The Changing Landscape of Transportation

Allen Parrish, Executive Director



Alabama Transportation Institute







Transportation: A Changing Landscape

Infrastructure









Mobility

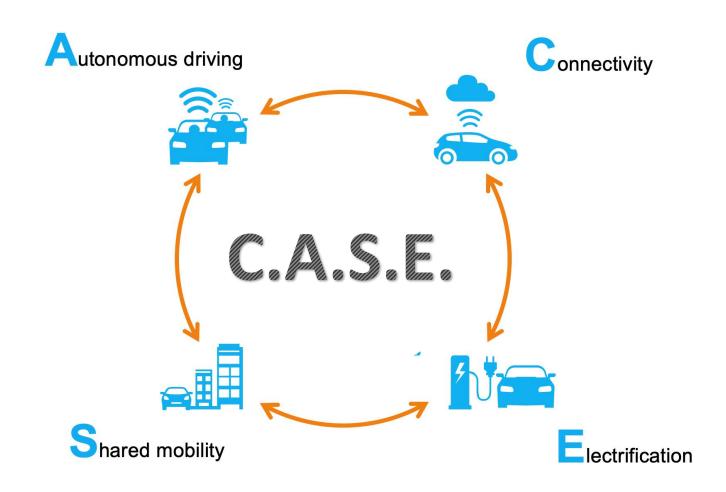








What Are The Components of Mobility?

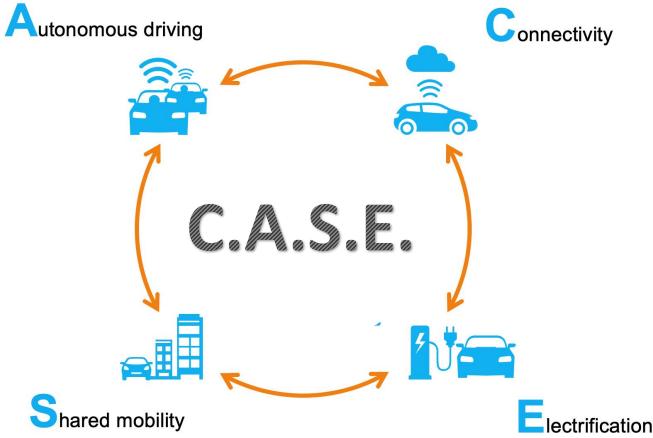


Degree of Change

	Incremental	Major
Autonomous	Assisted driving	Car drives itself
Connected	Assisted driving	No more traffic signals
Electric	Electric cars as an option	Electric cars as the only option
Shared	Ridesharing, better transit	Car ownership reduced or eliminated

What's Happening Right Now?

Gradual introduction of assisted driving systems **INCREMENTAL**



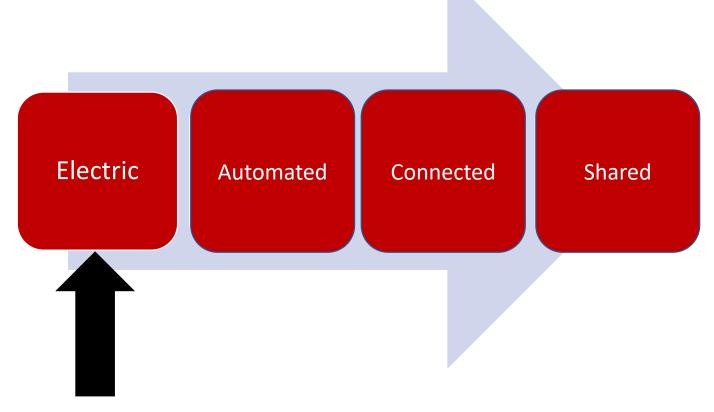
Gradual introduction of infrastructure connectivity **INCREMENTAL**

Ride Sharing Services **INCREMENTAL**

Change of production lines to eliminate ICE vehicles

MAJOR

Electric Can Catalyze Rate of Change



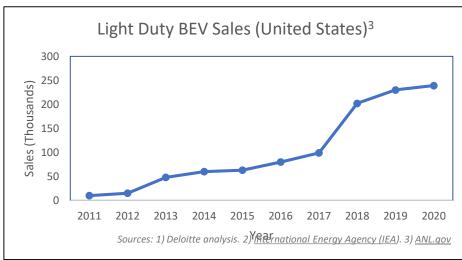
Will electric be successful?

