify America.
- **Vendor Days (Jan. 17th-19th)**: Detailed presentations were given by approximately 30 vendors across procurement categories to provide qualitative highlights of their capabilities and future plans that Electrify America should consider in its forward planning.
- **RFP issuance (March onwards)**: For priority procurement areas, RFPs began to be issued March 9, beginning with one for site identification, validation and acquisition. The highway network hardware RFP was also issued in March 2017.



1 22 standup meetings during Vendor Days; 7 additional conference calls outside of that.

FIGURE 7: OVERVIEW OF RFI/RFP PROCESS

2.2.1.4. Maintenance plan for ZEV infrastructure

Electrify America will issue RFPs to external vendors to ensure that periodic maintenance will be available across the network for 10 years after the Effective Date to enable the hardware to remain operational over the entire 10 year period. Furthermore, contract terms negotiated after completion of the RFP process will ensure that the charging equipment is marked with a toll-free customer service hotline available 24/7 and that this number will be answered by a live operator if any maintenance issue should arise. Additionally, service response time metrics will be tracked.

2.2.1.5. Interoperability and open access

In order to maximize public access to its charging network, infrastructure built by Electrify America will have the ability to service plug-in ZEVs using a mix of non-proprietary connectors, which can be built by multiple suppliers to a commonly developed specification and can charge electric vehicles produced by multiple automakers. Level 2 AC charging will utilize universally accepted J1772 connectors, while every DC fast charging station will utilize both non-proprietary charging standards (CCS and CHAdeMO) in the first cycle in order to maximize access.

Through the National Outreach Plan process conducted during the development of this plan, Electrify America confirmed that the field of vehicle charging is rapidly evolving, especially regarding charging speed and non-proprietary connectors and protocols. We will continue to evaluate which chargers and non-proprietary connectors should be deployed as the technology and industry evolves.

Electrify America will also support open protocols including Open Charge Point Protocol (OCPP) that allow more standardized communication between different chargers and networks. Electrify America will also work to maintain OCPP compliance and other measures to help maximize interoperability, a term that describes the ease of communication between the charger and the network it is on. A highly interoperable charger network is one that is able to communicate easily with other chargers and networks, much like cellphones that have roaming capabilities today or highway toll transponders that work across multiple toll systems.

Infrastructure will also have the ability to accept multiple payment methods (e.g., subscriptions, mobile pay, RFID, credit cards, and “Plug-and-Charge” standardized in IEC/ISO 15118) to simplify usage as much as possible across a range of buyers. This will be consistent with the Federal Highway Administration’s recent call for a consistent and convenient charging experience along charging corridors, especially with regard to payment methods [*FHWA, 2017*]. In particular, a key part of the business model will be providing true ‘pay-as-you-go’ access to

potential customers, who will be able to use a credit card or other potential payment methods to recharge their vehicles without having a pre-existing relationship with a charging network operator. Note that there is also a disproportionate focus on publicly-accessible infrastructure (e.g., highway chargers, community depots, municipal parking lots and garages) to maximize access as well as promote exposure as broadly as possible.

Through the support of multiple charging standards, the ability to accept multiple payment methods, and a strong focus on publicly-accessible infrastructure, Electrify America will be building a highly interoperable network that provides access to as many consumers as possible. This is consistent with Electrify America's vision to promote 'universal access' as much as possible, well beyond the standards of many current players in the industry.

