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NSTSCE

National Surface Transportation Safety Center for Excellence

New Tech Educational Outreach

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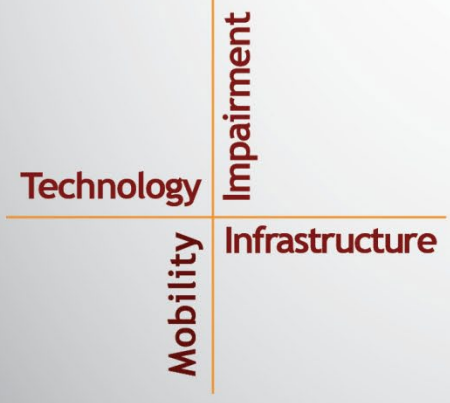

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EXECUTIVE SUMMARY

The impacts of transportation on human health and safety may be addressed at least in part by new vehicle technologies such as advanced driver assistance systems (ADAS) and electric vehicles (EVs). To reap the safety and health benefits of these technologies and overcome barriers to adoption, the driving public needs to understand the benefits of these technologies, their limitations, and how to properly use them. One way to address barriers to proper use and adoption of these new vehicle technologies is through educational outreach.

The objectives of this project were to gather information and materials from current EV educational outreach efforts and the National Highway Traffic Safety Administration's (NHTSA's) ADAS educational outreach program to inform the development of a New Tech Outreach (NTO) educational outreach program and to identify potential partners for a future effort. The approach to conducting the project involved two steps. As a first step, the project team reviewed materials from NHTSA's ADAS educational campaign among others and conducted a scan of current literature on EV educational outreach. The second step was reviewing three EV educational outreach programs being conducted by public-facing organizations to include as examples of how to conduct EV educational outreach. As part of the program review, the project team reviewed program websites and key reports, attended events, and interviewed a program lead from each program. Interviews, which were conducted between May 1 and November 14, 2024, covered a range of topics including program goals, target audiences, topics, approaches, funding, partnerships, implementation barriers, and lessons learned. Each interview also explored future opportunities for collaboration and partnership not only with the Virginia Tech Transportation Institute (VTTI) but for the types of organizations represented by the National Surface Transportation Safety Center for Excellence.

A set of key takeaways was identified, including potential partnership opportunities. The key takeaways are not an exhaustive list of everything reviewed or generalizable findings on this topic; rather, they are meant to serve as a summary of what the project team considers to be potential inputs to the design of a future NTO program. Throughout the takeaway discussion, resources that the project team may use or reference in a future NTO program are highlighted. In addition, an important aspect of this project is how VTTI can partner with organizations such as those included here in a future NTO program. Working with universities in general and VTTI specifically was discussed during each program review, and numerous suggestions were made for how such collaboration can occur in the future. As a next step, the report concludes with a suggestion and basic outline for an NTO pilot project.

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LIST OF ABBREVIATIONS AND SYMBOLS

AAA	American Automobile Association
ADAS	advanced driver assistance systems
AFDC	Alternative Fuels Data Center
BTSCRP	Behavioral Traffic Safety Cooperative Research Program
CBO	community-based organization
CFO	Clean Fuels Ohio
D2D	Dock to Door
DEUSA	Developing Replicable, Innovative Variants for Engagement for EVs (DRIVE) Electric USA
DET	Drive Electric Tennessee
DOE	Department of Energy
DOT	Department of Transportation
ETCleanFuels	East Tennessee Clean Fuels
EPA	Environmental Protection Agency
EV	electric vehicle
ICE	internal combustion engine
LPC	local power company
KEVA	Knoxville Electrical Vehicle Association
NEVI	National Electric Vehicle Infrastructure Program
NGO	nongovernmental organization
NHTSA	National Highway Traffic Safety Administration
NSC	National Safety Council
NSTSCE	National Surface Transportation Safety Center of Excellence
NTO	New Tech Outreach
OEM	original equipment manufacturer
PAVE	Partners for Automated Vehicle Education
PEV	plug-in electric vehicle
TDEC OEP	Tennessee Department of Environment and Conservation Office of Energy Programs
TRB	Transportation Research Board
TVA	Tennessee Valley Authority
UT	University of Tennessee
U.S. DOT	U.S. Department of Transportation
VARK	Visual, Aural, Read/write, and Kinesthetic
VCC	Virginia Clean Cities
VTO	Vehicle Technology Office
VTTI	Virginia Tech Transportation Institute

CHAPTER 1. INTRODUCTION

The impacts of transportation on human health and safety may be addressed at least in part by new vehicle technologies such as advanced driver assistance systems (ADAS) and electric vehicles (EVs). In a statement about the potential of ADAS technologies to save lives, the National Highway Traffic Safety Administration (NHTSA) reported that "Driver assistance technologies hold the potential to reduce traffic crashes and save thousands of lives each year. In 2022, 42,514 people died in motor vehicle crashes — many of these crashes were tied to human error" (NHTSA, n.d.). In January 2023, the U.S. Departments of Energy (U.S. DOE), Transportation (U.S. DOT), Housing and Urban Development, and the Environmental Protection Agency (EPA) released the *U.S. National Blueprint for Transportation Decarbonization* to address the health challenge that the transportation sector poses as the largest source of greenhouse gas emissions in the United States with emissions contributing to poor air quality (DOE, 2023). The blueprint states that "decarbonizing the transportation system will reduce air pollution and its associated health impacts. For example, transitioning to [EVs] powered by clean electricity will eliminate tailpipe emissions and the associated air quality and health impacts" (p. 29).

To reap the safety and health benefits of these technologies and overcome barriers to adoption, the driving public needs to understand why these technologies are valuable. A barrier to the lifesaving benefits of ADAS, as reported by AAA, is that "while many of these technologies are rapidly being offered in newer vehicles, many drivers are unaware of the safety limitations of the systems in their vehicles. Lack of understanding or confusion about the proper function of these ADAS technologies can lead to misuse or overreliance on the technology, which could result in a deadly crash" (AAA, n.d.-a). Realizing the health and environmental benefits from EVs will require consumers to overcome a variety of concerns that limit adoption. A survey conducted by *Consumer Reports* in 2022 found that while "a growing number of consumers are eager to buy a battery [EV]" they have concerns about charging logistics, range, and the costs involved with purchasing and maintaining an EV (Bartlett & Bergmann, 2022).

One way to address barriers to proper use and adoption of these new vehicle technologies is through educational outreach. In 2022, NHTSA launched a yearlong education campaign to help drivers learn about the safety benefits of ADAS technologies in newer vehicles. As former NHTSA Deputy Director Dr. Steven Cliff stated, "Vehicles equipped with lifesaving technologies can prevent or reduce the severity of a crash, but they are most effective when drivers learn how to use them" (NHTSA, 2022). Filling knowledge gaps about EVs may also address adoption barriers. Dr. Quinta Warren, *Consumer Reports* associate director of sustainability policy, commented on the *Consumer Reports* survey that "there is clear interest among Americans in reducing costs for transportation and lowering their environmental impact," and the survey "underscores some key concerns, but fortunately, many of these barriers to owning a battery-EV can be addressed through experience and education" (Bartlett & Bergmann, 2022).

PROJECT OBJECTIVES

The objectives of this project were to gather information and materials from current EV educational outreach efforts and NHTSA's ADAS educational outreach program to inform the

development of a New Tech Outreach (NTO) educational program and to identify potential partners for an NTO educational outreach program.

Approach

The approach to this project involved two steps. As a first step, the project team reviewed materials from NHTSA's ADAS educational campaign (which was later expanded to include others such as the National Safety Council [NSC]) and conducted a scan of current literature on EV educational outreach. The second step was identifying two or three EV educational outreach programs being conducted by public-facing organizations to include as examples of how to conduct EV educational outreach. As part of the program review, the project team reviewed program websites and key reports, attended events, and interviewed a program lead from each program. Interviews, conducted between May 1 and November 14, 2024, covered a variety of topics, including program goals, target audiences, topics, approaches, funding, partnerships, implementation barriers, and lessons learned. Each interview also explored opportunities for collaboration and partnership moving forward, not only with VTTI, but also with the types of organizations represented by the National Surface Transportation Safety Center for Excellence (NSTSCE; i.e., universities, insurance companies, OEMs, and departments of transportation [DOTs]). After this information was collected for each program, a member of the project team qualitatively analyzed the program information to identify key themes related to topics, approaches, etc., and created a summary of findings for each program. A member of the project team then reviewed the findings (i.e., ADAS education, literature scan, program reviews) and pulled key takeaways for the NTO program that VTTI hopes to develop in the future, as well as a list of potential partnership opportunities between the organizations reviewed and NSTSCE stakeholders including VTTI. The key takeaways are not an exhaustive list of everything reviewed or generalizable findings on this topic; rather, the key takeaways are meant to serve as a summary of what the project team considers to be potential inputs to the design of a future NTO program.

CHAPTER 2. ADAS EDUCATION REVIEW & EV OUTREACH LITERATURE SCAN

ADAS EDUCATIONAL CAMPAIGN REVIEW

As background for developing an NTO educational outreach program, the research team proposed conducting a review of NHTSA's ADAS educational campaign. Once the project was underway, it was decided that it would be helpful to also review ADAS educational outreach information from additional organizations such as the NSC. Below is a review of key information from these organizations that could serve as helpful reference materials for the NTO program.

NHTSA

NHTSA's ADAS educational campaign was reviewed for content and approach (NHTSA, n.d.). NHTSA's ADAS website provides an overview of ADAS technologies grouped according to function:

- Collision warning: forward collision warning, lane departure warning, rear cross traffic warning, blind spot warning
- Collision intervention: automatic emergency braking, pedestrian automatic emergency braking, rear automatic braking, blind spot intervention
- Driving control assistance: adaptive cruise control, lane centering assistance, lane keeping assistance
- Other systems: automatic high beams, backup camera, automatic crash notification

For each technology, NHTSA provides a written description accompanied by an animated infographic demonstrating the technology. In addition to citing the technology's capabilities, limitations are also noted (e.g., lane departure warning systems will provide a warning to the driver but do not take action to avoid a crash).

NHTSA also provides several easy-to-understand videos that demonstrate the technologies. For example, through a partnership with Jason Fenske of "Engineering Explained," videos were created on blind spot and forward collision warnings, and automatic and pedestrian automatic emergency braking. Additional videos demonstrate rear automatic braking, blind spot intervention, lane keeping assistance, and automatic high beam technologies.

To further assist drivers, NHTSA provides an option for site visitors to search for their vehicle make and model to identify the technology in their vehicle.

My Car Does What

In addition to NHTSA's ADAS educational outreach materials, the NSC and the University of Iowa Public Policy Center provide educational materials about ADAS features through MyCarDoesWhat.org. The website uses a variety of approaches, including videos demonstrating how features work and quick guides with feature descriptions and animations. The website is designed to help address questions such as "How do I find out what an icon or warning means?" and "How do I use these features the way they were intended?" (NSC, n.d.). The videos and quick guides, among other resources, can be found on the MyCarDoesWhat.org website.

In a MyCarDoesWhat.org blog, Heidi Simon reported that NSC is developing additional resources and partnering with Consumer Reports to revamp MyCarDoesWhat.org (Simon, 2023). The blog also reported that NSC and Consumer Reports, along with several other consumer safety organizations, including the American Automobile Association (AAA), J.D. Power, Partners for Automated Vehicle Education (PAVE), and SAE International have created a resource called *Clearing the Confusion: Common Naming for Advanced Driver Assistance Systems* (Consumer Reports, 2022).

Clearing the Confusion

Clearing the Confusion is a two-page educational resource explaining how AAA, Consumer Reports, J.D. Power, NSC, PAVE, and SAE worked together to develop standard terms for ADAS technologies. The organizations are together asking automakers to adopt these terms to "help reduce consumer confusion about the intent and functionality" of the various ADAS technologies (Consumer Reports, 2022). The resource also includes a brief description of each feature (e.g., forward collision warning) by category (e.g., collision warning). The terms were created to "provide clarity to consumers by naming and describing the functions of ADAS in a consistent, easy to understand manner."

The ADAS technologies listed in *Clearing the Confusion* closely mirror those provided by the NHTSA educational outreach campaign, though *Clearing the Confusion* provides a more extensive list of features. In a few cases, the terminology or the category the features fall under differs slightly. In these cases, Table 1 notes the variation between NHTSA and *Clearing the Confusion* by showing the term used by the latter in square brackets. In a few other cases, the term is the same for the feature, but is listed under a different ADAS category; these cases are noted with an asterisk.

Though MyCarDoesWhat.org is an NSC program, there are some differences between Clearing the Confusion and MyCarDoesWhat.org. For instance, Clearing the Confusion lists blind spot warning under the category of collision warning, while MyCarDoesWhat.org places blind spot warning under a category called side assisting (NSC, 2025). Thus, for simplicity in comparing terminology, only NHTSA and Clearing the Confusion were compared in Table 1.

Table 1. ADAS feature list.

ADAS Category	ADAS Feature	NHTSA	Clearing the Confusion
• Collision Warning	• Forward Collision Warning	✓	✓
	• Lane Departure Warning	✓	✓
	• Rear Cross Traffic Warning	✓	✓
	• Blind Spot Warning	✓	✓
	• Parking Collision Warning		✓

ADAS Category	ADAS Feature	NHTSA	Clearing the Confusion
• Collision Intervention	• Automatic Emergency Braking	✓	✓
	• Pedestrian Automatic Emergency Braking	✓	
	• Rear Automatic Braking • [Reverse Automatic Emergency Braking]	✓	✓
	• Blind Spot Intervention	✓	
	• Automatic Emergency Steering		✓
	• Lane Keeping Assistance*		✓
• Driving Control Assistance	• Adaptive Cruise Control	✓	✓
	• Lane Centering Assistance	✓	✓
	• Lane Keeping Assistance*	✓	
	• Active Driving Assistance		✓
• Parking Assistance	• Backup Camera*		✓
	• Surround View Camera		✓
	• Active Parking Assistance		✓
	• Remote Parking Assistance		✓
	• Trailer Assistance		✓
• Driver Monitoring	• Indirect Driver Monitoring System		✓
	• Direct Driver Monitoring System		✓
	• Driver Re-engagement System		✓
• Other Systems • [Other Driving Assistance Systems]	• Automatic High Beams	✓	✓
	• Backup Camera*	✓	
	• Automatic Crash Notification	✓	
	• Heads-Up Display		✓
	• Night Vision		✓

*Indicates the ADAS feature is listed under different categories.

