

Literature review of electric vehicle consumer awareness and outreach activities

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I. Introduction

Governments around the world are implementing policies to promote electric vehicles to reduce dependence on oil, decrease greenhouse gas emissions, and improve air quality. In the past few years, annual global electric vehicle sales have been firmly on the upswing, from just hundreds in 2010 to over 500,000 in 2015 and over 750,000 in 2016. The cumulative global market reached the milestone of 1 million electric vehicles in September 2015, and from there quickly grew to 2 million in January 2017.

The early market growth for electric vehicles continues, but a number of barriers prevent their more widespread uptake. These barriers include the additional cost of the new technology, the relative convenience of the technology considering range and charge times, and consumer understanding about the availability and viability of the technology. This last point, typically referred to as “consumer awareness,” is crucial. The development of electric vehicle markets is fundamentally tied to prospective consumers’ general awareness and understanding of the potential benefits of electric vehicles.

Governments at national and local levels, automobile manufacturers and dealers, electric utilities, and other groups are engaged in many activities to help overcome barriers to consumer awareness about electric vehicles. These communication efforts include developing print and online information and tools, organizing public events and workshops, increasing exposure to electric vehicles from fleet and carsharing services, developing action plans for electric vehicle readiness, executing highly visible technology demonstration projects, conducting social media marketing campaigns, and more. These actions are essential because many prospective consumers generally lack strong understanding of what electric vehicles are, what benefits they offer, the models that are available, and the associated incentives.

This paper reviews global practices on electric vehicle consumer awareness activities in order to explore actions that governments can take to foster growth of the market and understand how to better implement such campaigns. It summarizes practices in consumer education, awareness, and outreach regarding electric vehicles. We examine literature that identifies

and discusses the importance of consumer awareness, catalogue the range of awareness and outreach activities in place in key electric vehicle markets, identify exemplary actions in leading electric vehicle markets, and provide additional discussion for several case studies.

The information in this report comes from governments’ and nongovernmental organizations’ websites, published research, reports and surveys, online news articles and blogs, and websites for specific programs/actions. Section II reviews the literature that has focused on identifying and determining the importance of consumer awareness. Section III discusses exemplary actions in leading electric vehicle markets. Section IV offers additional discussion of five case studies to provide further details on some of the more mature consumer-oriented electric vehicle campaigns.

II. Background on electric vehicle consumer awareness activities

This section reviews the research literature related to the importance of consumer awareness activities in

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encouraging the adoption of electric vehicles. Based on the literature, we identify specific actions implemented around the world to promote consumer awareness and understanding. Finally, this section provides an initial catalogue of the various outreach activities that are in place in leading electric vehicle markets.

IMPORTANCE OF CONSUMER AWARENESS

Several studies have found that there is a general lack of knowledge and awareness about electric vehicles. For example, less than half of U.S. consumers are able to name a specific plug-in electric vehicle make and model (Singer, 2015), and less than 35% of California households are aware of incentives offered for the purchase of electric vehicles (Kurani & Tal, 2014). In a survey of 21 U.S. cities (Krause, 2013), about two-thirds of the respondents had misunderstandings about the basic characteristics of plug-in electric vehicles, and about 95% of them were not aware of available incentives. An IBM consumer survey (Gyimesi & Viswanathan, 2011) similarly found that 45% of the surveyed drivers had little to no understanding of electric vehicles.

Federal incentives in the United States amount to up to \$7,500 per electric vehicle, and additional state incentives typically amount to more than \$2,000. These, and similarly substantial incentives globally (see Yang et al., 2016), are meant to overcome the critical cost barrier to electric vehicles. The U.S.-focused Kurani et al. (2016) study found that only 49% of California new-car buyers were aware of the federal tax incentive, and only about 33% were aware of California's state-level incentive. Nationwide, only 44% of people were aware of the federal tax incentive. Of the consumers who could correctly name any plug-in electric vehicle model, 95% of the respondents

could only name either the Nissan Leaf or Tesla Model S, indicating low awareness about the diversity of available models.

Consumers who have exposure to electric vehicles are more likely to value them more highly and consider them as a choice for future purchases (Kurani et al., 2016; Larson, 2014; Gyimesi & Viswanathan, 2011). A survey by Consumer Federation of America (CFA, 2015) revealed that greater consumer knowledge about electric vehicles and their desire to purchase one are correlated. However, only 21% of the respondents said they know a "fair amount" about electric vehicles, and far fewer reported knowing a "great deal" about them. In a paper examining e-mobility in Stuttgart, Germany, Reiner & Haas (2015) note that as people have more experience driving an electric vehicle, they show more favorable attitudes towards e-mobility. A study by Kannstatter & Meerschiff (2015) in Europe found that 71% of participants expressed interest in considering an imminent purchase of an electric vehicle after a test drive. In another study (Bunce et al., 2014), the number of drivers who were willing to pay a premium for a more environmentally friendly vehicle jumped from 51% to 74% after exposure to the Ultra Low Carbon Vehicle campaign in the United Kingdom.

Table 1 summarizes literature that identifies the importance of consumer awareness for electric vehicles. The literature include results from surveys, interviews, trials, and synthesis reports from various other programs. Some of the research gives a cross-sectional/snapshot view of consumers' knowledge of electric vehicles (e.g., Singer, 2015). Other work connects consumer awareness of electric vehicles to their evaluation of the vehicles and how likely they are to consider them as a purchase option

(e.g. Kurani et al., 2016; Gyimesi & Viswanathan, 2011; CFA, 2015). Other reports compare consumer perception before and after a test drive or a longer trial period (Kannstatter & Meerschiff, 2015; Bunce, 2013). Overall, these studies show that general consumer awareness of electric vehicles is relatively low, and this includes lack of familiarity with the new technology, lack of knowledge of available incentives and models, and misperception about the potential savings from lower fuel and maintenance costs. In general, consumers with greater knowledge or experience are more likely to value electric vehicles higher, consider electric vehicles as a future purchase option, and be willing to pay a premium for the technology.

CATEGORIZATION OF CONSUMER OUTREACH AND AWARENESS ACTIVITIES

A wide variety of activities are in practice that help to reduce consumer barriers related to understanding and awareness of electric vehicles. Table 2 provides a list of studies that help to highlight various aspects of electric-drive vehicles, their infrastructure, and the actions being taken to increase consumer understanding and awareness. Governments at national and local levels, as well as other stakeholder groups, have carried out a suite of consumer outreach actions. Electric vehicle outreach activities include initiatives by nonprofit groups, city and state government agencies, automakers, and charge provider companies that organize public-private partnerships and ride-and-drive events. The focus of other outreach and awareness activities tends to differ across markets as a result of local context and priorities for each activity. For example, Empire Clean Cities of New York developed a targeted outreach campaign for local commercial vehicle

Table 1. Overview of studies evaluating the importance of consumer awareness

Author	Year	Region	Title	Description
Bailey et al.	2015	Canada	Is awareness of public charging associated with consumer interest in plug-in electric vehicles?	<ul style="list-style-type: none"> Investigation of whether visibility of public chargers has an impact on PEV demand. There is no significant relationship between perceived existence of one charging station and PEV interest, however there is a weak yet significant relationship between perceived existence of multiple charging stations and PEV interest.
Bunce et al.	2014	U.K.	Charge up then charge out? Drivers' perceptions and experiences of electric vehicles in the U.K.	<ul style="list-style-type: none"> Questionnaires and interviews to assess drivers' attitudes and experiences driving an EV before and after a three-month trial. Before a three-month trial, 51% of drivers were willing to pay more for a less environmentally damaging vehicle. After the trial, 74% of drivers expressed willingness.
Cahill et al.	2014	California	New car dealers and retail innovation in California's plug-in electric vehicle market	<ul style="list-style-type: none"> Interviews with automakers and dealers, and analysis on customer satisfaction data. Overall, consumer experience at dealerships is much better for conventional vehicle buyers than PEV buyers. Introducing new methods for educating and scaling dealer competence regarding electric vehicles could greatly improve the consumer experience.
CFA	2016	U.S.	New data shows consumer interest in electric vehicles is growing	<ul style="list-style-type: none"> Second annual electric vehicle survey by Consumer Federation of America shows consumer interest in the technology is growing. Electric vehicle model availability is increasing while prices continue to drop. Electric vehicle sales are outpacing hybrid vehicle sales in their respective years of market introduction.
CFA	2015	U.S.	Knowledge affects consumer interest in EVs, new EVs guide to address info gap	<ul style="list-style-type: none"> Survey by Consumer Federation of America that shows how knowledge affects consumer interest in EVs. Clear and significant correlation between EV knowledge and positive attitudes towards the technology. Positive attitudes and a willingness to purchase them are also correlated. For consumers that were more knowledgeable, there was a significant correlation between understanding and purchase desire.
Edwards, Turrentine & White	2016	U.S.	PEV marketing to consumers: What's missing?	<ul style="list-style-type: none"> Three Plug-in Electric Vehicle Collaborative meeting presentations. Discusses challenges and opportunities in EV market development, especially on consumer awareness and acceptance.
Egbue & Long	2012	U.S.	Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions	<ul style="list-style-type: none"> Survey that samples technology enthusiasts to determine attitudes toward EVs. Consumer attitudes and uncertainty regarding EV battery technology and sustainability of fuel sources may be a barrier to widespread adoption; this uncertainty may stem from lack of understanding and familiarity.
Gyimesi & Viswanathan	2011	U.S.	The shift to electric vehicles	<ul style="list-style-type: none"> Interviews with executives from auto companies and survey of consumers to understand their attitudes towards EVs. 45% of the drivers they surveyed have little to no understanding of EVs. Consumers with better understanding are generally more willing to pay a premium for the technology. Nevertheless, even well informed consumers are sometimes unaware of the lifetime fuel savings that EVs offer.
Krause et al.	2013	U.S.	Perception and reality: Public knowledge of plug-in vehicles in 21 U.S. cities	<ul style="list-style-type: none"> Survey analysis examines consumer knowledge of PEVs and current public policies. Most survey respondents were misinformed regarding basic PEV characteristics. Nearly 95% of respondents were unaware of state and local policies. Misperceptions regarding potential fuel and maintenance cost savings can notably hinder PEV interest.
Krupa et al.	2014	U.S.	Analysis of a consumer survey on plug-in hybrid electric vehicles	<ul style="list-style-type: none"> Survey analysis on PHEV market penetration to reveal quantitative patterns and correlations. Advertising up-front incentives may be more effective than advertising long-term fuel savings Targeting advertising and marketing towards progressive and environmentally concerned citizens may be more effective than those for a general audience Displaying EV fuel savings in gallons, rather than dollars, may be more persuasive