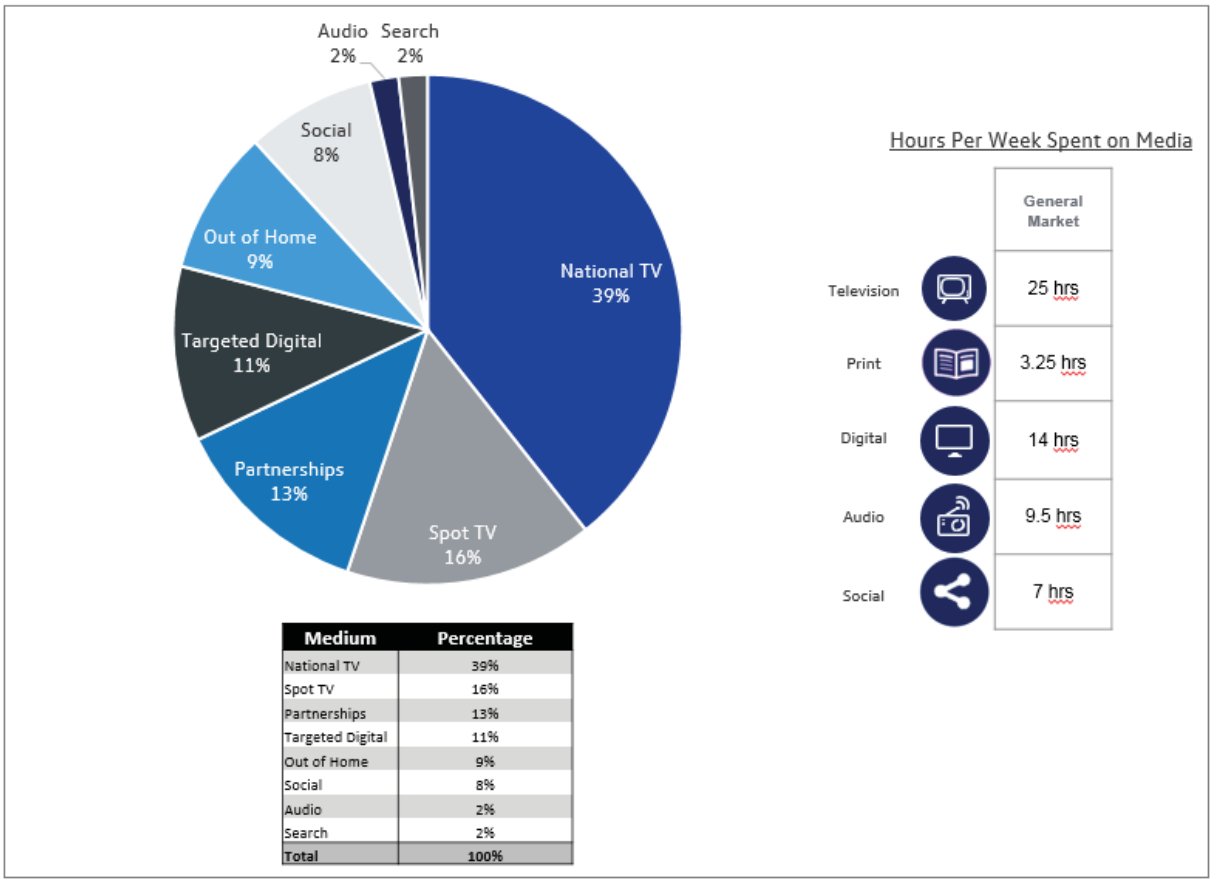
2.2.2. Public education

2.2.2.1. Guiding principles

The National Academy of Sciences' landmark 2013 report, *Overcoming Barriers to Electric Vehicle Deployment*, found that "…most potential PEV customers have little knowledge of PEVs and almost no experience with them. Lack of familiarity with the vehicles and their operation and maintenance creates a substantial barrier to widespread PEV deployment." The principles of the education campaigns, which can help to address the above finding, begin with an understanding of the current adoption rates of ZEVs.

2.2.2.2. Investment selection methodology

Total spend allocation within the first 30-month investment cycle for education will be $43-50 million across the entire United States (with at least $25 million of this spend outside of California). This spend will be allocated across multiple media channels to reach consumers at critical touchpoints based on their consumption habits, as shown in Figure 8.



