

# Advancing Sustainable Transportation in America Through Electric Vehicles - A Case Study of Mississippi

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## Abstract

This research paper focuses on advancing sustainable transportation in Mississippi by adopting and integrating electric vehicles (EVs). It explores opportunities for state policymakers to support the growth of electric vehicles by offering incentives, expanding charging infrastructure, and promoting renewable energy sources such as solar and wind to power sustainable transport options. The study also addresses the critical need for safe disposal and recycling of electric vehicle batteries and existing fossil fuel-powered vehicles to ensure environmental sustainability. The paper provides a strategic framework for policymakers, leveraging existing federal incentives under the Inflation Reduction Act (IRA) and proposing additional incentives at the state level to encourage a shift towards increased adoption of electric vehicles in Mississippi.

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## 1. Introduction

Concerns are growing continually over climate change and the critical need to reduce greenhouse gas emissions. The transportation sector has been identified as responsible for a significant portion of these emissions and has come under scrutiny. Electric vehicles (EVs) have emerged as a practical solution to decarbonize the transportation sector. However, the adoption of EVs differs widely across the United States, with states like Mississippi lagging far behind due to the lack of incentives and infrastructure. This study investigates the barriers to Electric Vehicle adoption in Mississippi and proposes plans to enhance the state's sustainable transportation initiatives.

### 1.1 Background of the Study

The transportation sector accounts for approximately 29% of all U.S. greenhouse gas emissions; the majority coming from the burning of fossil fuels for trucks, trains, cars, planes, and ships. The shift from internal combustion engine vehicles to electric vehicles is seen as a necessary step towards reducing these emissions. Notwithstanding federal incentives available under the Inflation Reduction Act (IRA), Mississippi has not been as receptive to adopting electric vehicles. As of 2023, the state had fewer than 1,000 registered electric vehicles, one of the lowest rates in the country.

This slow adoption can be ascribable to a myriad of factors, including limited public awareness, a lack of state-level incentives, and insufficient charging infrastructure. This paper explores these potential blockers and offers a roadmap for policymakers to fast-track the transition to electric vehicles in Mississippi.

### 1.1.1 Purpose

The purpose of this study is to analyze the adoption and impact of electric vehicles in Mississippi and to provide recommendations for advancing sustainable transportation, highlight how the state can leverage existing federal tax credits, and introduce additional state-level incentives to encourage the shift towards electric vehicles. Additionally, it seeks to promote sustainable transportation policies that support the economic, social, and environmental well-being of Mississippi, ensuring that the state does not lag in the national push toward sustainability. This approach is in alignment with the United Nations Sustainable Development Goals (SDGs), those related to affordable and clean energy (SDG 7), sustainable cities and communities (SDG 11), and climate action (SDG 13).

### 1.1.2 Design/Methodology/Approach

#### 1.1.2.1 Research Design

This research has adopted a mixed-method approach, combining both qualitative and quantitative data collection techniques. The study includes a comprehensive review of existing literature on electric vehicle adoption and sustainable transportation, as well as primary data collection through surveys.

#### 1.1.2.2 Sample Selection

The target population for this study includes transportation policymakers, environmental experts, and potential electric vehicle users (in retail, healthcare, hospitality, education, construction, manufacturing, and agriculture) in Mississippi. A sample of 100 respondents was selected through purposive sampling to ensure the inclusion of individuals with relevant knowledge and experience in the transportation and environmental sectors.

#### 1.1.2.3 Current State of Transportation in Mississippi

Electric vehicle (EV) adoption in Mississippi is growing, but it is still far behind some other states in the U.S. As of recent data, Mississippi has about 1,300 all-electric vehicles and 1,100 plug-in hybrid electric vehicles registered. This indicates a modest but notable presence of EVs compared to traditional gasoline-powered vehicles in the state (Visual Capitalist, Alternative Fuels Data Centre)

Public transportation usage in Mississippi is relatively low in comparison to other states, reflecting the state's heavy reliance on personal vehicles. Data from the U.S. Department of Transportation shows that, like some of the rural and suburban areas, most of the commuting and travel within Mississippi is conducted via private cars, while public transit accounts for a small portion of overall travel. Key urban areas like Jackson and Gulfport have many public transit options, including buses, but usage rates remain low due to factors such as service coverage, frequency, and overall convenience compared to personal vehicle travel.