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Author	Year	Region	Title	Description
Kurani et al.	2009	U.S.	Learning from consumers: PHEV demonstration and consumer education, outreach, and market research program	<ul style="list-style-type: none"> • A trial was carried out followed by interviews and surveys to reveal consumer behaviours. • Major themes included driving behaviour, recharging habits and etiquette, confusion about PHEVs and their operation, and potential cost savings. The trial identified that drivers accrue information and develop complex ideas about the technology and its possible impact on lifestyle.
Kurani et al.	2016	U.S.	New car buyers' valuation of zero-emission vehicles: California	<ul style="list-style-type: none"> • Online survey and interviews to measure buyers' awareness of EVs and understand their decision making. • Addressing broader consumer awareness is the first step to expand the ZEV market. Just 49% of survey respondents were aware of federal incentives; 33% of respondents were aware of the CA state incentive. EV model recognition has not spread beyond early models. • Individuals with greater familiarity and experience with EVs are more likely to value ZEVs higher.
Larson et al.	2014	Canada	Consumer attitudes about electric cars: Pricing analysis and policy implications	<ul style="list-style-type: none"> • A survey of consumer attitudes was carried out and results were analysed. • Individuals with greater familiarity and experience with EVs are more likely to value the vehicles higher and consider them in future purchases.
National Research Council	2015	U.S.	Overcoming barriers to the deployment of plug-in electric vehicles	<ul style="list-style-type: none"> • A comprehensive report addressing different aspects of EVs, including technologies, customer purchase & market development, incentives, infrastructure, and implications for the electricity sector. • A primary barrier to PEV widespread adoption is lack of awareness and knowledge regarding available models and incentives.
Rezvani et al.	2015	Multiple	Advances in consumer electric vehicle adoption research: A review and research agenda	<ul style="list-style-type: none"> • Identifies drivers for and barriers hindering adoption of plug-in electric vehicles. Includes an overview of previous perspectives used to evaluate consumer purchase desire and electric vehicle adoption behaviour.
Singer, M.	2016	U.S.	Consumer views on plug-in electric vehicles - National benchmark report	<ul style="list-style-type: none"> • Survey and findings that cover consumer awareness, attitudes, and purchase behavior regarding plug-in EVs. • Fewer than 50% of survey respondents were able to name a plug-in electric vehicle make and model.
Vergis et al.	2014	Norway	The Norwegian electric vehicle market: A technological innovation systems analysis	<ul style="list-style-type: none"> • Applies a technological innovation system framework consisting of seven indicators to examine Norway. • Since the 1990s, durable political support, as well as strong BEV-enthusiast groups, has contributed to broader consumer awareness in Norway.
Vergis et al.	2014	U.S.	Understanding variations in U.S. plug-in electric vehicle markets	<ul style="list-style-type: none"> • Analysis on full range of social, economic, and policy factors influencing statewide PEV sales for all 50 states. • Although a number of factors are statistically correlated with EV uptake, a broader combination of social and economic factors, as well as policy action, are needed for widespread adoption.
Vyas & Hurst	2013	U.S.	Electric vehicle consumer survey: Consumer attitudes, opinions, and preferences for electric vehicles and EV charging stations	<ul style="list-style-type: none"> • Web-based survey and analysis of results to understand consumer attitudes toward BEVs and PHEVs. • Fewer than 50% of survey respondents were familiar with the Chevrolet Volt, compared to 31% with the Nissan Leaf, and below 25% for Tesla Model S, Ford C-Max Energi, and BMW i3.
WWF	2013, 2014	Canada	Transportation rEVolution: Electric vehicle status update	<ul style="list-style-type: none"> • Update on Canada's progress in electrification of personal transportation. • Since 2013, the number of Canadian citizens who consider EVs a viable option has increased 50%. It is clear that greater outreach and awareness is needed: 92% of citizens believe there are limited public charging stations and 14% were unaware that the vehicles can be plugged directly into a household outlet.
Williams & Johnson	2016	California	EV Consumer Characteristics, Awareness, Information Channels & Motivations	<ul style="list-style-type: none"> • Analyzes the results of a consumer survey from California electric vehicle purchase rebate recipients. • Based on electric vehicle consumer data, the researchers identify who is adopting the technology, what their main sources of information are, and the motivations influencing their decision to select an electric vehicle.

fleets (NASEO, 2013). Their targets include Manhattan Beer Distributors, Coca-Cola, and Walmart, all of which make short deliveries and have large fleets. Such targeted programs can increase sales and exposure to the public, while also providing hands-on experience to drivers who otherwise

may have not had any prior exposure to or understanding of the technology. Several government outreach and awareness programs provide benefits to both consumers and local utilities. For example, efforts in Japan have promoted electric vehicle technology by providing incentives for individuals

who participate in electricity demand response (DR) programs. In Kyoto, a project by the electric vehicle Charging Management Center uses email and navigation systems to send out DR messages to electric vehicle drivers, and rewards those who respond with shopping points (IEA, 2014).

Table 2. Overview of studies identifying electric vehicle awareness actions

Author	Year	Region	Title	Description
British Columbia	2015	British Columbia	Clean Energy Vehicle program phase 1 review	Review of phase 1 of BC's CEV program, which started in 2011.
California	2015	California	2015 ZEV action plan	An updated roadmap to CA's ZEV goal.
Filho et al. (Editors)	2015	EU	E-Mobility in Europe: Trends and good practice	The book consists of a range of articles on e-mobility development in Europe.
Frades	2014	U.S.	A guide to the lessons learned from the Clean Cities Community Electric Vehicle Readiness projects	DOE/C2ES report summarizing the work of a series of projects carried out by the awardee organizations and partnering coalitions.
IEA	2012, 2014	Multiple	EV city casebook	Identify actions and best practices in key cities around the world.
IEA	2016	Multiple	Global EV Outlook 2016	A global look at EV and EVSE deployment.
Li et al.	2015	Multiple	Factors affecting the electric vehicle demonstration: 14 international cities/regions cases	Summary of policies and innovative actions as well as analysis in 14 selected cities/regions.
Lutsey et al.	2015a	Multiple	A comparative analysis of electric-drive policy in Germany and California	Compares policy landscapes in Germany and California, and identifies the most critical factors in deployment.
Lutsey et al.	2015b	U.S.	Assessment of leading electric vehicle promotion activities in United States cities	Identifies actions being taken by state and local governments and public utilities to facilitate electric vehicle deployment in the 25 largest U.S. metro areas, as well as city-specific analysis.
Lutsey et al.	2016	U.S.	Sustaining electric vehicle market growth in U.S. cities	Identifies actions being taken by state and local governments and public utilities to facilitate electric vehicle deployment in the 50 largest U.S. metro areas, as well as city-specific analysis.
NASEO	2013	U.S.	State strategies for electric vehicle deployment: Outreach and education campaigns	Explores perspectives from stakeholders, strategies for increasing EV deployment and lessons learned in outreach.
Plug In America	2015a	U.S.	The promotion of electric vehicles in the United States	PEV promotion landscape and where improvements need to be made in different areas.
Searle et al.	2016	California	Leading edge of electric vehicle market development in the United States: An analysis of California cities	Compares leading electric vehicle markets in California and identifies consumer awareness and other policies in place in markets where electric vehicle uptake is high.
Tietge et al.	2016	EU	Comparison of leading electric vehicle policy and deployment in Europe	Investigation and analysis of incentives for EVs in the five largest EV markets in Europe.
Van der Steen et al.	2015	Multiple	EV policy compared: An international comparison of governments' policy strategy towards e-mobility	Presents and analyzes findings from a research project on eight European countries and California.
Vergis et al.	2014	Multiple	Plug-in electric vehicles: A case study of seven markets	Case studies of Norway, Netherlands, California, U.S., Japan, France and Germany.
Wang & Liu	2015	China	City readiness system assessment of electric vehicle adoption in China	Analysis and model to assess the city readiness of electric vehicle adoption in demonstration cities.
ZEV Program Implementation Task Force	2014	8 U.S. states	Multi-state ZEV action plan	The cross-state action plan provides a broad overview of the current status of the ZEV market, determines priorities for government action, and proposes a research agenda and key partnerships.

Table 3 provides an initial catalogue of the different actions in select electric vehicle markets. The markets have been selected here because they are leaders in electric vehicle sales and uptake (e.g., see Tietge et al., 2016; Slowik and Lutsey, 2016; Lutsey et al., 2016). We note that, although the exact actions can differ greatly by scale and details, we have attempted to capture the major categories for actions underway in the various markets. These actions occur at different scales, from national campaigns to activities within small vehicle-enthusiast clubs. The noted actions in the table had a significant level of exposure and affected more than a small group of people, but they were

not necessarily all government initiatives. In the following sections, we categorize and discuss the wide range of outreach and awareness actions that are currently being implemented around the world. Examples within each category are provided. As indicated above, all of the actions described below help to address and overcome key consumer barriers related to awareness and understanding of electric vehicle technology.