Medium	Percentage
National TV	39%
Spot TV	16%
Partnerships	13%
Targeted Digital	11%
Out of Home	9%
Social	8%
Audio	2%
Search	2%
Total	100%

FIGURE 8: OVERVIEW OF GENERAL MEDIA CONSUMPTION HABITS

2.2.2.3. Specific description of investments

Based on segmentation analysis and consumer media consumption habits, we have developed a comprehensive plan to deliver messaging about both ZEV benefits and overcoming barriers to ZEV adoption. Media will be used to put ZEVs on the "big stage" in order to help consumers see that ZEVs not only meet the majority of their needs today, but also, as infrastructure networks grow further, adoption barriers continue to be reduced.

A preliminary illustration of this 360 degree messaging is summarized in Figure 9. A more detailed view of this is still under development by the creative and media agencies, but the messaging will be split across traditional advertising channels like TV, targeted digital advertising channels including digital radio, social media, websites, as well as partnerships with various platforms to further spread messaging.

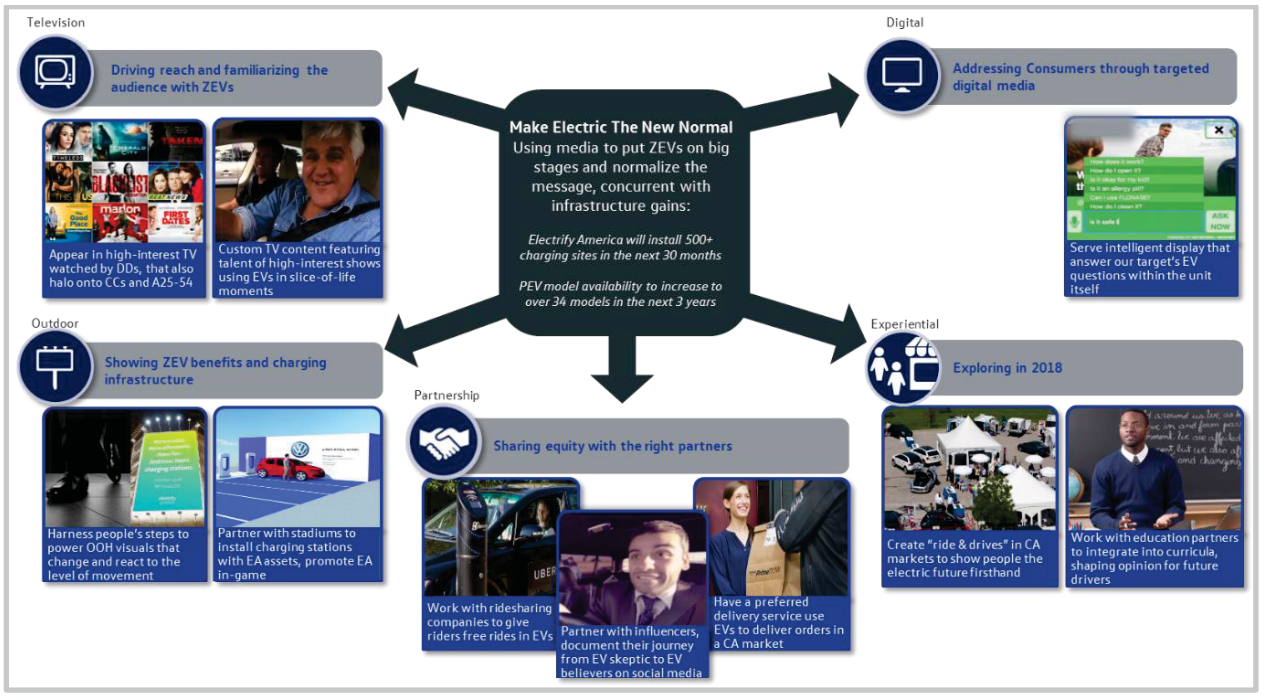


FIGURE 9: PRELIMINARY MULTI-CHANNEL APPROACH TO REACH CONSUMERS AT CRITICAL TOUCHPOINTS[4]

In order to quickly maximize messaging presence, a coordinated National/Local media strategy was developed. This allows for a quick ramp-up across the country, followed by

[4] The experiential programs, if considered access or exposure activities under Appendix C, are subject to written pre-approval by EPA before they may be considered creditable costs.

sustained messaging in top high potential ZEV markets. An overview of these planning principles can be seen in Figure 10.

