U.S. HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER

Building a Workforce to Navigate the Electric Vehicle Future

Friday, May 20, 2022
10:00 am – 12:00 pm ET
Oakland County Commission Chambers
1200 Court Tower Boulevard, Pontiac, Michigan

PURPOSE

This hearing is an opportunity for members to explore the workforce needs for the automotive mobility and electrification industry in order to position the United States at the center of growth for electric vehicles (EVs). Members will explore issues facing workers across the emerging EV ecosystem, including design, manufacturing, installation, and maintenance of EVs and charging infrastructure. Witnesses will provide insights and strategies for meeting clean energy goals while bolstering national competitiveness and ensuring shared prosperity for American workers.

WITNESSES

- **Ms. Marcia Black-Watson**, Industry Engagement Division Administrator, Workforce Development, Michigan Department of Labor and Economic Opportunity
- **Ms. Jennifer Mefford,** National Co-Chair, Electric Vehicle Infrastructure Training Program (EVITP)
- **Mr. Benigno "Ben" Cruz**, Director, Center for Advanced Automotive Technology (CAAT), Macomb Community College
- **Mr. Josh Nassar**, Legislative Director, United Auto Workers (UAW)

KEY QUESTIONS

- What is the state of the U.S. EV workforce? What are the types of EV skills and competencies in highest demand? What, if any, skills shortages have EV manufacturers experienced?
- What are promising approaches to providing the education and skills training workers need to meet the evolving needs of the EV sector?
- What challenges are auto workers facing as the industry shifts to a larger focus on Evs and what is needed to mitigate these challenges?

BACKGROUND

Electric motors and battery packs distinguish electric vehicles (EVs) from conventional internal combustion engine (ICE) vehicles. The battery pack provides all or part of the power to the motor that

drives the vehicle. The motor intermittently acts as a generator, sending electricity back to the battery. EVs can be separated into three broad categories:

- Hybrid-electric vehicles (HEVs): The ICE primarily powers the wheels. The battery pack and electric motor provide supplemental power.

- Plug-in hybrid-electric vehicles (PHEVs): The battery pack can be charged by an external source of electricity. Depending on the model, primary power to the wheels may be supplied by the battery pack and electric motor, the internal combustion engine, or a combination.

- All-electric vehicles (AEVs; also called battery-electric vehicles or BEVs): The battery pack must be charged via an external source of electricity. The battery pack and electric motor power the wheels.

Climate Change Mitigation

According to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, "On-road passenger and freight vehicles dominate global transport-related CO_2 emissions and offer the largest mitigation potential."[1] The report includes several potential scenarios for improvements in transportation and their projected reduction in greenhouse gas emissions. On average, the scenarios indicate that the carbon intensity of the transportation sector would need to decrease by about 50% by 2050 and as much as 91% by 2100 when combined with a cleaner electricity grid to stay within the 1.5-degree Celsius (2.7 Fahrenheit) target for global warming. Electric passenger vehicles hold the most potential for mitigation, with PHEVs providing the greatest emission reduction compared with HEVs and BEVs due to the possibility of charging the battery with low-carbon electricity and the longer full-electric range.

EV Production

Conventional ICE vehicles continue to make up the bulk of industry production, but a growing share of the auto sector works on EV technology.[2] In 2019, global sales of electric cars totaled 2.2 million, about 2.5% of global car sales. In 2020, electric vehicles accounted for 4.1% of total car sales. In 2021, electric vehicle sales doubled again to 6.6 million, representing almost 9% of total car sales.[3] This aggressive growth is taking place in the United States as well as abroad. EV sales doubled in the United States from 308,000 in 2020 to 608,000 in 2021.[4] For context, internal combustion engine car sales grew by just 2.8% in the same period. S&P Global Platts Analytics projects that global EV sales will soar another 400% by 2030.[5] The explosive commercial uptake of electric vehicles has been enabled in large part by the falling costs of batteries. Battery cells saw an 89% cost reduction in the last decade, falling from an average of $1,200/kWh in 2010 to $132/kWh in November 2021.[6]

[1] https://www.ipcc.ch/report/ar6/wg3/
[2] https://www.energy.gov/sites/default/files/2021-07/USEER%202021%20Main%20Body.pdf
[3] https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales
[4] https://www.energy.gov/energysaver/articles/new-plug-electric-vehicle-sales-united-states-nearly-doubled-2020-2021
[5] https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/energy-transition/021622-global-light-duty-ev-sales-to-rise-to-268-mil-by-2030-platts-analytics
[6] https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/