These educational outreach approaches (flyers, videos) could be used by the NTO program to provide information to participants at an event. For instance, *Clearing the Confusion* could be used to create a handout of the specific ADAS features in an EV being used during a ride and drive event so that participants can understand the functionality and intended use of the ADAS features in the EV they drive. Or an interactive display could be set up during an outreach event on which participants could watch NHTSA videos and animations so that when they go to purchase their next vehicle, they are better informed about the features they might want.

Transportation Research Board

Also noteworthy is work being done by the University of Iowa under a Transportation Research Board (TRB) Behavioral Traffic Safety Cooperative Research Program (BTSCRP) project to

study “ADAS Education and Outreach.” TRB notes that while ADAS features may reduce crashes, the features can be confusing to users (e.g., varying terms and functionality). The study is being done because “as ADAS technologies continue to advance and permeate the vehicle fleet, it is critical to ensure all roadway users understand how the systems work and how to safely use them” (TRB, n.d.). The objectives of the project are to:

> (1) characterize the current state of ADAS education, training materials, and methods of delivery; (2) identify populations in need of ADAS education and training; (3) identify gaps in existing educational materials and methods of delivery; and (4) identify effective methods of delivering ADAS information and educational materials to target populations (TRB, n.d.).

This research, which was underway at the time of this ADAS review, should provide helpful guidance and resources for integrating ADAS educational outreach into an NTO program. The study outcomes will also help target populations in need of education and training and how best to provide that education.

LITERATURE SCAN OF EV EDUCATIONAL OUTREACH PROGRAMS

The literature scan of EV educational outreach efforts sought to better understand the work being done in this growing educational outreach space, in particular, what topics are being covered and what approaches are being used. The ADAS review and EV educational outreach literature scan informed the program interviews and may serve as input to the development of an NTO program.

The research team conducted a scan of EV educational outreach programs using Google, Google Scholar, the Virginia Tech Library database, and the Transportation Research International Documentation database. The scan identified a variety of sources, including journal articles, program plans and reports, and websites. Sources were reviewed to see what they had to say about the primary areas of interest for this project: goals, audiences, topics, approaches, and partners. The scan also included a look at the types of organizations involved in supporting and/or leading EV educational outreach.

Lead Organizations

Below are brief descriptions of some organizations involved in EV educational outreach. The focus of this project was on public-facing (e.g., public agencies, nonprofit organizations) rather than private sector organizations, though there may be public/private partnerships. The reason for this focus was primarily to gather information on how organizations similar to VTTI are doing EV educational outreach.

Government

The primary government agency supporting EV educational outreach is the DOE. The DOE’s Vehicle Technology Office (VTO) has a resource called the Alternative Fuels Data Center (AFDC), managed by the National Renewable Energy Laboratory (AFDC, n.d.-a). The AFDC “provides information, data, and tools to help fleets, fuel providers, policymakers, cities, states, Clean Cities and Communities coalitions, and other transportation decision makers find ways to

reach their energy, environmental, and economic goals through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving strategies" (AFDC, n.d.-b). Some of the other programs that the DOE supports are discussed in more detail here, including the Clean Cities and Communities Coalition Network and Developing Replicable, Innovative, Variants for Engagement for EVs in the USA (DRIVE Electric USA; hereafter DEUSA)..

There were also a few examples of state or local governments leading educational outreach programs, including the State of Colorado, the City of Columbus in Ohio, and the Tahoe Regional Planning Agency. For example, the Colorado Energy Office and the Colorado Department of Transportation launched a multiyear EV education and awareness campaign in 2022 designed to "raise awareness about EVs among all Coloradans, focusing on the financial and environmental benefits of EVs and how EVs can fit into Coloradans' everyday routines" (Colorado Energy Office, 2023, p.19).

Clean Cities and Communities Coalition

Clean Cities and Communities (formerly called Clean Cities and referred to as "Clean Cities" in this literature scan) supports EV educational outreach efforts. Clean Cities is a U.S. DOE "partnership to advance clean transportation nationwide" (Clean Cities and Communities, n.d.-a). Clean Cities has over 75 active coalitions across the United States (Figure 1; Clean Cities and Communities, n.d.-b).

In 2021, Clean Cities coalitions reported conducting "a total of 3,756 activity days… which were estimated to have reached over 25 million people" (Singer et al., 2021, p. 15). Most of these events included EV demonstrations, along with other types of technology demonstrations, such as biodiesel and hydrogen fueling.

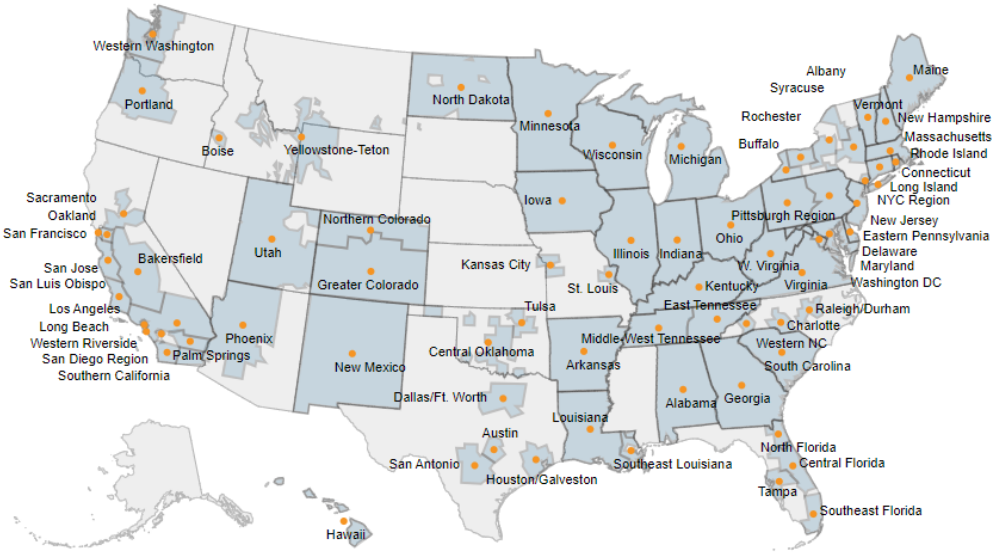

Figure 1. Map. Clean Cities locations (Clean Cities and Communities, n.d.-b).

Drive Electric USA

Another organization in the implementation of EV educational outreach is DEUSA, which "is developing state-based 'Drive Electric' programs across the U.S. that are engaging individuals, utilities, legislators, dealerships, and others towards removing adoption barriers and accelerating plug-in [EV] use" (DEUSA, n.d.-a). DEUSA accomplishes this through collaboration with Drive Electric and Clean Cities chapters/organizations (Figure 2; DEUSA, n.d.-a).

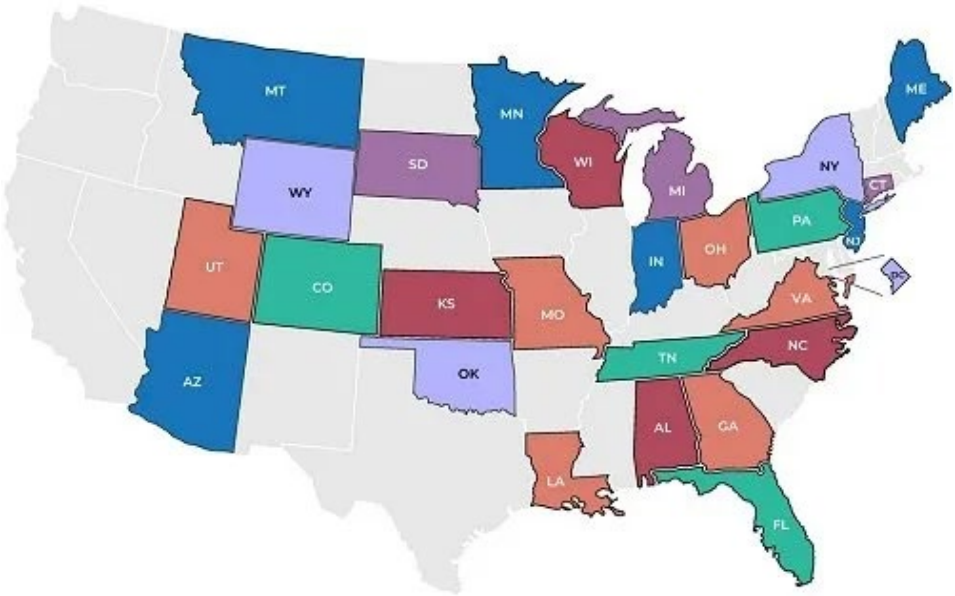

Figure 2. Map. Drive Electric partner states (DEUSA, n.d.-a).

DEUSA began as a proposal put forward by staff from East Tennessee Clean Fuels (ETCleanFuels) and Clean Fuels Ohio (CFO) that was selected and awarded by the DOE in the summer of 2020. The project has numerous stakeholders, including Clean Cities coalitions from 14 states and "a diverse set of other committed partners who are dedicated to raising awareness and adoption of EVs in their states" (DEUSA, n.d.-b).

Nongovernmental Organizations

Numerous nongovernmental organizations (NGOs) conduct educational outreach activities. A variety of these programs were reviewed, often in the form of websites with informational resources for the public (e.g., Plug-In America) and/or members (i.e., Consumer Reports, AAA). An example prevalent in the literature scan is the nonprofit Forth. Forth has a mission to "electrify transportation by bringing people together to create solutions that reduce pollution and barriers to access" (Forth, n.d.). Forth works to accomplish this through many channels; however, outreach and engagement are among their top priorities. Another example is a partnership of nonprofits including the Sierra Club, Plug-In America, and the Electrification Coalition, who utilized ride and drive events to give "people the chance to kick the tires and check out EVs for themselves, so they can see just how easy a transition it is" (Sierra Club et al., 2023, p. 31).

Program Goals

A few primary EV educational outreach goals were identified through the literature scan, including providing information to raise awareness of EVs, helping consumers decide if an EV is right for them, and increasing EV adoption. In some cases, the goals were clearly stated, while in others (e.g., websites) the goal was inferred from the content. While the goals may be related and overlap to some extent, they are a bit different in their intent and seem to be on a spectrum from providing information to trying to accelerate adoption. Below are some examples of these goals:

- Raise EV Awareness: AAA has a comprehensive website about driving electric called "The Future Together" to help drivers "learn about core EV topics" such as EV basics, charging, affordability, and advanced safety features (AAA, n.d.-b).
- Support EV Decision-Making: Consumer Reports created a guide called "Electric Cars 101; Answers to All Your EV Questions" to help drivers "determine whether going electric is right for you" (Consumer Reports, 2023).
- Increase EV Adoption: The Colorado Electric Vehicle Plan states their goal is to "increase adoption of EVs in the light-duty sector to approximately 2.1 million vehicles by 2035" (Colorado Energy Office, 2023, p. 5).

One of the goals identified in the literature scan that was mentioned less often but which merits note is the goal of supporting equity.

- Support EV Equity: The goal of the Colorado Equity Study was "to establish an understanding of factors that would prevent areas with greater socioeconomic or transportation need from accessing electric transportation and its benefits, and to provide tools for the state of Colorado and its partners to design programs that support equitable electrification" (Colorado Energy Office, 2022, p. 1).

Audiences Targeted

The main audiences targeted by public-facing EV educational outreach programs were communities, the general public, and consumers who may be interested in purchasing an EV. In terms of communities and the general public, there were references to educational outreach being done for people living in specific localities, regions, or states. For instance, the Tahoe Regional Planning Agency developed a website that provides tools and information about EVs for community members and visitors to the Tahoe-Truckee Region (Tahoe Alternative Fuels, n.d.). Another example is Colorado's 2023 EV Plan, quoted previously (Colorado Energy Office, 2023, p. 19).

The literature scan also identified resources for consumers who may be interested in learning more about EVs. For example, FuelEconomy.gov is a government website that helps consumers make informed fuel economy choices when purchasing a vehicle. One source that appeared several times in the literature scan was Consumer Reports, which requires membership to access certain information on their website, while other information they provide is open to all consumers. For instance, only members can use their "Electric Vehicle Savings Finder" tool to "search local and federal EV incentives and tax rebates by ZIP code and model" (Consumer Reports, n.d.). A few sources, such as Smart Columbus, mentioned focusing on specific types of

consumers, such as early adopters or those considering making the shift to an EV (Smart Columbus, January 2020, p. 2).

A couple of sources noted that their target audience was students. For example, the Richmond Electric Vehicle Initiative describes in their EV Readiness Plan how they presented students from the Hanover Center for Trades and Technology with a documentary called *Revenge of the Electric Car* (Virginia Clean Cities [VCC], 2013). After the documentary, they had a discussion with the students that touched on the benefit of EVs. They conducted this outreach because they saw value "in reaching the next generation of EV owners and industry employees" (VCC, 2013, p. 52).

Other audiences mentioned were beyond the scope of this project and included dealerships, utilities, and fleets. Some sources noted that they are trying to reach multiple audiences. For example, DEUSA states on their website that they are engaging "individuals, utilities, legislators, dealerships, and others towards removing adoption barriers and accelerating plug-in [EV] use" (DEUSA, n.d.-a).

Equity considerations were an issue related to audiences that cut across many of the sources. For example, the Northern New England Rural EV Adoption Toolkit explains that due to the number of people living in rural areas, "it is critical for the unique qualities of rural communities be considered as strategies are developed to encourage greater EV deployment" and that "rural EV adoption is an important equity consideration and will require targeted programs to ensure the benefits of EVs are available to all" (VEIC, 2022, p. 5). Another example of the priority placed on supporting equity was described in a report prepared by a group of nonprofits, noting many "drive electric events aim to combat the stereotypes and myths often associated with EVs and EV drivers, and work to promote EVs in lower-income and more diverse communities that face higher barriers to EV adoption" (Sierra Club et al., 2023, p. 31).

Topics

EV educational outreach campaigns share numerous topics with audiences. For example, in the Education and Awareness Roadmap prepared by E Source for the Colorado Energy Office, Maxwell et al. (2020, slide 84) suggest that there are five pillars of EV messaging or topics:

1. EVs are affordable.
2. EVs are fun to drive.
3. EV charging is easy and convenient.
4. There's an EV for you (numerous models available).
5. EVs are good for the environment.

