Oregon Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

Accelerating Alternative Fuel Vehicle and Infrastructure Deployment with Innovative Finance Mechanisms

Workshop Summary Report

April 11, 2016

Hosted By: ODOT/U.S. DOT-FHWA
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U.S. Department of Transportation Headquarters, Washington, DC

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This workshop was held as part of the Deployment of Alternative Vehicle and Fuel Technologies initiative, a joint project of Oregon Department of Transportation and other state DOTs, along with the U.S. Department of Transportation's Federal Highway Administration. The initiative is being supported by The Cadmus Group, Atlas Public Policy, and Vermont Energy Investment Corporation.

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Background

In June 2014, the Oregon Department of Transportation (ODOT) and the U.S. Department of Transportation's Federal Highway Administration (FHWA) initiated a pooled fund to assist state and local transportation agencies interested in promoting the use of alternative vehicle and fuel technologies at a state, regional, or corridor scale and provide tools, information, and knowledge to do so. The Deployment of Alternative Vehicle and Fuel Technologies initiative will implement a series of workshops around the country and develop a "toolkit" for state and local transportation agencies that will facilitate their deployment of alternative fuel vehicle and related technologies.

Workshop Summary

ODOT and FHWA hosted the second workshop under this initiative, titled "Accelerating Alternative Fuel Vehicle and Infrastructure Deployment with Innovative Finance Mechanisms," on February 22, 2016. Attendees included federal, state, and local transportation officials; finance professionals; industry and non-profit representatives; automakers; alternative fuel infrastructure providers; and academics. The workshop featured an opening plenary followed by two breakout discussions. All speaker presentations are available online at http://altfueltoolkit.org/.

Key Outcomes

The workshop was organized around two case studies that explored financing of alternative fuel vehicle (AFV) and infrastructure deployment. Brief presentations were given in the morning and afternoon to provide context, including examples of relevant projects in the State of Colorado and City of Atlanta, Georgia. The following are some of the key outcomes from the day as identified by workshop participants:

- Well-designed finance can help overcome AFV deployment barriers by minimizing upfront costs, unlocking unrealized savings, capturing additional value, and leveraging the private sector.
- Although often a complex process, formation of a public-private partnership (P3) from a state DOT perspective roughly follows these steps:
    - Determine internal skills, capabilities, objectives
        - If needed, seek external assistance
    - Review policy, legal, and statutory opportunities and challenges
    - Determine scope of project
    - Identify key partners and stakeholders
    - Evaluate the business case
        - If needed, deploy policy measures
    - Perform risk assessment
    - Select / develop financing structure
- While the business case for electric vehicle (EV) infrastructure deployment looks challenging in the near term, continued government support will result in more financing options, specifically those that leverage the private sector.
- The business case for EV infrastructure can be improved by capturing value from traditionally external stakeholders like automakers, utilities, and retailers.
- Public lease models, like the one used by Vision Fleet, have been used successfully in the cities of Atlanta and Indianapolis. Key aspects of these models include:
    - Enabling a fleet manager to capture federal alternative vehicle incentives
    - Providing telematics to track driver behavior
    - Providing maintenance for vehicles, and
    - Providing driver training

- EVs can offer lifetime savings to fleet managers compared to internal combustion engines, as EVs have lower operating costs, despite higher upfront costs. However, fleet managers often have limited capital resources for the purchase of vehicles, and in some cases, operational budgets for vehicles are administered separately from the capital budget, so the benefits from the total cost of ownership are hard to realize.
- Alternative fuel infrastructure deployment can be challenging because of restrictions around the commercialization along the right-of-way of many Federal-aid highways.
- Coordination of multiple stakeholders tends to be the most challenging aspect of building strong public-private partnerships.
- Co-location of several types of alternative fuel infrastructure (e.g., fast charging stations adjacent to compressed natural gas (CNG) dispensers) can lower the fixed capital cost of the station.
- The speed of change in technology development and the relatively slow pace of the government procurement process and policy development process is a challenge because of the rapidly evolving needs of alternative fuel vehicles. For example, as the electric range of EVs increases and driver expectations shift to expect traveling longer distances on a single charge, the need for fast charging infrastructure increases and public policy may not be structured to support this kind of infrastructure.

Action Plan

In order to address the goals, barriers, challenges, and objectives to AFV and infrastructure deployment outlined in the section above, an online toolkit accompanying this workshop is available at http://altfueltoolkit.org/. This toolkit features a resource library of guides, websites, tools, and research reports intended to provide state DOTs with relevant information related to financing AFV and infrastructure deployment. In addition, the toolkit provides engaging synopses of three areas of interest that emerged at the workshop: the inclusion of alternative fuels in the Fixing America's Surface Transportation (FAST) Act, using Congestion Mitigation and Air Quality Improvement (CMAQ), and Surface Transportation Block Grant Program (STBGP) funds for AFVs, and key assumptions made for the two case studies presented at the workshop. The toolkit is accompanied by the AFV Planning Guide, an interactive guide showing a progression of actions that state DOTs can take to advance through stages of engagement on AFVs, from no engagement ("Starting Points") to advanced engagement ("Leader").

Workshop Proceedings

Welcome and Introductions

David Kim, Deputy Administrator, FHWA

- Emphasized that alternative fuel vehicle deployment is an important topic for the U.S. DOT and the White House, adding that the administration has a goal to reduce greenhouse gases by 26-28 percent by 2025.
- Highlighted that President Obama recently signed the FAST Act, which is the first long term transportation bill in a decade, and which includes section 1413, requiring the Secretary of Transportation to designate alternative fuel corridors by December of 2016.
- Added that the FAST Act also establishes National Surface Transportation and Innovative Finance Bureau, to serve as a one-stop shop for state and local governments to receive federal funding, financing, or technical assistance.

Art James, Senior Project Executive, Oregon DOT

- Provided an overview of the Pooled Fund study (Deployment of Alternative Vehicle and Fuel Technologies initiative), explaining the intent is to conduct a series of workshops and develop associated online toolkits.
- Indicated that the current workshop has been designed to be a very interactive session.

Mark Sullivan, Strategic Delivery Team Leader, FHWA

- Highlighted that innovative finance is about lending, borrowing, and credit.
- Added that if there is going to be adoption of alternative fuel vehicles, it has to be a compelling business proposition.
- Noted that participants should consider what kinds of credit tools are suitable for advancing the industry, and added that state infrastructure banks have not been widely used for transportation to date.

Jennifer Brickett, Director, BATIC Institute, AASHTO

- Explained that the mission of the Build America Transportation Investment Center (BATIC) Institute is to provide information to state DOTs and is designed to help project sponsors understand federal programs.
- Added that the BATIC Institute is the education and training arm of the BATIC, housed within the U.S. DOT.
- Provided participants with handouts outlining the financing services offered by the BATIC Institute.