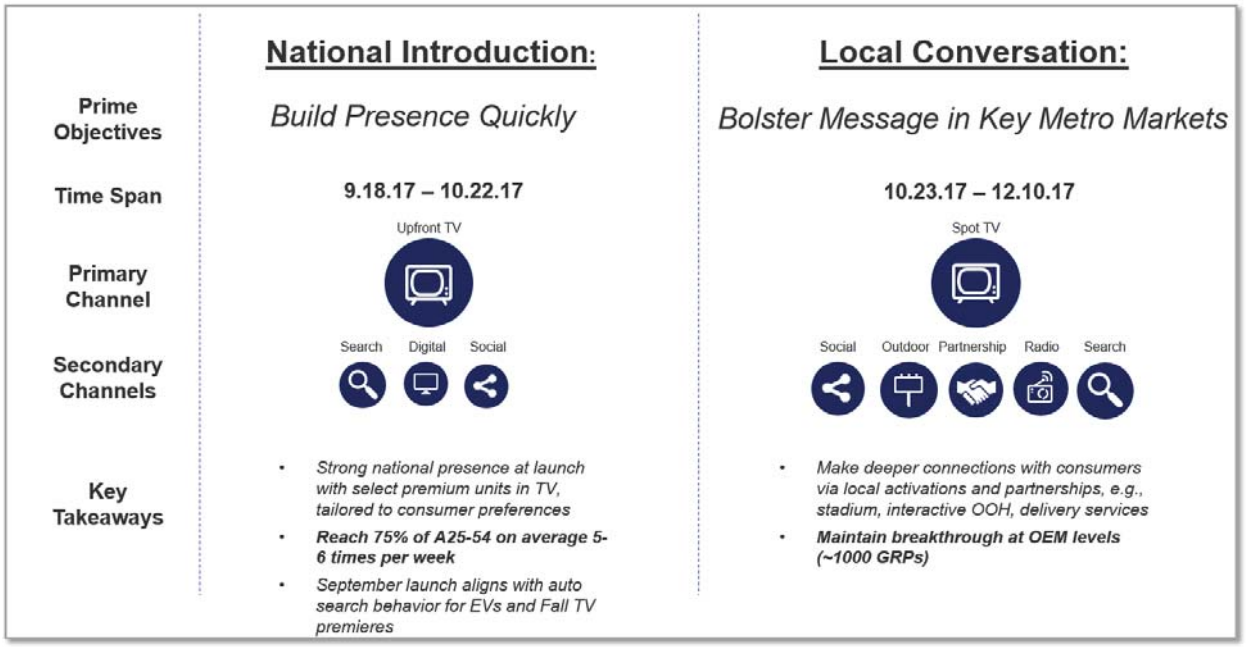


FIGURE 10: PRELIMINARY NATIONAL AND LOCAL MEDIA PLANNING PRINCIPLES

2.2.2.4. Public education timeline and milestones

Electrify America's creative agency continues to refine the creative content based on the segmentation analysis (highlighting the most impactful benefits of ZEVs), and creative concepts should be finalized in the next month, followed by finalization of media planning by summer.

2.2.3. Public access initiatives

Experiential initiatives like ride-and-drive events are being planned to help increase ZEV access and exposure for as many Americans as possible. The purpose of these activities is to increase the public's awareness of and access to ZEVs and allow them to experience ZEVs without having to purchase a vehicle. Options here are currently being explored, and updates will be provided in future reporting cycles. Electrify America will seek written approval for its access program from EPA before making these investments, as required by Appendix C.