The literature scan revealed a similar list of key topics across sources, including cost considerations, drive experience and operation, charging and range, vehicle information or types of EVs available, and environmental and public health benefits. Topics not mentioned in the five pillars of EV messaging included safety and battery issues, though battery issues could be considered as falling under charging and range. Table 2 provides a summary of the topics identified and examples of each.

Table 2. EV topic areas.

Topic Area	Examples
Cost considerations	Total cost of ownership, incentives
Vehicle information	Types of EVs, vehicle availability
Charging and range	Types of chargers, factors impacting range (e.g., winter weather, terrain)
Drive experience/operation	Acceleration, regenerative braking
Environmental and public health benefits	Lower tailpipe emissions, improved air quality
Safety issues	Quiet/noise, ADAS features widely available
Battery issues	Performance, life

An issue that arose less often, but that may be important moving forward as more people buy EVs, is maintenance. Some of the sources compared maintenance on EVs to that of internal combustion engines (ICEs). For example, Consumer Reports shared on their website that EVs cost less for routine maintenance than gas-powered cars, but owners should be aware that "you'll still have to pay attention to your tires, suspension, and other wear-and-tear items" (Barry, 2024).

Some sources were comprehensive, covering most, if not all, of these topics. In the Northern New England Rural EV Adoption Toolkit, the Drive Electric Vermont website is described as "a hub for consumers and potential EV buyers to learn more about the benefits of EVs, available incentives, charging station locations, and EV models on the market" (VEIC, 2022, p. 27). Another example is AAA, which has a website dedicated to all things EV and includes information on EV basics (e.g., comparing types of EVs), charging and range, affordability, performance (e.g., drive experience including regenerative braking), environment, and safety (AAA, n.d.-b). The AFDC also has a website covering many of these topics, including vehicle availability, prices and incentives, charging, and driving and maintaining an EV (AFDC, n.d.-c).

Approaches

Many of the approaches to conducting educational outreach identified in the literature scan fall into one of the four modalities used for learning described in the Visual, Aural, Read/write, and Kinesthetic (VARK) model (VARK, n.d.). Kinesthetic approaches, or those related to experience or practice, such as ride and drive events or test drives, were commonly mentioned. The report *Northern New England Rural EV Adoption Kit* states that "ride and drive events are in-person events designed to demystify EVs and may be especially beneficial in rural areas where exposure to EVs can be limited" (VEIC, 2024, p. 36). Table 3 provides examples of the approaches identified in the literature scan by learning modality, as well as descriptions of the VARK modalities (VARK, n.d.).

Table 3. VARK modalities.

VARK Modality	VARK Model Modality Descriptions*	Literature Scan Examples
Visual	Learning related to depiction of information graphically (e.g., maps, charts, diagrams).	Map of charging locations, graphic showing how vehicles are charged, and bar graph comparing maintenance costs across vehicle types.
Aural	Learning related to "heard or spoken" information (e.g., group discussions, radio, lectures).	Focus group, workshop, one-on-one conversation, EV owners sharing experiences at events, telephone outreach and support, and marketing/multimedia campaigns using radio.
Read/write	Learning related to text-based input and output (e.g., reports, quotations, lists).	Online and printed information about EV topics (EV101, myths versus facts, and questions and answers), marketing/multimedia campaigns using print media.
Kinesthetic	Learning related to use of experience or practice (e.g., demonstrations, simulations, and videos of "real" things).	Ride and drive/test drive, calculators (costs, emissions), interactive maps, interactive hands-on displays (types of charging plugs), videos (driving an EV, charging).

*Model examples are from the VARK website (https://vark-learn.com/introduction-to-vark/the-vark-modalities/)

The sources reviewed often described using a variety of learning modalities. For instance, the nonprofit Forth hosted a "Northwest Electric Showcase" in Portland, Oregon. The showcase engaged people through a variety of learning approaches, including exhibits with definitions of the different types of EVs (read/write), an interactive display of charging units for visitors to view and handle (kinesthetic), and having staff or EV ambassadors on hand to speak to the public (aural) (Henkin & Ramzy, n.d.). Forth also conducted a marketing campaign to attract people to the showcase using social media, a short radio clip, and a prize promotion. Another example is DEUSA, which uses online interaction via social media and in-person interaction at events (aural), as well as ride and drives (kinesthetic), to engage consumers (DEUSA, n.d.-c).

Another common approach identified in the literature scan, which does not fit into one learning modality but typically includes a variety of modalities, is the educational website. For example, the AAA website touches on all the learning modalities, providing educational information via text about EVs (read/write), a map of charging locations (visual), a video explaining charging levels to address range anxiety (kinesthetic), and the ability to send a question via email to The Car Doctor," John Paul, an automotive technician and columnist (aural).

Several sources for relaying information (read/write) relied on fact sheets and/or myths and facts pages. For instance, PlugStar.com by Plug In America has a page addressing EV safety myths. It covers safety testing, battery durability, fire risk, and maintenance. The website notes that experts "conclude that EVs are just as safe or safer than ICE vehicles and are less prone to fires and rollover crashes" (Plug In America, n.d.).

Partners

The sources reviewed for this literature scan often described the involvement of a variety of stakeholders or partners to support an EV educational outreach program. The types of partners most often included utilities, OEMs, car dealerships, Clean Cities coalitions, government agencies, nonprofit or advocacy groups, and charging infrastructure providers. In the *Northwest Electric Showcase* report, Forth describes how many of these key partners support their EV educational outreach efforts:

- "Ride and drives have typically relied on one or more community partners, often a utility, and whenever possible Forth has tried to engage nearby dealerships. The most successful events have encompassed multiple partners, a variety of dealerships, and the local city as well. The City of Seattle National Drive Electric Event is an example of this where Forth collaborated with Western Washington Clean Cities, The City of Seattle, and the Seattle Electric Vehicle Owners Group in an event that attracted more than 1000 consumers" (Henkin & Ramzy, 2019, p. 9).

Another partner identified was the community. A few different types of community partners were noted, including community-based organizations (CBOs), community resources such as libraries, and members of the community (e.g., hiring fluent Spanish speakers from the community to support equitable access to program information). EVHybridNoire describes how they "normalize" EV adoption in diverse spaces by building "relationships with 'grasstop' community leaders to educate them on advancements and developments in the transportation landscape so they can disseminate information to their communities" and building "coalitions of community-based organizations across a variety of disciplines to build support for e-mobility solutions" (EVHybridNoire, n.d.).

Broad partner support was a theme seen running through several of the sources identified in the literature scan. The authors of the *Drive Electric Vermont Case Study* (2016) describe how early and broad partner or stakeholder involvement is important to the success of a program. The report lists the involvement of multiple government agencies (e.g.., Public Service Department, Agency of Natural Resources, Agency of Transportation, and Agency of Commerce and Community Development) who were "engaged with regards to PEVs [plug-in electric vehicle] and charging infrastructure." The report goes on to describe how support needs to "come from multiple sources and partnerships with entities such as utilities, the energy and business communities, auto dealerships, nonprofits, and health care providers being key" and how each of these entities "offers a different constituency and provides expanded reach, audiences, communication mechanisms, resources, and perspectives" (Wagner et al., 2016, p. 14).

The review of ADAS educational campaign information (e.g., NHTSA, NSC) and the EV educational outreach literature scan covering lead organizations, goals, audiences, topics, approaches, and partners served as background for understanding the overall landscape for an NTO educational outreach program. The review of these sources also provided helpful context for the next step of the project, the program reviews.

CHAPTER 3. PROGRAM REVIEWS

Initially, the research team identified for review two EV educational outreach programs being conducted by public-facing organizations. Since VTTI plans to develop community and public EV educational outreach in the future, the focus was on programs conducting outreach to communities or the public, rather than other types of audiences such as dealers or rideshare drivers, though additional audiences such as these may be considered in the future. In addition to these two program reviews, the project team identified a third EV educational outreach program being conducted in Virginia. The project team wanted to learn about efforts in Virginia and how VTTI could potentially partner with organizations in the state to implement an NTO program. Though a different approach was used to identify the third program, all the reviews were conducted in the same way.

The project team took a case study approach to reviews, analyzing documents and websites, attending events, and interviewing a staff member with a lead role in implementing their educational outreach. Patton (1990) explains how, when conducting a case study approach, "multiple sources of information are sought and used because no single source of information can be trusted to provide a comprehensive perspective … by using a combination of observations, interviewing, and document analysis, the fieldworker is able to use different data sources to validate and cross-check findings" (as cited in Merriam, 1998, p. 137). This type of qualitative case study approach was used for these program reviews.

The purpose of program reviews was not to create generalizable findings but to explore and better understand the types of topics, approaches, etc., being used by public-facing organizations conducting EV educational outreach. These types of topics could serve as guidance for VTTI as it develops an NTO program, as well as help identify potential partners for such a program.

PROGRAM SELECTION

There were three basic criteria for selecting the first two programs: (1) the project was funded through DOE VTO, (2) the project had an EV educational outreach component, (3) the project was either completed with ongoing activities or was still in progress. The first two programs selected were identified by a member of the project team through a review of the Clean Cities Coalition Network website, which lists projects and initiatives/programs the DOE VTO has funded to "advance affordable, domestic transportation fuels and technologies" (Clean Cities and Communities, n.d.-c). If a project or initiative described having an EV educational outreach component, it was pulled into a spreadsheet for the project team to consider whether or not it was a good candidate for review. From the list of projects and programs, the research team selected one completed within the past 10 years that was led by an organization that has ongoing activities and one in progress with activities underway. The project team looked to see that the projects and programs were not isolated efforts but conducted by organizations with comprehensive EV educational outreach.

The first program identified, the Northwest Electric Showcase, was completed in October 2016 and led by a nonprofit called Forth (formerly Drive Oregon). The project team reviewed Forth's website and confirmed that, though the Northwest Electric Vehicle Showcase Project has ended,

Forth has an ongoing EV educational outreach program called Access to Electric Cars. Forth's multifaceted educational outreach approaches were reported in the literature scan.

The second program, DEUSA is in progress, with activities underway in numerous states. One of the awardees for the DEUSA funding was East Tennessee Clean Fuels (ETCleanFuels) Coalition, which administers the Drive Electric Tennessee (DET) program. The project team reviewed the DET website and confirmed that EV educational outreach is being conducted with communities and the public. ETCleanFuels's leadership in the grant application for DEUSA was also noted in the literature scan.

The third program identified, Electrifying Virginia, was chosen because it is an EV educational outreach program currently underway in Virginia. The research team also identified the nonprofit that manages the program EVHybridNoire through the literature scan, exposure through other project events, and interactions via the Dock to Door (D2D) Coalition. The D2D Coalition is a Virginia Tech-led partnership of 85+ member organizations, which includes representatives from industry, higher education, community groups, and government partners (D2D, n.d.). The nonprofit EVHybridNoire and the closely related organization EVNoire are active in EV educational outreach in Virginia, collaborate with members of the project team that work with D2D, and may be potential partners in future NTO educational outreach efforts.

PROGRAM REVIEW APPROACH

As mentioned earlier, the project team took a case study approach to the program reviews, reviewing websites and documents, attending events, and interviewing at least one staff member with a leadership role in the program. For each program, documents were reviewed, as was the program website. The project team attended at least one event that each program was hosting or involved in to see how educational outreach was being conducted. As a final step after reviewing materials and attending events, the project team reached out to each organization and requested an interview with a member of their staff with a lead role in their EV educational outreach program. Interviews were conducted between May 1, 2024, and November 14, 2024. Each interview lasted approximately 1 hour and covered the key issues of interest for this project (i.e., goals, target audience, topics, approaches, partners), along with additional areas of interest to the future development of an NTO program (e.g., safety-related outreach topics, opportunities for partnership). Interviews were transcribed and key points pulled from the discussions. It should be noted that the initial interview script was simplified slightly after the first interview to ensure interviews could be completed within an hour (see Appendix A). Prior to attending in-person events and conducting interviews, the project team submitted a determination form to the Virginia Tech Institutional Review Board to ensure that observing and participating in events and talking to staff about their programs did not require a Board review.

As a key focus of this project is educational outreach approaches for sharing information on new vehicle technology (i.e., ADAS, EVs), it is notable that the programs reviewed all offer approaches across the different modalities listed in the VARK model. Table 4 includes examples of the different approaches each program includes by VARK model modality. These are covered in more depth under each program description.

Table 4. Educational outreach approaches by program.

VARK Modality	VARK Model Modality Descriptions*	Access to Electric Cars	DET	Electrifying Virginia
Visual	Learning related to depiction of information graphically (e.g., maps, charts, diagrams).	Graphic on the website comparing the different charging levels (Level 1, Level 2, and Level 3 – DC Fast Charging).	Charging station maps on the website	Links to resources such as Appalachian Power's website that includes graphic information on cost savings related to off-peak charging (Appalachian Power, n.d.)
Aural	Learning related to "heard or spoken" information (e.g., group discussions, radio, lectures).	Events with panels and presentations (i.e., Roadmap Conference, Webinars)	Monument summit with panels and presentations, discussions with EV drivers at ride and drive events.	Events and webinars with panels and presentations
Read/write	Learning related to text-based input and output (e.g., reports, quotations, lists).	Text description on website of different electric vehicle options (i.e., pure electric, plug-in hybrid, extended-range electric)	Booths with informational materials including written text on topics such as "what is an electric vehicle'"	Text on website (What's an EV)
Kinesthetic	Learning related to use of experience or practice (e.g., demonstrations, simulations, and videos of "real" things).	Ride and drive events, Mobile Showcase	Ride and drive events	Ride and drive events

*Model examples are from the VARK website (https://vark-learn.com/introduction-to-vark/the-vark-modalities/)

ACCESS TO ELECTRIC CARS

The first EV educational outreach program reviewed is run by an organization called Forth, a nonprofit based in Portland, Oregon, whose mission is to "electrify transportation by bringing people together to create solutions that reduce pollution and barriers to access" (Forth, n.d.). Forth was identified, as noted earlier, through The Northwest Electric Showcase. Forth now has a broader EV educational outreach program called Access to Electric Cars.

Online and Document Review

To better understand the goals, target audiences, topics, approaches, and partners involved in Forth's EV educational outreach, the project team reviewed the Forth website and reports, including The Northwest Electric Showcase Final Report, Forth's 2023 Annual Report, and Forth's Best Practices for Electric Vehicle Outreach. Though the Northwest Electric Showcase project officially ended in October 2019, Forth's EV educational outreach efforts continued and expanded to what is now called their Access to Electric Cars program.