The Role of Public Finance Programs in Encouraging Private Investment in Alternative Fuel Vehicles and Infrastructure

Nick Nigro, Founder, Atlas Public Policy

- *See presentation for more information*
- Low gas prices in the near term will decrease the incentive to invest in alternative fuels and could reduce political will. Since gas prices have started to fall, all transportation fuel prices have started to converge.
- Gasoline and diesel vehicles are getting more efficient, but we still need alternative fuels if we're going to reach our greenhouse gas (GHG) goals.
- Public charging doesn't pay back for the private sector when revenue is only from a direct user fee, as it competes with residential charging and has high upfront costs.
- Public charging business models must capture indirect sources of value, such as value to car companies selling more cars, retailers with charging stations acquiring more business, and electric utilities lowering the cost of managing the grid.
- Since alternative fuels can offer net cost savings through lower operating costs, budgets need to adapt to not depend on low upfront costs.
- Alternative fuels can be locally produced with lower air and greenhouse gas emissions, benefits that must be monetized by funding programs.

Philip Quebe, Senior Associate, Cadmus

- *See presentation for more information*
- A financing continuum exists, with complex and unproven projects on one side, and standardized, proven projects on the other, such as mortgages and credit cards. Complex projects are harder to finance and cost more as a result of perceived risk.
- Alternative fuel projects are all over this continuum, depending on the specific project in question. For instance, public charging and refueling infrastructure is on the complex side of the continuum while auto loans for electric passenger cars is on the simple side of the continuum.
- Well-designed finance can help overcome the barriers Nick discussed in his presentation, by minimizing upfront costs, unlocking unrealized savings, capturing additional value, leveraging the private sector, and potentially minimizing impacts on debt limit.
- The structure of a P3 is flexible and can be applied across all kind of different industries. Each player within a P3 brings something different to the table and expects something different in return.

Tyler Svitak, Director of Air Quality and Transportation, American Lung Association in Colorado

- *See presentation for more information*

- Refuel Colorado is a program that provides energy coaches to fleets throughout the entire state.
- Refuel Colorado began with Clean Cities coalitions, then brought in two other organizations to serve as consultants/coaches for fleet managers. These consultants are free to fleet managers and can help them monetize lifecycle costs of vehicles, provide grant application assistance, and determine emissions savings.
- The program has five coaches throughout the state and has funded 14 CNG stations and procured 124 alternative fuel vehicles.
- The City of Aurora requested help greening their fleet, and with the assistance of Refuel Colorado coaches, the city is now on a procurement plan.
- Since CNG stations can be large investments, Refuel Colorado coaches can aggregate fleet demand in an area so a developer can justify this investment.
- Refuel Colorado began as a Department of Energy (DOE)-funded program in 2013 and is now state-funded through the Colorado Energy Office.

Stephanie Stuckey Benfield, Director, Mayor's Office of Sustainability, City of Atlanta

- *See presentation for more information*
- Atlanta Mayor Kasim Reed has a goal for Atlanta to be a top-tier green city. Atlanta has a sustainability plan with ten priority areas, many of which are affected by alternative fuel vehicles.
- Nearly a third of Atlanta's greenhouse gas emissions comes from transportation. The city has a goal to reduce emissions from transportation by 20%.
- Atlanta partnered with Vision Fleet on a pilot to incorporate 50 EVs into Atlanta's fleet. The vehicles targeted for replacement had high lifetime mileage, high maintenance costs, low fuel efficiency, and high cost of ownership.
- While Georgia's tax credit for EVs has expired, Vision Fleet was still able to take advantage of the federal tax credit and pass the savings along to Atlanta.
- Vision Fleet provides Atlanta with data on charging behavior so the city can see if plug-in hybrid electric vehicle (PHEV) drivers are relying more on gasoline than electricity; this information could be used for educational and training purposes.
- One of the primary reasons Atlanta selected Vision Fleet was to be able to cut through red tape. Atlanta's Office of Sustainability worked closely with the fleet manager and led this turnkey project, which helped get buy-in from City Hall and get the project approved. The Office of Sustainability had to make both the financial and environmental case in order to get the project approved.
- EVs have just started being put in the city's fleet and so far staff at City Hall and other departments using the vehicles have been supportive.

Moderated Discussion

Question: How did you determine where charging/fueling infrastructure would be located?

- Colorado chose to locate CNG refueling stations 50-100 miles apart because that is the distance at which fleets felt the most comfortable. With EV charging stations, workplaces were prioritized since people don't want to have to go somewhere else to charge.
- All of Atlanta's vehicles are public, so the city worked with Georgia Power to determine where the electricity deserts were and overlaid that map with a map of city-owned properties, in order to identify where the city should focus.

Question: What types of barriers held you back in your efforts?

- Local government procuring takes a long time, so there is a need to be patient. Another barrier is driver education. For bi-fuel vehicles, drivers often don't use the optimal fuel, so education at every level is important so that people know what to fuel with.
- Vision Fleet provided education for the City of Atlanta. In the month or so since Atlanta has had some AFVs in the fleet, the city has encountered some issues with convincing staff to rely more on charging than on fuel. Getting them comfortable with the new vehicles will be very important.
- Technology changes very rapidly. A bus system in Colorado didn't go with CNG because the fueling infrastructure didn't exist at the time, but now it is available.

Question: Is Georgia Power installing the EV charging stations in Atlanta with their own funds?

- Atlanta's charging stations are being funded through the Vision Fleet contract. They are owned by the city and solely to be used by city employees. The city is closely monitoring employee behavior at the stations. Atlanta has another project focused on developing charging stations at concrete islands, and that is being done through a public-private partnership with Georgia Power.
- The example with Georgia Power really demonstrates the value of engaging an electric utility. Georgia Power has deployed charging stations in public spaces and will likely seek cost recovery soon. Electric utilities can show where the gaps are in electricity access, and can play a strong role in filling these gaps with infrastructure.
- The State of California is another great example of utilities going in that direction.

Question: The contract with Vision Fleet seems very comprehensive. What happens when it ends?

- Atlanta's contract term with Vision Fleet is for two years, with the option to renew three times. Atlanta's contract office didn't want to bind city council with a long term agreement. At the end of the term, the city has the option to buy the vehicles. However, in order for the tax credit to work, Vision Fleet has to hold the vehicles for a certain number of years.
- In order to monetize the tax credit, Vision Fleet has to hold the vehicles for at least one year. For tax depreciation purposes, they need at least three years, but most of that can be attained in the first year.

Question: Could you speak to the process of co-locating charging stations?

- Colorado will have about four stations that will have three different fuels available. For fleets that have fueling on site, stations are being co-located on site.
- The City of Atlanta is looking to host stations at concrete islands for the public perspective, not for City of Atlanta vehicles. Atlanta's Office of Sustainability is looking to sustain and grow the EV market, and with the loss of Georgia's tax credit, concern exists about losing momentum. Since the tax credit went away, EV sales have plummeted. Atlanta's Office of Sustainability is looking to ensure that they are still supporting the EV community and show how Atlanta can step up as a leader.

Question: Are there successful private sector business models outside of utilities?

- The business case for fast charging stations within public corridors is currently weak. In retail locations, it's better. Cadmus and Atlas have been working on other sources of value to capture, such as monetizing value to car manufacturers, or to the retailers. In the short term, public intervention is necessary to make it work.
- A public role is needed in the near term. In the State of Washington, in about five years or so, if all of the values can be captured, the return on investment should be attractive to the private sector. In the near term, there's a role for government in facilitating these types of partnerships.
- The Level 2 charging station market has a large space, and they're a great investment.