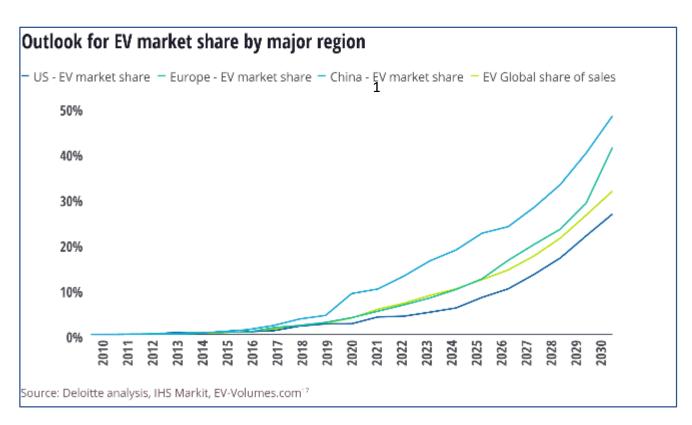
The rate of change of the other modalities depends on electric

High Growth Projections for Electric

Electric vehicle growth and market demand projections are promising...





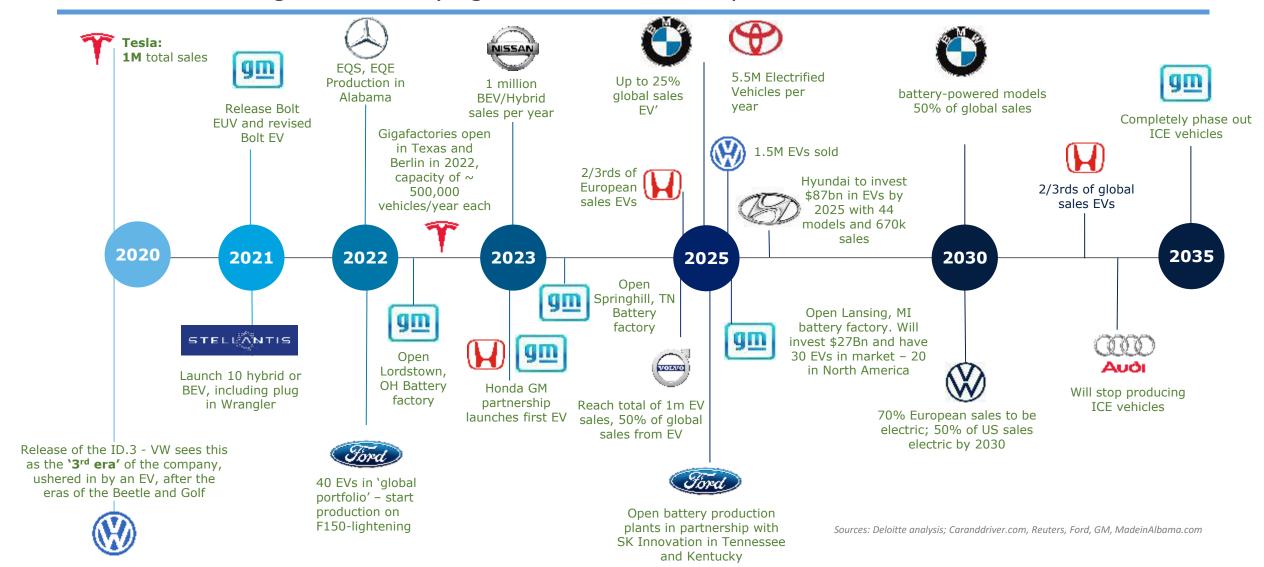


Will this rate of EV adoption come to fruition?

Will customers really move towards EV?