Northwest Electric Vehicle Showcase

The initial showcase project, discussed in the Northwest Electric Showcase final report, which was initiated in 2016, was used to reach consumers and help increase EV adoption in Oregon and Washington. The showcase covered topics such as charging (e.g., method, location), EV operation (e.g., battery, regenerative braking), definitions of types of EVs, and incentives. The showcase used a variety of approaches to engage consumers, including an "[EV] showroom; long-term test-drives facilitated through carsharing; mobile 'pop-up' showcases; and targeted campaigns aimed at low and moderate-income drivers" (Ramzy et al., 2019, p. 4). The brand-neutral showroom had hands-on displays providing information about charging and included "rotating displays of new [EVs]" (p. 8). Another important component of the program was holding EV ride and drive events across Oregon and Washington. The development of the showroom and ride-and-drive events required a variety of partnerships (e.g., utilities, localities, dealerships).

Access to Electric Cars

The Forth website (see Figure 3) lists goals or focus areas of the Access to Electric Cars program, including EV outreach and education, reducing cost barriers to EV adoption by providing financial tools, and increasing awareness and access, especially to communities that have been traditionally underserved (Forth, n.d.). The website mentions audiences, such as people who have traditionally faced barriers to electrification and communities throughout the Pacific Northwest, where Forth is based. The Forth website touches on a variety of topics (e.g., benefits to the environment, EV costs, types of EVs) and highlights the different types of educational outreach approaches Forth uses, including a mobile showcase, ride and drive events, monthly networking events and workshops, and the annual Forth Roadmap Conference. Partners noted include utilities, underserved communities, and community organizations (e.g., local credit unions, media outlets, and tourism destinations).

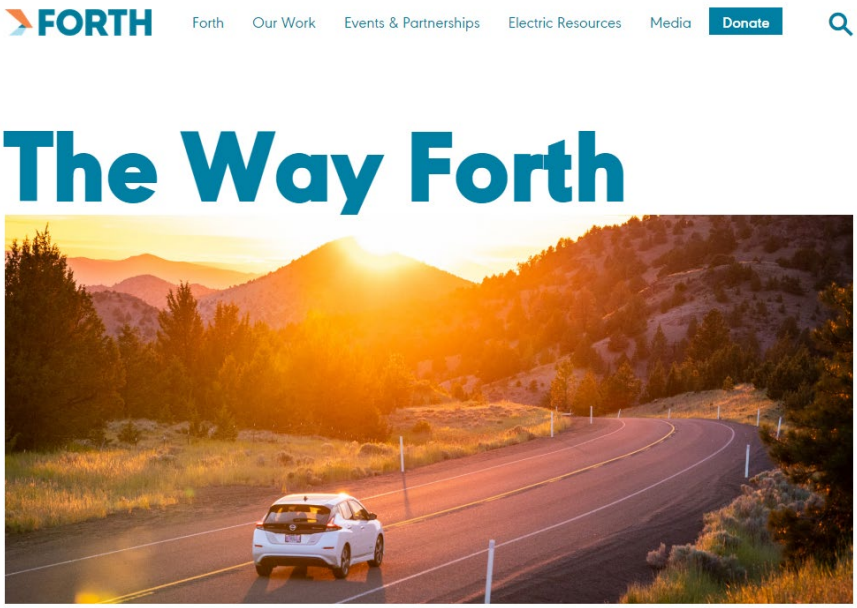

Figure 3. Screen capture. Forth website (Forth, n.d.).

In their 2023 annual report, Forth stated that they are working in "partnership with historically underserved communities to build models that expand access to electric transportation" to "reduce pollution and barriers to access to meet the urgent need for zero-emission, affordable and accessible transportation" (Forth, 2023, p. 4). Forth is working toward this goal through its Access to Electric Cars program, which includes a mobile showcase and ride and drive events. Though the focus on this program review is on Forth's Access to Electric Cars program, it is notable that in addition to the Access to Electric Cars program, Forth also has an Access to Charging and an Emerging Modes (e.g., electric school buses) program.

Best Practices

In their 2024 report on best practices for EV outreach programs, Forth shares guidance from their years of experience conducting EV educational outreach. The report describes gains in EV adoption, the reality that much of that adoption occurred in wealthy areas and not low-income and rural communities, and suggested approaches to addressing this gap in access to make EV adoption more equitable. The report shares how they "found that the greatest success comes when our programs are designed to respect and center the needs of the communities we aim to serve" (Forth, 2024, p. 4). Forth's best practices for EV outreach and adoption include:

- "Strong partnerships with electric utilities for education, promotion, and training.
- Clear plans for community engagement, including relationship-building with trusted representatives from faith-based communities, tribal leaders, and others.
- Consumer-friendly test-drive events featuring a variety of EV models and price points.
- Inclusive outreach materials, with educational and promotional information translated into multiple languages.
- Guidance to help consumers understand rebates, discounts, low-interest loans, and other financing to lower the cost of an EV.

- A diverse funding mix (grants, sponsorships, subsidies, and in-kind donations) that allows for sustained program growth" (Forth, 2024, p. 4).

The best practices document also includes a list of key stakeholders, their potential roles in a program, budget and funding strategies, and a sample budget for events.

Events

In addition to reviewing the Forth website and key reports, the project team also attended a workshop and a conference hosted by Forth.

Design and Fund Equitable Electric Mobility for Your Community

A member of the project team attended Forth's "Design and Fund Equitable Electric Mobility for Your Community" workshop, held in Washington, DC, on March 14, 2024. The purpose of this event, which was free to government and nonprofit organizations, was to help organizations explore how to bring electric mobility to their communities. The event included sessions on centering equity, listening to communities, developing a transportation electrification strategy, program funding and design, building a budget, and designing a memorandum of understanding (MOU). A variety of nonprofit and government representatives were involved in the sessions. The workshop had a combination of presentations, hands-on activities, and discussions, with a focus on thinking strategically about how to engage communities in meaningful ways. Hands-on worksheets and activities explored how to design and fund successful projects. These worksheets will serve as practical tools the project team can use when developing an NTO program.

Forth Roadmap Conference

A member of the project team also attended the Forth Roadmap Conference in Detroit, Michigan, on September 25–26, 2024. There were several sessions related to EV educational outreach. Topics covered included range anxiety, how charging works, incentives and costs, myth busting, EV safety, environmental impacts, emissions reduction, and workforce development. During a session titled "Tribal Transportation Electrification," one speaker noted that range and charge anxiety are real when dealing with wildfires, and people may not know if charging stations will be operational. Another issue raised in the session was that homes may not have electrical systems that are up to standard, and in such cases, people cannot plug in an EV for home charging. The topic of workforce development came up during a session on Justice40 and how a trained workforce is needed to service charging stations and to upgrade homes to standard. It was noted that workforce development for some communities is the most exciting part of the conversation about EVs and how well-paying jobs may come to their communities to support this technology. A theme that arose through these sessions was the importance of understanding the audience. For instance, during the "Tribal Transportation Electrification" session, it was noted that messages need to be tailored to the community and materials need to look like the community that is being served. In the same way, in the discussion about accelerating the EV market, listening and understanding the perceptions and needs of the audience was mentioned as an initial step in educational outreach.

A fireside chat with media representatives was also held to discuss electric transportation trends, challenges, and opportunities. Representatives from Automotive News, Resource Media, and Axios shared their thoughts on a variety of issues around EV consumer education. The media representatives discussed topics to cover when doing outreach (e.g., total cost of ownership, benefits of charging at home, range anxiety, how EVs differ from ICE vehicles) and approaches to use (e.g., sharing from experience, storytelling about how EVs can be used as a source of energy when power goes out). They also touched on the importance of staying focused on topic but being ready to address misperceptions and fears, such as the impact of battery mining or EV fires, and how these concerns compare to those of ICE vehicles.

The conference also included a Ford ride-along event. A Mustang Mach-E and F-150 Lightning truck were available for conference attendees to ride and experience. The VTTI project team member filled out a waiver and rode in both vehicles. During the Mach-E ride, the other passengers in the vehicle wanted to know how fast the vehicle would go from 0 to 60, the range of the vehicle, the impact of increased power on range, charging and using adapters for Tesla charging stations, and battery fires. In the Lightning ride, the project team member asked the driver what topics they typically cover about the truck. The driver said topics typically included charging and the impact on the battery of fast charging too often, how towing can impact range, and how the vehicle can be used as a generator. When asked about safety topics, the driver said sometimes questions arise about safety issues around batteries and issues for first responders. The driver said it can be helpful to highlight how the vehicle may fit with the activities of interest to the person you are talking to, such as running electrical equipment from the truck or tailgating. After the ride, the project team member was shown the areas in the bed of the truck where electrical equipment could be plugged in for those that might be interested in using the truck as a source of power for activities such as work or tailgating.

The project team member also visited booths dealing with EV educational outreach, including those hosted by VCC, EPA, and GM. The VCC booth had information produced by the DOE (e.g., Electric Vehicle Basics, Electric Vehicle Fire Primer for Fleet Manager). The EPA booth had information on EV myths and facts and confirmed that their educational materials could be used by VTTI in future EV educational outreach efforts. The GM booth had information on GM's EV Live experience, during which people can have a virtual experience and talk one-on-one with an EV specialist for free; group demos can be done as well.

Interview

A final step in the Forth program review was the interview with the lead for the Access to Electric Cars program. The interview covered the key issues of interest for this project (i.e., goals, target audience, topics, approaches, partners), along with additional areas of interest to the future development of an NTO program (e.g., safety-related outreach topics, opportunities for partnership). A summary of the points from the discussion of each is provided here.

Goals

The Access to Electric Cars program manager shared that the goals of Forth's EV educational outreach are to raise awareness and provide education about EVs in general and the benefits of EVs (e.g., financial, convenience). Forth also wants to make people aware, especially lower-

income households, of how to save on the purchase of an EV (e.g., incentives) and what the overall cost of ownership (e.g., lower maintenance costs) would be for an EV.

Targeted Audiences

A primary target audience for the program is historically underserved communities. As the program lead stated, "our interest and the mission of our organization is to foster the electrification of transportation … in an equitable way." The lead went on to describe how, in the past when transportation infrastructure was established or updated, there were certain communities that seemed to always lose out. Forth is "focused on making sure that those communities have an opportunity to take advantage" of the benefits of EVs.

Topics

The key topics covered in Forth's educational outreach are centered on the benefits of EVs (i.e., climate, economy). From a climate point of view, reducing emissions benefits the health of everyone. The second benefit is how EVs are economical and accessible given the incentives currently being provided.

Approaches

During the interview, a few of the most effective approaches to covering these topics were mentioned. The first was that it is important to go into communities and engage with people: "the one thing that we find is always useful is first listening, listening to the situation of the audience." Being in the community creates a space for people to come up and talk one-on-one and ask questions; this approach works well at mobile events where Forth can answer questions about topics such as cost and charging. Another approach is conducting brand-agnostic events where people can ride in an EV and receive educational information. Forth participates in events ranging from small community meetings to larger events such as auto shows.

Materials and Equipment

The most important materials and equipment to have when conducting educational outreach such as a Forth's ride and drive events included demonstration vehicles, accessible charging for the vehicles, and educational materials about the vehicles. Forth typically has four cars available for people to ride in and a corresponding one-page information sheet about each (e.g., range, acceleration, price). Where charging is located is also important to consider. For instance, the Forth representative pointed out that "one of the things you have to think about, especially as you're looking into rural locations today, is where does charging exist in that community? Because in most cases a lot of the charging happens in the urban areas or suburban areas. But public charging is just starting maybe to show up in some rural communities."

Funding

Funding comes from a few different sources, including federal, state, and local governments and utilities. The Forth program lead noted that "luckily these days there is quite a bit of funding available because it's an area of interest for governments [and] for the utilities."

Partners

A variety of key partners were mentioned beyond those already noted that may fund educational outreach. Key partners included communities and CBOs, OEMs and dealers, and event holders. CBOs are important partners because they are familiar with their communities and can help with appropriate messaging. For example, when going into a rural community, "it's kind of off-putting to have someone from outside bringing a new technology and saying, 'You know, this is the best thing, it's going to solve all your problems.'" It is also helpful to have relationships with OEMs, who can help provide vehicles for demonstrations, dealers who can support ride and drive events, and event hosts so that Forth can go to where people are already congregating."

Implementation Barriers

When asked about implementation barriers, funding was cited as requiring significant attention. Forth depends on grants, and grants can take a long time, so "you have to be way ahead of the time when you want to do something to be able to get the funding and then go do it." The funding barrier can be overcome by having a strategy that involves building supportive relationships, being aware of grants that are available or coming available, staying on top of the grant calendar, and having a grant team that can work on grants while others are conducting programs.

Lessons Learned and Best Practices

Lessons learned and best practices were closely related. One lesson learned is the importance of understanding your audience (e.g., knowledge about EVs, barriers they face to adoption) and asking questions in small groups or one-on-one, such as how familiar individuals are with an EV, if they have ever sat in an EV, or if they have driven one. It is also important to stay brand agnostic, so that people do not feel like you are trying to sell them something. The Forth representative recommended that, when talking to people at events, the conversation should be about needs and how EVs benefit the people using them, rather than about selling the latest technology.

Safety

When asked about safety, the Forth program lead pointed out two questions people ask, both related to batteries. The first concerns battery safety and worries about battery fires: "People don't know much about batteries, and they hear about battery fires." The second is mining; people are concerned about "mining battery materials and is that safe for the environment." If these questions come up, Forth tries to address the issue with facts. The program lead said Forth would be interested in information VTTI could provide related to EV safety for inclusion in their program: "anything that would help us keep on top of the battery technology … especially from a safety point of view because that is what people are interested in." He also noted that EV vehicle crash test information would be something they would be interested in including in their program.

ADAS

Forth said that it only discusses or demonstrates an EV's ADAS technology if a person is interested in the features. Typically, at events, Forth is trying to relay basic information about EVs, and adding in ADAS features could be confusing. Forth's program lead explained that it would be appropriate when the market matures and the public's knowledge of EVs and ADAS grows. But right now, "I think there is a lot of confusion out there … different manufacturers have different branding around their features … and so it gets very confusing what they actually do." He added "it would be helpful to have information on that [ADAS features], it's just I think we're not at the right point in the adoption curve" for people trying to learn about EV basics.