INFORMATION AND TOOLS

We identify five distinct elements of electric vehicle awareness that relate to information and tools: general information, cost comparison, public charger location, incentives, model availability, ride and drive, EV showcase, public fleet, government fleet, carsharing/rental cars, company cars, and tourism.

location, incentives, and model availability. Most markets analyzed here have some combination of online electric vehicle-related resources that address most of these potential information needs. For example, electric vehicle informational materials are available on websites in Norway (Elbil, 2016), the Netherlands (Nederland Elektrisch, 2016), British Columbia (Plug in BC, 2016), Québec (Hydro-Québec, 2016a; AVEQ, 2016; CAA, 2016), and many others. Some regions have a dedicated one-stop-shop for most of the information that consumers need, e.g. the United Kingdom’s Go Ultra Low website (Go Ultra Low, 2016), while the information can be more dispersed in other regions.

Table 3. Electric vehicle consumer awareness and education actions

Region	Information and tools					Public events		Exposure to EVs from fleets				Regional planning		Consumer awareness campaigns	Youth education and professional development	Awards and recognitions	Auto dealer awareness activities	Consistent Signage and labeling	
	General information	Cost comparison	Public charger location	Incentives	Model availability	Ride and drive	EV showcase	Public fleet	Government fleet	Carsharing/Rental cars	Company cars	Tourism	Action plan/Initiative						Demonstration projects
Germany	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	
Netherlands	X	X	X	X		X	X	X	X	X	X		X	X		X			
Norway	X	X	X	X	X			X	X	X	X		X	X					
United Kingdom	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X			
California	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Oregon	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X
Northeast U.S. States	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X	
British Columbia	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Québec	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Beijing							X	X	X	X			X						
Shanghai						X	X	X	X	X			X	X					

Websites tend to differ in terms of how much information is provided, how consumer-oriented the information is, and how easy it is to locate information.

To identify the differences across regions' informational materials, we provide more details on electric vehicle cost comparison tools. The results of a survey in California of recipients of electric vehicle purchase rebates indicate that fuel cost savings are the primary motivation for selecting an electric vehicle (Williams & Johnson, 2016). Most of the regions provide simple cost comparison information or tools to help consumers understand the potential cost savings. Some of them only give comparisons of upfront costs, while others also include operating costs such as fuel, servicing, and insurance. Some of them present the information in tables (Go Ultra Low, 2016), while others provide some degree of interactivity, allowing users to input their own preferences, such as vehicle model and travel data (Drive Clean, 2016). One of the more sophisticated examples is Germany's interactive online total cost of ownership calculator (Schaufenster elektromobilität, 2016a), which shows different results in tables and graphs in real time.

Another key piece of consumer information is the location and availability of public charging infrastructure. There are many charging availability maps available, and related mobile applications in Norway, Netherlands, the United States, and France that provide additional convenience. Key features of mobile applications are to ensure a continually updated network and to provide real-time information about whether particular charge points are available for use.

PUBLIC EVENTS

Regularly occurring public events such as ride-and-drives and electric vehicle showcases are effective ways to draw media attention and allow consumers

to experience electric vehicles. In fact, one survey suggests that first-hand experience shared by electric vehicle experts is one of the most influential sources of information (Williams & Johnson, 2016). The ride-and-drive events discussed here occur at least once a year. Examples are California's Experience Electric campaign (CSE, 2016) and Best.Ride.EVer! ride-and-drive series; National Test Drive Day in the Netherlands (Tietge et al., 2016); Mass Drive Clean (Mass Drive Clean, 2016); Branchez Vous in Québec (Branchez Vous, 2016); the Regent Street Motor Show in the United Kingdom; and the Electric Vehicle Symposium and Exhibition (EVS, 2016). Good examples of EV showcases are Oregon's EV Fest (OEVA, 2016) and Shanghai's EV Zone (EV Zone 2016a, b).

EXPOSURE TO ELECTRIC VEHICLES FROM FLEETS

Incorporation of electric vehicles into fleets both directly increases their use and provides prospective owners with increased exposure to the vehicles. All the regions covered in Table 3 have incorporated electric vehicles into public and government fleets to some extent, and there are also electric vehicles available in carsharing/rental services in these regions. Many companies in the markets discussed above are devoted to electrifying their fleets, either with or without the support of government incentives. Few regions in this study have seen major efforts to promote electric vehicles in tourism. Exceptions include the West Coast Green Highway (West Coast Green Highway, 2016), Oregon's Plug and Pinot program (Plug and Pinot, 2016), and Canada's Okanagan Eco Wine Tour (Sun Country Highway, 2016).

REGIONAL PLANNING

Most governments now have some form of action plans for electric vehicles, and most have associated

demonstration projects for the new technology. Examples are California's ZEV action plan (California, 2016), the Multi-State ZEV Action Plan (ZEV Program Implementation Task Force, 2015), Oregon's Electric Avenue demonstration (Halvorson, 2015), Québec's Transportation Electrification Action Plan 2015-2020 (Québec Ministry of Transportation, Sustainable Mobility and Transport Electrification, 2016a), Germany's Electromobility Model Regions and Showcase Regions for Electric Mobility, and China's "Ten Cities and 1,000 New Energy Vehicles" project. Germany's Showcase Regions for Electric Mobility project has a budget of €180 million (about \$202 million), which has been allocated to four regions from 2012-2016 to spark public interest in electric mobility (Meyer, 2015). Québec's 2015-2020 action plan has a budget of more than \$420 million. Such overarching electric vehicle planning programs cover many of the activities discussed below.

CONSUMER AWARENESS CAMPAIGNS

Electric vehicles are an emerging technology that has not reached beyond the "innovator" and "early adopter" consumer categories in most markets. The marketing of a new and different technology presents challenges, and the right messaging can be enormously helpful in increasing public acceptance. The campaigns included here are dedicated efforts that aim to raise consumer awareness of electric vehicles. Examples are United Kingdom's Go Ultra Low campaign, British Columbia's Emotive campaign (Emotive, 2016), the E-mazing race in Canada (E-mazing, 2016), and social media marketing actions in Vermont (U.S. DOE, 2016b) and Québec (e.g., digital press and television advertisement in French). Initiatives from nonprofit and nongovernmental organizations (NGOs), for example enthusiast clubs such as AVEQ (2016) in Québec, are notable for how

active they are on social platforms (e.g., Facebook, Twitter, Pinterest) and their outreach to younger drivers.

YOUTH EDUCATION AND PROFESSIONAL DEVELOPMENT

Many regions have support for formal youth education and professional development in their campaign, and some universities/colleges offer dedicated degrees/certificates in electric vehicle technology. For example, Germany's Showcase Regions (Schaufenster Elektromobilität, 2016b; Tietge et al., 2016) provides support for education and training; British Columbia provides funding for electrician training (Government of British Columbia, 2016); and Gateshead College and Sunderland University in the United Kingdom offer a certificate/degree in electric vehicle-related technology. In addition, institutions such as the University of California-Davis provide extensive research and training for future leaders in the field of electric vehicles.

AWARDS AND RECOGNITIONS

Governments and organizations present various types of awards in recognition of individuals, organizations, or businesses that play an important role in advancing electric mobility. These range from general awards for environmental leadership to awards specific to electric mobility. For example, points can be earned for Leadership in Energy and Environment Design (LEED) certification, one of the most popular green building certification programs used worldwide, through installing electric vehicle chargers and providing preferred parking for electric vehicles (U.S. Green Building Council, 2016).

AUTO DEALER AWARENESS ACTIVITIES

Dealer actions with relation to electric vehicles continue to receive more attention due to their importance in marketing and at the ultimate point of

sale. The development of the market could gain from programs that educate, engage, and motivate dealerships and their salespeople to support electric vehicle sales. Strategies for governments include developing relationships with dealer associations, holding workshops and training sessions with dealers, and offering awards and recognition.

Dealers are in the unique position of interfacing with customers, so dealer actions can be critical in informing consumers about electric vehicles. Cahill et al. (2014) and Lunetta & Coplon-Newfield (2016) summarize some of the experiences, and the difficulties, at the dealer-consumer level. As shown by Reichmuth & Anair (2016), electric vehicle availability can often be very low across many markets, and this limited model availability could be related to dealers' level of effort. Better consumer experiences at the dealership can facilitate the sales of electric vehicles. The Corporation of Québec Automobile Dealers operates a website that allows prospective consumers to identify dealerships that have particular electric vehicle models available (La Corporation des concessionnaires d'automobiles du Québec, 2016). More information on exemplary auto dealer awareness activities is provided in Section III below.

CONSISTENT SIGNAGE AND LABELING

Programs that establish consistent signage and labeling for electric vehicle infrastructure can help increase awareness and convenience, and is important to safety (Seisler, 2012). Consistent signage is needed for both directional signs, which are used to guide drivers to charging stations, and regulatory signs, which convey restrictions related to charging and associated parking, such as time or access limits. Several governments have been especially active in this area. Although such developments are underway, formal harmonization of electric vehicle signage (e.g.,

indicating charging stations, access to high-occupancy vehicle and bus lanes, designated parking, etc.) at the national or international level are yet to emerge.

TOURISM

Tourism-based outreach efforts can also play a role in increasing awareness and use of electric vehicles. As mentioned above, there are several examples where electric vehicles are being integrated within rental car and car-sharing fleets that target resort destinations. In addition, electric vehicle promotion events at resort destinations help connect the new technology with enjoyable driving experiences. The Oregon Tourism Commission (2016) has developed Oregon Electric Byway itineraries to support tourism in electric vehicles across with location of charging infrastructure on popular attractions in the state, and facilitate electric vehicle rentals for tourism through private-sector partnerships. Another example is South Korea's Jeju Island, which is aiming to go all-electric by 2030 and is making progress in greatly increasing its electric vehicle fleet and charging infrastructure (Tweed, 2014).