Auto Manufacturers Are Mostly Committed

Auto maker strategies show varying timelines for EV adoption

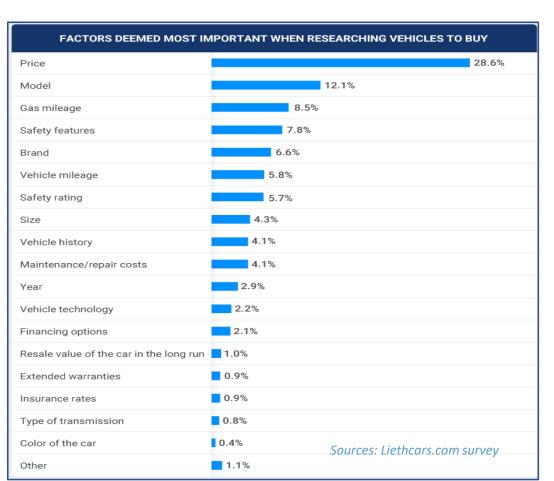


But.....

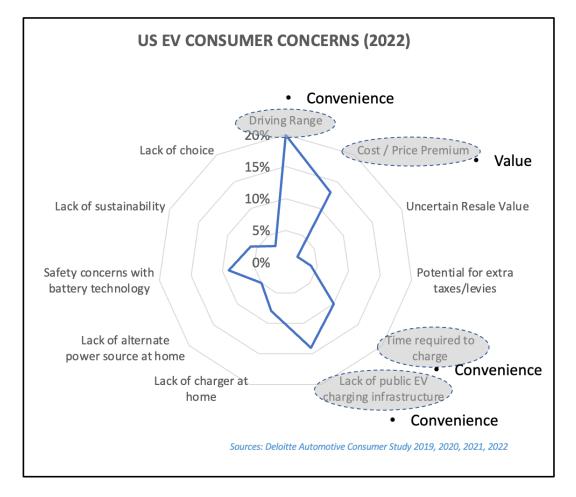
- Consumers aren't convinced yet
- Electric utilities are woefully unprepared in general
- We don't have a sustainable supply chain
- Electric vehicles aren't as green as they seem

EV Consumers Aren't Totally Convinced

Traditional (ICE) vehicles



Electric vehicles (EV)



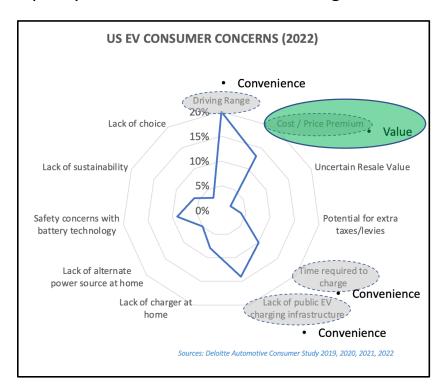
EV value and EV convenience

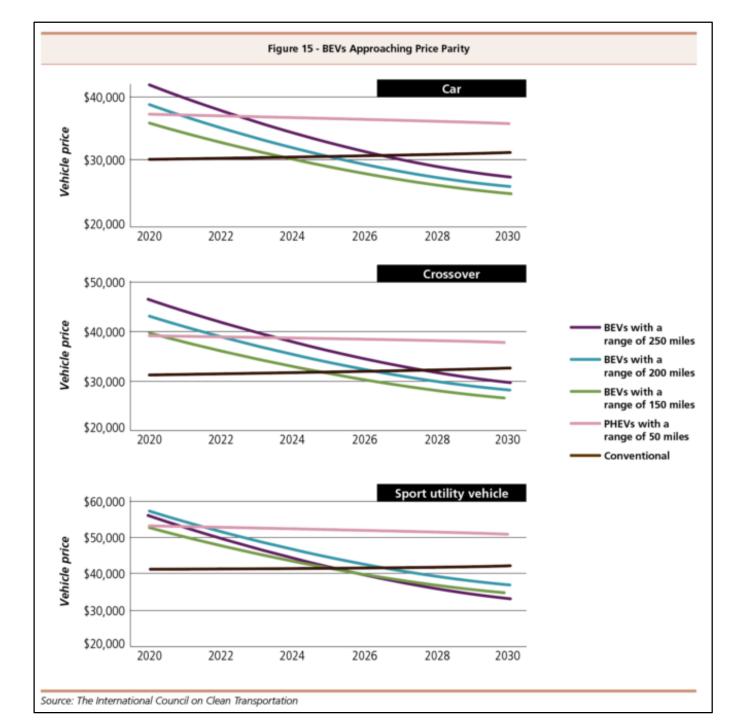
will be the major influencers for customers transitioning to EV