Planning and Evaluation

When it comes to educational outreach planning, the lead noted the importance of staying in contact with site hosts to confirm an event and a spot at the event. About a month in advance of the event, Forth secures vehicles and schedules staff for an event. In terms of evaluation**,** Forth keeps track of metrics (e.g., number of people spoken to, number of people who drove an EV) related to their goals of education and awareness.

NSTSCE Partnering Opportunities

In terms of partnering with stakeholders like those in NSTSCE (universities, OEMs, government agencies, insurance agencies), Forth mentioned a few ways they have worked with these types of organizations and/or can imagine their involvement. In terms of universities, some clubs and special interest groups are interested in new technology, climate change, and sustainability. DOTs provide grants and Forth has received OEM funding (e.g., GM Climate Equity Fund). Though Forth has not worked with insurance companies, the lead mentioned that they could be a helpful source of educational information about the actual repair costs on EVs.

Describing ways that VTTI and Forth can partner in the future, Forth mentioned a few safety-related research topics. He noted, "We're always looking to partner with others," and thought that it would be helpful if VTTI could provide information on battery safety and vehicle safety in general as it pertains to EVs. Other areas of research mentioned included standards to address differences across charging stations (e.g., need for different apps at different stations) and safety research on adapters other companies are using to access Tesla's charging station network (e.g., Ford, Rivian).

Access to Electric Cars Summary

Community engagement, centering equity, understanding the audience, providing hands-on experiences, and sharing the benefits of EVs were a few of the key themes emerging from Forth's EV educational outreach. As the best practice document summarized, strong partnerships, thoughtful community engagement, consumer friendly ride and drive events, and inclusive educational materials that cover key topics (e.g., affordability), and a diverse funding mix to support program activities were all hallmarks of the Forth program.

DRIVE ELECTRIC TENNESSEE

DEUSA began as a proposal put forward by staff from ETCF and CFO that was selected and awarded by the DOE in the summer of 2020. DET was one of the programs chosen for review for this project. DET is based in Knoxville, Tennessee.

Online and Document Review

To better understand the goals, target audiences, topics, approaches, and partners involved in DET, the project team reviewed the DET website and several documents, including *A Roadmap for Electric Vehicles in Tennessee*. The *Roadmap* puts forward the vision for DET of "collaboratively pursuing initiatives that will significantly increase EV adoption from 5,000 EVs today (2019) to 200,000 EVs by 2028, guided by shared principles that benefit all residents of Tennessee" (DET, 2019, p. 3).

The *Roadmap* breaks DET work into four opportunity areas: (1) Driving Charging Infrastructure Availability, (2) Driving Awareness, (3) Driving Innovative & Supportive Policies, and (4) Driving EV Availability, Offerings, & Innovation. The focus of this review is on DET's Driving Awareness opportunity area, which includes EV Ride & Drive Promotion and EV Consumer Education, which "emphasize the sharing of information and experiences" (DET, 2019, p. 9).

While the broad goal of DET is to increase adoption, the Driving Awareness opportunity area has additional goals, including exposing people to EVs, increasing awareness, and educating them on the benefits of EVs. The audience for DET's awareness program is all Tennesseans (e.g., all income levels, rural and urban populations, diverse audience). As noted on the website, DET "is committed to engaging with as many communities as possible" (DET, n.d.-a). While the roadmap document states that the driving awareness area has two audiences, personal drivers and fleet owners (DET, 2019, p. 9), the project team only looked at DET's work related to personal drivers.

Numerous topics were identified in the document and online review, many of which were related to the benefits of EVs. Those mentioned most often included charging (e.g., where to charge, how to charge), cost savings (e.g., incentives, reduced maintenance and fuel cost), environmental and health benefits (e.g., reducing greenhouse gas emissions, improved air quality), buyer resources (e.g., dealer information, price points and availability of various models), and performance (e.g., handling, acceleration). Some of the other topics included range, comparisons to ICE vehicles (e.g., fuel economy, emissions), owner experience and testimonials (e.g., why they switched to an EV, what they drive, how they charge), EV workforce (e.g., training, jobs), EV batteries (e.g., how long they last), EV safety (e.g., EV fires) and environmental concerns (e.g., mining), along with EV FAQs and myth-busting information.

A few key approaches for conducting EV educational outreach included holding ride and drive events and conducting consumer marketing and awareness. EV ride and drive events leverage chapters of EV owners who engage with the public, showing people their personal vehicles and sharing their experiences of owning an EV, and include booths with informational materials. As described on the website, the use of regional or local chapters is central to DET's community-level educational outreach:

> DET Chapters are regional or local collections of plug-in electric vehicle (PEV) drivers and other partners who wish to expand the use of EVs in their community. DET cannot meet its goal of having 200,000 EVs on Tennessee roads without the successful work of these very important, local citizens. No one can do the outreach and education to area citizens and businesses *like people from those communities* (DET, n.d.-b).

In a DEUSA report, *DRIVE Electric USA Program Success Stories from Program Area 2: Educate Consumers and Develop Local EV Chapters*, DET Administrator Jonathan Overly shared, "Grassroots engagement and education action is one of the fastest ways to grow EV adoption. Nothing can help accelerate a citizen's understanding of EVs and all the benefits they bring better than in-person exemplification. And allowing them to drive (or ride in for some) an EV is the ultimate conversion mechanism" (DEUSA, 2024).

Consumer marketing and awareness is also a key outreach approach. The DET *Roadmap* describes this approach as an effort to "develop and conduct broad-based consumer awareness campaign to improve education about EVs" (DET, 2019, p. 20). DET has an information-rich website (e.g., charging station maps, links to informational websites such as the Alternative Fuels Data Center, FAQs, a bar graph showing increases in EV adoption, and informational videos), and social media (e.g., Facebook, Instagram) sharing information about events. For instance, Figure 4 is an example of a Facebook post that DET made regarding the Knoxville Electrical Vehicle Association's (KEVA) event (DET Facebook, November 15, 2024). Additional educational outreach approaches mentioned included EV charging signage, conferences (e.g., annual Monument Summit), extended test drives, and specialty DET license plates.

Figure 4. Photos. DET Facebook post (DET Facebook, November 15, 2024).

DET has numerous partners involved in their EV educational outreach. In a DEUSA Replication Playbook report on efforts to educate consumers and develop local chapters, ETCleanFuels listed the major partners for DET as individual Tennesseans; Tennessee Valley Authority (TVA); Tennessee Departments of Environment & Conservation (TDEC); Middle-West TN Clean Fuels Coalition (MWTCF); Tennessee-based local power companies (LPCs); and universities (DEUSA, 2024). The DET Ride & Drive Guide notes the importance of coordinating with the site host, identifying event partners including "local sponsors, EV Owners Clubs, local power companies, sustainability nonprofits, local government representatives, etc., who may support

your event" and "contacting local car dealerships to secure EVs for test drives" (DET, January 2021, p. 3).

Events

As part of the DET review, on September 23, 2023, a member of the project team attended the Knoxville Drive Electric Festival, which was held in conjunction with National Drive Electric Week. Outreach information advertising the event noted that "the KEVA, Pellissippi State Community College, and DET" were working together to make the festival "bigger and better" (National Drive Electric Week, 2023). Other event sponsors and partners included an OEM (i.e., Nissan), a bank (i.e., Wells Fargo), dealerships (e.g., Cadillac of Knoxville), nonprofits (e.g., Sierra Club), academic institutions (e.g., University of Tennessee Institute for a Secure and Sustainable Environment), and the public power company TVA.

During the event, a project team member visited several booths, spoke with EV owners, and took part in the ride and drive. The organizational booths visited included ETCleanFuels, KEVA, TVA, City of Knoxville, and the Sierra Club. The booths covered various topics, such as charging and incentives, and organizational representatives shared their roles in EV adoption and education. For instance, the TVA booth had a charging display and shared how TVA is helping build out charging in Tennessee. A project team member had the opportunity to also speak with the festival organizer from KEVA, who shared that the number one thing that helps people with adoption is getting "butts in seats" or giving people first-hand experience in an EV.

A project team member visited with EV owners who were showcasing their vehicles (e.g., Volkswagen ID.4, a Rivian R1S, and a Chevy Bolt) to see the vehicles and hear about the experiences of EV owners. The primary topics discussed include charging (e.g., charging at home and how EV drivers map out charging on a trip route) and cost savings (e.g., incentives). The project team member also met an EV owner who had a Chevy Bolt that was used for driver education (see Figure 5).

Figure 5. Photo. 2023 Knoxville Drive Electric Festival (EV showcase).

A team member took part in the ride and drive event. To ride or drive in a vehicle, participants had to fill out an online survey and release form (e.g., accepting risks, confirming insurance) and

wear a wristband showing that the release form had been completed. The team member visited the ride and drive tent (Figure 6) and signed up to experience a Cadillac Lyriq.

Figure 6. Photo. 2023 Knoxville Drive Electric Festival (ride and drive).

The project team member opted to first ride in and then drive the Lyriq. A local Cadillac dealer drove the vehicle first and talked about how it operated. He shared information on charging, regenerative braking, Super Cruise driver assistance technology, the battery warranty, and his involvement in events such as the festival. He said that he preferred to bring the car to events like the festival where there are potential customers instead of waiting for them to come to the dealership. He said that he sees these events as an opportunity to get people into EVs. After riding, the project team member drove the vehicle and the dealer explained, for instance, how the regenerative braking was working while the project team member was experiencing it.

Interview

For the DET interview, the project team had the opportunity to interview both the program manager and the administrator for DET, who also serves as the lead for DET's Driving Awareness working group. DET has several programs; the Driving Awareness program was the focus of this project. For the purposes of this interview summary, input was generically noted as coming from a program lead since both individuals are DET program leads.

Goals

The goal of the DET Driving Awareness program is to "increase awareness and firsthand experience of the benefits of driving an EV to as many potential owners as possible, and to give them an idea of what the process of purchasing an EV would look like."

Audiences Targeted

Three target audiences were mentioned: the general public, college students, and LPCs, with the key target audience being the general public. DET reaches the general public by focusing EV education efforts on specific regions of Tennessee (e.g., Knoxville and surrounding area) and having individual EV owners from the areas "speak essentially to their neighbors." DET adapts information and messaging to the interests of the audience. For instance, if they are in an area where the demographic is not interested in climate change, they may be interested in information pertaining to jobs or health. DET tries to have three or four things to talk about that are of interest to the audience regarding why EVs are beneficial. As one of the program leads noted, even if climate change does not interest someone, there may be something else that is of interest, such as how EVs can benefit their child's health. The lead went on to add that "personal stories are often the most effective, especially from a human health perspective" and gave the example of a public school bus driver who spoke at an educational event and shared how headaches he was experiencing from exposure to diesel fumes and noise diminished once he began driving an electric school bus.

An emerging target audience for DET is college students; DET wants to let students know the workforce development benefits of EVs. As one of the program leads said, "There are a lot of OEMs that manufacture [EVs] in our state, and so making people aware of the jobs surrounding that, and the benefits to Tennessee citizens from a jobs and economic perspective is so valuable and giv[es] students the opportunity to know that this is a career option and supporting that within the State."

Though not within the scope of this project, the program leads also described LPCs as a target audience for education because having people in the electrical space with more expertise about EVs helps the general public feel more comfortable installing chargers in their homes and helps combat misinformation or misunderstandings around EVs (e.g., how EVs impact the grid).

Topics

Several topics were mentioned, including addressing misinformation about EVs or EV-related information that is being misinterpreted from current events (e.g., news of cold temperatures in Chicago impacting EV batteries, an issue less likely to occur in Tennessee), concerns over how utilities work and who to contact about charging, awareness about electric school buses for public schools, and educational opportunities surrounding jobs and manufacturing workforce development.

Approaches

Three approaches were shared for how to address these topics: having someone with experience do the talking (e.g., have someone who drives an EV talk about EVs, have someone who installs home charging talk about charging), getting people into EVs because "there's nothing like the first-hand experience," and building strong partnerships. It is helpful to have strong partners who are also providing educational resources and working together to unify the message.

Materials and Equipment

The materials and equipment that are important to implement DET's educational outreach include having individual EV owners participate in events, EVs of interest to the event's focus audience, and promotional items (e.g., logo stickers, magnets) that direct people to the website to learn more or contact DET for further information.

Funding

The primary or consistent funding source for DET is memberships (e.g., power companies), with TVA providing additional support beyond their membership.

Partners

DET has numerous partners, including TVA, Drive Electric Chapters, the Tennessee Department of Environment and Conservation Office of Energy Programs (TDEC OEP), universities, LPCs, and cities/municipalities. A brief description of each partner's contribution is described below:

- TVA does its own educational outreach and awareness and partners with DET to expand its EV educational reach.
- Drive Electric Chapters such as KEVA are strong partners; KEVA existed prior to the establishment of DET and serves as a model for other chapters.
- DET works "hand-in-hand" with the TDEC OEP, which promotes the DET website and outreach events and advises on the direction of the program.
- DET is housed out of the University of Tennessee (UT) and partners on projects with universities doing public education such as Tennessee Tech and their Rural Reimagine project, which provides a free loaner EV for people to try for a week.
- DET partners with LPCs to bring awareness to the resources that LPCs have (e.g., rate schedules, incentives, safety education around the installation of chargers).
- Cities/municipalities (e.g., Knoxville, Nashville) are educational partners, coming to events and providing education on the resources they have available for EV infrastructure and awareness.

Implementation Barriers

The program leads shared a variety of implementation barriers concerning chapter development, closed minds, misinformation, and enough staff hours to get to all the things DET aspires to do. Coalition building or chapter development is hard work, and it is challenging to find people with the time to volunteer and willingness to be in leadership roles. DET addresses this challenge by building trust in the community and strong relationships across the state. To address closed minds, DET works on education at the regional level, having chapters across Tennessee so that "someone locally is talking to someone else locally." DET addresses misinformation by populating the website with fact-rich information, including research, that addresses peoples' questions and counters myths. DET also lists local chapter leaders on the website so people can reach out to get information specific to their community.