Question: When the feasibility study was done with Vision Fleet gas prices were much higher. How has it been now that they've dropped?

- As of yet, Atlanta's Chief Financing Officer has not pushed back, perhaps because the city looked at comprehensive costs, including maintenance costs. Atlanta was strategically looking to replace old, clunky cars. If the program continues to be ramped up, it might be a concern. This is not a new issue to Atlanta's Office of Sustainability, as they are looking into solar even though coal is cheap. If the whole lifecycle cost of the vehicles is taken into account, including maintenance and repair, the financial case can still make sense.

Question: How important was right sizing of the fleet?

- The City of Atlanta is not reducing any vehicles right now; the city is swapping vehicle for vehicle, though a reduction in vehicles may be something to consider in the future. Atlanta's Office of Sustainability initially proposed to swap 25 vehicles in the fleet with AFVs and the mayor doubled it, so he is very supportive of this effort.

Question: Washington State has a million-dollar infrastructure bank that can be used for charging stations. Does Colorado have grants or loans for DC fast charging?

- Colorado has the Charge Ahead Colorado grant program. Colorado has a $50 excise tax, and $20 of that goes to the charging program. Applications are open to public or private organizations.

Question: How do you prioritize who receives grants?

- The program works through a competitive grant process and there is plenty of money left. About 80-90% of applicants are funded. The State of Colorado has installed 200 chargers through that program but there hasn't been a lot of interest in DC fast chargers. Colorado's Energy Office hopes to use this program to build up corridors.

Question: How many companies tried to work with the City of Atlanta?

- The City of Atlanta sole-sourced the project with Vision Fleet. Atlanta's Office of Sustainability made the case that there is no other company with this business model. The office received a lot of questions regarding whether this was appropriate to be sole-sourced, and the city council did scrutinize the agreement before it was approved.

Question: Have any of you run into situations where fleets are consolidated under different agencies? Then it can feel like you're working against each other. Do you have funds transfers to offset that?

- The Colorado statewide fleet does work in that fashion. It has been difficult to convince the state department heads, though Colorado's governor just issued an executive order with strong reduction targets.
- The structure described in the question is not unique to transportation. If you look at ESCOs for building efficiency, the same issue exists between who owns the property and who pays the bills. A lot of times changes in budget accounting practices are needed to make it work.

Question: What were the politics around EV charging? It is politically challenging to lose gas tax revenue. The Vermont Agency of Transportation is looking at net metering as a way to support charging costs so they can show they're not giving electricity for free.

- EVs have had a target on their back in Colorado. Meetings were held with EV stakeholders and the state, and it was clear EV drivers needed to pay something but without dampening the market. It was demonstrated that Colorado's 3,000-5,000 EVs on the road don't cause a serious infrastructure funding problem. Stakeholders agreed to a $50 fee, which is about half of what a gas vehicle would cost.
- Atlanta's city council imposed a $200 fee for EVs, and the city doesn't have net metering. Some stakeholders will likely try to reduce that fee on EVs.
- Washington State had a $100 EV fee, and then another $50 was added for the infrastructure bank. The state is looking to implement a road usage charge on a mileage basis, modelled after the OReGO program in Oregon, and anticipates the registration renewal fee will go away once the per-mile fee comes into effect.

Preparing Corridors for Long-Range EVs

Group A: Favorable Market Conditions

- *See Preparing Corridors for Long-Range EVs (Favorable Market Conditions) case study for more information*
- Given the assumptions provided in the case study, participants calculated that they needed to make up a gap of $1,200 per station per year.
- Participants in this group identified the following as key partners for this project:
    - Investor owned utilities
    - Network operators/electric vehicle supply equipment (EVSE) providers
    - Communication companies
    - Solar companies
    - Car dealers
    - Automakers
    - Marketing firms
    - Tourism boards
    - Convenience stores
    - The public
    - Energy storage firms with interests in used batteries
- Participants in this group identified the following as key barriers for this project:
    - Disaggregated purchases of equipment and electricity
    - Stranded capital
    - Multi-state coordination
    - Varying standards/codes for EVSE
- When reporting back out to all attendees, the following were the main outcomes from the group discussion:
    - The case study presented a deficit of $1 million over ten years, and a 10% profit over capital investment.
    - State intervention can address some of the barriers identified earlier. Each of the ten states in the case study would have to contribute $118,000 each. States have been using sources of funding such as RGGI or CMAQ funds.
    - Utilities and/or advertisers can be a source of revenue for the project. Advertisements could promote amenities located around the charging station.
    - One way to reduce cost would be to partner with a private sector entity such as Tesla to co-locate stations in order to reduce trenching costs and reduce demand costs over time.

Group B: Neutral Market Conditions

- *See Preparing Corridors for Long-Range EVs (Neutral Market Conditions) case study for more information*
- Participants in this group identified the following as key partners for this project:
    - Dealerships
    - Utilities
    - Public utility regulators
    - U.S. DOT/FHWA
    - Site hosts (retailers)
    - State agencies such as environmental, energy, and tourism
    - Local jurisdictions
    - Automakers
    - Renewable energy providers
    - Drivers / EV owners
    - Banks
    - Charging service providers
    - Charging equipment manufacturers
- Participants in this group identified the following strategies to tap into revenue streams and make the business case for this project:
    - A driver subscription service
    - Reducing energy costs (potentially through on-site renewable energy)
    - Setting up a special purpose utility entity in deregulated markets
    - Monetizing the public health benefit
    - Automakers (marketing/sales)
    - Utilities (additional electricity sales)
- When reporting back out to all attendees, the following were the main outcomes from the group discussion:
    - The case study presented a $2 million dollar gap to make up.
    - Utilities may be able to recover their investment in charging stations through rate-payer funds.
    - The concept of bundling projects may be useful to EV charging projects, i.e. the project could be bundled with another infrastructure project (like a toll road) that has a quicker rate of return.

Group C: Challenging Market Conditions

- *See Preparing Corridors for Long-Range EVs (Challenging Market Conditions) case study for more information*
- Participants in this group identified the following as key partners for this project:
    - EVSE providers
    - Electric utilities, who could help provide public funds

  - State DOTs, who can identify the proper use of roads along the rights of way, can assist with branding (e.g., West Coast Electric Highway signage), and are responsible for providing ease of access (rest areas)
  - Automakers, who could contribute funds and promote projects
  - Competitive suppliers of electricity
  - Green crowdsourcing
  - State governments
  - Station hosts (retailers)
  - Governor's offices could help the executive branch of government serve as a champion of the project
    - Need to see a plan for eventually reducing government's financial involvement
  - Environmental Protection Agency (EPA) – compliance with GHG standards
  - National Governors Association (NGA)

- When reporting back out to all attendees, the following were the main outcomes from the group discussion:
  - The case study presented a $23/day gap to make up.
  - State governments need to find a way to socialize the benefits of the project.
  - Crowdsourcing could be used as a source of capital.
  - Companies such as Google and Apple will require infrastructure for success of their autonomous vehicle technology.
  - Installation costs can be lowered if stations are installed where power sources already exist. Electric utilities can help identify these locations.
  - Metropolitan planning organizations (MPOs) can help identify locations.
  - EV charging station projects provide an opportunity to incorporate renewable energy and energy storage technologies.
  - To create political will for the project, pressure needs to come both internally and externally.
  - There are several policies that could enlist demand for the project:
    - Private companies receive EPA credit for their participation in building charging infrastructure
    - Public fleet mandates
    - Consumer education, including ride and drive experiences
    - Targeting schools

Cross-Cutting Themes across Groups

- It's important to identify where the constraints are in a project, where there is elasticity, and which areas simply cannot be changed. This information allows those involved in the project to identify which partners need to be engaged to work through the challenges that can be overcome.
- Even if there is a business case to be made, scale is important to keep in mind because certain types of loan programs require a project to be of a certain scale.