EV Consumers Aren't Totally Convinced

EV Value

- BEVs will become cost competitive with Internal Combustion Engine (ICE) vehicles between 2024 and 2027 as the cost of lithium-ion batteries declines.
- BEVs with range greater that 250 miles will be among the last electric vehicles to reach cost parity with internal combustion engines

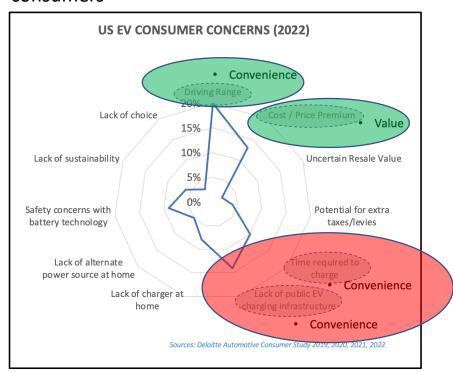




EV Consumers Aren't Totally Convinced

EV Convenience

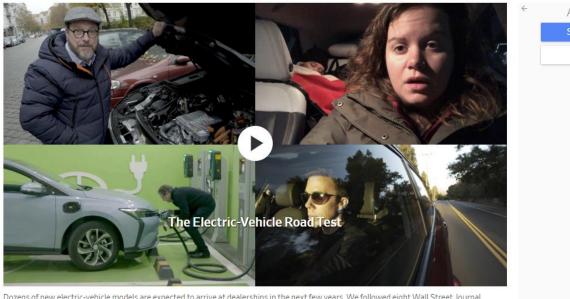
 BEV average range is comparable to ICE vehicles, but range anxiety remains prevalent among consumers



BUSINESS | AUTOS & TRANSPORTATION | AUTOS INDUSTRY

I Rented an Electric Car for a Four-Day Road Trip. I Spent More Time Charging It Than I Did Sleeping.

Our writer drove from New Orleans to Chicago and back to test the feasibility of taking a road trip in an EV. She wouldn't soon do it again.



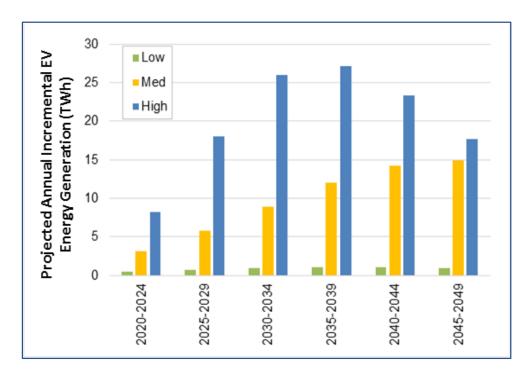
Dozens of new electric-vehicle models are expected to arrive at dealerships in the next few years. We followed eight Wall Street Journal reporters in four countries to see if they, and the world, are ready to make the switch.

Ads by Google

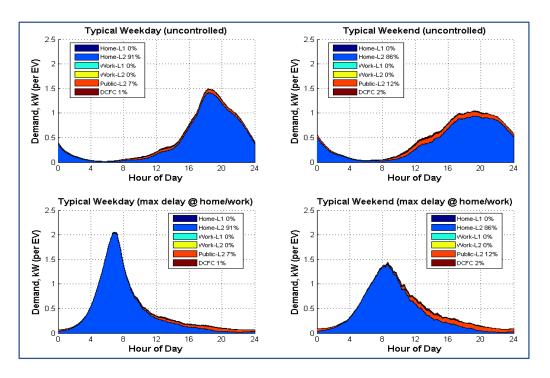
Stop seeing this ad

Why this ad?

Power Distribution Is Not Aligned to Aggressive Growth Expectations



Projected annual incremental energy generation to support EVs, averaged to five-year periods for the low, medium, and high market penetration scenarios.



Demand left uncontrolled will lead to spikes in demand. Systems must be put in place to equalize the load though out the day.