Lessons Learned and Best Practices

Three suggestions emerged from the discussion on lessons learned and best practices for EV educational outreach. The first is to develop chapters so that "you have local people talking to local people." The second is knowing audience needs or concerns (e.g., people living in rural versus urban areas have different questions). For instance, it is important to know if there is a predominant industry in a town and people are concerned that manufacturing EVs may take jobs or change how jobs work in the area. As one of the leads said, "knowing what people need from you as far as education goes before you arrive, which again goes back to knowing the people in the area and having strong relationships." The final suggestion was to get partners "rowing in the same direction" to amplify the EV educational work that is taking place, so people know what is happening in their area and how to learn more and get involved.

Safety

The primary safety topic that DET hears about is EVs and fires. The program leads also described safety pros and cons of various EV aspects, including regenerative braking helping people brake faster, the quietness of EVs helping drivers hear better (e.g., school bus drivers), and Tesla autopilot potentially being used by people incorrectly. When asked what additional safety information DET would be interested in having for their educational outreach, the program leads mentioned better data on EV fires and education beyond light-duty EVs to medium- and heavy-duty EVs, charging, and micro-mobility, since people are asking questions about topics such as e-bike safety or charging (e.g., how to safely install a charger).

ADAS

In terms of ADAS features, one program lead said there is not a lot, if anything, on the DET website about ADAS and that the issue arises more in individual conversations at events where someone is asking about the safety of a vehicle and what kind of features are on it. There was interest in having more information on ADAS features "if it's crafted for easy absorption by individual consumers." A format was suggested of less than six bullets on what consumers should know about ADAS that can be put on a website or one-pager that can be shared with individuals and read quickly.

Planning and Evaluation

A few planning and evaluation tools were described by the program leads. In terms of planning, knowing the audience is important because that knowledge guides decisions on what materials and information to bring to an event. The two main evaluation tools mentioned included tracking event metrics and conducting surveys. DET tracks several event metrics, including the number of people that rode in an EV, the number of people engaged in conversation, and how people heard about an event, from which they can determine which outreach approaches are the most effective. DET also uses surveys that are simple, short, and audience specific. For instance, when doing EV educational outreach on a college campus, the survey may ask about views on future EVs or if there is interest in purchasing an EV.

NSTSCE Partnering Opportunities

Program leads commented on how DET could partner with the types of organizations represented by NSTSCE. They said the obvious partner would be DOTs because they typically manage National Electric Vehicle Infrastructure (NEVI) program funding, which is focused on helping solve problems EV owners have related to charging (e.g., "How am I going to charge when I'm away from home?" and "How am I going to get to a specific location that may be states away?). The NEVI program is "dedicated funding to States to strategically deploy EV charging infrastructure and establish an interconnected network to facilitate data collection, access, and reliability" (FHWA, n.d.).

While DET does not work currently with insurance companies and has limited collaboration with OEMs, they do work with universities, as mentioned under the section on key partners. DET is housed out of UT and is currently "trying to get our first student and faculty focused chapter off the ground for EV awareness." They hope this will be a model that can be expanded to other community colleges and universities. DET conducted a survey and found that a majority of students were interested in learning about EVs and more open to buying an EV in the future than general public audience of all ages. DET also wants to raise awareness and promote the educational aspect of workforce development within universities. When asked about future partnering opportunities with VTTI, the program leads said they would be interested in collaborating with VTTI on events in Southwest Virginia (e.g., Abingdon, Bristol).

At the end of the interview, when asked if there was anything additional to share, a word of advice was offered related to funding. One of the program leads noted that long-term it is important to make sure the program has a diverse group of funding sources to avoid the risk of funds drying up and a program not being able to continue to do what that funding supported.

DET Summary

A key theme of the DET program review was the development of regional DET chapters to facilitate "locals talking to locals" rather than having someone from outside a community trying to tell people about EVs. This goes along with DET's focus on knowing the audience so that the information that is of concern or interest to that audience is provided in discussions. Hands-on experience in the form of "butts-in-seats" was also highlighted, along with the importance of an informative website to address questions and concerns and to combat misinformation. An emerging topic for DET is workforce development, in particular a focus on the college student audience and how EVs can be a source of jobs in the future. There was interest in additional ADAS and safety information on EV fires that VTTI researchers may be able to provide. Educational outreach partnering opportunities are promising, with DET suggesting collaboration in Southwest Virginia (e.g., Abingdon, Bristol).

ELECTRIFYING VIRGINIA

The last program reviewed was Electrifying Virginia. The program is overseen by EVHybridNoire, a nonprofit whose mission is "to advance [EVs] and multimodal electric mobility (e-mobility) solutions (e.g., electric buses, electric bikes, electric scooters) across the United States, and ensure those solutions are inclusive and equitable" (Ezike et al., n.d., p. 4). The nonprofit EVHybridNoire and the closely related organization EVNoire are active in EV educational outreach in Virginia.

Online and Document Review

To better understand the goals, target audiences, topics, approaches, and partners involved in Electrifying Virginia, the project team reviewed the Electrifying Virginia website, an example of an MOU used for partnership agreements, and information being shared online about the project by the partner organization VCC. The Electrifying Virginia website states that it "is a statewide campaign with communities and organizations" with goals "to educate and engage Virginia residents on the benefits and cost savings of EVs" (Electrifying Virginia, n.d.-a). The primary audience is Virginia residents, and there is mention in program materials of engaging with "communities most negatively impacted by transportation emissions," including communities of color and rural communities (ElectrifyingVA.com Partnership, n.d.). The importance of reaching these impacted communities is in line with EVHybridNoire's vision for "a world where communities are free of air pollution from cars and trucks, and everyone can reap the benefits of [EVs] and other e-mobility solutions" (Ezike et al., n.d., p. 5).

The topics covered on the website (see Figure 7) and associated documents are centered on EV benefits (Electrifying Virginia, n.d.-a), including cost savings (e.g., incentives and rebates, lower fuel and maintenance costs), health and environmental benefits (e.g., improved air quality, sustainability), performance (e.g., quiet, works well in winter), safety (e.g., lower risk of fires and rollover crashes than an ICE), and workforce and economic development opportunities (e.g., job creation to support EVs). There is also information on different types of EVs, how they work, their various price points, and charging (installation, locations, time to charge). The website encourages people to learn more and break myths about EVs.

Figure 7. Screen capture. Electrifying Virginia website (Electrifying Virginia, n.d.-a).

Several educational outreach approaches were identified, including events and a multimedia campaign. In-person events, such as 2024 EV Day at The Capitol, included speakers, ride-along opportunities, spaces for EV drivers to share their experiences (e.g., driving, charging, benefits of EVs), and participants answering questions related to EVs (e.g., experience riding in an EV, concerns about EVs, awareness of incentives, and their likelihood to purchase an EV). The multimedia campaign includes a website which has detailed information on these topics with links for further information (e.g., the Internal Revenue Service's website which includes information on credits for new clean fuel vehicles, alternative fuels data center for EV charging station locations), as well as pictures of different EVs and their price points (Electrifying Virginia, n.d.-a). The website also includes links to events, social media (e.g., Facebook, Instagram) and includes a petition to support increased investment and commitment to EVs in Virginia.

A variety of partners are listed on the website as being involved along with EVHybridNoire in Electrifying Virginia (e.g., Generation180, Drive Electric VA, Southern Environmental Law Center, International Brotherhood of Electrical Workers, VCC, and ReCharged). Information from the EV Day at The Capitol noted speakers that included state senators and a representative of the Virginia Conservation Network. The VCC website notes that partner activities involve "facilitating in-person and virtual EV events, data collection, EV ride and drives, and stakeholder engagement" (VCC, n.d.).

Events

As part of the Electrifying Virginia review, members of the project team attended the 2024 Clean Fuels Summit and Electric Vehicle Festival at Dominion Raceway and Entertainment. Electrifying Virginia was one of several event partners. Other event sponsors and partners included utilities (e.g., Dominion Energy, Rappahannock Electric Cooperative), nonprofits (e.g., VCC, Drive Electric Richmond), and other EV-related companies (e.g., Tesla, Sonny Merryman, Oasis Charging).

At the event, the Electrifying Virginia program lead made a presentation on "Multifaceted Communication and Outreach Tactics to Improve Awareness and Attitudes of Electric Vehicles" and had a booth with information about Electrifying Virginia and free t-shirts with the website link. The presentation went over best practices and lessons learned from the program, which was described in the agenda as "a multimodal statewide campaign engaging communities, government, businesses, EV advocacy organizations, and e-mobility stakeholders to educate and engage Virginia residents on the benefits of [EVs]" (Clean Fuels Summit, 2024). EV educational outreach approaches were covered during the Electrifying Virginia presentation, including the statewide campaign, which features in-person events (e.g., ride along, EV drivers sharing experiences), virtual events (e.g., webinars), and a multimedia and ad campaign (e.g., billboards, metro and gas station ads, social media). In addition to Electrifying Virginia, there were other sessions at the event; topics covered during presentations included range anxiety, charging (infrastructure, cost), battery life, costs (maintenance, as compared to ICEs, tax credits), understanding the EV lifestyle, debunking myths about EVs, and workforce development related to EVs and charging infrastructure.

The EV Summit and Festival were held simultaneously, and the project team took part in both events. Though the EV Festival was not run by Electrifying Virginia, the team took advantage of learning more about EV educational outreach approaches during the EV ride along and vehicle showcase. The festival had EV owners and dealers showcasing vehicles and a ride along in an EV on the speedway. One project team member spoke to people showcasing EVs, while another took part in the ride along, which required a waiver and wearing a helmet. Figure 8 is a picture of a VTTI project team member taking part in the ride along. The project team member that visited the showcase discussed charging with a Tesla owner and talked with a Rivian dealer, who said common questions asked at events are often about vehicle cost and battery range.

Figure 8. Photo. Project team member participating in ride along.

Though a member of the project team was not able to attend an in-person ride along or showcase run by Electrifying Virginia, a member of the team reviewed media clips on the Electrifying

Virginia website about these types of events. The media clips provide a glimpse into events where people can ride in an EV or speak to an EV owner.

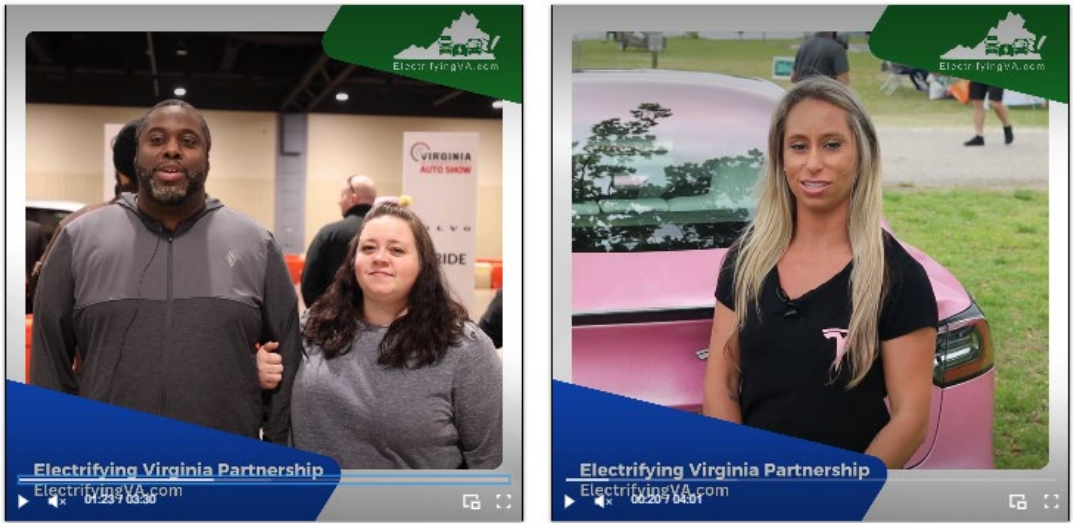

Figure 9. Photos. Electrifying Virginia event (Electrifying Virginia, n.d.-b).

Figure 9 is a screenshot of the media clips (Electrifying Virginia, n.d.-b). The clip on the left includes people being asked at an event about their experience riding in an EV and answering questions including "How was your experience riding in an EV?"; "What EV did you try?"; "Are you considering buying an EV in the future?"; and "What makes you hesitant to buy one?" For instance, the rider in the clip said that the "experience was great, loved it [and] enjoyed it quite a bit." He reported riding in a Mach-E and a Ford Lightning and said he would consider buying an EV in the next 6–8 months. In terms of what makes him hesitate to purchase an EV, he commented that his hesitation was around the technology being new: "I'm looking to get more information on the technology and how reliable it is."

The clip on the right in Figure 9 highlights EV owners showcasing their vehicles and responding to questions including "What EV are you currently driving?"; "What do you like about owning an EV?"; and "How important is the initiative that Electrifying Virginia is doing?" For example, the owner of the pink Tesla commented that she had a used Model 3 and liked being able to charge at home and not have to go to gas stations. In terms of the importance of what Electrifying Virginia is doing, she said, "Doing things like this helps bring new people into the Tesla and electric community and I believe people can feel the passion I have for my car and then they want the same thing." The clips enable people to listen to EV owners talk about their lived experiences with an EV.

The clips serve as a resource for people who were not able to attend an event but still want to learn more. The questions posed to participants about their concerns (e.g., what makes you hesitant to buy an EV) are juxtaposed against questions posed to owners that might address participant concerns (e.g., "What do you like about owning an EV?").

Interview

Goals

The lead for the program shared that the goals of Electrifying Virginia's EV educational outreach are to help educate and raise awareness of the benefits of EVs specifically and, more generally, to broaden understanding of EVs in Virginia.

Targeted Audience

While the target audience for the program is Virginia as a whole, the program goes to different parts of the state and interacts with different populations. It is good, the lead said, to talk to people who have questions about EVs or want to get more information before considering making the switch to an EV. The lead said they try to talk to people who do not have as much knowledge of EVs or have heard misinformation so they can help raise awareness about the benefits of EVs and dispel myths. He said that they do not give every target audience the same information but instead listen to questions and concerns, then answer questions and provide general information. When asked about the top questions people have about EVs, he said the two biggest concerns are the starting price point and range anxiety. He noted that when addressing such concerns, they talk through what the ranges are for EVs, provide people with resources such as a map showing where public chargers are located, and share information about cost savings, such as how utilities such as Dominion Energy have incentives for installing EV chargers.