Alternative Fuel Vehicle Acquisition in the Federal Government

Christine Harada, Chief Sustainability Officer, White House Council on Environmental Quality

- Executive Order 13693 contains the goal of a 30% reduction in fleet-wide per mile greenhouse gas emissions by 2025, based on a FY 2014 baseline.
- The federal government is planning for agency fleet composition such that by December 31, 2020, zero emission vehicles or plug-in hybrid vehicles account for 20 percent of all new agency passenger vehicle acquisitions and by December 31, 2025, zero emission vehicles or plug-in hybrid vehicles account for 50 percent of all new agency passenger vehicles.
- Currently EVs make up less than 1% of the federal fleet.
- Lessons for other fleets can be learned from the U.S. Navy's RFP for alternative fuel vehicles and GSA's RFI on achieving zero emission vehicles lease rates equivalent to other lease rates. These developments can lead to advances across the government.
- Through the Smart City Challenge, we can determine the opportunities for defining EV deployment in the selected cities.

Question: What do you see the role of government being in developing infrastructure?

- The government can play a role on the policy side and operations side. If the federal government wants to electrify its fleets, it needs to work with the states and engage state DOTs. The federal government also needs to determine a priority order, and progress can be made more easily among large metropolitan statistical areas (MSAs) that have a large federal presence.

Question: Executive orders and chief sustainability officers are vulnerable to politics. How do you plant roots to ensure policies remain?

- The federal government is working to ensure this in three ways:
    - Making sure that these sorts of items are incorporated into the budget, as the budget is prepared two years out.
    - Ensuring a governance mechanism through the Office of Management and Budget (OMB).
    - Being flexible about how sustainability is talked about, and thinking through appropriate messaging for each audience. For instance, the Department of Defense views these issues from an energy resilience point of view.

Making an All-American Public Fleet

Group A: Fuel Savings Guarantee Model

- See *Making an All-American Public Fleet (Fuel Savings Guarantee Model)* case study for more information

- Participants in this group identified several important assumptions that were critical to being able to answer the discussion questions:
    - What are the annual mileage assumptions for all vehicle types?
    - What are the lifetime assumptions for each vehicle type?
    - What restrictions would be in place on the contract?
    - Could a tax credit on biodiesel or EVs be monetized under this structure?
    - How is benchmarking done (this method requires a fuel-use baseline be established)?
    - Who is the purchasing authority?
    - What is the promotional/marketing value of having each vehicle type?
    - Is there counter-party risk?
    - Could this be structured as an off balance sheet transaction?
- Participants in this group identified the following strategies to improve the business case:
    - Restructure the financial mechanism to capture the tax credit
    - Replace the upfront fee with a pay for performance model
    - Capture the value of emissions reductions
    - Capture operations and maintenance savings (not just fuel)
    - Would original equipment manufacturers (OEMs) be interested in financing or deploying a model like this?
- When reporting back out to all attendees, the following were the main outcomes from the group discussion:
    - In order for a fuel savings guarantee model to work, it's crucial to have a good grasp on what the baseline you're working with is, such as the baseline mileage of the fleet.
    - A complicating factor for this model would be if the use or routing of vehicles in the fleet were to be changed.
    - The model has to be structured so that the tax credit can be taken advantage of.
    - The model potentially could be structured as to be off balance sheet, but it would likely be difficult.
    - It would be beneficial if operations and maintenance savings could be captured in the model.

Group B: Fleet Vehicle and Infrastructure Lease Model

- *See Making an All-American Public Fleet (Lease Model) case study for more information*
- Participants in this group discussed the following as the benefits of a lease model:
    - Allows for federal tax credit to be captured
    - Allows for data collection/telematics
    - Fuel infrastructure is maintained by a knowledgeable entity
    - Maintenance is provided
    - Education on driver behavior is provided
- When reporting back out to all attendees, the following were the main outcomes from the group discussion:

- In the fleet vehicle and infrastructure lease model, a third party company maintains ownership of the vehicles, which provides governments with a turnkey solution.
- The company leasing the vehicles can pass along tax credits, and also be responsible for fueling infrastructure and maintenance and operations.
- The model can take the risk out of fuel price differentials and does not require the government to learn a new set of skills.
- The model works well for financing the transition of passenger vehicles to plug-in electric vehicles (PEVs) in the case study, and also for the refuse trucks due to their high mileage and fuel efficiency. The model does not work well for replacing the delivery trucks in the case study.

Group C: Public Benefit Finance Model

- *See Making an All-American Public Fleet (Public Benefit Model) case study for more information*
- Participants in this group identified the following as key partners for this project:
  - Fleet managers
  - Technology providers
  - Public benefit funders
  - Vehicle operators
  - Private fleet partners
  - Service companies
  - Third party finance/purchaser entities
  - Local political groups
  - Utilities
  - Biofuel distributors
- Participants in this group identified the following as key assumptions for this project:
  - Cost of fuel, infrastructure
  - Emission savings
  - Fuel use
  - Incentives
  - Maintenance costs
  - Public availability of infrastructure
  - Public perception/equity
  - Goodness of fit for fuel and vehicle duty cycle
- Participants in this group identified the following as key considerations/discussion points for this project:
  - Greatest emission reductions are from CNG
  - Risk of BEV lasting 10-15 years – fleet is unlikely to hold vehicle for that long
  - Biodiesel credits could go away
  - Vehicle leasing mitigates risk of EVs and allows tax credit to be captured
  - Fuel provider contracts could provide fuel cost certainty
  - Aggregating fleet purchase could lower costs

- Participants in this group identified the following as key public benefits for this project:
    - CNG offers the biggest emissions savings
    - Carbon pricing alone won't make biodiesel make sense
    - Midwest might have more opportunity for grant funding for biofuels
    - Carbon dioxide savings from BEVs matters, but need to lower emissions more
- Participants in this group identified the following as key risk mitigation strategies for this project:
    - Reselling fuel at public station
    - Leasing for BEVs
    - Reusing fuel for other providers
    - Seasonal fuel challenges for biodiesel could require lower blends than B100 to accommodate cold weather performance issues
    - Fleet partnerships (e.g., UPS, FedEx, etc.) to increase station use
- When reporting back out to all attendees, the following were the main outcomes from the group discussion:
    - Under a public benefit finance model, fleets receive funding based on emission savings overall. Emission savings are thus a crucial component for this finance model.
    - The refuse trucks being replaced by CNG trucks in the case study look to be most appropriate for the public benefit finance model.
    - Vehicle leasing would mitigate the cost of the vehicles.
    - The city featured in the case study could join with a city nearby to purchase vehicles together.
    - CNG showed the biggest emission savings over the lifetime of the vehicle.
    - From a public perception perspective, the Midwest would like to promote homegrown fuels, so the biodiesel case could be bolstered by that.