OTHER

Other indirect consumer outreach actions may also be important for prospective electric vehicle buyers. One example is programs that are directed at electric vehicle leasing. Leasing an electric vehicle removes the risk of uncertain resale value, battery degradation, and rapid technology updates for the consumer. Based on a 2013-2014 survey (NRC, 2015), the electric vehicle leasing rate is significantly higher than that for conventional vehicles in the United States; 86% of Nissan Leaf drivers, 44% of Chevrolet Volt drivers, and 22% of conventional vehicle drivers are leasing their vehicles. In the United Kingdom, the leasing companies are playing an important role for ultra-low emission vehicles, with 4.7% of all new leased cars registered in 2015 being plug-ins,

compared with just 1.1% across all new registrations (BVRLA, 2016). One study (Lamberth-Cocca, 2016) investigates several cases in European countries and indicates that mobility-as-a-service (e.g., carsharing) programs help to minimize the risk and cost for users and can help spur electric mobility. Major incentive programs around the world recognize the importance of leasing (Yang et al., 2016), and it seems likely that consumer awareness campaigns might gain from

specifically targeting the potential leasing market.

III. Exemplary consumer awareness actions in leading ZEV markets

Different categories of actions mentioned above often complement each other to increase consumer awareness. Table 4 shows some of the examples of programs and actions from

our literature review across various categories (in Table 3). The major stakeholders are the primary implementers of these actions, although many receive in-kind support or funding from other collaborating entities.

INFORMATION AND TOOLS

Creating a one-stop shop for electric vehicle-related information and tools, including basic information, model

Table 4. Exemplary actions from major ZEV markets

Category	Sub-category	Region	Major stakeholder	Program	Description
Info and tools	Technology, cost	U.K.	National government	Go Ultra Low	A comprehensive and easy-to-navigate website that gives consumers everything that they need in one stop.
	Infrastructure, policy	U.S.	National government	AFDC, Drive Clean	Suite of information for EV consumers.
	Policy, incentives	California	State government	Drive Clean	Comprehensive information tailored for CA consumers.
Public events	Ride and drive	U.S.	NGOs	National Drive Electric Week	An annual event that aims to increase awareness of EVs. It typically lasts for one week and has events all over the country. Each event is led by local EV drivers and advocates and includes some combination of EV parades, ride-and-drives, informational booths, and more. Individuals can also volunteer to organize an event.
		Québec	NGO and government	Rendez-Vous Branchés	Annual multi-city campaign to demonstrate the benefits of transportation electrification in Québec. The event includes consumer ride-and-drives, electric bicycles, sightseeing tours in electric buses, keosks and panels from EV experts, and more.
	EV showcase	Shanghai	National, city government	EV Demonstration Zone	The EV zone includes EV carsharing, an EV rental plan, a service center that can import EVs without having to go through cumbersome customs procedures, a network of charging stations, data collection, and free EV test drives for the public.
Exposure from fleets	Private fleets	Netherlands	Business	Electric buses and taxis	One example is Schiphol Airport, which has a fleet of e-buses and taxis to shuttle passengers. Taxi Electric, the first fully electric taxi company, also has a fleet of electric cars that offer transfer services to Schiphol.
		U.K.	Business	Companies	Marketing in trade magazines, LinkedIn paid-for advertising, organized fleet summit to educated fleet managers and purchasers, launched “Go Ultra Low Companies” initiative to celebrate leading businesses.
	Government fleet	California	State government	Executive order	CA’s fleet is on track to exceed the goal that at least 10% of state fleet purchases of LDVs be zero emissions by 2015 and 25% by 2020.
		Québec	State government	Transportation Electrification Action Plan 2015-2020	The government has set a target to add 1,000 electric vehicles to its fleet by 2020.
	Carsharing/ Rental cars	Canada, Germany, Netherlands, U.S.	Business	Car2Go	Carsharing services operating with electric vehicle fleets in multiple cities in the world.
	Company cars	Norway	Business	Posten and others	In 2015, 24% of new passenger cars sold in Norway were EVs. Approximately 42% of new car registrations in Norway are company cars (Tietge, 2016). For example, Norway’s postal service, Posten, ordered 240 electric vehicles to add to its fleet in 2015, which already has 900 electric vehicles.

continued on next page

Category	Sub-category	Region	Major stakeholder	Program	Description
Exposure in regional planning	Action plan/ Initiative/ Partnership	U.S.	National and local government	Clean Cities	The Clean Cities program is a national network of more than 100 local coalitions with the goal of reducing petroleum use. The program provides funding and resources to support local projects. One of them is Electric Vehicle Community Readiness, of which Oregon and California are among the awardees.
	Demonstration projects	Germany	National government	Electromobility Model and Showcase regions	Two programs that promote electric mobility in a number of regions, both of which combine government and industry funding and expertise.
Consumer awareness campaigns	NA	U.K.	National government	Go Ultra Low	Go Ultra Low is a joint government and industry campaign which aims to increase EV market share by helping consumers understand the benefits of EVs.
Youth education and professional development	NA	U.K.	University, college	University college degree program	Gateshead College's Skills Academy for Sustainable Manufacturing and Innovation provides electric vehicle-related training ranging from manufacture to maintenance. Sunderland University is the first university in the United Kingdom that offers a Master of Science in Low-Carbon Vehicle Technology.
Awards and recognitions	NA	Bavaria, Germany	State government	eCarTec Award	Award for furthering electric mobility by the state of Bavaria. It is awarded in four categories and endowed with €60,000 in total.
Auto dealer awareness activities	NA	Canada	Industry, NGOs	Electric Vehicle Dealership Awards	Canadian Electricity Association and Plug'n Drive, an electric car advocacy group, awards dealerships that promote EVs; 2015 was their second year giving the award.
Consistent signage and labeling	NA	California, Oregon, British Columbia	State government	West Coast Green Highway	The departments of transportation in Washington, Oregon, and California adopted a standardized symbol to identify publicly accessible electric vehicle charging stations along major roadways.
	NA	Québec	Government of Québec	Electric vehicle pictogram	The government of Québec has standardized signage and labeling for electric vehicle license plates, EV designated parking spaces, and EV access to HOV lanes.
Tourism	N/A	Oregon	Government and business	Oregon Electric Byways EV Tourism Initiative	State agency supports tourism in electric vehicles across the state, with information, location of charging infrastructure at popular attractions, and partnerships to facilitate electric vehicles in rental fleets.

availability in a given area, incentives, cost comparison, and public charger locations, can be key for facilitating consumer understanding. According to results of a survey of battery electric vehicle owners in Norway (Figenbaum, 2016), the most important sources of information for owners were the Norwegian EV association, blogs, media, dealers and friends, in that order. This shows that an effective online information hub can aid the diffusion of electric vehicles. Table 4 includes three examples of one-stop shop websites for electric vehicle-related information. The websites, from the United Kingdom (Go Ultra Low, 2016), California (Drive Clean, 2016), and the United States (AFDC, 2016), are supported by the government and

offer comprehensive information that is consumer-oriented (i.e., compared with others that are more policy-focused). Other state-sponsored campaigns with well-managed online informational electric vehicle resources include those by Connecticut and New York (see Connecticut Department of Energy and Environmental Protection, 2016; NYSERDA, 2016).

PUBLIC EVENTS

National Drive Electric Week is an annual event that continues to gain popularity in the United States as well as multiple other cities around the globe. The EV Zone in Shanghai (EV Zone, 2016a,b) has served as a combination of a testing ground, a

hub for consumer experience, and a service center for electric vehicles. Easy access to this suite of facilities and services has made it valuable in promoting electric vehicles and raising consumer awareness. They are further discussed in the case study below. Public events offer first-hand experience with the technology and can increase purchase desire. For example, about 15% of the participants in the 2015 Best.Ride.EVer! ride-and-drive series in California purchased or leased a plug-in electric vehicle three to six months after attending a ride-and-drive, and 94% shared their experience with others (Paauwe, 2016). Similarly, participants in the Drive Electric Northern Colorado's test drive campaign stated that they were more

likely to purchase an electric vehicle after test drives (Freyschlag, 2016). Other notable state-sponsored ride-and-drive campaigns include those by Massachusetts, Rhode Island, Vermont, and New York (see Mass Drive Clean, 2016; Rhode Island Office of Energy Resources, 2016; Vermont, 2016; New York, 2016).

Electric vehicle showcases also contribute to overall awareness. Drive Oregon was the recipient of a recent \$1 million U.S. Department of Energy grant to develop and launch a regional electric vehicle showcase. Over the three-year project, Drive Oregon will develop a permanent storefront to showcase electric vehicles as well as a number of “pop-up” showcases throughout Oregon and Washington. The program also includes showcases of charging infrastructure, expert staff on site, ride-and-drive events, a multimedia marketing campaign, and partnerships with utilities and other stakeholders (Drive Oregon, 2016). A number of Northeast U.S. states have showcased electric vehicles in recent auto shows (e.g., Balestriere, 2016). Government officials in Connecticut and Massachusetts used such events as an opportunity to announce additional funding for their state purchase incentive programs (Hartford Courant, 2015; Massachusetts Office of Energy and Environmental Affairs, 2016).

EXPOSURE TO ELECTRIC VEHICLES FROM FLEETS

A number of fleet activities provide multiple benefits, including increasing electric vehicle sales, usage, exposure, and awareness. Larger electric vehicle purchases by governments and companies increase sales and usage by drivers who otherwise may not have had any knowledge of, or previous exposure to, electric vehicles. These purchases also serve broader public awareness objectives, as they are likely

to draw news coverage and pique greater understanding and interest among the public. Carsharing or rental car services that have sizable electric vehicle fleets and operate in multiple regions (e.g. Car2Go, Autolib), could have a greater impact on consumer awareness, as they increase name recognition and raise the daily visibility of electric vehicles in the communities they serve.