Topics

Choice of topics depends on the event and the audience. They "focus on who the audience is going to be" and use that knowledge to "find out what information would be most helpful." Depending on the event or webinar and the audience, they may talk about a variety of topics (e.g., workforce development, environmental benefits, range). The lead mentioned, for example, taking a Ford F-150 Lightning to an event in Shenandoah Valley and talking about the truck's range and how it can serve as a mobile battery for a work site.

Approaches

Electrifying Virginia has three main educational outreach approaches: in-person events (i.e., EV ride and drives, showcases, conferences), a communications campaign (e.g., social media, ads across newspapers, billboards, train and gas stations), and webinars. In terms of in-person events, they prefer ride and drives because riding in an EV gives people the opportunity to experience an EV and become more comfortable with it. They try to make sure the people providing the rides own or regularly drive an EV "so they can talk about their own lived experiences." He noted for insurance purposes they cannot always have the people attending an event drive, but they can instead give them the experience of riding in an EV. For showcases, where vehicles are on static display, they try to bring vehicles that people might not realize are EVs to help raise awareness of how more vehicles on the road are EVs than they may think. When Electrifying Virginia brings a vehicle to a showcase, they look up specifications in advance (e.g., range, battery capacity, price point) and have that information at a table or booth. They try to have EV owners attend showcases to talk about their vehicles. In terms of the events, they plan events themselves, as well as attend partner and external events (e.g., cultural events) where they can reach a

broader audience of people that may not be expecting to see an EV and "who may have different levels of knowledge about EVs or different thoughts on EVs." In terms of their communications campaign, they use social media to cover a variety of EV benefits. They have placed ads at gas stations, airports, and metro stations with unique QR codes. Through the QR codes, Electrifying Virginia can learn what ads people interact with the most as input to future ad planning. They also host webinars, for example, on topics like workforce development.

Material and Equipment

Electrifying Virginia has several types of materials and equipment that are important for events. The most pressing thing is making sure to have an EV at an event. In addition, they like to have a mix of high-tech and low-tech educational materials, including handouts, a QR code linking people to their website, and a table or booth with a banner and tablecloth with the website on it. The table holds handouts and promotional items (e.g., free T-shirts) that include the website link so that people who wear them may direct people to the website.

Funding

Electrifying Virginia is funded by a single private philanthropy.

Partners

Electrifying Virginia has numerous partners, including nonprofits (VCC, Generation180), government (City of Richmond), academia (Virginia State University, Norfolk State University), utilities (Dominion Energy), and community organizations (EV enthusiast groups). Members of these types of organizations serve on the advisory board. In terms of how Electrifying Virginia works with each type of partner, nonprofits help plan events and webinars, and government partners, including a mayor and state legislators, have spoken about the benefits of EVs at events. In terms of academia, Electrifying Virginia and more broadly EVHybridNoire, who oversees the program, have planned events in coordination with EVHybridNoire's e-mobility fellowship program. For example, they worked with e-mobility fellows to plan an "EV education day on campus" to "help promote [EVs]." Electrifying Virginia has worked with Dominion Energy, which serves on the advisory board, and hopes to expand partnerships with utilities to include smaller co-ops in the state as well. The final group discussed was community organizations, specifically EV enthusiast groups such as Drive Electric. If one of these groups is planning an event, they "try to support them and be there," or if Electrifying Virginia is putting on an event, they may reach out to see if the EV enthusiast group is interested in participating.

Implementation Barriers

Implementation barriers were related to events and misinformation. For instance, a lot of events that are EV related (e.g., Earth Day, National Drive Electric Week) happen around the same day of the year. When planning, they must consider what event makes the most sense to attend and/or is in a location that might allow them to reach the most people. The other barrier, or challenge, is misinformation.

Lessons Learned and Best Practices

A key lesson is figuring out what people want to know or have questions about. It is better to be ready to talk about a variety of benefits (e.g., cost savings, national security) and figure out what people care about most and be ready to pivot the conversation. An additional lesson learned is that some people come to events to argue and are not really interested in having a conversation. It is better to disengage from a person that just wants to argue as "you might be missing a person who's coming by who actually does have questions."

There were a few best practices related to events and communications. One best practice is to have different types of EVs at events and have people doing the ride and drives who drive EVs themselves and are comfortable talking with people. Another best practice is to think about the communications effort and do a wide variety of ads or outreach. For instance, having ads at gas stations, where people may be frustrated with gas prices, or at airport car rental agencies, where people can consider renting an EV.

Safety

When asked about safety topics, the lead noted that the website includes safety information, such as the number of vehicle fires per capita for ICE vehicles compared to EVs. In general, if there is misinformation regarding safety, they put out accurate information, as well as present the benefits of EVs. For instance, the lead noted that information is coming out after Hurricane Helene related to saltwater and battery fires. They will gather accurate information about that concern and share how EVs like the F-150 Lightning were used by some people to power their homes. When asked what additional safety information they would be interested in having, the answer was that additional research on battery fires, especially after the hurricane, that they could share with people on their website would be helpful.

ADAS

ADAS features are less of a topic that Electrifying Virginia covers, but they are open to including it on their website. They try to keep up-to-date information on the site and would be interested in information on ADAS for their website because "there's always people asking different questions" and "having the information would be great."

Planning and Evaluation

When it comes to planning and evaluation, the program lead shared a few things they have done. In terms of planning, they did some initial research looking at Black and Hispanic populations in Virginia because these two populations had the lowest uptake of EVs. They asked questions related to attitudes and awareness of EVs (e.g., "What are your biggest concerns?" and "Are you aware of federal rebate programs?"). They also had conversations with other organizations to figure out what was already being done to avoid replicating work and to identify an area/areas where not a lot of work was being done.

On the evaluation side, pre- and post-event surveys are done to get a better understanding, especially at ride and drive events, of people's feelings on EVs before and after the event. Through the surveys, they look at concerns people may have about making the switch to an EV

and what vehicles they like driving to help determine what vehicles to bring to future events. The team also uses conversations with people (e.g., concerns, questions) to gauge if additional information needs to be added or updated to the website or materials brought to events.

NSTSCE Partnering Opportunities

When asked how Electrifying Virginia may partner with NSTSCE, the program lead said that they are open to meeting with different types of groups to discuss partnering, for example, on an event or webinar. As noted under the discussion of key partners, they already work with academia on events (i.e., Virginia State University, Norfolk State University). They have also worked with AAA Virginia, who spoke at their EV Day at The Capitol event. Several ways were discussed that VTTI and Electrifying Virginia could partner, including webinars and sharing research findings (e.g., automated vehicles).

At the end of the interview, when asked if there was anything additional to share, the program lead mentioned how they have started working with dealerships to do free EV test drives. People can sign up on their website and are connected to the nearest dealer that is part of the program to schedule a test drive without the concern of having to make a purchase. The lead also added that there is a petition on their website to show that "Virginians want the State to move forward on vehicle electrification."

Electrifying Virginia Summary

A clear theme from Electrifying Virginia was their focus on learning who the audience is, finding out what questions the audience has, and providing information people need. Electrifying Virginia focuses on understanding the diverse range of EV benefits and then using the knowledge to address people's specific questions and concerns. The focus on having people with EV experience available at events to provide rides and share their lived experiences of driving EVs was also important. Electrifying Virginia is creative in its multimedia campaign (e.g., ads at gas stations) and partners with a wide range of organizations. Electrifying Virginia is interested in partnering with VTTI in the future (e.g., research, webinars).

CHAPTER 4. KEY TAKEAWAYS AND PARTNERSHIP OPPORTUNITIES

The objectives and steps of this project were to (1) gather information and materials from current EV educational outreach efforts and NHTSA's ADAS educational outreach (which was expanded to include others such as NSC) to inform the development of an NTO program and to (2) identify potential partners for an NTO educational outreach program. After these steps were completed, a member of the project team compiled a list of the key takeaways from the project that may serve as inputs for a future NTO program. The review of ADAS education was not as extensive as that of the EV educational outreach programs, which included a literature scan and program reviews. Key takeaways for ADAS are included under goals, target audience, topics, and approaches, while the EV review covered additional areas (e.g., materials and equipment, funding). Throughout the takeaway discussion, key resources that the project team may use or reference in a future NTO program are highlighted (e.g., NHTSA's ADAS website). In addition to key takeaways, the project team explored partnership opportunities with each of the organizations involved in a program review.

KEY TAKEAWAYS

Goals

The goals identified in this project to consider for an NTO program are to:

1. Help people understand the purpose, functionality, limitations, and safety benefits of ADAS features;
2. Raise awareness (through education and engagement) of the benefits of EVs;
3. Help consumers decide if an EV is right for them; and
4. Support equitable access to EVs.

Equity is a broad term identified in literature and program reviews. As an example of equitable access, the Forth program lead described providing education to lower-income households on how they can save on the purchase of an EV (i.e., incentives) and what the overall cost-of-ownership (e.g., lower maintenance costs) would be for an EV. This idea of equity could be extended to ADAS features (e.g., providing education for lower-income households on more affordable vehicles with ADAS features).

Audiences Targeted

Several target audiences were identified to consider for an NTO program. In terms of ADAS features, ultimately "it is critical to ensure all roadway users understand how the systems work and how to safely use them" (TRB, n.d.), so an effort will be made in designing a future NTO program to integrate easy-to-understand ADAS educational materials into program materials with the understanding that different content or approaches may be appropriate depending on the audience. For instance, the IIHS reports that "the safety benefits of crash avoidance technologies like front crash prevention and lane departure warning could be particularly relevant for teen drivers" (2021) so a program targeted towards novice drivers or those that are teaching them to drive could focus on raising awareness of the purpose, functionality, and limitations of these ADAS technologies.

On the EV side, target audiences are communities/the general public and, in some cases, a specific target audience such as students. Within that broad range, one aim is making sure to reach communities that are rural, lower income, or overburdened by the impacts of transportation-related greenhouse gas emissions. Within the overall population, it is good to talk to people who have questions about EVs and/or are less familiar with them. Another audience for educational outreach is students (e.g., trade school, colleges); there is value "in reaching the next generation of EV owners and industry employees" (VCC, 2013, p. 52). This idea of students being an important audience as the next generation of vehicle owners and industry employees could also apply to ADAS features.

Topics

The topics identified for the ADAS features include names and descriptions of features (e.g., forward collision warning) under several categories (e.g., collision warning). In terms of EV-related topics, Table 5 is an expansion of Table 1, adding EV maintenance and other topics that arose during the program reviews, including workforce development and current events. Being prepared to address current events related to EVs could also be considered an approach.

Table 5. EV topic areas expanded.

Topic Area	Examples
Cost considerations	Total cost of ownership, incentives
Vehicle information	Types of EVs, vehicle availability
Charging and range	Types of chargers, factors impacting range (e.g., winter weather, terrain)
Drive experience/operation	Acceleration, regenerative braking
Environmental and public health benefits	Lower tailpipe emissions, improved air quality
Safety issues	Quiet/noise, ADAS features widely available
Battery issues	Performance, life
Maintenance	Maintenance needs compared to an ICE
Workforce development	Education, job opportunities in EV industry
Current events	News about weather events (e.g., frigid temperatures, flooding) impacting EV batteries

Approaches

Key takeaways on ADAS approaches are in line with the VARK model of providing a variety of educational approaches to relaying information. For instance, for each technology, NHTSA's ADAS website (n.d.) provides a written description accompanied by an animated infographic demonstrating the technology and several easy-to-understand videos that demonstrate the technologies. NHTSA's website, as well as the ADAS educational resource, *Clearing the Confusion*, produced by Consumer Reports (2022), will be resources the project team can reference moving forward in developing an NTO program.

The VARK model will be a guide for future EV educational outreach. The NTO program will draw from the different learning modalities (i.e., visual, aural, read/write, and kinesthetic) when designing educational outreach. The literature scan and program reviews provided a plethora of examples of each type of approach in the VARK model to draw from and resources the project team could use in a future NTO program. For example, an approach identified in the literature scan for relaying information (read/write) was the use of fact sheets and/or myths and facts pages. At the Forth Roadmap conference, a member of the project team visited the EPA booth and was told that the project team could use the information EPA produces on EV myths and facts in future EV outreach. Myths and facts information can be found on the EPA website (EPA, 2024). In addition to read/write approaches, there were numerous examples in the literature and program reviews of kinesthetic approaches, namely ride and drive events and showcases where people can see and experience an EV.

A few approaches the project team wants to highlight from the program reviews are the importance of planning for community engagement, involving local people and community organizations, listening to the audience and sharing information of salience, providing hands-on experiences, and conducting creative multimedia campaigns. As a few examples, community engagement was emphasized at the Forth Roadmap conference during the session on "Tribal Transportation Electrification" as important for understanding the audience and being able to tailor messaging and materials to the community. Also, during the Forth interview, the lead described how being in the community creates a space for people to come up and ask questions. Similarly, a DET program lead spoke of involving local people who are experienced with EVs in outreach (e.g., having someone who drives an EV talk about EVs, having someone who installs home charging talk about charging) to create trust because local people with experience are talking to local people. This was a big theme for DET, which relies heavily on building local EV chapters. The Electrifying Virginia lead stressed the importance of listening to the questions and concerns of the audience before providing information. Listening allows the person conducting outreach to better understand and highlight how the vehicle may fit with the person's specific interests. Experience riding or driving an EV was emphasized, as one of the DET administrators commented, "there's nothing like the first-hand experience." Finally, being creative in reaching people was something highlighted by Electrifying Virginia, which created a multimedia and ad campaign that included billboards, metro and gas station ads, and social media outreach.

Materials and Equipment

This project identified a variety of materials and equipment that the NTO will consider in future planning. The first is EVs, which should be on hand for showcases and/or ride and drive events. Suggestions were made to be brand agnostic, including a variety of EVs that are of interest to people, or to include vehicles that people may not know are EVs. Having EV owners and/or people available who have experience driving or riding in EVs is also helpful. Educational materials, such as handouts with information on EVs and promotional materials and banners that have a QR code or display the link to the website are useful so people can learn more or point others to the website. For such events, having surveys (more on this under planning and evaluation) and the appropriate waivers for riding or driving a vehicle are important. Several suggestions for materials and equipment to have at ride and drives were included in Forth's best practices for EV outreach, including "a variety of EV models and price points, inclusive outreach materials, with educational and promotional information translated into multiple languages, and

guidance to help consumers understand rebates, discounts, low-interest loans, and other financing to lower the cost of an EV" (Forth, 2024, p. 4).