Identify, Develop, and Refine Promising Solutions

Question: In addition to the examples provided by Tyler and Stephanie this morning, are there other case studies that anyone knows about? In the toolkit, should we have that information distilled for state DOTs?

- The toolkit needs to stay focused on what DOTs are doing and what is feasible. The DOTs are responsible for highway right of way, for example. When starting to talk about the private sector, the role of DOTs really can get expanded. Details of how to use federal highway dollars for charging infrastructure has not been discussed.
- STP funds are eligible for these types of projects, though there hasn't been much funding going towards them.
- New expansion projects can provide an opportunity to incorporate EV infrastructure.

- There is a prohibition against commercialization of the right of way (Federal Aid Highway Act of 1956 prohibits commercialization of rest stops on all highways built with funds from the Highway Trust Fund).
- DOTs can get involved in charging corridors.
- The West Coast Electric Highway benefited from amazing leadership from the states involved. DOTs can play a role in the planning realm, but the operations role is different.
- Different agencies lead in different states. In some, the Department of Energy or the Department of Environmental Protection takes the lead on these types of projects. The federal government can provide funding, but cannot be the group on the ground.

Question: What would be a good resource that DOTs could point their colleagues to?

- It would be beneficial to see a basic summary of what each state DOT is doing, i.e. to have a core depository of how the project came about and how it was installed.
- The type of activities discussed at the workshop are within the domain of DOTs. If DOTs stay within their defined span of control, are there missed opportunities to work between agencies?
- The ZEV states have a regional action plan. It would be good to look at that model and see what is working.

Question: In the breakout groups, one issue that emerged is that figures with indirect value, such as convenience store sales, are not readily available. These factors must be entered into models in order to build the business case. What data is most important for DOTs to have in this regard?

- Washington State is getting ready to embark on an infrastructure bank. It would be good to have data that shows preferred distance between stations, how to prioritize corridors, and how to prioritize station locations within those corridors. It would also be helpful to have background on how the assumptions in the case studies were determined.
- The two case studies were developed using a model based on a Cadmus/C2ES developed tool called the EV Charging Financial Analysis Tool and DOE's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool. Both of these models are publicly available.
- It would be good to list the things that a DOT *cannot* do in the toolkit.

Question: What are the key questions that the toolkit needs to answer? What processes or decisions are going to be answered?

- How to evaluate service providers for EV charging. Also, an example of the procurement decision-making process (i.e., sole source vs. competitive) and example contract language.

- It would be good to have information on capital markets, such as at what scale private entities start to get interested. On the fleet side, maybe things have changed now and there may be competitors to Vision Fleet.
- Walk through an exercise on how to pick a rate to charge consumers.
- That would need to be in a calculator form, so states could enter electric rates.
- Identify best practices for selecting technologies for different vehicle duty cycles.

Question: Will the toolkit include information from outside sources?

- The toolkit will include a comprehensive, tailored resource library.
- How about a way to facilitate information in real-time through an exchange platform between parties?
    - The requirements of such an exchange would need to be discussed offline.

Question: The FAST Act includes a provision to designate alternative fuel corridors. What does this mean for DOTs?

- FHWA is working on addressing section 1413 of the FAST Act, regarding alternative fuel corridors. The law itself does not have any funding associated with it. FHWA is considering putting out a federal register notice and soliciting information through the federal highway division offices. FHWA will have to come up with criteria to determine corridor designation. Once a corridor has been designated, it will have priority in terms of getting CMAQ funding. And FHWA will likely do some sort of listening session or webinar as well.
- Are there any thoughts on what the criteria would be?
    - Not yet, first FHWA has to figure out the process of soliciting information. FHWA is looking into how byways were designated, as an example.

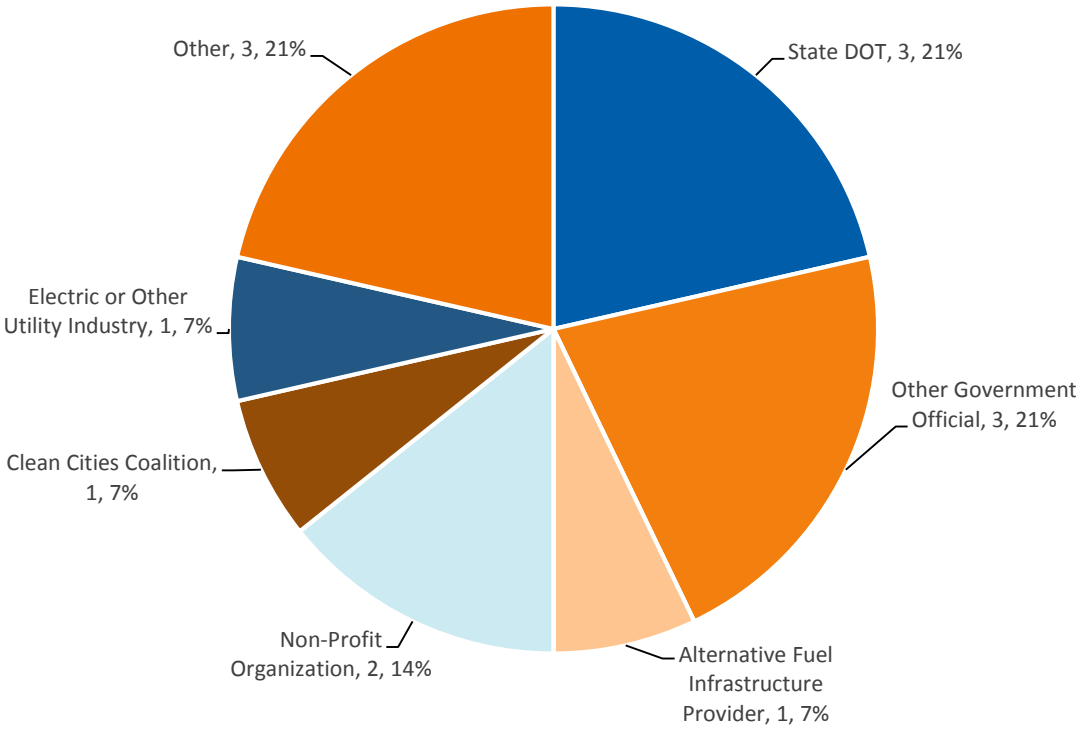
Question: Are there other components of the toolkit that would help transportation agencies?

- It would be helpful to see how state infrastructure banks or TIFIA apply to alternative fuel vehicles.
- It would be great if the toolkit was not all links. It should include things like videos to make it more interesting.