The Go Ultra Low program in the United Kingdom also aims to increase consumer awareness through exposure to fleets. The comprehensive fleet program includes paid marketing in trade magazines and on LinkedIn, participation at fleet events, and a Go Ultra Low organized fleet summit to educate fleet owners and purchasers about the benefits of electric vehicles. In addition, the Go Ultra Low Companies initiative highlights and acknowledges businesses that have already adopted electric vehicles in their fleets and furthermore plan to make 5% or more of their fleets electric by 2020 (Go Ultra Low Companies, 2016).

REGIONAL PLANNING

There are numerous examples of broader government commitments that are important in developing electric vehicle roadmaps, along with demonstration projects in key areas, which can engage and mobilize local stakeholders in e-mobility. One such example is the EV Everywhere program by U.S. Department of Energy (U.S. DOE, 2016a), which is the umbrella effort to increase the adoption of plug-in electric vehicles, including a range of campaigns such as Workplace Charging Challenge, the Clean Cities network of local coalitions, the EV Community Readiness project, and the Best.Ride.EVer! awareness campaign. These varied programs target different aspects to advance the uptake of electric vehicles and have been

successful in advancing the development of the sector. For example, more than 270 employers have committed to providing charging at more than 600 workplaces, with more than 5500 installed or planned stations under the Workplace Charging Challenge (Graham, 2016).

Germany has implemented electric vehicle demonstration projects through the Electromobility Model Regions and Showcase Regions for Electric Mobility programs. Funded by both industry and the federal government, these programs are implemented and operated at the local and regional level. The Electromobility Model Regions program supports the research and development of more than 100 electric vehicle projects that aim to overcome barriers to making electric vehicles appropriate for everyday use. Similarly, the Showcase Regions for Electric Mobility program funds approximately 90 projects and 300 activities that aim to overcome technological and social barriers to electric vehicle uptake, including consumer awareness. Together these programs combine more than €440 million in funding from the federal government and the private sector over multiple years of implementation. More information on these programs can be found in Tietge et al., 2016.

CONSUMER AWARENESS CAMPAIGNS

Consumer awareness campaigns, when accompanied with other promotions, can be powerful in increasing visibility of electric vehicles and prospective consumers' engagement. In a survey of more than 2,000 potential car buyers in Québec, 21% said they learned about electric vehicles from social media (The Climate Group, 2013). The results of a survey in Norway (Figenbaum, 2016) illustrated the importance of a social network: After owning electric vehicles

for just two years, 67% of owners had inspired at least one friend or family member to buy an electric vehicle, and about 14% of owners had inspired three or more friends or family members to buy one. This social network effect is especially notable, as Norway is the only national market, with more than 20% of new car sales being plug-in electric vehicles, to reach a level of market penetration beyond early adopters into the mainstream.

The United Kingdom's Go Ultra Low campaign is an example of a successful multi-media campaign, and it is discussed in greater detail in the case study section below. Another key project that is underway in 2016, stemming from the U.S. Department of Energy Clean Cities initiative, is the PHEV Demonstration Program and Social Media Campaign. The grant awardee, ASG Renaissance, is partnering with Ford, the New York Department of Transportation, Massachusetts Clean Cities, and several other Clean Cities coalitions to implement the campaign. Total project funding is over \$900,000, with about half from U.S. DOE (Prebo, 2016). The campaign is focused on several key Northeastern markets, and aims to promote electric vehicle uptake by giving 60 to 70 social media influencers extended test drives. During this period, they will share experiences with friends through blogs, Facebook, Twitter, Instagram, and YouTube.

A similar, but smaller effort in the U.S. is led by Drive Electric Vermont. The social media program has a \$5,000 annual budget and includes outreach through Facebook, Twitter, and YouTube (U.S. DOE, 2016). Olympic snowboarding gold medalist Ross Powers, a Vermont native, starred in a 2015 video demonstrating the benefits of electric vehicles, even in the

state's snowy winters (Drive Electric Vermont, 2015). Connecticut and New York have also produced videos to dispel some of the myths about electric vehicles and share some of their benefits; both are available on YouTube (Connecticut Department of Energy and Environmental Protection, 2015; New York Department of Environmental Conservation, 2016). High-profile challenges and contests are another form of raising public awareness, such as the Formula E Championship (Formula E, 2016), and the E-mazing race (E-mazing, 2016) in Canada.

Another ZEV consumer education and awareness campaign stands out. In April 2016, the eight states that have signed a memorandum of understanding to promote zero-emission vehicles (see Multi-State ZEV Task Force, 2016), along with the automotive industry, established a public-private partnership to develop and launch a multi-dimensional campaign that will engage consumers and familiarize them with electric vehicle benefits and features. The campaign is rolling out in two phases. The first phase, which began in 2016, includes market research to develop a campaign strategy under different budget scenarios. This strategy will outline creative concepts, target audiences, and key messaging; identify appropriate channels and mix for target audiences; test key messages with target audiences in diverse markets; and describe metrics for measuring success. During the planned second phase, which is contingent on adequate funding, one or more firms would implement the strategy and launch the campaign. This will include providing creative executions, a logo, media planning and procurement, website creation and support, and public relations and stakeholder engagement activities.

YOUTH EDUCATION AND PROFESSIONAL DEVELOPMENT

Education that provides some kind of degree or certificate, and systematic training that targets professionals, are essential to the sustainable growth of the electric vehicle industry. The programs at Gateshead College and Sunderland University in the United Kingdom, cited earlier, are such examples. Gateshead College's Skills Academy for Sustainable Manufacturing and Innovation provides electric vehicle-related training ranging from manufacture to maintenance. Sunderland University is the first university in the United Kingdom to offer a Master of Science in Low Carbon Vehicle Technology (IEA, 2012).

In Québec, the CEGEP Saint-Jérôme and Rivière-du-Loup have set up programs to train the workforce in transportation electrification. Through training and education, the program aims to achieve a workforce capable of meeting the current and future needs of businesses operating in electromobility (CEGEP, 2016).

AWARDS AND RECOGNITIONS

Awards and recognitions to organizations or other entities complement other electric vehicle promotion actions. One example of awards targeting electric mobility is the annual eCarTec awards, presented annually at the eCarTec Trade Fair for Electric and Hybrid Mobility in Munich (eCarTec, 2016). Awards are given in four categories, with prizes of €15,000 for each. Another example is the 2016 Prix Génie innovation award in Québec, which was given to the Innovative Vehicle Institute for its contribution to the development of the eLion electric school bus (Ordre des ingénieurs du Québec, 2016). A more general program for environmental leadership

is the Vermont Governor's Awards for Environmental Excellence (Department of Environmental Conservation, 2016).

In the United Kingdom, the Go Ultra Low campaign identifies and highlights companies that are incorporating zero-emission vehicles in their fleets. A number of organizations, including Microsoft and the London Fire Brigade, are already adopting electric vehicles in their fleets and have been recognized by the government as "Go Ultra Low Companies." In order to be given this distinction, firms must pledge to make at least 5% of their fleet electric by 2020 (Go Ultra Low Companies, 2016).

Awards recognizing dealers who actively promote electric vehicles are growing in popularity. Two Vermont dealerships that invested significantly in promoting plug-in electric vehicles were recipients of the Governor's Awards for Environmental Excellence in 2014. Although Massachusetts does not have such an award program, its rebate program website shows statistics on retailers that sold the most electric vehicles in terms of rebates received (MOR-EV Program, 2016), which can have a similar motivational effect on dealers. Examples of awards that target dealers are the Annual Electric Vehicle Dealership Awards in Canada (Klippenstein, 2015), the Automobile Dealer Zero Emission Vehicle Promotion category under the annual California Governor's Environmental and Economic Leadership Awards (CalEPA, 2016), and the Connecticut Revolutionary Dealer Award (Department of Energy and Environmental Protection, 2016). Some of these programs have notable features, including developing partnerships with industry associations to gain additional impact and widely publicizing the award to attract dealer participation and help gain media traction.

AUTO DEALER AWARENESS ACTIVITIES

Auto dealers' activities to raise electric vehicle awareness can include strategies for governments to support dealers and the development of documentation for best practices for successful dealerships. For the first aspect, conducting conferences and workshops, such as the EV Roadmap Conference (EV Roadmap, 2016), is a common way for governments to communicate with the dealers and discuss possible strategies. As discussed above, awards and recognition programs, if designed effectively, can be part of the approach to motivating dealers. One key factor is developing evaluation metrics for the award. For example, the evaluation criteria of California's Governor's Environmental and Economic Leadership Awards includes not only the sales volume of zero-emission vehicles, but also outreach and support to customers during and after the sale, and efforts to create a greener dealership (GEELA, 2016). Similarly, Canada's Electric Vehicle Dealership Awards takes into account sales, marketing efforts, community events and education, and onsite promotion such as number of days with inventory, percentage of salesperson trained to sell electric vehicles, visibility of promotional materials and etc. (CEA, 2016). Another approach is to involve automobile associations, as well as other stakeholders, in the process to encourage participation and maximize impact and publicity. For example, Canada's award program is a collaboration of a nonprofit called Plug'n Drive, the Canadian Electricity Association, the Canadian Automobile Association, and other sponsors. Another example is the Connecticut Revolutionary Dealer Award, which is a collaboration of the state's Department of Energy and Environmental Protection (DEEP) and the Connecticut Automotive Retailers Association (CARA). The kickoff event

for the program is held during a regular auto dealers meeting. CARA secures extensive press coverage via its media contacts, which increases exposure and encourages broader participation (Multi-State ZEV Task Force, 2015).