Furthermore, Mississippi's public transportation infrastructure is not as extensive as in more densely populated states, leading to a heavier reliance on personal cars for commuting and other travel needs. This is consistent with the state's broader transportation profile, which emphasizes road and highway travel over public transit options (Mississippi Public Transit Association, BTS.gov).

These findings are integral when considering the role of electric vehicles (EVs) in advancing sustainable transportation in Mississippi. The limited public transportation infrastructure presents a unique opportunity for EV adoption as an alternative sustainable transportation solution, potentially reducing carbon emissions from the state's significant number of private vehicles. Understanding these patterns will be essential when assessing how EVs can fit into the broader transportation landscape in Mississippi.

Mississippi's transportation sector heavily relies on internal combustion engine vehicles, resulting in substantial fuel consumption and emissions. The state consumes approximately 2.5 billion gallons of gasoline and over 1 billion gallons of diesel annually. This high fuel usage contributes significantly to Mississippi's carbon emissions, which total more than 50 million metric tons of CO<sub>2</sub> annually, with per capita emissions exceeding the national average (Energy Info EIA). Transitioning to electric vehicles (EVs) could play a crucial role in reducing these emissions and advancing sustainable transportation in Mississippi.

#### 1.1.2.4 Infrastructure for Electric Vehicles

Mississippi currently has about fifty electric vehicle (EV) charging stations, mainly located in urban areas and along major highways. The state's efforts to expand this network are supported by the National Electric Vehicle Infrastructure (NEVI) Formula Program, which aims to install charging stations every fifty miles along key transportation routes, including major interstates. These initiatives are designed to improve access to charging facilities and support the increasing adoption of electric vehicles in the state (EV Gas, ChargeHub).

State and local policies that relate to the adoption of the use of Electric Vehicles vary widely across the U.S., as each state designs incentives and regulations to fit its unique transportation systems and environmental, and economic goals. The U.S. federal government provides a tax credit for Electric Vehicle buyers. As of 2023, this can be up to \$7,500, depending on the vehicle's battery capacity and the automaker's qualification.

State and local policies play a vital role in influencing or hindering EV adoption. While most areas are promoting the use of Electric Vehicles through tax incentives, rebates, and infrastructure expansion, many are balancing these efforts with measures aimed at offsetting lost revenues from traditional fuel sources. For a sustainable approach to adoption, a balance between incentives, regulatory frameworks, and infrastructure development is necessary Patel, S. (2021).

Federal policies have a great influence on Mississippi's transportation landscape, particularly when it comes to sustainable transportation initiatives like electric vehicles, public transit, and clean energy projects. The state can avail itself of numerous federal grants, tax incentives, and funding opportunities, boosting the development of sustainable transportation infrastructure. Under the Infrastructure Investment and Jobs Act (IIJA), Mississippi is set to receive \$51.5 million over five years to expand its electric vehicle charging network. The NEVI program focuses on developing Electric Vehicle charging stations along highways, in rural and underserved areas. This initiative will help reduce "range anxiety" by ensuring drivers in Mississippi can access reliable charging infrastructure for their electric vehicles.

The CMAQ program makes provision of federal funds to states and municipalities to help decrease traffic congestion and improve air quality. Mississippi qualifies to receive CMAQ funding for ventures related to alternative transportation, including Electric Vehicle infrastructure, public transportation, and bicycle lanes. These funds help combat transportation-related emissions, which are a major contributor to air pollution.

The Federal Transit Administration offers grants via the Low or No Emission Vehicle Program. This program offers funding to transit agencies to buy electric or hydrogen-powered buses and develop charging infrastructure that is associated with them. Mississippi transit agencies, which include those in larger cities like Jackson and Gulfport, are qualified for these grants.

Under the Bipartisan Infrastructure Law, the Clean School Bus Program provides \$5 billion over five years to encourage the transition of diesel-powered school buses to electric or low-emission alternatives. Mississippi's school districts can apply for these funds, to reduce children's exposure to diesel exhaust. The relative benefits of electric vehicles are heavily dependent on diesel fuel price, travel demand, electric drive battery replacement and price, electricity generation and transmission efficiency, electric truck recharging infrastructure, and the cost of purchase • (Feng, W., Figliozzi, M. A., & Zmud, J. (2021)

As part of wider efforts to back rural communities, the federal government offers grants that specifically target sustainable transportation development in areas that are less densely populated. Programs like the Rural Surface Transportation Grant Program and the Rural EV Charging Grant Program seek to provide underserved regions with the infrastructure needed for modern transportation systems. With much of the state being rural, Mississippi is positioned to benefit from these programs, which will help ensure that rural areas are not left behind in the transition to cleaner transportation. These grants will help build the infrastructure needed for EVs and promote accessibility in all regions.

