EAST TENNESSEE CLEAN FUELS

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# Shelby County Roads, Bridges, and Engineering Department Fleet Electrification Case Study

East Tennessee Clean Fuels Coalition

Spring 2024

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## Top-Level Summary

In 2020, the Memphis and Shelby County Office of Sustainability and Resilience (OSR) won a grant to purchase several light- and medium-duty (LD and MD, respectively) electric and hybrid vehicles as replacements for older gasoline vehicles within the Shelby County Roads, Bridges, and Engineering (RBE) Department. As a result of the grant, the OSR has been able to purchase and implement one Lion6 electric truck, four Ford F-150 Lightning trucks, one DC Fast Charging unit, and one Level 2 charging unit, with additional charging infrastructure being installed within the next few months.

*In late 2022, the Roads and Bridges Department received its lone MD EV, a Lion6 electric truck to be used for collecting tires and received vehicle training from Lion Electric that same day. Shown above (at left) are officials with the OSR (within the Memphis and Shelby County Division of Planning & Development) with the Lion6 and the new DC fast charging equipment that was installed to refuel the truck. At right are Shelby County Roads and Bridges Department officials receiving training from the Lion Electric representative.*

## Narrative

As a result of the 2020 Memphis Area Climate Action Plan (an integral part of the City's Develop 901 initiative), members of the Memphis and Shelby County OSR began working on a grant application that would allow the Roads, Bridges, and Engineering Department to purchase several LD and MD electric and hybrid electric vehicles as replacements for older vehicles. The proposal, titled "Advancing Climate and Innovation Goals of Memphis and Shelby County: Electrification of Key Fleet Vehicles to Capture Cost Savings and Climate Benefits," was submitted to the Department of Energy's Office of Energy Efficiency and Renewable Energy (DOE-EERE) Vehicle Technologies Office as part of a 2020 Funding Opportunity, and in early 2021, the department was awarded funding for the

project! Around that same time, the department was experiencing some staff turnover and a new municipal planner – Leigh Huffman – was brought in and put in charge of the project. Additionally, it should be noted that COVID did impact project timelines and expectations, causing some delays in procurement.
For multiple reasons, acquiring the vehicles stipulated as part of the proposal proved difficult as the project started. As a result, Huffman was able to work with DOE to update the vehicle choices to support more all-electric vehicle purchases and remove the hybrids (as that is what DOE preferred and, at that point, what the project leadership team wanted to do as well). After a fair amount of considering several different replacement EVs, the project team's efforts led to the purchase of four Ford F-150 Lightnings, all acquired through Lonnie Cobb Ford, a fleet dealership in Jackson, Tennessee (this dealership has pricing for several Ford EVs that were/are on the statewide contract). The Lightnings were purchased to replace older internal combustion engine trucks like Chevrolet Silverado, Dodge Ram 1500s, and Ford F-150s, which perform several different jobs for the Department. The team experienced further delays when the Lightnings were approved in July 2022 but did not arrive until November 2023. However, this was caused by a combination of general supply chain issues as well as the United Auto Workers (UAW) strike that occurred in 2023. The Lightnings are currently being used for general transportation to meetings or worksites, with some of the trucks provided specifically to more EV-aware staff to let them have some of the first experiences with the new electric trucks.

Regarding medium-duty (MD) vehicle replacements, the department was interested in replacing a gasoline-powered Ford F-350 tire truck used to pick up abandoned tires throughout Shelby County and haul them to processing locations. After doing some research, Huffman was able to find and acquire (and in a strange twist, relatively quickly) a Lion6 electric truck in a stake-body setup, which was also one of the first MD EVs in the state. (As can be seen in the photo at right, a "stake body" essentially has a flatbed with open paneling around the outside to hold larger objects in the back.) As noted above, a rep from Lion Electric attended their unveiling event and trained the potential drivers and maintenance workers on some of the vehicle's components and "How-to's." Basic triage maintenance while on the road and general vehicle safety (including how to identify the high-voltage wiring) were covered, and more in-depth training focusing on procedures related to vehicle operations, towing, and safety, particularly around the electrical system occurred later. Due to the nature of the truck's use – collecting discarded tires that have been illegally dumped on the side of the road throughout the entire county – there is no set route for the vehicle. However, once the department is able to hire a dedicated driver, the truck will have a set schedule to run on.

