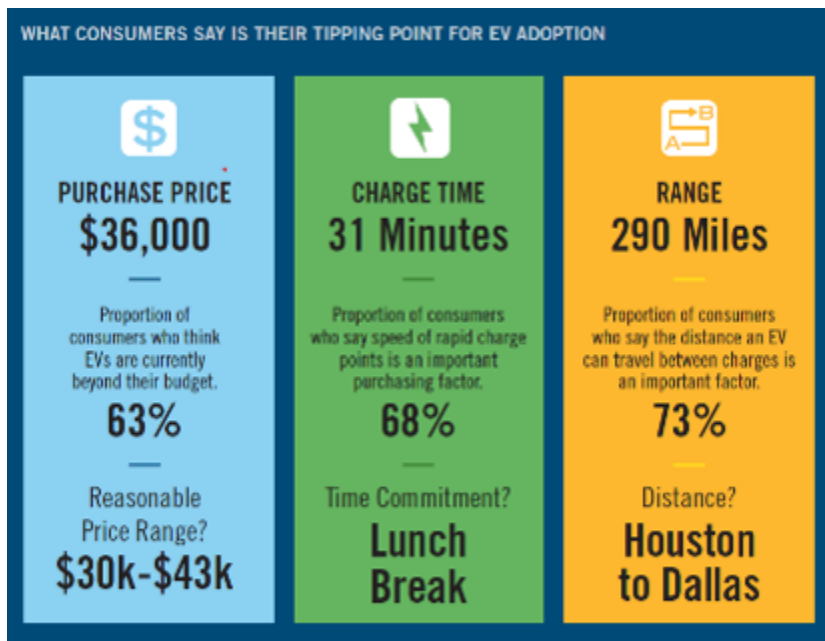


Responses on Behalf of the MSU EcoCAR EV Challenge Team and Other Research Engineers at CAVS

What are the main challenges for EV adoption in rural communities?

- Range anxiety – From Figure 1, most consumers want to be able to travel 290 miles on a full charge
- Vehicle cost – From Figure 1, most consumers think \$30k-\$43k is a reasonable price range
- Charging time/cost – From Figure 1, most consumers think a reasonable charging time is 31 minutes
- Limited vehicle choices
- Batteries
 - lifetime
 - disposal
 - cost of replacements



Source: Gaston EV Survey, 2020

Figure 1: What Consumers Say is Their Tipping Point for EV Adoption [1]

[1]

<https://www.cobank.com/knowledge-exchange/power-energy-and-water/co-op-evolution-bridging-the-rural-urban-divide-on-ev-adoption>

It is important to note that these main challenges are being addressed with both public and private resources and there are many technical advances taking place in these areas.

- o *Infrastructure Investment and Jobs Act (addressing range anxiety and charging times)*
 - MS is receiving \$51M over 5 years to support the expansion of an EV charging network in the state
 - Money can only be spent on EV fast chargers along FHWA-designated EV charging corridors
 - MDOT has established EV Charging Corridors (I-10, I-20, I-22, I-59, I-55, I-69, I-269) (pending)
 - One requirement for an EV Corridor designation, no greater than 50 miles between one station and the next on the corridor, and no greater than 5 miles off the highway
 - “The Mississippi Department of Transportation (MDOT) is developing a plan to ensure all Mississippians and visitors have access to the Electric Vehicle (EV) charging infrastructure with a focus on the connectivity of rural and urban areas.” [2]
- o *EVs in the news in the Southeast (addressing vehicle choices, costs, and batteries)*

**This is by no means meant to endorse particular vehicles nor is this an all-inclusive list for the Southeast, plus there is a lot of news regarding battery plants and new technologies that are not included in this list.*

***Many companies have targeted EV sales by 2025-2030, but those numbers change, so you may want to pull their latest news releases on that*

 - **Nissan [3]**
 - Announced that they will be manufacturing 2 all-new, all-electric models at MS assembly plant in Canton, MS
 - Investing millions to transform Canton assembly plant to build all-new Nissan and Infiniti EV models starting in 2025
 - **Ford [4]**
 - Locating its EV (F-150 Lightning) and battery manufacturing plant in West TN
 - Range of ~240 miles on full battery charge
 - Bi-directional charging that could restore home power for several days
 - **GM [5]**
 - Spring Hill, TN assembly plant will be dedicated to EV production
 - **Rivian [6]**
 - Produces EV trucks
 - Building its second production plant just outside of Atlanta, Georgia

[2] https://mdot.ms.gov/portal/electric_vehicle_charging_infrastructure

[3]

<https://usa.nissannews.com/en-US/releases/release-ea2ada92a067df51a78ce3a3b211f2d6-nissan-to-build-two-all-new-all-electric-models-at-mississippi-assembly-plant>

[4]

<https://media.ford.com/content/fordmedia/fna/us/en/products/evs/all-electric-f-150-lightning/all-electric-f-150-lightning.html>

[5] <https://www.gm.com/electric-vehicles>

[6] <https://rivian.com/>

What is the estimated job impact from EVs in the Southeast?