#### 1.1.2.5 Barriers to Electric Vehicle Adoption in Mississippi

Electric vehicles sometimes come with a higher upfront price in comparison to traditional vehicles, a primary reason is the cost of batteries and limited economies of scale. In Mississippi, where the median household income is below the national average, this cost difference most likely is a major deterrent. Although Mississippi currently lacks state-specific tax credits for Electric vehicle purchases, introducing such state incentives could make them a bit more affordable for residents. (Some neighbouring states offer rebates and tax credits to offset the cost of purchase).

The total cost of ownership of electric vehicles in Mississippi comprises several components: cost of purchase, fuel (electricity), maintenance, registration fees, and available incentives. While electric vehicles have a higher upfront cost than gasoline vehicles, the federal tax credit of up to \$7,500 helps reduce this. Mississippi's electricity rates are lower than the national average, making it cheaper to charge Electric Vehicles—about \$500 per year compared to higher gasoline costs. Maintenance for Electric Vehicles is also lower, around \$500 annually, as they have fewer moving parts and do not need services like oil changes. However, the state does not offer additional rebates or incentives, and the owners must pay an annual registration fee of \$150 to compensate for lost gas tax revenue.

Over five years, an electric vehicle like the Tesla Model 3 could cost around \$45,750, including charging, maintenance, and fees. This compares favorably to a traditional gasoline vehicle, which could cost over \$55,000 due to higher fuel and maintenance costs. While depreciation rates for Electric Vehicles are slightly faster, the long-term savings on fuel and maintenance make them a cheaper choice over time.

To summarize this, although Mississippi lacks state-specific incentives, the low electricity rates and federal tax credit make electric vehicles an attractive preference. The total cost of ownership is lower overall due to reduced fuel and maintenance costs, despite the higher upfront purchase cost and registration fees. For cost-conscious consumers, these long-term savings can be attractive, but the higher initial cost of an electric vehicle may still eclipse these benefits for lower-income buyers, especially if the financing options is limited.

The average income in a Mississippi household is lower than the national average, making the higher upfront cost a significant blocker for many residents. Even with the federal tax credit of up to \$7,500, many lower- and middle-income households may find the initial expense unaffordable. While Electric Vehicles typically offer long-term savings through lower fuel and maintenance costs, these potential savings may not be a good enough reason to justify the purchase for families struggling with immediate financial concerns. In many cases, the availability of cheaper, used options could offer a solution but the used Electric Vehicle market in Mississippi is quite underdeveloped, and lower-income buyers might find limited options.

If the loan terms or incentives are favorable, this could make accessibility easier for lower-income buyers, but residents with limited credit history may struggle to obtain such loans. Mississippi's financial institutions, including credit unions and community banks, can play a role by offering specialized loans with lower interest rates or more favorable terms. Leasing could also provide a more affordable option, reducing upfront costs and offering flexibility. However, the availability of leasing options, particularly in rural areas, is limited, which reduces accessibility.

Presently, Mississippi does not offer state-specific incentives or rebates for purchasing electric vehicles, which worsens the affordability challenge. In other states, such incentives can drastically reduce the overall cost of ownership for Electric Vehicle buyers. Without such support, Mississippi residents must rely solely on federal incentives, which may not be enough to drive widespread adoption, taking into consideration lower-income households.

One of the main advantages of Electric Vehicle ownership is the potential for lower fuel costs compared to gasoline vehicles. Mississippi's electricity rates are relatively low, around 11.45 cents per kWh, this means that electric vehicle owners can charge their vehicles at a lower cost than in many other states. A typical full charge with a 60-kWh battery would cost around \$6.87, this offers substantial savings over the cost of gasoline for the same driving range. However, the upfront cost of purchasing and installing home charging infrastructure is a barrier for some, especially those who are renting or those living in homes without easy access to off-street parking and charging options.