Power demand and availability will be heavily influenced by charging methods.

Power Distribution Is Not Aligned to Aggressive Growth Expectations



We Need More Grid Capacity

The Washington Post

THE ROAD TO ELECTRIC VEHICLES

Plug-in cars are the future. The grid isn't ready.

By 2035, the chief automakers will have turned away from the internal combustion engine. It'll be up to the grid to fuel all those new cars, trucks and buses.



By Will Englund

Updated October 16, 2021 at 4:06 p.m. EDT | Published October 13, 2021 at 7:30 a.m. EDT



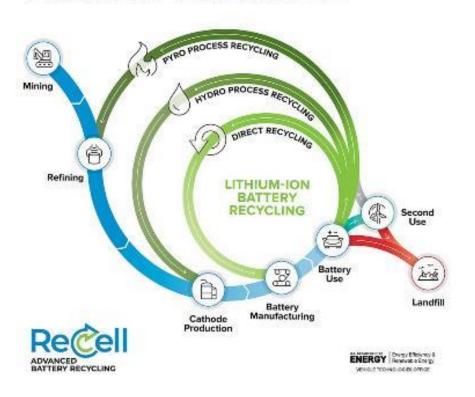
Maple Ridge in Lewis County is New York's largest wind farm. (Kate Lovering for The Washington Post

Challenges

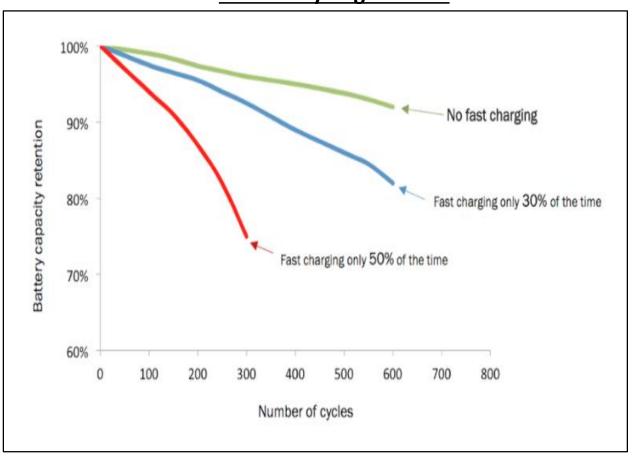
- Level 3 charging during peak hours
- Global transition to renewable sources
- Electric utilities are one of several constituencies not full embracing the optimistic growth curve

Batteries Are Not Yet Green

LITHIUM-ION BATTERY LIFECYCLE



EV Battery degradation



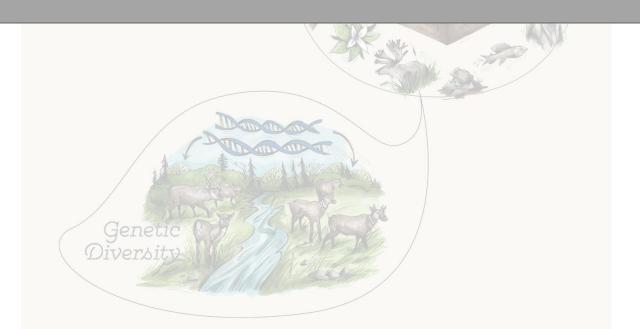
Although most EV batteries have not reached EOL, cell degradation is an inevitable outcome.

A comprehensive EV strategy must also encompass this outcome.