EV Workforce

The automobile industry represents a significant segment of the U.S. labor force, employing almost 3 million Americans in auto dealerships and manufacturing.[7] Almost 1 million Americans work in motor vehicle and motor vehicle components manufacturing alone,[8] with roughly three-quarters of autoworkers employed in auto parts and one-quarter working in assembly.[9] The auto industry has grown steadily since the Great Recession, bringing back almost 360,000 manufacturing jobs since mid-2009. [10] While the COVID-19 crisis resulted in significant job loss, with auto manufacturing employment down by more than 30% in May 2020 compared with May 2019, employment has since largely recovered to pre-pandemic levels.[11]

The emerging EV workforce includes workers from a variety of educational and employment backgrounds, such as the research scientists and engineers who study electric drive technology, the manufacturing workers who build the vehicles, and the maintenance technicians who repair the vehicles. Many of the workers employed in the design, manufacture, repair, and maintenance of electric vehicles are those who have worked in similar roles for ICE vehicles. As electric vehicles become more prevalent, new occupations with unique skill sets are emerging, resulting in the need for specialized training.

Research: Research scientists and engineers in the EV industry conduct research to improve electric vehicle technology. For example, both chemists and materials scientists conduct research on improving battery life and recharging time. Materials scientists also research and develop new materials for use in electric vehicles.[12]

Design and Development: Workers who design and develop EV technology include engineers and engineering technicians, software developers, and industrial designers. Engineers design, test, and integrate components to produce designs for new products. Following the design phase, engineers evaluate design effectiveness, cost, reliability, and safety.[13]

Specialized programs for engineering students pursuing EV careers are available at the Department of Energy (DOE) Graduate Automotive Technology Education (GATE) Centers of Excellence.[14] DOE also sponsors a collegiate experimental learning competition, called the ECOCar EV Challenge, for students to develop and demonstrate innovative battery technologies for EVs.[15] Another DOE initiative, the Clean Energy Innovator Fellowship Program, place recent graduates in industry or government clean energy programs for hands-on learning and professional development.[16]

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[7] https://www.bluegreenalliance.org/wp-content/uploads/2018/09/Electric-Vehicles-At-a-Crossroads-Report-vFINAL.pdf
[8] https://www.bls.gov/iag/tgs/iagauto.htm
[9] https://www.nelp.org/wp-content/uploads/2015/03/Manufacturing-Low-Pay-Declining-Wages-Jobs-Built-Middle-Class.pdf
[10] https://data.bls.gov/timeseries/CEU3133600101?amp%253bdata_tool=XGtable&output_view=data&include_gra
[11] https://www.bls.gov/iag/tgs/iagauto.htm
[12] https://www.bls.gov/green/electric_vehicles/#occupations
[13] https://www.bls.gov/green/electric_vehicles/#occupations
[14] https://www.energy.gov/eere/vehicles/vehicle-technologies-office-graduate-automotive-technology-education-gate
[15] https://www.energy.gov/articles/doe-announces-15-universities-selected-ecocar-electric-vehicle-challenge
[16] https://www.energy.gov/eere/articles/doe-announces-clean-energy-innovator-fellowship-program-help-build-diverse-us

Manufacturing: Manufacturing EVs is a complex process that requires a skilled workforce. Many of the workers involved in the manufacture of EVs have previously worked in conventional ICE vehicle manufacturing. Skilled technical manufacturing jobs in the EV industry include various assemblers, machine tool operators, and machinists.[17] Automotive manufacturing occupations tend to be geographically clustered around industrial centers in the Great Lakes region and the Midwest, with the largest concentration of jobs in Michigan and Ohio.

Repair and Maintenance: As with any vehicle, electric vehicles require regular maintenance and occasionally need to be repaired. Much of the routine maintenance and repair work can be done by traditional automotive repair workers, but the electrical systems and drivetrain often require skilled workers with experience and training on those components.[18]

Community colleges play a central role in expanding the skilled technical workforce for the manufacture, repair, and maintenance of EVs. Community colleges engage with local industry to identify the skills and training in high demand and to tailor curriculum to meet the industry's evolving needs. Community colleges also engage with universities to enable students to pursue EV career pathways that require advanced degrees.