Encouraging Electric Vehicle manufacturers to set up factories in Mississippi can reduce the costs associated with transportation and taxes. This would not only lower vehicle prices but also create local jobs, boosting the state's economy. A small network of charging stations leads to situations where drivers fear running out of power without access to a charger. This concern is particularly pronounced in rural areas of Mississippi. To solve this, partnerships between the state government and private companies can increase the development of charging infrastructure. Giving tax breaks or grants to businesses that install charging stations can also increase the network, especially in underserved areas. Incorporating renewable energy sources like solar panels with charging stations can reduce operational costs and promote sustainability.

Several Mississippi residents may not be aware of the benefits of Electric vehicles or hold misconceptions about their performance and reliability, the state can therefore launch sensitization initiatives to inform the community about the advantages of adopting electric vehicles, this can alleviate some of the concerns of residents

### 1.1.3 Data Collection

The data was collected using a structured questionnaire which was distributed electronically. The questionnaire included sections on demographic information, awareness of electric vehicles, perceived barriers to EV adoption, and thoughts on the effectiveness of potential policy interventions.

The questionnaire was divided into four main sections:

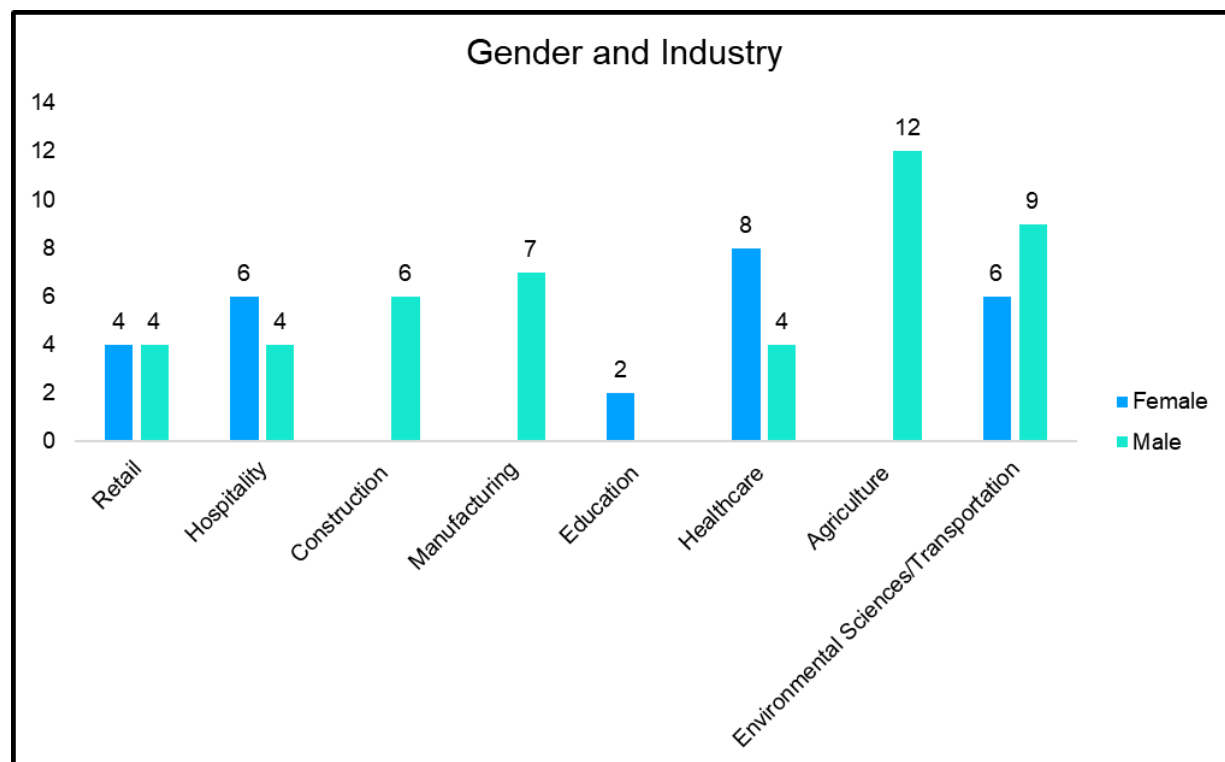
1. Demographics: Data was collected on age, gender, occupation, and experience with electric vehicles.
2. Awareness and Perception: Questions focused on respondents' awareness of electric vehicles and their perceptions of the adoption in Mississippi.
3. Barriers to Adoption: Identifying the key barriers to the adoption of electric vehicles, including infrastructure, cost, and policy incentives.
4. Policy and Infrastructure Preferences: Understanding respondents' opinions on various policy measures and infrastructure developments that could support EV adoption.