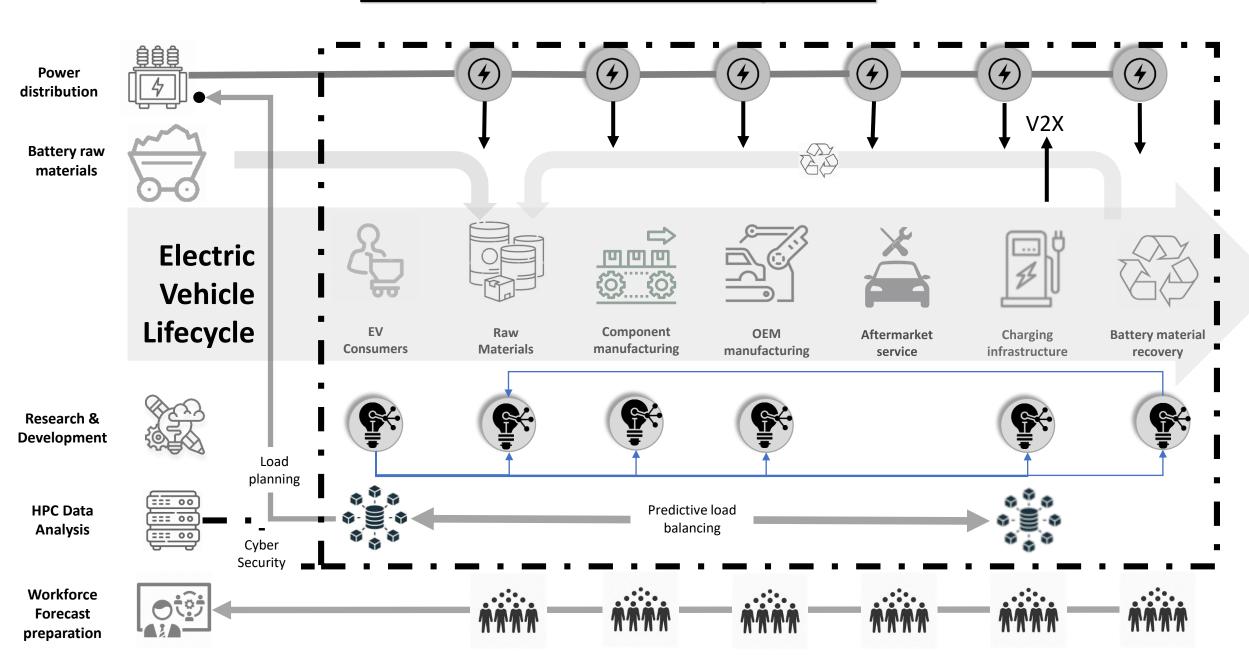
Can We Influence Success?



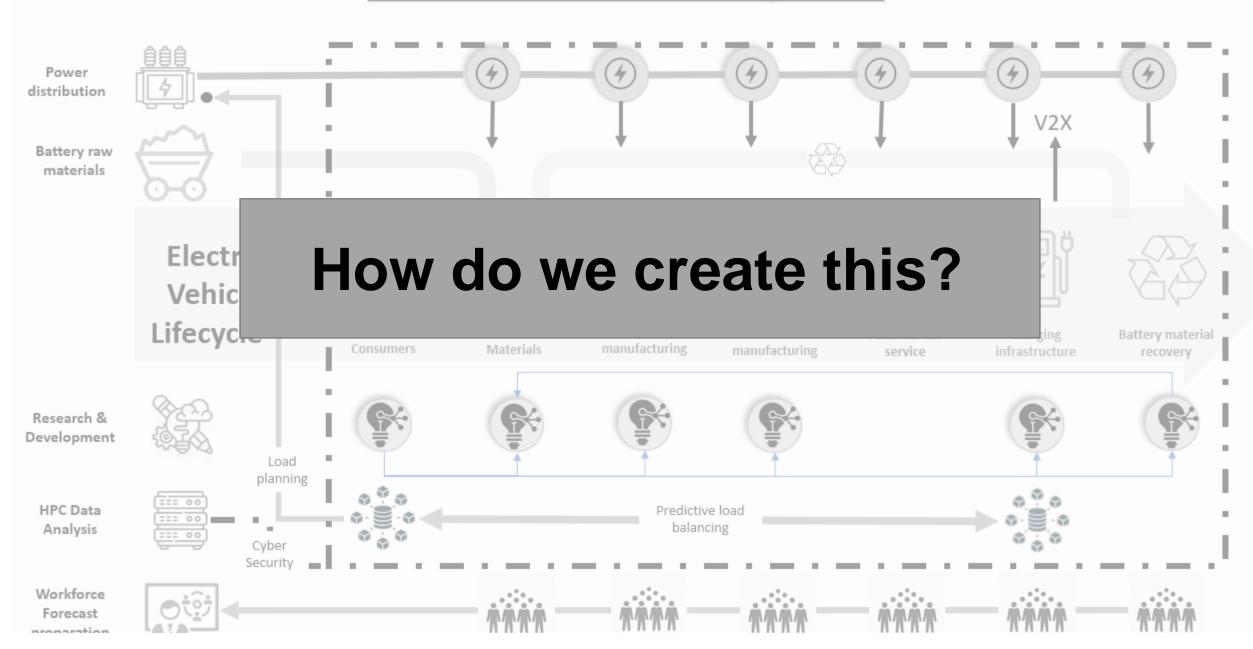
We need an "ecosystem"