Another important activity in this category is improving the dealership experience for consumers. A detailed assessment of manufacturers' marketing of electric vehicles is not available, but there are several resources on dealers' practices regarding electric vehicle promotion. Table 5 summarizes the related findings from several papers that were focused on the U.S. market. The literature indicates that dealerships can improve their marketing of electric vehicles by ensuring educated and motivated salespeople, maintaining consistent and sufficient inventory of electric vehicle models, using complementary and supportive displays, and developing recognition programs for leading sales staff. One study (Lunetta & Coplon-Newfield, 2016) shows that there is substantial room for improvement among dealerships and automakers. For example, the chance of not finding an electric vehicle at a dealership more than doubles in ZEV states outside California. When visiting dealerships with electric vehicles on display, the salesperson failed to talk about tax incentives one-third of the time. In recognizing the importance of engaging auto dealerships, the National Automobile Dealers Association has created "A Dealer Guide To Marketing Electric Vehicles," which includes critical information for educating and familiarizing sales staff with electric vehicle technology and the major federal policies and initiatives in place to promote it (NADA, 2015a).

CONSISTENT SIGNAGE AND LABELING

Consistent signage and labeling can increase visibility of electric vehicles

Table 5. Studies related to dealer-level electric vehicle activities

Author	Year	Region	Title	Best practices
Carney	2016	U.S.	A dealership perspective: How we can sell millions of EVs	Need at least 10 electric vehicle models on site for sufficient selection, and should have at least 20-30 during periods of peak demand. Having EVs displayed under a solar canopy with charging stations greatly increases consumer interest.
Collantes et al.	2014	U.S.	New Vehicle Dealerships and Plug-in Vehicles: Workshop Summary and Insights	Maintain an adequate selection of at least 10-15 PEVs during peak demand; these cars should be in good condition, cleaned, charged and ready to drive. Featuring PEVs alongside collateral products such as chargers and solar canopies helps associate PEVs with buyer values such as oil independence and environmental friendliness.
Lunetta & Coplon-Newfield	2016	U.S.	REV UP Electric Vehicles: Multi-State Study of the Electric Vehicle Shopping Experience	Articulate to consumers the value of EV technology and incentives can be one of the most effective tools to increase widespread EV adoption. Engage in certification and training programs to ensure that salespeople have the proper knowledge and enthusiasm about EVs, including charging methods and state and federal rebates and tax credits. Place vehicles in prominent locations, such as in a showroom, by the side of the road, next to charging stations, or under special canopies. Advertise EVs on dealer web site and in local media. Provide website on when the EV expert(s) are available. Work with local pro-EV groups to participate in test-ride events. Help buyers in charging station networks. Help prepare state incentive paperwork for customers at point of sale. Recognize and reward high-performance EV sales staff.
NADA	2015a	U.S.	A Dealer Guide to Marketing Electric Vehicles	Have a suite of sales information and training programs to help dealership staff with PEV marketing.
NADA	2015b	U.S.	Dealers Urged to Turn to Salespeople to Win New EV Customers	Marketing EVs hinges on a dealer’s ability to turn salespeople into “EV experts,” in order to make a customer feel confident about investing in a vehicle that may require them to think differently about commuting, long-distance travel, service, financing, and even parking.
Reichmuth & Anair	2016	U.S.	Electrifying the Vehicle Market: Evaluating Automaker Leaders and Laggards in the United States	Improve the availability of EVs and the number of models available at dealerships.
Rushlow et al.	2015	U.S.	Charging Up: The Role of States, Utilities, and the Auto Industry in Dramatically Accelerating Electric Vehicle Adoption in Northeast and Mid-Atlantic States	Place EVs and charging stations prominently at the front of the lot. Include creative placement of HOV lane incentive stickers on the cars and/or signs about rebates to remind consumers of the types of incentives available. Five U.S. states offer some sort of incentive or recognition to dealerships that sell electric vehicles; Connecticut offers dealers an incentive payment worth 10% of the consumer rebate; Massachusetts tracks and displays online the auto dealers that are selling high numbers of electric vehicles.
Searle et al.	2016	California	Leading edge of electric vehicle market development in the United States: An analysis of California cities	About 70-80% of electric vehicle purchasers in California received the state rebate, with some companies and some electric vehicle models lower or higher. Not actively promoting the \$1,500-\$2,500 state rebate when marketing electric vehicles could squander sales opportunities.

and make life easier for their drivers. In addition, consistent signage is needed to guide drivers to charging stations and indicate any restrictions related to charging and parking, such as time or access limits. A number of governments

have been especially active in this area. For example, in response to concerns raised by Oregon, the Federal Highway Administration issued an interim approval for the optional use of an alternative general service

symbol for electric vehicle charging that incorporates a representation of an electrical cord rather than a fuel pump and hose. This alternate symbol is used by the states of California, Connecticut, Delaware, Illinois,

Maryland, Minnesota, New Jersey, New York, Oregon, Vermont, Virginia, and Washington (U.S. DOT, 2016), following a recommended action for its use by the Multi-State ZEV Task Force (ZEV Program Implementation Task Force, 2015). The California Department of Transportation also identifies standardized regulatory signs (e.g., parking and standing signs) for plug-in electric vehicle stations in Traffic Operations Policy Directive 12-01. Germany has developed official signs for electric vehicle parking spaces (Wirges, 2016). As the charging network continues to expand with specialized options, the signs may need to be updated to include more technical information regarding those options.

TOURISM

Initiatives that link electric vehicle awareness programs to tourism can also expand awareness beyond existing users to new potential consumers. The West Coast Green Highway, a corridor between California, Washington, Oregon, and British Columbia, includes eco-tourism and wine country elements. The Oregon Tourism Commission provides relevant information on available charging infrastructure along key tourist attraction routes, and facilitates electric vehicle rentals through private-sector partnerships (Oregon Tourism Commission, 2016). Other examples that incorporate electric vehicles and intelligent transportation into the local tourism industry include resorts in Zermatt, Switzerland; the Goto Islands in Nagasaki, Japan; the Hakone electric vehicle town project in Kanagawa, Japan (IEA, 2012, 2014); and Jeju Island, South Korea (Tweed, 2014). In 2015, New York partnered with private-sector stakeholders to study the feasibility of supporting electric vehicle use in key tourist attractions in the state (see NYSERDA, 2015).

IV. Case studies on consumer electric vehicle programs

This section provides additional discussion of five case studies that provide further detail about more mature electric vehicle consumer-oriented campaigns. The five case studies presented here include a multi-faceted public-private campaign in the United Kingdom; a U.S. campaign with dozens of cities providing local and personal experiences to prospective new buyers; an electric vehicle demonstration zone in Shanghai that provides a unique automaker, government, and consumer experience; an assortment of actions in Amsterdam that together increase the exposure and visibility of electric vehicles; and an exemplary provincial-level program in Québec. In each case, we summarize how the campaigns work, the key aspects of the program, and the scale of activity.

UNITED KINGDOM: GO ULTRA LOW NATIONAL CAMPAIGN

The Go Ultra Low campaign is a collaborative effort between the United Kingdom government and industry to increase public awareness of the benefits, cost savings, and capabilities of electric vehicles. It brings together the Government's Office for Low Emission Vehicles, the Society of Motor Manufacturers and Traders, and eight car manufacturers on a brand-agnostic campaign designed to encourage more drivers to go electric.

The program's website (www.goultralow.com) provides a one-stop shop for information about owning and operating electric vehicles, including basic details on incentives, cost comparison, charger locations, model availability, and information for companies and fleets. The campaign also includes national press, radio

and digital advertising, consumer experience events, community-focused programs, and fleet-focused press. The campaign has, at times, also featured sports stars and television personalities who test-drive different electric vehicles and talk about their experiences on social media and online videos (Go Ultra Low, 2014).

In 2016, the campaign budget was £4 million, co-sponsored evenly between the government and the industry. The campaign has actively tracked various metrics to evaluate the impact. With £2.5 million in media spending in 2016, the campaign achieved a total of 93% in its *reach* metric (i.e., among target upper middle and middle class demographics) and a 21.9 in its *opportunity to see* metric ("OTS" is a measure of how many times the target audience is exposed to the campaign over its duration). In addition to media spending, there was a £250,000 budget for creative production; £670,000 for public relations, social media, events, and partnership marketing; and £110,000 for research and evaluation. The results from the 2016 campaign show that 51% of campaign recognizers agreed the campaign changed the way they think about electric vehicles, 53% said the campaign increased their interest in considering an electric vehicle the next time they buy a car, and 66% took action to find out more about electric vehicles, including spreading the word to friends and searching for further information. These statistics suggest that the campaign has been successful in increasing uptake of ultra-low emission vehicles.

The national media actions are part of a much broader overall effort that also engages cities across the United Kingdom. The British government has allocated more than £600 million between 2015-16 and 2020-21 to support uptake and manufacturing

of ULEVs in the country (Department for Transport, 2015). Earlier this year, eight cities were awarded a share of £40 million under the Go Ultra Low City Scheme to deliver innovative and locally focused initiatives to encourage uptake of electric vehicles (Department for Transport, 2016). One of the cities, Milton Keynes, will receive £9 million to open an Electric Vehicle Experience Centre that will provide consumer advice and offer short-term vehicle loans. Bristol is receiving £7 million for programs that include developing a scheme to encourage people to lease a plug-in car for up to four weeks. Nottinghamshire and Derby will use a portion of their £6 million to pay for a new program letting local companies “try before they buy.”

It is difficult to draw a direct line between these efforts and electric vehicle uptake, but the market in the United Kingdom has grown in step with the Go Ultra Low campaign. The campaign was launched in January 2014. Before that, electric vehicle market share in the country was 0.11% in 2012 and 0.16% in 2013, with less than 3,600 electric vehicle sales per year. In 2014, annual electric vehicle registrations more than tripled to over 14,000, and doubled again from there to over 28,000 in 2015 (SMMT, 2016).