Summary of Workshop Evaluations

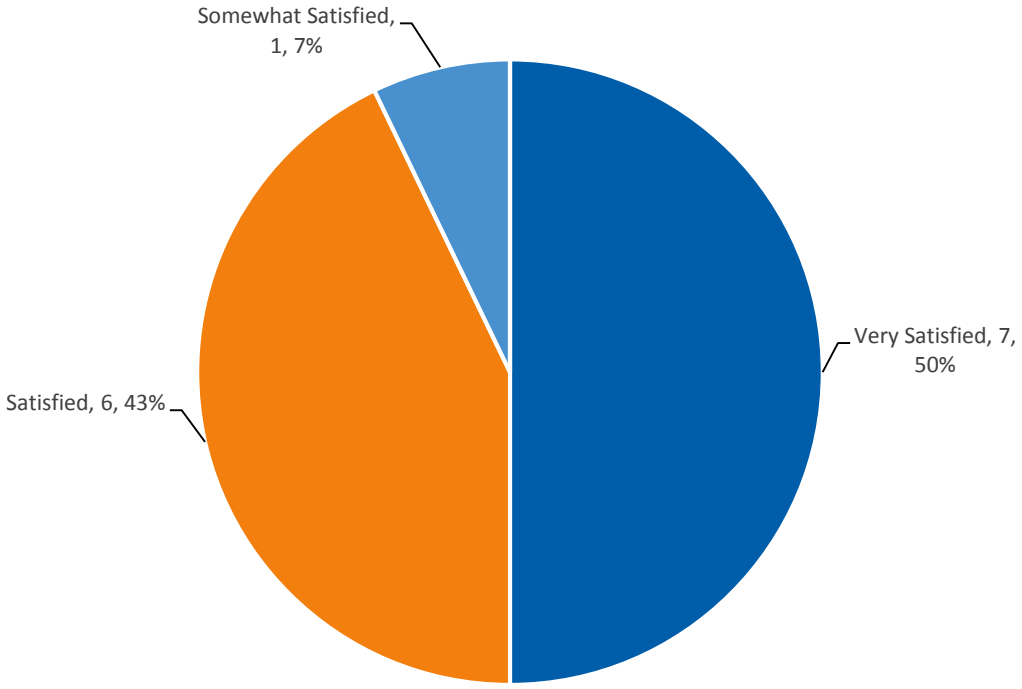
An online survey was distributed to workshop attendees on February 24, 2016. The survey was intended to assess the effectiveness of the workshop, help build the workshop toolkit, as well as inform the development of future workshops. A total of 14 attendees responded, and their answers are summarized below.

Figure 1. What best describes your role in AFV deployment?



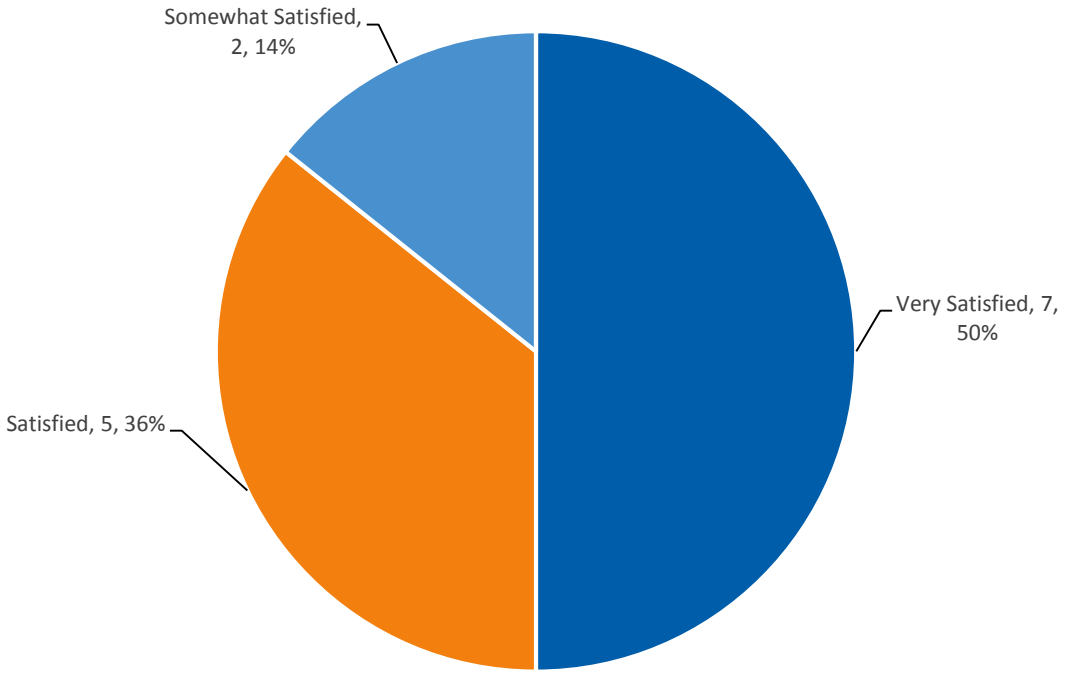
Out of those that responded to the survey, there was an even split between state DOT representatives, other government officials, and "Other." Two of the respondents who selected "Other" indicated they were transportation consultants while one was a boat fleet operator.

Figure 2. How satisfied were you with the overall content and organization of the workshop?



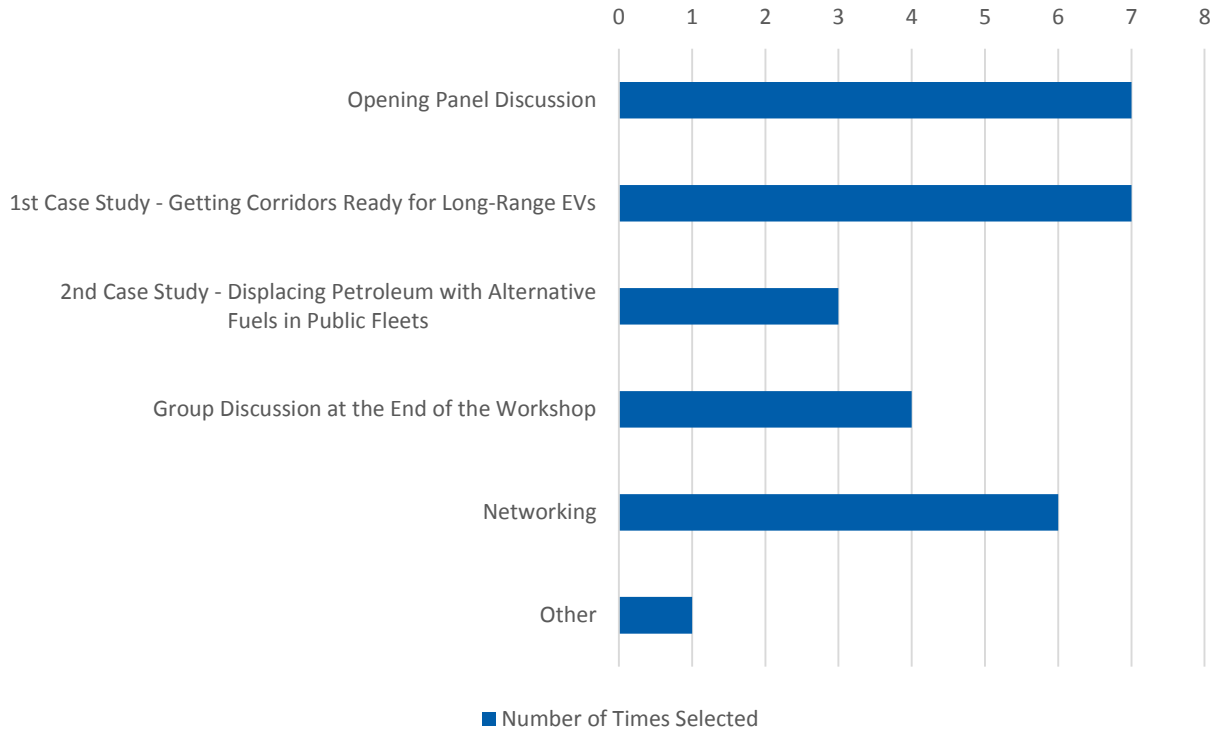
The vast majority of respondents (93%) were either satisfied or very satisfied with the overall content and organization of the workshop. No respondents indicated that they were "Not Satisfied," which would have required further explanation.