Electric Vehicle Eco-system



Electric Vehicle Eco-system



Scope major themes Electric Vehicle Eco-system THE UNIVERSITY OF Alabama Transportation **ALABAMA**° Institute **Alabama Mobility and Power Center** CASE Cyber Electric **Power** Vehicle Research distribution Security Lifecycle Consumer **Materials** Intelligence research start-up companies Workforce Forecast preparation **** ŶŶŶŶ Innovative Annual Consortium fees **growth** Capital Investment **Economic** Development growth DURA Li-Cycle EDPA ALABAMA MOBILITY AND POWER Industry Marketable needs CENTER Alabama Power solutions PowerSouth Mercedes V Consortium رن الم Research Use inspired inspired products research THE UNIVERSITY OF **ALABAMA**° Research Innovation/ initiatives Research

Other Similar Efforts Underway



- Detroit Regional Partnership Foundation, Global Epicenter of Mobility, \$52.2M
- Indian Nations Council of Governments, Tulsa Regional Advanced Mobility Cluster, \$39M

Automated, Connected, Electric, Shared, Safe Mobility RESEARCH

ATI Centers

Alabama **Transportation** Institute

Transportation Policy Research Center

Alabama Mobility and Power Center

Center for **Advanced Public** Safety

Alabama Learning and Work Research Incubator

\$100M

Federally-supported projects ATI assisted in obtaining to help communities build transportation infrastructure

Publications, Presentations, and Patents

\$210M

External funding to The University of Alabama

107K

Users of ATI products in Alabama and beyond

1.2B

Uses of ATI products in Alabama and beyond

228

ATI-affiliated employees

UA Collaborating Centers

Center for Advanced **Vehicle Systems**

Center for Business and Economic Research

Institute for Data and Analytics

Center for Insurance Information Research

Multi-Institutional Centers

Center for Transportation Operations Planning and Safety

Center for Efficient Vehicles and Sustainable **Transportation Systems**

Rural Road Safety Center







Dual Former Auto Executives at ATI

Mike Oatridge



- Executive Director, Alabama Mobility and Power Center
- Former Senior Vice President for Honda responsible for all North American operations
- Led the Lincoln, AL Honda manufacturing facility



Bharat Balasubramanian



- Chief Mobility R&D Officer, Alabama Transportation Institute
- Former Vice President of Research for both Mercedes and Daimler
- Led research world-wide for Daimler



Indy **Autonomous** Challenge

- UA is partnered with The University of Milan – one of the top universities in the world.
- Object is to deploy software to drive a standard issue racecar at high speeds under challenging performance conditions.
- "Performance autonomy" can be an area of international collaboration and world leading strength.

Friday April 29, 2022 Daily Mail

Robo-car breaks the world speed record! Fully autonomous PoliMOVE vehicle reaches an incredible 192.2mph on the Space Shuttle airstrip at NASA's Kennedy Space Center

- The car is a Dallara-built AV-21 that has hardware to enable automation
- It took to the track on the Space Shuttle airstrip in Cape Canavera on April 27
- The speed of 192.2mph was obtained as an average of over 0.6 miles (1km) in two consecutive attempts in opposite directions, to eliminate the effects of the wind

By SHIVALI BEST FOR MAILONLINE " **PUBLISHED:** 10:59 EDT, 29 April 2022 | **UPDATED:** 10:59 EDT, 29 April 2022



















A robotic car has broken the world speed record, reaching impressive speeds of 192.2mph (309.3kph).