Partnerships

The importance of having broad and strong partnerships is a key takeaway. The literature scan identified a variety of partners that may support an EV educational outreach program, including utilities, OEMs, car dealerships, Clean Cities coalitions, government agencies, nonprofits, and charging infrastructure providers. During program reviews, additional partnerships were highlighted, including communities (e.g., CBOs, individual community members), cities/municipalities, academia, and event holders. Forth's 2023 annual report states that they work in "partnership with historically underserved communities to build models that expand access to electric transportation" to "reduce pollution and barriers to access to meet the urgent need for zero-emission, affordable and accessible transportation" (Forth, 2023, p. 4). In the DET interview, the suggestion was made that it is helpful to have strong partners (e.g., power companies or utilities such as the TVA) who are also providing educational resources and working together to unify the message. For DET, EV owners' clubs or chapters are key to outreach events so that local people are talking to local people. EVHybridNoire, which manages Electrify Virginia, has an e-mobility student fellowship program, and students helped plan an EV day on campus to promote EVs.

Funding

The key takeaway regarding funding is to have a diverse group of funding sources to sustain the program. Funding sources mentioned in program reviews included government, utilities, memberships, and philanthropic organizations. A member of the project team attended an event hosted by Forth that included worksheets and activities on how to design and fund successful projects. These resources will serve as practical tools for the project team when developing an NTO program. During the Forth program review, funding was identified as a challenge that could be overcome by having a strategy that involves building supportive partnerships, being aware of grants that are available or coming available, staying on top of the grant calendar, and having a team that can work on the grants while others are conducting programs.

Planning and Evaluation

During the program reviews, several planning and evaluation steps were identified. One of Forth's best practices is to have "clear plans for community engagement, including relationship-building with trusted representatives from faith-based communities, tribal leaders, and others" (Forth, 2024, p. 4). As noted earlier, a member of the project team attended an event hosted by Forth, "Design and Fund Equitable Electric Mobility for Your Community," that included presentations, hands-on activities, and discussions on thinking strategically about how to engage communities in meaningful ways. Electrifying Virginia has taken the planning step of conducting research looking at Black and Hispanic populations in Virginia because these two populations have the lowest uptake of EVs. They asked questions related to attitudes and awareness of EVs (e.g., "What are your biggest concerns?" and "Are you aware of federal rebate programs?"). Thus, a key takeaway is to understand the audience (e.g., needs, concerns) so that appropriate materials and information can be provided. Other planning steps included

Electrifying Virginia using unique QR codes on outreach materials (e.g., ads at gas stations, airports, and metro stations) to learn which ads people interacted with most as input to future planning. Similarly, DET asks people how they heard about an event to determine which of the outreach approaches used was the most effective. Finally, the program lead for Forth described the importance of event logistics, such as staying in contact with the event host, securing vehicles, and scheduling staff.

In terms of evaluation, the two main tools mentioned were capturing event metrics and surveys. Event metrics included the number of people spoken to and the number who drove an EV. DET described using surveys that are simple, short, and specific to the audience. For instance, when doing EV educational outreach on a college campus, DET may use surveys to ask about views on future EVs or interest in purchasing an EV. Electrifying Virginia also mentioned using surveys to gain a better understanding, especially when doing a ride and drive event, of people's feelings on EVs before and after the event. Through the surveys, they look at concerns people may have about making the switch to an EV and which vehicles they like driving to help determine what vehicles to bring to future events. The team also uses conversations with people (e.g., concerns, questions) to gauge if additional information needs to be added or updated to the website or materials being brought to events. In this way, the surveys are both an evaluation and a planning tool that can guide future event planning.

Safety

During the program reviews, several safety issues were identified related to EVs, the most common being concerns about EVs and fires. During the Forth interview, the program lead said there are two safety questions people tend to ask, both related to batteries. The first is battery safety and concerns about battery fires: "people don't know much about batteries, and they hear about battery fires." The second is mining; people are concerned about "mining battery materials and is that safe for the environment." The issue of EVs and fires was identified across all the program reviews. The programs address safety concerns with factual information, either through conversations at events or on their websites (e.g., myths and facts pages). For instance, the Electrifying Virginia lead indicated that their website has information on the number of vehicle fires per capita for ICE vehicles compared to EVs. Similarly, the DET website has an EV FAQs page that provides information related to EV fires and mineral mining (DET, n.d.-c).

Other safety issues mentioned less often were related to EV fast acceleration, misuse of Tesla's autopilot (an ADAS feature), and health impacts related to EVs. As an example of fast acceleration (how fast an EV can go from 0 to 60), during the Forth Roadmap Conference a member of the project team participated in a ride along, and another passenger in the vehicle asked the driver how fast the EV could accelerate. Moving forward, the project team will be careful with messaging related to fast acceleration and may consult with VTTI researchers who conduct studies related to the dangers associated with fast acceleration (or fast starts), particularly for novice drivers (Klauer et al., 2017, p. 12), to share in educational outreach.

Again, regarding ADAS, one safety-related comment came up during the program reviews about the Autopilot feature on Tesla vehicles and whether it could be misused and lead to crashes. The Tesla website describes Autopilot as "an advanced driver assistance system that enhances safety and convenience behind the wheel" that when used properly "reduces your overall workload as a

driver" (Tesla, n.d.) The description goes on to add that Autopilot is "intended for use with a fully attentive driver, who has their hands on the wheel and is prepared to take over at any moment." As mentioned in the section on ADAS education, a barrier to the life-saving benefits of ADAS reported by AAA is that "while many of these technologies are rapidly being offered in newer vehicles, many drivers are unaware of the safety limitations of the systems in their vehicles. Lack of understanding or confusion about the proper function of these ADAS technologies can lead to misuse or overreliance on the technology, which could result in a deadly crash" (AAA, n.d.-a). The project team moving forward will integrate resources such as the NHTSA's ADAS video into NTO programs to raise awareness of the limitations of ADAS features and their proper function.

Another safety issue for EVs identified during the project was related to human health. During the DET interview, one of the program leads noted that even if someone is not interested in climate change, they may be interested in how EVs can benefit their child's health. The lead went on to add that "personal stories are often the most effective, especially from a human health perspective" and gave the example of a public school bus driver who spoke at an educational event and shared how headaches he was experiencing from exposure to diesel fumes and noise after each shift diminished once he began driving an electric school bus. A key takeaway is to find meaningful ways, such as personal stories, to share information about the benefits to human and environmental health that people may be interested in learning.

The program leads were asked if there was any further safety information they would like to have in their programs. The key topic mentioned was information related to EV battery fires. The Forth program lead requested "anything that would help us keep on top of the battery technology … especially from a safety point of view because that is what people are interested in." Additional safety topics mentioned included crash test information, educational information beyond light-duty EVs to medium and heavy-duty EVs, charging, and micromobility.

ADAS

ADAS features were not a focus of educational outreach for the programs reviewed. Two of the program leads said that ADAS features are not something they typically cover at events unless the person is interested in the safety of the vehicle or vehicle features. One of the program leads went on to say that they are typically trying to relay basic information about EVs and adding in ADAS information could be confusing. In contrast, during the ride along that a member of the project team participated in during the DET event, the dealer introduced a few ADAS features and shared that the features have limitations that require the driver to stay attentive. All of the program leads indicated a willingness to receive information from VTTI on ADAS features for their programs. For instance, one of the DET program leads said they were interested in having information on ADAS features "if it's crafted for easy absorption by individual consumers," for instance a six-bullet or less information page that could go in a handout or on a website.

PARTNERSHIPS OPPORTUNITIES

Program leads were asked if they thought their program could partner with the types of organization represented in NSTSCE, including universities (in general and specifically VTTI), OEMs, DOTs, and insurance companies (see Table 6). There were not many suggestions beyond

what has already been described in the partners section of the key takeaways. It was suggested that OEMs and DOTs may be able to provide funding and that DOTs are obvious partners because of their involvement with the NEVI program, which was described as focused on helping solve problems that EV drivers have around access to charging. The Forth program lead mentioned a specific suggestion for partnering with insurance companies and said that, though Forth has not worked with insurance companies in the past, they could be a helpful source of educational information about the actual repair costs on EVs.

Table 6. Partnering suggestions by NSTSCE organization type.

NSTSCE Organizations	Partnering Suggestions
OEM	• Providing funding
DOT	• Providing funding • NEVI-related efforts
Insurance Companies	• Providing educational information related to EVs (repair costs)
University	• Providing safety information related to EVs (battery, vehicle) • Working with university clubs interested in new technology, climate change, and sustainability • Developing EV chapters on campus to raise awareness and promote workforce opportunities • Collaborating on outreach

Working with universities in general, and VTTI specifically, was the biggest partnership discussion. Forth mentioned that some university clubs and groups are interested in new technology, climate change, and sustainability and are potential partners for outreach. DET also works with universities and is starting a student and faculty EV chapter on the UT campus to raise awareness and promote the educational aspect of EVs related to workforce development. DET hopes this will be a model that can be expanded to other community colleges and universities. When asked about future partnering opportunities, one of the DET program leads said they would be interested in collaborating with VTTI on EV educational outreach in Southwest Virginia (e.g., Abingdon, Bristol). The Forth program lead noted that VTTI could provide safety-related information (e.g., battery, vehicle, charging) as it pertains to EVs. Electrifying Virginia, as noted under the discussion of key partners, works on events with academia (e.g., Virginia State University, Norfolk State University) and said in general they are open to meeting with different types of groups represented in NSTSCE to discuss partnering, for example on an event or webinar. The project team is hopeful that the takeaways gleaned and

contacts made through this project will serve as a springboard for collaboration and development of an NTO program.

NEXT STEPS (DEVELOPING AN NTO PILOT)

Suggested next steps in the development of an NTO program are to choose a target audience that would benefit from ADAS and/or EV content and pilot a project related to the delivery of that content. To this end, the project team is developing a proposal to conduct a pilot project focused on delivering educational content about ADAS to parents of novice drivers. The leading cause of death for teens in the United States is motor vehicle crashes (CDC, 2024). An IIHS report suggests that this issue may be addressed, at least in part, by "crash avoidance features and teen-specific vehicle technologies," which have the "potential to prevent or mitigate up to three-quarters of fatal crashes involving teen drivers" (IIHS, 2021). IIHS reports that "the safety benefits of crash avoidance technologies like front crash prevention and lane departure warning could be particularly relevant for teen drivers" (2021).

In this current NTO study, VTTI researchers explored educational outreach around ADAS features and reviewed ADAS educational outreach programs (e.g., NHTSA's ADAS educational campaign, Clearing the Confusion). The study team learned about goals, target audiences, topics, and approaches for conducting educational outreach related to ADAS. With a focus on ADAS features, the suggested pilot study would build on a key takeaway from this current study: that it is important to help roadway users understand the purpose, functionality, and limitations of ADAS features and that a variety of educational resources may be helpful in relaying this information. For instance, NHTSA's educational materials include a written description, animated infographic demonstrating the technology, and easy-to-understand videos that demonstrate the technologies (NHTSA, n.d.).

The objective of the pilot would be to identify the delivery method parents of teen drivers who have ADAS features in their vehicles prefer to use to help them explain the proper function and limitations of ADAS to their teen driver (e.g., handout, video, interactive webpage). NSTSCE's focus on the safety of vulnerable road users would be a solid fit for such a pilot study since the target audience is the parents of teen drivers, who, per mile driven, have crash rates approximately four times greater than drivers over age 20 (Children's Hospital of Philadelphia, n.d.).

An approach to the pilot study could include a scan for guidance on ADAS features most relevant for teen drivers and content on the proper function and limitations of those ADAS features, identification of examples of delivery methods for ADAS content (e.g., NHTSA videos) drawing from what was identified during this current NTO study, and expert interviews and/or focus groups with parents about the preferred delivery approach or methods for the ADAS educational content. Such a pilot would be the first of hopefully many related to providing educational outreach about new vehicle technologies (ADAS, EVs) to communities in general or to specific target populations such as parents of novice drivers.

APPENDIX A. INTERVIEW SCRIPT

Below are the primary questions posed during interviews. Prior to these questions being asked, a member of the project team described the purpose of the project and logistics for the discussion (e.g., 1 hour). The script was slightly simplified after the first interview so discussions could be focused on key areas of interest and completed within one hour.

Introduction	Please briefly describe [ORGANIZATION'S PROGRAM] and share your role in it.
Goal	What is the goal of [PROGRAM]?
Audience	Who is the target audience(s)? What about this audience is of interest? Are there any special considerations for how you reach this audience?
Topics	What are key topics the program covers?
Approach	What are the key approaches used to address those topics?
Funding	How is the program funded?
Partners	What partners, if any, help implement the program? And how are they involved?
Additional Partners – *if not mentioned under Partners*	In what ways could stakeholders (universities, insurance companies, OEMs, and DOTs) partner in the program? [*Note these are organizations like those represented in NSTSCE]*
Materials & Equipment	What materials and/or equipment are the most important when implementing the program (educational outreach)? May VTTI (*and/or project stakeholders*) include [ORGANIZATION/PROGRAM] materials (e.g., website/flyers) in our programs (e.g., link from our program website to yours)?
Implementation Barriers	Has [ORGANIZATION] faced barriers to implementing EV educational outreach? If so, how has [ORGANIZATION] overcome/addressed barriers?
Lessons Learned /Best Practices	Are there 1-2 lessons learned that could help us as we develop our EV educational outreach program? Are there 1-2 best practices that we should try to integrate into our program?
Safety	Are there safety topics [ORGANIZATION] covers about EVs in this program that we haven't touched on already? Would [ORGANIZATION] be interested in information on EV safety to include in the program?
ADAS Features	Does the program cover anything related to the Advanced Driver Assistance Systems (ADAS) such as forward collision alerts or lane departure warning in the program? Would [ORGANIZATION] be interested in including information on ADAS features in the program?
Planning & Evaluation	Are there key planning steps [ORGANIZATION] takes prior to implementing the program? Are there evaluation tools [ORGANIZATION] uses to assess program effectiveness?
Additional Info & Partnering Opportunities	Are there ways VTTI could partner with [ORGANIZATION] on future EV educational outreach programs? Are there key people I should speak to (*within ORGANIZATION or partner organizations*) about this program? *If so,* who/why? Are there resources (online/print) that you'd suggest we review for our report/program?
Closing	Is there anything about [ORGANIZATION's] EV educational outreach program that we should've discussed today but I neglected to cover?

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