2.3. Anticipated Creditable Costs

Creditable costs for the first 30-month investment cycle have been identified across the twelve categories specified in §2.5.3 of Appendix C. The creditable costs reflect Electrify America's current perspective and best estimate of anticipated costs, but are subject to change as the business continues to develop (e.g., vendors identified, full organization hired, office lease signed) and actual costs are incurred. Which costs incurred by Electrify America are creditable costs is determined by the Final Creditable Cost Guidance approved by EPA in March 2017.

Specific creditable costs that fall within the taxes and governmental fees line item have not yet been identified and will be detailed in future Annual ZEV Investment Reports. Services provided through SLAs (Service Level Agreements) between Electrify America and other Volkswagen group companies include finance, tax, treasury, human resources, legal, and purchasing. As the vast majority of creditable costs are driven by goods and services obtained pursuant to third-party contracts, additional detail has been provided for major investment categories (i.e., Infrastructure, Green City, Education/Access, Outreach, other Overhead).

2.4. Advancement of ZEV technology in the United States

The activities described in the National ZEV Investment Plan are designed to promote and support the increased use of ZEVs in a number of ways:

- The ZEV infrastructure plan is designed to **increase the use of ZEVs in the US**. The support of multiple use cases in the local community network and the spatial coverage of the highway network are intended to reduce range anxiety, which is cited as a primary barrier to ZEV adoption by prospective buyers.

- The gap between the current existing energy supplied by charging infrastructure and the projected demand calculated in the ZEV infrastructure investment selection methodology (section 2.2.1.2) illustrates **there is a clearly existing present and projected need for the additional ZEV charging infrastructure** that the Electrify America network will help satisfy.

- Electrify America will build charging stations in the areas of highest ZEV demand (section 2.2.1.2), where there is the **highest likelihood of utilization and provides accessibility/availability where most needed and most likely to be regularly used.**

– The ZEV infrastructure is intended for, and compatible with ZEV technologies **that are not limited to ones supported by VW group brands. Instead, the goal is to promote universal access**. In particular, multiple technologies (L2, DCFC) and **multiple non-proprietary connectors and charging protocols** (e.g., CHAdeMO, CCS) will be offered to maximize public access to Electrify America's charging infrastructure.

– The combination of the above factors will help to **support and/or advance the market penetration of ZEVs in the US and help to build positive awareness of ZEVs**.

2.5. Certification of activities

Electrify America certifies that none of the activities described in the ZEV investment plan described above was/is:

– approved by the Board of Management prior to September 18, 2015

– required by a contract entered prior to the date of lodging of the Consent Decree

– a part of a joint effort with other automobile manufacturers to create ZEV infrastructure

– required to be performed by any federal, state, or local law, or anticipate will be required to perform during the planned 30-month period

2.6. Supporting literature

In developing the methodology for the National ZEV Investment Plan, a number of sources from peer-reviewed academic literature, government, and industry were used. Important data and information from these sources was used to ensure that, in developing our plan, the investments have the highest likelihood of increasing the use of ZEVs in the U.S., address a clearly existing need, have a high likelihood of utilization and provide accessibility where most needed, support the market penetration of ZEVs, and help build positive awareness for ZEVs. For example, in developing our local community-based charger plan, a number of sources providing information on major U.S. metropolitan areas were used to determine the suitability of investment needed across metro areas, allowing us to select metros with the most significant need for investment in ZEV infrastructure.

A selection of key sources used is included below:

1. Alternative Fuels Corridors. Advancing America's 21st century transportation network. Jan. 2017. https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/

2. Carson, Barney (2016). DC Fast Charging Infrastructure: 50 kW to 350 kW. Idaho National Laboratory. https://avt.inl.gov/sites/default/files/pdf/presentations/INL_DCFastChargerInfrastructure.pdf

3. California Center for Sustainable Energy (2013). California plug-in electric vehicle driver survey results.

4. Chehab, Nay (2017). Pump up the charge with extreme fast charging. Office of Energy Efficiency and Renewable Energy. Jan. 2017. https://energy.gov/eere/articles/pump-charge-extreme-fast-charging

5. Clark-Sutton, Kyle; Siddiki, Saba; Carley, Sanya; Wanner, Celeste; Rupp, John; and Graham, John D. (2016). Plug-in electric vehicle readiness: Rating cities in the United States. The Electricity Journal, 29, 1, 30-40.