This will result in the employment of hundreds to thousands of people in the Southeast, at the assembly plants, and across the supply chain. New jobs will also be created in the service and aftermarket areas. This will also require us to train automotive technicians with new skills.

What role do you think local educational institutions, like universities and technical schools, can play in preparing the workforce for the electric vehicle industry in Mississippi?

Institutions such as Mississippi State University provide the highest caliber instruction in areas such as electrical and mechanical engineering, chemistry, industrial engineering, physics, math, communications, marketing, business, etc. These institutions also provide students with connections to work at automotive companies that are developing EVs.

However, nothing beats a world-class, hands-on competition to train students and give them experiences not possible in traditional classroom settings. International competitions such as the EcoCAR EV Challenge give the Mississippi State University team's students a phenomenal experience working with EVs. There are 15 universities in the US and Canada competing in the challenge [7], which has headline sponsors General Motors (GM), MathWorks, and the U.S. Department of Energy. They work with a state-of-the-art EV (the Cadillac LYRIQ), designing, implementing, integrating, and testing electric propulsion systems as well as several complex autonomy tasks such as Eco-Cooperative Adaptive Cruise Control, Lane Centering, Parking Assist, and Intersection Navigation.

Team members are advised by experts from industry and government, to perform hands-on work on the vehicles, learn procedures and techniques used in industry, and sharpen their technical written and oral communication skills. This is truly a multidisciplinary effort involving electrical, mechanical, industrial, and computer science engineering. Furthermore, we have communications, marketing, and business majors who help the team with outreach, social media campaigns, and Diversity, Equity, and Inclusion (DEI) events. This competition is designed to bring up the next generation of automotive engineers, communications personnel, and DEI professionals. Many of the students intern over the summer with companies such as GM, dSpace, PACCAR, NXP Semiconductor, and Argonne Labs, to name a few, and gain valuable experience.

[7]

<https://www.energy.gov/articles/doe-announces-15-universities-selected-ecocar-electric-vehicle-challenge>

It is also important to note that researchers at the Center for Advanced Vehicular Systems (CAVS) are part of several regional collaborations and proposal efforts focusing on EVs and the future of mobility in the Southeast. These efforts will support developments for the entire ecosystem from the supply chain, workforce, disposal/end of life of key components, advancements in technologies of key components, and consumer support and outreach, just to name a few.

CAVS is also researching technologies that have been enabled by EVs such as connected and autonomous vehicles. These connected and autonomous* vehicles typically have enhanced sensors which result in improved road safety. This is enabled due to the onboard power available with EVs.

*Note that autonomous does not necessarily mean fully self-driving vehicles. There are different levels of autonomy with the lower level ones available in many combustion engine vehicles on the road today such as lane keeping, adaptive cruise control, automatic parking, blind spot awareness, pedestrian awareness, etc.

Can there still be emissions from EVs?

It is true that there are no tailpipe emissions with the EV, but the electricity to charge the vehicle still has to be produced. The mix of sources of power available from the grid impact how environmentally friendly the electric vehicle actually is. In some areas of the country, where renewables make up a larger percentage of the power sources on the electrical grid - the environmental benefits are much higher than in other areas of the country. EVs also have a large battery pack that must be manufactured and recycled/disposed of at the end of battery life which may be an environmental impact.

Why are the prices for EVs so steep right now?

Some EVs are being introduced at lower price points, however, overall the median price for EVs is higher than for traditional combustion engine vehicles.

It is also important to note that as more people have EVs, there could be a higher demand for electricity from the grid, which will possibly lead to increased prices. Furthermore, too much load by people charging their EVs at night at home could increase rates during that period also.

What's the future of EVs?

We think most people want a reliable vehicle at a reasonable cost. Currently, most EVs are expensive and there are too few charging stations. However, these constraints are being addressed with major investments going on around the world by both private and public sectors.

New research is emerging which holds great promise – e.g., faster more efficient charging stations, and enhanced battery designs with longer durations. Electric vehicles are here and will increasingly be part of the future mix of types of vehicles, and we want Mississippi to be well-represented and educated on EVs.