The National Science Foundation (NSF) Advanced Technological Education (ATE) program provides funding to community colleges to develop innovative education and training programs for skilled technicians working in all sectors, including EVs.[19] The Center for Advanced Automotive Technology (CAAT) at Macomb Community College in Warren, Michigan is an active ATE Center of Excellence and a leader in EV workforce training.[20]

Infrastructure: As the number of EVs on the road increases, the need for charging stations will grow. Most of these chargers will be in the homes of EV owners or in public charging stations. Electricians install charging stations and other equipment needed for EVs. They attach the charging stations to lines that have been installed by electrical power-line installers and ensure that the chargers are working properly. When there is a problem with the charger, electricians are called to make necessary repairs.

Electricians must go through a 3-year apprenticeship during which they receive formal classroom instruction as well as on-the-job training from an experienced electrician. In addition, most states and localities require an electrician to be licensed, which typically involves passing an examination. Before electricians can be certified to install an EV charging station, they are required to go through specialized training.

The Electric Vehicle Infrastructure Training Program (EVITP) was developed in 2011 in response to the demand for qualified individuals who were skilled in the installation and maintenance of EV supply equipment (EVSE) infrastructure. Developed by a consortium of public and private industry organizations and associations, EVITP is a non-profit national training and certification program that trains licensed or

[17] https://www.bls.gov/green/electric_vehicles/#occupations
[18] https://www.bls.gov/green/electric_vehicles/#occupations
[19] https://beta.nsf.gov/funding/opportunities/advanced-technological-education-ate
[20] http://autocaat.org/Home/

certified electricians on the specialized requirements of EVSE installation and maintenance to support EVs.[21]

EV Workforce Challenges

Displacement: A shift to EVs could result in a reduction in job opportunities for autoworkers. EV powertrains have fewer moving parts than ICE powertrains. This simplicity could significantly reduce the amount of labor necessary for vehicle production, maintenance, and repair, particularly for engines, transmissions, exhaust systems, and fuel systems.

Additionally, the U.S. has a relatively limited domestic capacity to produce EV powertrain components compared with conventional engines and transmissions. Rapid, large-scale adoption of EVs could lead to fewer domestic automotive jobs, because currently a large share of powertrain components is supplied by producers in Europe and China. According to an Economic Policy Institute analysis, without a significant boost to domestic EV manufacturing capacity, a 50% market penetration of EVs by 2030 could result in a loss of 33,000 auto parts jobs. However, if the U.S.-produced share of EV powertrain components were increased to equal that of conventional vehicles, the loss of auto parts jobs in the same market penetration scenario could be reduced dramatically (to 2,500). [22] The study also assessed a third scenario, in which U.S. produced share of EV powertrain components matched that of conventional vehicles and the share of domestically produced vehicles sold in the U.S. increased by 10%. In this scenario, a 50% market penetration of EVs would lead to the creation of 150,000 new auto parts jobs. The study concluded that boosting domestic capacity in EV technology manufacturing and vehicles sales is essential to mitigate a dramatic degradation of job opportunities for U.S. autoworkers.

As employers and policymakers embrace increased adoption of EVs, worker advocates are raising alarms about the potential negative impacts for autoworkers. Organizations like United Auto Workers (UAW) are calling for a commitment to re-tooling existing plants, re-training incumbent autoworkers, and ensuring new EV components are manufactured in the U.S.[23]

Job Quality and Access: While high rates of unionization have historically helped ensure that auto sector jobs provided a pathway to the middle class, today, job quality varies significantly among U.S. autoworkers. Some autoworkers still earn in the range of $20 to $30 per hour and high-quality benefits. Yet many of the jobs created in the past decade are nonunion or temporary positions, which come with lower wages and benefits as well as fewer job protections.[24] While automotive manufacturing is more representative of Black workers than are other parts of the manufacturing sector, Hispanic, Asian, and female workers remain underrepresented in motor vehicle manufacturing.[25]

[21] https://evitp.org/
[22] https://www.epi.org/publication/ev-policy-workers/
[23] https://uaw.org/wp-content/uploads/2019/07/190416-EV-White-Paper-REVISED-January-2020-Final.pdf
[24] https://www.epi.org/publication/ev-policy-workers/
[25] https://www.bls.gov/cps/cpsaat18.htm

Federal Government Actions

In the first year after taking office, President Biden issued two executive orders to spur large-scale adoption of EVs: one to transition the approximately 600,000 cars and trucks in the federal fleet to zero-emission light-duty vehicles by 2027[26] and the other to set a target of 50% EV sales share by 2030. The bipartisan *Infrastructure Investment and Jobs Act* (P.L 117-58), signed into law in November 2021, includes $7.5 billion for electric vehicle charging stations and establishes a National Electric Vehicle Infrastructure (NEVI) Formula Program to support State projects.[27]

The Department of Transportation (DOT) partnered with the Department of Energy (DOE) to announce in 2022 that the NEVI Formula Program will provide nearly $5 billion over five years to help States create a network of EV charging stations along designated alternative fuel corridors.[28] Further, a separate competitive grant program designed to increase EV charging access, including in rural and underserved communities, is set to be announced later in 2022.