As part of the future fleet electrification build-out of the Division of Planning and Development's inspector vehicles, the OSR installed two DC Fast Charging stations to support the transition before installing anything at the RBE fleet location. When the Lion6 arrived ahead of schedule, the OSR and Division of Planning and Development agreed to allow the truck to charge at the new Blink DC Fast Charging units while waiting for the dedicated fleet infrastructure to be installed. The plan is to install three Level 2 chargers and one additional Fast Charger at the main offices of the Roads, Bridges, and Engineering Department, which is responsible for

operating and maintaining the vehicles. This setup will allow the truck (and future MD/HD vehicles) access to a dedicated, parallel parking spot to charge in when needed.

Future forecasting for the fleet is tied to Shelby County's Green Fleet Ordinance that went into effect in March 2023. This ordinance sets guidelines for fleet vehicle purchases, stating that a percentage of all new vehicles purchased will be hybrid or electric (2027: 5%; 2028: 50%; 2033: 100%). This only affects LD vehicles, so the Department will focus the majority of its efforts on replacing these vehicles. For MD and HD vehicle replacements, this will likely result in additional conversations with other interested county departments to get a sense of what they would be using the vehicle for and if their needs would be met with an EV option.

## Outputs & Outcomes

Shelby County is Tennessee's largest and most populous county (United States Census Bureau). According to the American Lung Association's 2023 State of the Air, over 10% of Shelby County's population suffers from Asthma (American Lung Association), with over one-quarter of those being pediatric asthma cases. As the county (and subsequently, the city of Memphis) work toward transportation electrification, the output of a reduction in criteria pollutants (e.g., nitrogen oxides, particulate matter) from the use of these new EVs will translate into an outcome via the health benefits for area residents, especially those at risk of developing or worsening asthma symptoms (more information on the links between air pollution and childhood asthma is available on this EPA page). Another output is a reduction in the amount of Greenhouse Gas (GHG) emissions generated by the EV fleet, which helps progress towards the Climate Action Plan. The outcome is that the local government in the area will do its part to reduce GHG emissions in the area, and physical examples will be shown to other members of the community – both fleet and individual – to help drive even greater emissions reductions.

On the GHG-reductions side, and due to the relatively easy calculations, the older F-350 gasoline tire truck emits the following carbon dioxide based on these numbers:

- ✓ 105,000 lifetime miles on the 2006 F-350, that is now 17 years old = X
- ✓ An assumed 12.62 miles/gallon as the fuel economy of the old truck (link) = Y
- ✓ 19.6 pounds of CO2 are emitted for every gallon of gasoline burned = Z

$$\frac{(X \text{ miles/life} * Z \text{ pounds } CO_2/\text{gas gallon})}{Y \text{ miles/gallon}} = \frac{163{,}074 \text{ pounds } CO_2}{\text{vehicle life}} \text{ (which equals 81+ tons } CO_2)$$

In the TVA region, nearly 60% of their electricity production is carbon-free (e.g., nuclear, hydro, solar), and since 1995 TVA has reduced its total GHG emissions produced from all of its electric power plants from over 114 million tons in 1995 to just under 45 tons in 2022 – a 60% reduction in total GHG emissions. Using TVA's current generation grid mix and multiple analyses on gasoline versus electric vehicles from the East Tennessee Clean Fuels Coalition, this will likely equate to a 50-60% reduction in the lifetime GHG emissions from that truck… or roughly 75,000 pounds CO2 eliminated.

## Best Practices & Lessons Learned

An interesting aspect of the Lion6 is that its ground clearance is several inches less than the truck it replaced, making it difficult for the truck to access some of the more rural areas covered in the route. As a result, the Roads, Bridges, and Engineering Department has had to reevaluate the areas the truck could go to and keep an older vehicle in the fleet to cover the areas the Lion could not go. The project team learned that depending on what type of service a vehicle may handle, be sure to check some of the things that might be considered uncommon facets of a new MD/HD EV to ensure that it can do the full job of the old one (a one-for-one swap). It is also important to factor in supply chain delays when implementing EVs, as projects can sometimes be delayed several years due to the inability to procure the desired vehicle.

## Conclusions

Though the process toward transportation electrification has not been seamless, the Memphis and Shelby County Office of Sustainability and Resilience is committed to continuing to support further implementation of EVs into the county's fleets. They are also uniquely poised to provide insight for other departments transitioning to EVs to ensure successful future deployments. Additionally, the OSR has the opportunity to lead the charge for making significant impacts on the air quality in the area by reducing the number of gasoline – and one day diesel – vehicles on the road, thus improving the quality of life for many area residents.