### 1.1.4 Data Analysis

The collected data was analyzed using descriptive statistics, including frequencies, means, and standard deviations. The analysis aimed to identify trends and patterns in the respondents' awareness, perceptions, and preferences regarding electric vehicle adoption in Mississippi. The data was processed using statistical software, and the results were presented in tables and charts to illustrate the findings.

### 1.1.5 Findings and Analysis

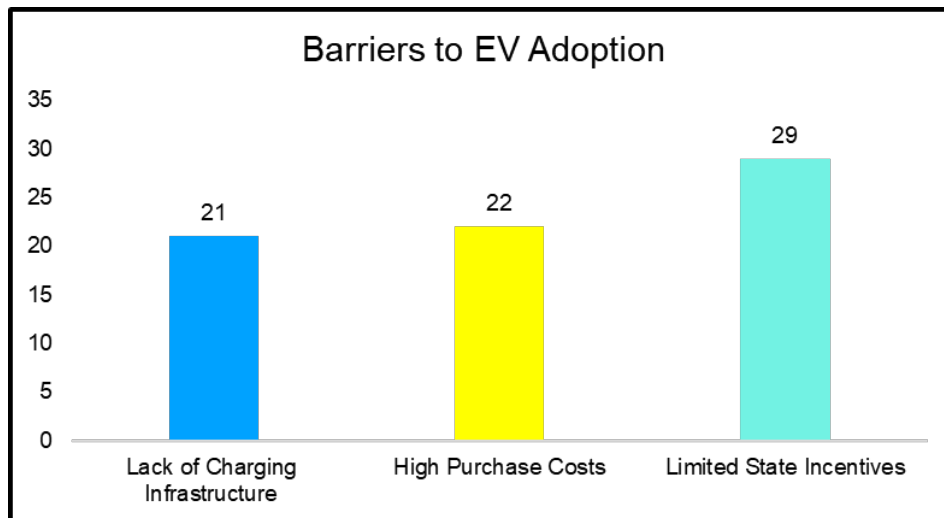
#### 1.1.5.1 Demographic Profile of Respondents



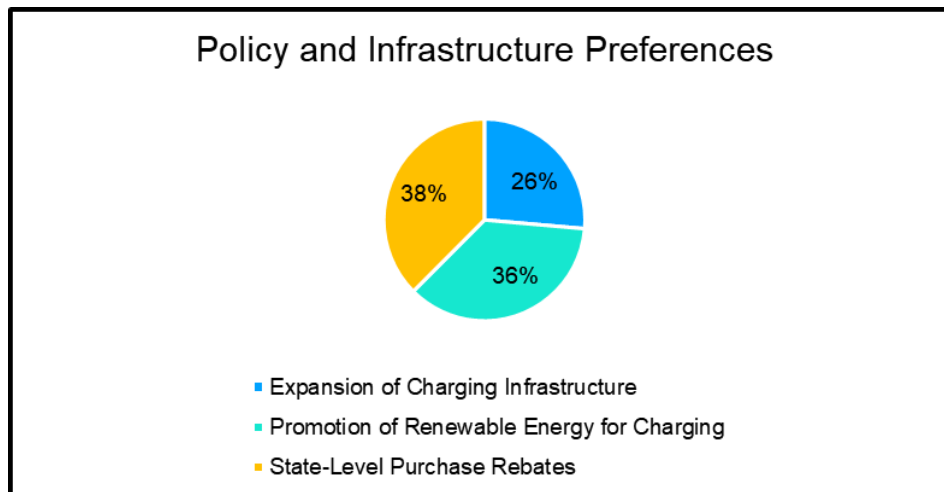
### 1.1.5.2 Awareness and Perception of Electric Vehicles

What is your level of awareness of electric vehicles?	Count	Mean	Percentage
Aware	67	0.93	93%
Limited Knowledge	5	0.07	7%
<b>Total Respondents</b>	<b>72</b>	<b>1.00</b>	<b>100%</b>
Would you consider purchasing an electric vehicle?			
Yes	29	0.40	40%
No	43	0.60	60%
<b>Total Respondents</b>	<b>72</b>	<b>1.00</b>	<b>100%</b>