UNITED STATES: NATIONAL DRIVE ELECTRIC WEEK CITY EVENTS

National Drive Electric Week is a nationwide event to increase awareness and highlight benefits of electric vehicles across U.S. cities. Three nongovernmental organizations (Plug-In America, the Sierra Club, and the Electric Auto Association) serve as the national team to support the various events across the country. In addition, many local organizations and individuals work together at the

grassroots level to bring the full range of events to local communities. This event continues to increase in scale each year.

Each local event is led by electric vehicle drivers from the area and advocates, and includes some combination of parades, ride-and-drives, tailgate parties, press conferences, award ceremonies, informational booths, and more. Most of the vehicles displayed at showcases either belong to local drivers or are put on display by dealerships or company corporate offices. People have the chance to see and experience the vehicles, talk to owners and dealer representatives, and learn about driving experience, range, pricing, and model availability. Organizations or individuals can also volunteer to organize an event in their community; the Drive Electric Week website offers rich and detailed resources on how to run local events.

Apart from the regular events, there are some special high-profile events each year, ranging from government announcements of new electric vehicle-related projects to manufacturer product debuts to celebrity engagements. For example, in 2015, National Drive Electric Week featured the debut of the 2016 Nissan Leaf and the Chevy Bolt electric vehicle concept on the West Coast. These vehicles were used for roughly 1,000 ride-and-drives at the Los Angeles event. Nonprofits, utilities, energy agencies, charging companies, academics, and others take part in the events. Some events initiate first-time conversations on topics such as improving cities' charging infrastructure. In Baltimore, the mayor announced the installation of the city's first fast charger, and a pilot program to test the viability of electric vehicles for the city's fleet. These events reached some 6.5 million recipients on social media and received

about 250 articles of news coverage in 2015, and more than 400 articles in 2016 (Plug In America, 2015b, 2016).

National Drive Electric Week started in 2011 as National Plug-In Day and expanded to an entire week of events due to its popularity. In 2011, there were events in 29 cities; in 2013, 100 events took place across 34 states with over 30,000 participants; in 2014, there were 152 events across 38 states, 5 Canadian provinces and 3 European countries, with over 95,000 participants; in 2015, 196 events took place across 41 states, 7 Canadian provinces, Hong Kong, and New Zealand, with more than 130,000 participants and 9,000-plus test rides. In 2016, there were 235 events across 46 states, 8 Canadian provinces, Hong Kong, New Zealand, Denmark, Croatia, and Italy (Plug In America, 2016). More than 100 cities participated in the 2016 event, which took place from September 10-18.

One city with particularly high participant turnout is San Diego, where over 1,100 people attended and 165 electric vehicles spanning across 24 models were available on display (National Drive Electric Week, 2016). National Drive Electric Week events have been linked to increased plug-in vehicle sales, which have jumped by as much as 23% the month after the events (Plug In America, 2016). Many of the leading electric vehicle uptake cities in the United States have hosted regular National Drive Electric Week and other ride-and-drive and promotion events over the years (See Lutsey et al., 2016; Kwan et al., 2016).

SHANGHAI, CHINA: EV DEMONSTRATION ZONE

Shanghai is one of China's chosen pilot cities with special goals, incentives, and local actions to spur the electric vehicle market. In January 2011, Shanghai was declared an International

EV Demonstration City by the Chinese government, and an important part of the designation was the creation of the EV Demonstration Zone in Shanghai's Jiading District. The Zone acts as a hub for electric vehicle technologies, and offers a suite of services including sales, test drive, business mode innovation, data collection, operation and maintenance, infrastructure support, and marketing.

The Zone is multi-faceted, with many partners and many activities. It features four centers (Test Ride and Drive, Business Innovation, Data Collection and Monitoring, Operation and Service), three platforms (International EV Pilot Cities Forum, EV and Parts Exhibition, EV Championship Challenge), and two clubs (an enterprises club and a user club). More than 50 organizations representing different areas of the industry have become partners in the Zone, including Nissan, General Motors, BYD, Chery, Das Auto, ABB, Siemens, Bosch, ThyssenKrupp, Hertz, State Grid, Tongji University, SAE China, China Pacific Insurance Group and others. Membership in the user club exceeds 8,700, including 1,300 long-term users.

A number of additional activities further show how unique the Zone is. The Test Ride and Drive Center has 23 brands, 29 models, and a total of 55 test drive vehicles. The Center provides a professional track where visitors can enjoy a test drive. It also has collaborated with Tongji University to establish a Students' Experience Center. By the end of 2014, total visitors and test drives exceeded 130,000 and 42,000, respectively, and about 10,000 surveys were completed. The Operation and Maintenance Center provides services such as vehicle import customs declaration, inspection, registration, and insurance, which make purchases easier for customers. It also works with the original equipment manufacturers and fire stations to conduct emergency response training.

The Business Mode Innovation Center has facilitated several electric vehicle business-to-consumer (B2C) and business-to-business (B2B) sharing programs and has more in the pipeline. By the end of 2014, it had completed 836 charging stations, one battery swapping station, one 'gas + charging' station, two hydrogen stations and one "charging, swapping and storing" station. Shanghai expanded its demonstration program to Pudong New Area in 2014. State Grid Shanghai Municipal Electric Power Co, Shanghai Expo Group, and Germany's BMW will collaboratively develop 50 public charging poles (Lu & Fu, 2014).

The growth of the Shanghai EV Demonstration Zone has coincided with the growth of the electric vehicle market. Shanghai is now the top market in China and one of the top markets globally for electric vehicles. By 2014, Shanghai had exceeded its nationally determined sales target by about 20%, ranking first among China's electric vehicle pilot cities in both actual sales and as compared to the city-specific targets. Approximately 10,000 electric vehicles were sold in Shanghai in 2014; in 2015, that number jumped to over 40,000, representing about 11% of all new electric vehicle sales. This increase in uptake is due to many factors, including a registration policy that prioritizes electric vehicles as well as consumer financial incentives for their purchase. The increased outreach and awareness activities like those in Shanghai's EV Demonstration Zone provided an important complement to those policies by helping ensure that consumers were well informed about the new technology.

AMSTERDAM, NETHERLANDS: LOCAL EXPOSURE AND VISIBILITY ACTIONS

A number of cities in Europe are pioneering new and comprehensive programs to reach and motivate buyers

in an increasingly broad electric vehicle market. Amsterdam is a prominent case. At the 29th Electric Vehicle Symposium and Exhibition in Montreal (EVS29), Amsterdam won the E-Visionary Award for the second time for its efforts in helping develop the electric vehicle market. In 2015, Amsterdam's new plug-in electric vehicle share was 9% (or over 5,000 new plug-in electric vehicles sold in the metropolitan area), which is among the highest of European cities.

There are many local goals, programs, and policies that have worked in concert to continue to expand Amsterdam's electric vehicle market. One of these is the goal to make as much transportation as possible emission-free by 2025, including taxis, buses, delivery vehicles, municipal vehicles, and boats (City of Amsterdam, 2016a). For example, Amsterdam is phasing in urban access regulations that restrict highly polluting vehicles from delivering goods in the city's inner urban core. As a result, logistics transit stations have been established around the city to transfer goods to electric trucks for delivery.

Fleets across Amsterdam are greatly increasing the volume of electric vehicles and are also increasing exposure to the vehicles among a much wider population of drivers. For example, carsharing service provider Car2Go has 350 vehicles across the city that are 100% battery electric, making it the world's first all-electric carsharing fleet. There are now more than 10,000 individuals registered and membership continues to grow, so these drivers have the opportunity to ease their way into electric vehicles, one trip at a time. The service offers one-way carsharing, meaning vehicles can be rented and parked in any commercial space without specifying a return time or location in advance (Amsterdam, 2016).

In addition to Car2Go's all-electric fleet, other fleet programs are contributing to

the exposure and awareness of electric vehicles in Amsterdam. For example, Schiphol Airport purchased 35 all-electric buses in 2013 to reduce maintenance cost and improve emissions performance (King, 2013). In 2014, the airport incorporated a fleet of 167 Tesla Model S electric taxis (Joseph, 2014). In addition, three taxi companies in the city operate fleets of more than 170 Nissan Leaf and e-NV200 all-electric vehicles (Nissan, 2015). Each of these programs cast a wider net than car buyers and car sharers, capturing a broader population of passengers and instilling the idea that the technology is now mature.

The breadth of publicly available charging infrastructure also greatly contributes to the exposure and awareness of electric vehicle technology. Amsterdam already has one of the highest densities of charging stations in the world; in 2014, there were more than 1,000 public charging stations, and 1,000 semi-public or private charging points (Amsterdam, 2016). Much of this charging infrastructure is curbside, making it a very visible and constant reminder that there is sufficient charging infrastructure for drivers to access easily. There is also a system that helps optimize the placement of chargers to where they are needed. When charging infrastructure is found to be insufficient or unavailable, citizens can request that the government install electric vehicle charging stations on streets where they live or work. As long as certain conditions are met (e.g., the electric vehicle owner does not have access to private parking), public charging points may be installed at no cost to the electric vehicle owner (Tietge et al., 2016).

Along with the increasing exposure to electric vehicles from fleets and charging infrastructure, there have

also been numerous awareness-raising events that create buzz and motivate prospective drivers to explore the technology. One example is the Plug'N'Party campaign, which aims to increase public awareness and send the message that electric vehicles are cool, fast, and fun to drive. At a Plug'N'Party, a car charging station is used as the electricity source for a disc jockey who sets up to play music on the street (TEDx, 2010).

Amsterdam also supplements these numerous exposure and awareness activities by providing online tools and informational materials (called "Amsterdam elektrisch") that inform and educate consumers on e-mobility (City of Amsterdam, 2016b). Also available online is real-time information on the location and availability of electric vehicle charging infrastructure. Amsterdam was among the first cities in the world to provide this type of real-time information via an open application programming interface. Such information has helped electric vehicle drivers in Amsterdam overcome the potential barriers related to charging availability and convenience.