The car, developed by a team from the Politecnico di Milano, called PoliMOVE, is fully autonomous and took to the track on the Space Shuttle airstrip at NASA's Kennedy Space Centre this week.

During the test drive, the racecar clocked speeds of 192.2mph (309.3kph), smashing the previous record of 175.49mph (282.42kph), held by Roborace.

EcoCAR Challenge Competitions

- US Department of Energy competition
- 11 top universities
- Topics:
 - Advance propulsion systems
 - Connected and automated technology
 - Improve energy, safety and consumer appeal
- Year 3
- Awards given June 9, 2021
- UA Won 1st Place
- We are one of the 13 teams chosen for Year 4



OVERALL AWARDS

1st Place Overall - University of Alabama

2nd Place Overall - Ohio State University

3rd Place Overall - West Virginia University

4th Place Overall – Mississippi State University



ALDOT West Central Regional Traffic Management Center





- Located on UA Campus
- 24/7 Operation
- Staffed by ALDOT Engineers and Regional Traffic Operation Program (RTOP) staff
- Goal: Enhance traffic flow and safety, while reducing vehicle emissions and congestion through improved signal timing

ACTION Project

- Tuscaloosa County Road Improvement Commission
- A







- Tuscaloosa County Alabama
- \$16.8M 5 year project
- Smart infrastructure
- Vehicle to infrastructure communication
- Automated traffic flow management
- Autonomous freight delivery
- Specific technologies:
 - Fiber optics
 - Deep learning camera detection
 - DSRC Radios and Cellular communication
 - Advanced data-logging traffic controllers
 - Active signal control
 - Traffic management centers
 - Crowdsourced probe data



Recent Awards

Federal Award to UA to Conduct Research and Help Electrify Crimson Ride



Out of over 150 funded projects, The University of Alabama is the only university to get funded directly from the U.S. Department of Transportation Federal Transit Administration's Low-and No-Emission Vehicle program. The \$10 million project at UA, which includes \$2 million in matching funds from UA, will be unique by adding research components and workforce development initiatives relating to electric transit vehicles.

Traffic and engineering researchers affiliated with the <u>Alabama Transportation</u>
<u>Institute</u> and the Center for Advanced Vehicle Technologies will install sensors that allow a first-of-its-kind study of how electric vehicle technology behaves and can be optimized in a transit setting. Researchers will also study battery performance and optimization of energy consumption and transportation efficiency.

<u>Dr. Bharat Balasubramanian</u>, professor in the UA College of Engineering, executive director of the Center for Advanced Vehicle Technologies and chief mobility research and development officer for the Alabama Transportation Institute led the proposal and will lead the project.

ATI-affiliated Faculty are Participants in Two of the Ten ATCMTD Awards





The FHWA awarded \$45.2 million in <u>Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)</u> grants to 10 projects using advanced intelligent transportation systems (ITS) technologies that improve mobility and safety, reduce congestion and support under-served communities. ATI-affiliated faculty are leading one and participating in another of the only ten of these highly competitive ATCMTD awarded nationwide.

The FHWA ATCMTD program funds early deployments of forward-looking technologies that can serve as national models. <u>Dr. Alex Hainen</u>, Associate Professor in Civil, Construction and Environmental Engineering, is the UA faculty lead in the <u>Proactive Route Operations to Avert Congestion in Traffic (PROACT) Alabama</u> project awarded to the Alabama Department of Transportation. Elsa Tedla, P.E., PTOE, ATI Transportation Research Engineer, is also involved in this project. <u>Dr. Mizan Rahman</u>, Assistant Professor in Civil, Construction and Environmental Engineering, is the UA faculty lead in the <u>Smart and Connected Atlantic City Expressway</u> project awarded to the South Jersey Transportation Authority. ATI is very proud of these ATI-affiliated faculty and staff and the research they are doing!

Augmenting First Responders' Cognitive Performance for Responses to Electric Vehicle Emergencies



<u>Dr. Yangming Shi</u> and his co-PIs, (<u>Jun Liu, Xinwu Qian, Krishna Shah, Dr. Laura Myers</u>) received a <u>National Science Foundation (NSF)</u> grant. Their project will develop new methods to help responders to deal with future Electrical Vehicle-Related emergency responses.

Questions?

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