### 1.1.5.3 Barriers to EV Adoption



### 1.1.5.4 Policy and Infrastructure Preferences



### 1.1.6 Discussion

The findings from the survey reveal a high level of awareness about electric vehicles among respondents, but adoption rates remain low due to significant barriers. The lack of charging infrastructure was the most frequently

cited barrier. This was followed closely by the high costs of electric vehicles. This aligns with the literature, which highlights infrastructure and cost as key determinants of EV adoption (Mekky & Collins, 2024; Patel, 2021).

The respondents indicated strong support for state-level purchase rebates and the expansion of charging infrastructure. These findings suggest that targeted incentives and infrastructure development could significantly enhance EV adoption in Mississippi. The preference for renewable energy-powered charging stations is also reflective of a growing awareness of the need for a holistic approach to sustainability.

The study also highlights the importance of public education and outreach. While awareness of electric vehicles is high, a thorough understanding of the available incentives and benefits is limited. What this highlights is a need for a comprehensive public awareness campaign to educate potential consumers about the advantages of Electric vehicles and the financial incentives available to them.

### 1.1.7 Conclusion and Recommendations

Based on the findings, these are some recommendations for Mississippi policymakers.

Implementation of direct financial concessions like rebates or tax credits to reduce the electric vehicle upfront cost. For example, the United States offers federal tax credits up to \$7,500 for eligible EV purchases, which has increased the rate of adoption remarkably.

Provision of grants or subsidies that cancels out the cost of installing home charging infrastructure. This method has seen successful implementation in countries like Norway, where homeowners obtain financial support for the installation of chargers; this makes overnight charging easier and convenient.

Offering reductions or exemptions on vehicle registration fees and road taxes for EV owners. These measures have been successfully implemented in some European countries, making EV ownership more financially attractive. Establishing partnerships between government agencies and private companies to co-develop charging networks. For reference, the UK government is working jointly with private firms to expand charging infrastructure with a focus on high-traffic areas and underserved communities.

If the state government offers incentives such as tax breaks or grants to private entities that invest in charging infrastructure, particularly in areas lacking sufficient coverage, this will encourage the expansion of charging networks without necessarily having to rely on public funds.

Development of policies and regulations that will ensure the interoperability and standardization of charging stations will allow Electric Vehicle users easy access to a variety of networks. This method has been adopted in the European Union to increase the convenience to users which in turn promotes widespread adoption. Implementation of strict regulations which mandate the safe disposal and recycling of electric vehicle batteries. The European Union's Battery Directive serves as a model, requiring manufacturers to take responsibility for the collection and recycling of used batteries.

Investment in the development of specialized facilities capable of recycling lithium-ion batteries. Some countries like China have set up extensive battery recycling networks to manage the increasing volume of used electric vehicle batteries. Funding of research into advanced recycling technologies and the development of batteries with longer lifespans and which are made with more sustainable materials. This proactive approach will address future challenges in battery disposal and utilization of resources. Encouraging the installation of charging stations that are powered by renewable energy sources like solar. This will reduce the carbon footprint that is associated with the charging of electric vehicles which will also enhance sustainability.

The development of smart grid systems that make the best use of renewable energy for Electric Vehicle charging, which efficiently balances supply and demand. The UK has implemented smart charging initiatives to integrate Electric Vehicles into the energy grid effectively.

Utilization of different media channels which include social media, television, and radio, to disseminate information about the benefits of the use of Electric vehicles, the available incentives, and the positive impact on the environment. Campaigns like Norway's national EV awareness programs have enjoyed success with increased public knowledge and adoption rates.

Organizing community events, workshops, and test-drive opportunities to provide first-hand experience with

Electric Vehicles; these kinds of initiatives have been effective in demystifying Electric Vehicles technology and addressing consumer concerns. Collaborating with local environmental groups, automotive groups, and educational institutions to improve and amplify outreach efforts and leverage existing networks for broader impact. This approach ensures that information will reach diverse demographics and communities.

By addressing these pertinent areas, Mississippi can overcome the current barriers/blockers to electric vehicle adoption and position itself as a leader in sustainable transportation in the Southeastern United States.

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