6. Council of Economic Advisors (2009). Estimates of job creation from the American Recovery and Reinvestment Act of 2009. https://obamawhitehouse.archives.gov/administration/eop/cea/Estimate-of-Job-Creation/

7. Dale Kardos and Associates. EV incentives by state Q2 2016 update.

8. Edison Electric Institute (EEI) (2016). EV market assessment and survey narrative summary.

9. EERE (Office of Energy Efficiency and Renewable Energy). Alternative Fuel Data Center. U.S. Department of Energy. http://www.afdc.energy.gov/

10. Esri street data. Esri GIS mapping software.

11. Experian (estimated 2020 total vehicles by CBSA). http://www.experian.com/automotive/auto-vehicle-data.html

12. Factiva press search or market reports on ZEV incentives / regulations. http://global.factiva.com

13. "FAST Act" or the "Fixing America's Surface Transportation Act.'' Public Law 114-94, enacted December 4, 2015.

14. Federal Highway Administration (FHWA) (2017). National Electric Vehicle Charging and Hydrogen, Propane, and Natural Gas Fueling Corridors. https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/section_1413_report/fhwahep170.pdf

15. FHWA (annual miles driven), https://www.fhwa.dot.gov/ohim/onh00/bar8.htm

16. FHWA Traveler Analysis Framework (high traffic long-distance routes between CBSAs), https://www.fhwa.dot.gov/policyinformation/analysisframework/01.cfm

17. Friedman, David (2017). Public Plug-in Electric Vehicle Charging Infrastructure Guiding Principles. U.S. Department of Energy. https://energy.gov/eere/articles/public-plug-electric-vehicle-charging-infrastructure-guiding-principles

18. Idaho National Laboratory (2015). Plugged in: How Americans Charge their Electric Vehicles – Findings from the Largest Plug-in Electric Vehicle Infrastructure Demonstration in the World. https://avt.inl.gov/sites/default/files/pdf/arra/SummaryReport.pdf

19. Idaho National Laboratory (2015b). DC Fast Charger Usage in the Pacific Northwest. https://avt.inl.gov/sites/default/files/pdf/evse/INL_WCEH_DCFCUsage.pdf

20. IHS Markit (2016). "Alternative powertrain forecasts: USA market framework factors impacting electrification." Prepared for VW AG – K – GVS – V3.

21. Kneebone, Elizabeth, & Holmes, Natalie (2015). The growing distance between people and jobs in metropolitan America. Washington D.C.: Brookings Institute, Metropolitan Policy Program.

22. Kwan, Irene; Lutsey, Nic; Slowik, Peter; & Lingzhi, Jin (2016). Identifying the leading regional electric vehicle markets in the United States. International Council on Clean Transportation, working paper 2016-20.

23. Laign, Keith. "Feds Move to Boost Electric Car Use." *Detroit News.* Nov. 3, 2016.

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2.7. ZEV charging infrastructure glossary

AC Charging

The majority of ZEV charging is done with AC voltage at Level 1 (120 volts or normal household current) or Level 2 (240 volts or an electric dryer power equivalent). AC charging is typically more cost effective for the equipment and installation and takes advantage of longer dwell times to provide lower power to a ZEV over a longer period of time. AC charging is an excellent solution for residential, workplace, multi-unit dwelling and other longer-term parking situations like hotels and municipal or airport parking garages.