Figure 3. How satisfied were you with the use of case studies as a means to learn about innovative finance mechanisms?



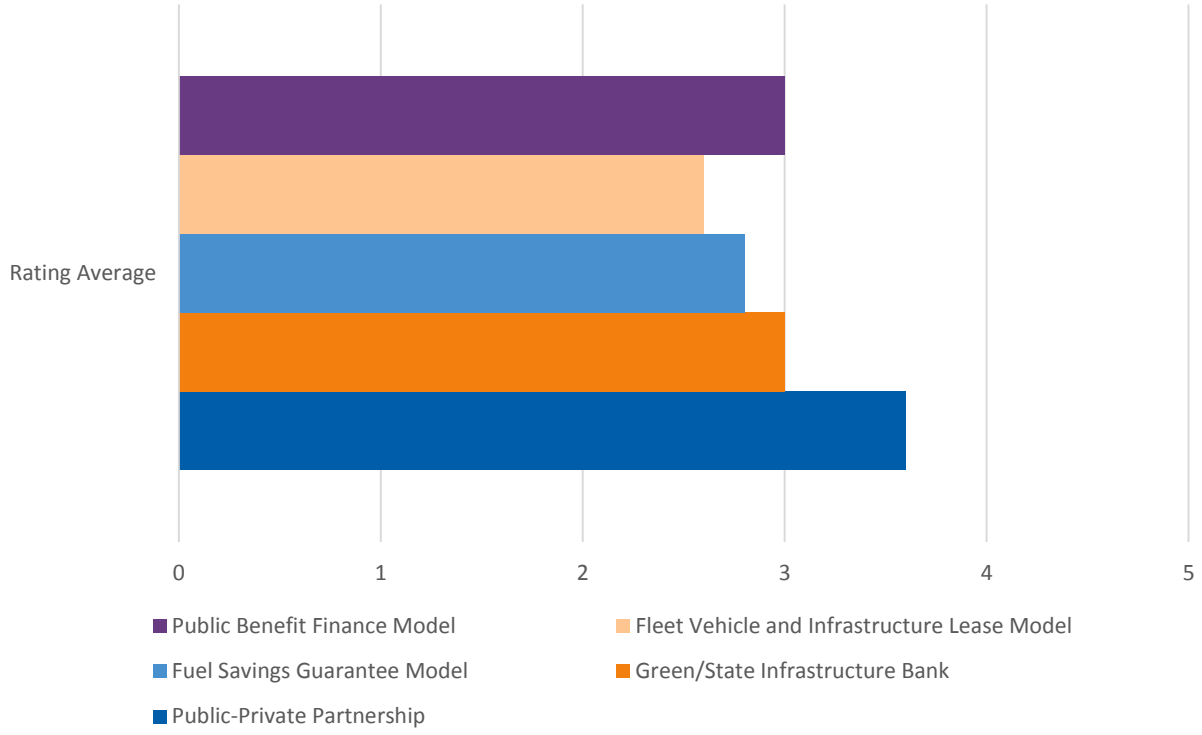
The vast majority of respondents (86%) were either satisfied or very satisfied with the use of case studies to convey the content of the workshop. No respondents indicated that they were "Not Satisfied," which would have required further explanation.

Figure 4. What were the most valuable aspects of the workshop for you?



Survey respondents found the opening panel discussion and the first case study were equally the most valuable portions of the workshop, with networking being a close second choice. The respondent that selected "Other" indicated that all aspects were equally valuable. Respondents were allowed to select more than one answer to this question.

Figure 5. How likely are you to use the following financing strategies in your work to advance AFV deployment?



The question summarized above was targeted at state DOTs to determine which of the financing strategies discussed at the workshop they would be most likely to integrate into their own efforts to accelerate AFV deployment. Respondents were provided with the strategies listed above and asked to rank them on a five-point likeliness scale, ranging from highly unlikely to highly likely. Public-private partnerships emerged as the most likely strategy to be adopted, followed by the public benefit finance model and green/state infrastructure banks. Respondents were allowed to select more than one answer to this question.

The last three questions in the survey were open ended. One of these questions solicited additional ideas for the resource library portion of the workshop toolkit. Two respondents replied with the following suggestions:

1. A list of grants and/or funding streams available in each state for AFV deployment.
2. The Oregon DOT solar highways website (http://www.oregon.gov/ODOT/HWY/OIPP/pages/inn_solarhighway.aspx)

Another question asked for volunteers to "beta" test the online toolkit that results from the workshop. Nine respondents provided their contact information; they will be asked to pilot the toolkit components before they are made public.

The final question allowed respondents to provide additional open-ended feedback on the workshop or future workshops. Four respondents replied with the following comments:

1. Land transport stakeholders should work more closely with maritime transport stakeholders.
2. Allowing participants time to introduce themselves at the beginning of future workshops would help with knowing the audience and networking.
3. The concept of case studies was good yet the variations between the groups didn't really grapple with the distinctions. Having completely different case studies to discuss in each group may have been more productive.
4. There is a need to integrate renewable energy sources with AFV infrastructure.

Appendix I: Workshop Agenda

<table>
<tr><td>8:30 am</td><td colspan="3">Arrival and Registration</td></tr>
<tr><td>9:00 am</td><td colspan="3">Welcome and Introductions
David Kim, FHWA Deputy Administrator
Art James, Oregon Department of Transportation
Mark Sullivan, U.S. Department of Transportation
Jen Brickett, AASHTO</td></tr>
<tr><td>9:30 am</td><td colspan="3">The Role of Public Finance Programs in Encouraging Private Investment in Alternative Fuel Vehicles and Infrastructure
Nick Nigro, Atlas Public Policy
Philip Quebe, The Cadmus Group
Tyler Svitak, American Lung Association in Colorado/Denver Metro Clean Cities Coalition
Stephanie Stuckey Benfield, City of Atlanta Mayor's Office of Sustainability

Moderator: Diane Turchetta, FHWA</td></tr>
<tr><td>10:30 am</td><td colspan="3">Break</td></tr>
<tr><td>10:45 am</td><td colspan="3">Preparing Corridors for Long-Range EVs
Automakers are beginning to offer vehicles with much longer electric ranges, which is increasing the need for an expansive fast charging infrastructure. For this breakout session, participants will explore the role of public finance programs, such as public-private partnerships, green infrastructure banks, energy service companies (ESCOs) for transportation, State Infrastructure Banks, etc., in helping to finance a major corridor project in the Northeast United States. Breakout groups will focus on different market conditions as defined below, and participants will apply innovative financing models, and any additional ideas, to address the market conditions.