Michigan expects to receive $110 million of the NEVI Formula Program funds.[29] The state has partnered with its Midwestern neighbors to form a coalition focused on a regional network of charging stations and has launched a workforce development initiative to prepare residents for jobs in the EV industry.[30]
The National EV Charging Action Plan, released in December 2021[31], outlines steps federal agencies are taking to support developing and deploying EV chargers in American communities across the country. Elements of the Action Plan include:

- ***Joint Office of Energy and Transportation***. In December 2021, the Biden Administration established a Joint Office of Energy and Transportation, leveraging the resources of DOE and DOT.[32] The Joint Office is tasked with ensuring agencies can work together to implement the EV charging network and other electrification provisions in the law and providing a "one-stop-shop" for resources on EV charging and related topics.[33]

- ***Stakeholder input***. The White House convened a series of stakeholder meetings on topics including partnerships with state and local government, domestic manufacturing, equity, environmental justice, and maximizing environmental benefits. DOT and DOE are working to assemble a new Advisory Committee on Electric Vehicles, although the target date (end of FY22 Q1), for the appointment of this Committee has passed.

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[26] https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-clean-energy-economy-through-federal-sustainability/
[27] https://www.congress.gov/bill/117th-congress/house-bill/3684/text
[28] https://highways.dot.gov/newsroom/president-biden-usdot-and-usdoe-announce-5-billion-over-five-years-national-ev-charging
[29] https://www.michiganbusiness.org/press-releases/2022/02/whitmer-announces-michigan-will-receive-$110-million-expand-electric-vehicle-charging-infrastructure/
[30] https://www.michigan.gov/whitmer/news/press-releases/2021/09/22/governor-whitmer-launches-two-initiatives-to-advance-michigans-ev-infrastructure-and-workforce-land
[31] https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-action-plan/
[32] https://www.energy.gov/articles/doe-and-dot-launch-joint-effort-build-out-nationwide-electric-vehicle-charging-network
[33] https://driveelectric.gov/

- ***Guidance and Standards for States and Cities***. In February 2022, DOT released an updated guide to deploying EV charging stations strategically to build out a national network along the highway system. [34] In the coming weeks, DOT is expected to publish standards for EV chargers in the national network to ensure they work, they're safe, and they're accessible to everyone. In April 2022 DOE announced a Vehicle to Everything (V2X) Memorandum of Understanding (MOU) that will leverage resources from DOE, DOE national labs, state and local governments, utilities, and industry to examine technical and economic feasibility of bidirectional charging into the electrical gird.[35] This announcement incorporated input received through a June 2021 RFI.[36]

- ***Requesting Information from Domestic Manufacturers***. In November, DOT and DOE released a request for information from domestic manufacturers to identify EV chargers and other charging related components that meet USDOT Buy America requirements and to highlight the benefits of shifting all manufacturing and assembly processes to the United States.[37]

- ***New Solicitation for Alternative Fuel Corridors***. In 2015, Congress passed the *Fixing America's Surface Transportation (FAST) Act* (P.L. 114-94), which required DOT to establish a national network of Alternative Fuel Corridors that built fueling and charging stations for vehicles powered by alternative fuels. In 2016, DOT announced its first wave of these corridors spanning 35 states. DOT has since designated 4 additional rounds. These corridors now span 49 states and approximately 165,000 miles of highway. The deadline for submissions for the sixth-round corridor designations was May 13, 2022.[38]

[34] https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf
[35] https://www.energy.gov/technologytransitions/articles/department-energy-announces-first-its-kind-collaboration-accelerate
[36] https://www.energy.gov/eere/articles/energy-department-releases-request-information-electric-vehicle-grid-integration
[37] https://www.federalregister.gov/documents/2021/11/24/2021-25717/buy-america-request-for-information
[38] https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/2022_request_for_nominations_r6.pdf