QUÉBEC, CANADA: GOVERNMENT ACTIONS TO PROMOTE ELECTRIC VEHICLES

Electrification of transportation is one of the means favored by the Government of Québec to contribute to the fight against climate change. The province's Transportation Electrification Action Plan 2015-2020 is its blueprint for moving toward this goal. The action plan aims to reach 100,000 electric vehicles registered in Québec by 2020, to reduce greenhouse gas (GHG) emissions in addition to creating jobs. To achieve this, 37 measures are carried out by some 15 ministries, agencies and state companies.

A \$1 million media campaign, Propelling Québec Forward with Electricity, was launched in the fall of 2015 to raise awareness of transportation electrification and the provincial action plan. The campaign included a kickoff press conference (bringing together key dignitaries, including four government ministers, 200 guests, and 12 members of the media, in addition to exhibiting two electric vehicles, an electric bus and charging stations), TV and radio ads and videos, a bilingual website (transportsElectriques.gouv.qc.ca), a presence on social media, and the development of the action plan logo. The logo, illustrated by an arrow representing movement, dynamism and the future, brings together and supports the main messages of the action plan. Its colors echo the branding of the Hydro-Québec Electric Circuit to create a continuity effect between the two initiatives.

The media buzz surrounding the launch of the Québec action plan and its advertising campaign was considerable. Nearly 80 positive or neutral articles were published on the subject, which also attracted a lot of interest in social media. On YouTube, there were 234,205 viewings, with a viewing time of 80%, well above the average in social media (40% to 50%). A post-campaign survey showed that the population's support for the action plan is very high (94%). Moreover, the retention of messages conveyed is excellent: 90% of respondents are of the opinion that the action plan will enable Québec to achieve its objectives.

Québec has a broad program for the promotion of electric transportation, which supports public awareness initiatives on electric vehicles (Québec Ministry of *Transportation, Sustainable*

Mobility and Transport Electrification, 2016b). The initiatives offer financial assistance for the implementation of electric vehicle outreach initiatives, and the organization of international events in Québec. The budget for electric vehicle awareness initiatives is approximately \$1.1 million per year. Québec provided financial assistance to host the Electric Vehicle Symposium & Exhibition (EVS29), one of the largest international electric vehicle conferences, in Montréal in June 2016. The symposium was promoted by range of social media campaigns, including e-press (e.g., infographics), television advertisement, and a video on the transportation ministry website to connect the event with public work on electric vehicles.

Funding from the action plan includes \$24.5 million for public transportation showcase projects, \$11.9 million for the Montréal City Mobility initiative, \$6.6 million for an electric taxi demonstration program, and \$30 million to support the deployment of electric school buses (Québec Ministry of *Transportation, Sustainable Mobility and Transport Electrification*, 2016c).

Finally, the action plan has invested \$2.5 million to support the installation of fast charging stations along main roads, \$5.4 million to support the installation of charging stations for multiunit residential buildings, new office buildings and for on-street parking and \$500,000 for charging stations in urban areas along business arteries in Montréal and Québec City. The government is deploying provincial recharging infrastructure throughout Québec, connected to neighboring provinces and states, and the public charging stations are deployed as part of the Hydro-Québec

Electric Circuit. The extensive Electric Circuit network has over 750 charging stations in operation, including sixty 400-volt fast charging stations, to help allay the range concerns of electric vehicle users.

V. Conclusions

This paper reviews leading global practices on electric vehicle consumer awareness and outreach activities. It reviews literature on the importance of consumer awareness and identifies exemplary actions in leading electric vehicle markets. Based on our review, we also selected five case studies for additional discussion to help better understand the key elements of successful comprehensive consumer awareness campaigns. Although this work is focused on how actions to increase awareness and understanding might influence electric vehicle uptake, we note that a broad array of promotion actions (e.g., financial and non-financial incentives, deployment of charging infrastructure, high model availability, effort to increase awareness and understanding, others) are key to expanding the market. We conclude with the following findings on electric vehicle consumer awareness activities:

Action to increase consumer awareness is a key part of supporting the growth in the early electric vehicle market. On average, consumers in many regions are largely unfamiliar with electric vehicle technology, unaware of available incentives, and uninformed about the range of benefits that electric vehicles provide. Consumers with some level of understanding of and experience with the technology are more likely to consider an electric vehicle in their future purchasing or leasing decisions. Markets with high electric vehicle growth and uptake have tended to have more sophisticated consumer campaigns. The areas

discussed in this report have implemented a diverse set of electric vehicle outreach and awareness actions, and the details vary significantly across programs. For example, consumer awareness campaigns can involve radio and television commercials (in the United Kingdom and Québec), celebrity ambassadors (in the United Kingdom), test drive and experience sharing (National Drive Electric Week in the United States and Shanghai's EV Demonstration Zone), social network posts and messaging (PHEV social media campaign in the Northeastern United States), competitions and challenges (E-mazing race in Canada; Formula-E), and more. Stakeholders can continue to devise approaches that expand, build upon, and innovate from these activities.

Stakeholders would ideally collaborate to leverage strengths and effectively utilize limited resources on electric vehicle awareness campaigns.

A wide range of stakeholders have taken action to increase education and awareness, including multiple levels of government, nonprofit organizations, businesses, academic institutions, local communities, and individuals. There are many opportunities to increase outreach efficacy through collaboration, especially as the technology and programs to promote it continue to mature. One example of successful collaboration is how the Connecticut government and the auto industry work together to give auto dealers incentives for selling electric vehicles. Another is how the United Kingdom's Go Ultra Low campaign brings together government ministries and the automobile industry to collaborate on efforts to increase consumer understanding and awareness. Local electric vehicle events that are co-organized by multiple groups (electric vehicle enthusiasts and nonprofit organizations, auto industry representatives, and governments) could ensure that

a wider audience of prospective electric vehicle buyers is reached. Governments can choose to use their convening power, implement these outreach activities, provide partial funding, form partnerships with other stakeholders, and sponsor or endorse established programs.

Sustained programs that utilize a broad range of outreach and awareness actions are more likely to capture a wider audience of prospective electric vehicle consumers.

A well-designed, comprehensive program would utilize a range of actions to maximize consumers' exposure to electric vehicles (e.g., fleet purchases, demonstration projects, consumer awareness media campaigns, signage), and provide prospective consumers with easy access to consumer-friendly information (e.g., one-stop shop websites, test drives, easy buying/leasing processes). The Québec case study presented above highlights the importance of allocating a general consumer awareness budget, but also of including outreach and awareness in the other electric vehicle programs (e.g., the incentive, policy, and charging infrastructure programs). An auto industry representative makes exactly this case: "We have to overpower these consumers. If you don't accompany an infrastructure program, or a vehicle incentive program, with an outreach campaign, you've lost the battle. Everything you do, you have to spend an equal amount of money to talk about it." (Wernle, 2016). It also appears to be clear that education and awareness campaigns would need to be sustained through early market development stages (e.g., from less than 1% to over 5% electric market share), before social network effects more substantially take over as the market grows.

Local context and resources can be important in assessing the feasibility and effectiveness of an electric vehicle consumer awareness program.

A number of existing programs have focused on the local landscape. For example, Empire Clean Cities of New York has a targeted outreach campaign for local commercial fleets, and the West Coast Green Highway includes eco-tourism and wine country elements. National Drive Electric Week largely features grassroots efforts that have continued to grow in size and number. The Norway case suggests that moving from innovators to the early majority market could rely on better understanding and encouraging network effects, at the local level, that are helping lure customers to electric vehicles.

This paper offers an initial step in exploring the consumer awareness and outreach actions in different regions. From our review of the literature, we have identified multiple studies that examine consumer attitudes towards electric vehicles and/or identify consumer awareness as a barrier to their greater adoption. The various reports and case studies summarized affirm that consumer awareness campaigns are a key component of comprehensive strategies to increase electric vehicle uptake. Each category of the awareness actions described in this paper is worthy of further research to identify best practices. For example, it would be worthwhile to investigate how adding more electric vehicles to various public and private fleets (government, taxi, car sharing programs) can reach more prospective purchasers. Best practices in conducting ride-and-drive events, engaging dealers through workshops, or other innovative approaches could be explored.

A further question is how to evaluate electric vehicle consumer awareness

programs. Developing and using metrics to evaluate programs' effectiveness could become helpful over time, especially as next-generation vehicles become available in larger numbers. Quantifying campaigns' precise impact, for example, on prospective consumers' willingness to purchase, and ultimately on electric vehicle sales, could remain difficult to do definitively considering the numerous barriers and promotion actions impacting electric vehicle uptake. Yet the United Kingdom's Go Ultra Low program evaluation framework tracked a number of metrics, including how well the campaign reached its targeted audience, what messages people took from the campaign, how viewers responded to the message, what immediate actions were taken by viewers, and the long-term effects of the campaign. A set of standard metrics (program reach, engagement, media value, and click-through-rate per dollar spent in social media campaign or online digital advertising, among others) might be devised and used more extensively as more of these campaigns are implemented. Furthermore, there are indicators that can be used to compare different kinds of programs (e.g., change of consumer purchase desire before and after participation, difference of purchase desire between consumers who know and do not know about the program, and electric vehicle sales change).

Other questions that might warrant further investigation in future research include addressing the role of dealerships and automakers, as well as considering the key messages to deliver to reach particular prospective electric vehicle customers. Furthermore, as electric vehicle markets mature, governments may gain from a better understanding of how communications and awareness actions might be

modified in order to adapt to technological advancements and broader overall awareness. Greater understanding of the factors deterring consumers from considering electric vehicles, both today and in the future, can help implementers of outreach and awareness actions tailor their efforts and communicate more effectively.

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