DC Fast Charging

Direct current charging for electric vehicles allows for higher charging speeds, as DC current can be supplied directly to the electric vehicle's battery at power levels normally higher than AC charging. The higher the DC power supplied, the faster the electric vehicle can be charged, provided the vehicle is designed to handle such power. A common DC power is 50 kW, which is the upper limit of all the current vehicles which support SAE CCS today, while the CHAdeMO DC standard will accept up to 62.5 kW power. The proprietary Tesla Supercharger technology can charge up to 140 kW and is currently the most powerful charging available. By 2019, it is expected that 150+ kW DC fast charging will be available on a number of vehicles, and speeds of up to 320 kW (at 350 amps of current at 200V to 920V power source) will be available on a limited basis. To illustrate the charging power difference between Level 2 AC and DC fast charging, a Level 2 7.2 kW AC charger will deliver about 27 miles of ZEV range per hour of charging, whereas a 50 kW DC fast charger will deliver well over 100 miles of range per hour.

CHAdeMO

A DC fast charging standard first developed in Japan for the Japanese market and capable in the U.S. of charging the Nissan Leaf, Kia Soul and Mitsubishi iMiEV.

CCS (Combined Charging System)

CCS is a DC fast charging protocol that is SAE certified and featured on vehicles produced by GM, BMW, Volkswagen Group, Ford and a number of other automakers headquartered in Europe and the United States. The "combined" term designates the CCS capability to incorporate the level 2 (J1772 standard) plug and DC fast charging connector into the same larger plug.

Dwell Time

The term for the amount of time a ZEV is parked in a location. The longer the "dwell" time, the longer it is parked.

Higher Power DC Fast Charging

New technology developments will feature 150 kW to 320 kW of charging power, capable of adding electricity to a new generation of longer-range ZEVs at a rate of between 9 and 19 miles per minute. The new chargers designed under CCS protocol will

be available in 2018, utilizing primarily "kiosk" designs, meaning the power electronics and other important components are housed outside the charger itself in an easier-to-service box in a separate location. Not only will these new chargers deliver higher charging power, the 350 amps of current they use will necessitate the use of liquid-cooled charging cables to present an easier-to-handle, thinner cable with which customers will be able to charge their vehicles. The CHAdeMO Association is also working to complete a 150 kW charging protocol by 2017.

OCPP

The Open Charge Alliance (OCA) is a global consortium of public and private electric vehicle (EV) infrastructure leaders that have come together to promote open standards. OCPP is the protocol they have developed to provide powerful, open, and interoperable communication between the different ZEV charging infrastructure companies, hardware and network.

Plug-and-charge

Plug-and-charge is part of the latest revision of the CCS combo standard, featuring the IEC/ISO 15118 standard which prescribes the means by which a charger and network can identify and authenticate a specific vehicle to allow for a charging session automatically, by simply "plugging in", without the need for supplemental membership cards or fobs.

Proprietary/Non-Proprietary Charging Connector and Protocol

A non-proprietary connector is not privately-owned or controlled and is thus easily available as a standard and does not require extensive development to be ready for application. Both CHAdeMO and CCS combo are non-proprietary DC fast charging protocols. A proprietary charging connector is a connector and charging network that is exclusively accessible to one brand of vehicle or type of user.

Zero Emission Vehicle (ZEV)

Under Appendix C, the following three vehicle types are considered Zero Emission Vehicles:

1. An on-road passenger car or light duty vehicle, light duty truck, medium duty vehicle, or heavy duty vehicle that produces zero exhaust emissions of all of the following pollutants: non-methane organic gases, carbon monoxide, particulate matter, carbon dioxide, methane, formaldehyde, oxides of nitrogen, or nitrous oxide, including, but not limited to, battery electric vehicles ("BEV") and fuel cell vehicles ("FEV");
2. An on-road plug-in hybrid electric vehicle ("PHEV") with zero emission range greater than 35 miles as measured on the federal Urban Dynamometer Driving Schedule ("UDDS") in the case of passenger cars, light duty vehicles and light duty trucks, and 10 miles as measured on the federal UDDS in the case of medium- and heavy-duty vehicles; or
3. An on-road heavy-duty vehicle with an electric powered takeoff.

ZEVs do not include: zero emission off-road equipment and vehicles; zero emission light rail; additions to transit bus fleets utilizing existing catenary electric power; or any vehicle not capable of being licensed for use on public roads.