Objective: Identify methods to leverage existing public finance programs to electrify a major corridor in the next five years.

Discussion Questions
• Who are the key benefactors of the project and how can a public-private finance program encourage them to participate?
• What deployment barriers can a public-private finance program address?
• What other public programs, incentives, or policies may be needed in order to make the project financially feasible?
• What are the key challenges of using a public-private finance program for a corridor project?</td></tr>
<tr><td></td><td>Group A: Favorable</td><td>Group B: Neutral</td><td>Group C: Challenging</td></tr>
</table>

12:00 pm	**Breakout Groups Report Back to All Attendees** Breakout Groups will report back to all attendees their findings, including lessons learned, major opportunities, or key information gaps.
12:30 pm	**Lunch**
1:30 pm	**Alternative Fuel Vehicle Acquisition in the Federal Government** *Christine Harada,* White House Council on Environmental Quality
1:40 pm	**Making an All-American Public Fleet** The government is a unique vehicle market participant, because it does not require a prompt return on investment and can internalize the public benefits of an investment. On the other hand, the private sector tends to use newer and often financially riskier business models when making capital investments. For this breakout session, participants will explore three business models that could be applied to public fleet projects. **Objective:** Identify promising roles for the private sector in accelerating a public fleet's transition to alternative fuels. *Discussion Questions* • What is the nature of the public-private partners under each given model? • Which barriers do the models help address? • What is the business case/finance case for fleet conversion? What is the net benefit to the public entity? • What conditions make the given model successful? • How does each model impact the state's budget (i.e. is it off-balance sheet)? • Is there a minimum fleet size or a specific vehicle type in which the model makes sense?
	Group A: Fuel Savings Guarantee Model / **Group B: Fleet Vehicle and Infrastructure Lease Model** / **Group C: Public Benefit Finance Model**
2:55 pm	**Breakout Groups Report Back to All Attendees** Breakout Groups will report back to all attendees their findings, including lessons learned, major opportunities, or key information gaps.
3:25 pm	*Break*

3:40 pm	**Identify, Develop, and Refine Promising Solutions** Participants will discuss the most promising solutions raised throughout the day. Following the discussion, the Cadmus Group and Atlas Public Policy will summarize its findings and offer next steps. *Discussion Questions* • What are the key information gaps? • Why aren't these ideas already happening? • How can the success/failure of the financing mechanisms we discussed be best monitored over time? • What are the good practices for applying each of the financing mechanisms we discussed?
4:40 pm	**Adjourn**

Appendix II: Workshop Participant List

*Not in Attendance

First Name	Last Name	Affiliation	Title
Stephanie	Benfield	Mayor's Office of Sustainability, City of Atlanta	Director
Susan	Binder	Cambridge Systematics, Inc.	Senior Associate
Linda	Bluestein*	U.S. Department of Energy/EERE	Clean Cities Co-Director
Jennifer	Brickett	AASHTO	Director, BATIC Institute
Anthony	Buckley	Washington State Department of Transportation	Director of Innovative Partnerships
Tonia	Buell	Washington State Department of Transportation	Project Development Manager
Gina	Campoli	Vermont Agency of Transportation	Environmental Policy Manager
Mauricio	Castro*	4Staff	Grants Administration
H. Clayton	Cook Jr.*	Cook Maritime Finance	Attorney & Counselor at Law
Jennifer	de Tapia*	Trillium CNG	Director of Market Development
Peter	Devlin	U.S. Department Of Energy	Market Transformation Manager, Fuel Cell Technology
Andrew	Dick	Oregon Department of Transportation	CAEV Program Advisor
Corey	Ershow	U.S. Department Of Energy	Senior Advisor
Thomas C.	Escher	Red and White Fleet	CEO
Nicholas	Farber	Colorado Department of Transportation	HPTE Operations Manager
Sandy	Fazeli*	National Association of State Energy Officials	Senior Program Director
Damon	Fordham	Cadmus	Principal
Alycia	Gilde	CALSTART	Northeast Regional Director
Matthew	Goetz	Georgetown Climate Center	Institute Associate
Sharon	Greene*	HDR	Global Director of Finance
Richard	Hanley	Connecticut Department of Transportation	Transportation Engineer
Christine	Harada	White House Council on Environmental Quality	Federal Chief Sustainability Officer
Sven	Hodges	White House Council on Environmental Quality	Deputy Associate Director for Clean Energy Finance
Bert	Hunter	Connecticut Green Bank	CIO
Art	James	Oregon Department of Transportation	Senior Project Executive, Office of Innovative Par
David	Kiley*	Piper Jaffray	Senior Vice President
Wayne	Killen	Audi of America	General Manager, EV Architect
David	Kim	U.S. Department of Transportation, FHWA	FHWA Deputy Administrator

First Name	Last Name	Affiliation	Title
David	Klinges	Piper Jaffray	Managing Director
TJ	Lamers*	McMAHON	Program Manager
Oana	Leahu-Aluas	Cadmus	Research Analyst
Matt	Macunas	Connecticut Green Bank	Legislative Liaison and Marketing Manager
Charlie	Maynard	HySky Technologies, Inc.	CEO
Susan	McSherry	New York City Department of Transportation	Program Manager
Kevin	Miller	ChargePoint	Director, Government Relations
Geoff	Morrison	Cadmus	Associate
Dr. Michael	Nicholas	Institute of Transportation Studies, UC Davis	Professional Researcher, PH&EV Research Center
Nick	Nigro	Atlas Public Policy	Founder
Stacy	Noblet	ICF International	Senior Manager
Dalton	Pratt	Texas Department of Transportation	Director, Fleet Operations Division
Philip	Quebe	Cadmus	Senior Associate
Kathy	Ruffalo*	Ruffalo and Associates, LLC	President
Vivek	Sakhrani	CPCS	Senior Consultant
Mike	Scarpino	U.S. Department of Transportation, Volpe Center	Transportation Project Engineer
Jeramy	Shays	American Council On Renewable Energy	Director of Transportation
Ann	Shikany	U.S. Department of Transportation	Associate Director, BATIC
Mark	Sullivan	U.S. Department of Transportation, FHWA	Strategic Delivery Team Leader
Tyler	Svitak	American Lung Association in Colorado	Director of Air Quality and Transportation
Diane	Turchetta	U.S. Department of Transportation, FHWA	Transportation Specialist
Alexander	Walsh	Edison Electric Institute	Analyst
Emma	Weaver*	University of Maryland, College Park	Graduate Research Assistant
Eric	Weaver	U.S. Department of Transportation, FHWA	Highway Research Engineer
Leo	Wetula*	U.S. Department of Transportation, FRA	Program Manager
Andrew	Wishnia	U.S. Department of Transportation, FHWA	Special Assistant for Policy to the Administrator
Michael	Yu*	Connecticut Green Bank	Senior Manager, Clean Energy Finance
Kathryn	Zyla	Georgetown Climate Center	Deputy Director