



Washington
**Green
Transportation
Program**



Initial Research Review for Workforce Development

Phase 1

Section 1: EV Industry Trends

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Energy Program

WASHINGTON STATE UNIVERSITY



Washington

Green Transportation Program

Moving forward with Washington's public fleets

The Washington State legislature passed legislation in 2019 directing the **WSU Energy Program** to establish and administer a technical assistance and education program for public agencies on the use of alternative fuels and vehicles. The **Green Transportation Program** provides education and assistance about alternative fuels and vehicles to all public agencies in the state, including cities, counties, tribes, transit agencies, ports, school districts, colleges and universities, utilities and PUDs, and other political subdivision.

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Energy Program

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Section 1: EV Industry Trends

The EV industry is undergoing a rapid transformation in technology, propelled by strong clean energy goals and increasing consumer demand spurred by incentives through public policy and forward-focused industry leadership. The following section begins with a global technology and market assessment, followed by international, national, state and local policies, as well as industry targets that are leading the rapid transformation underway in the EV industry.

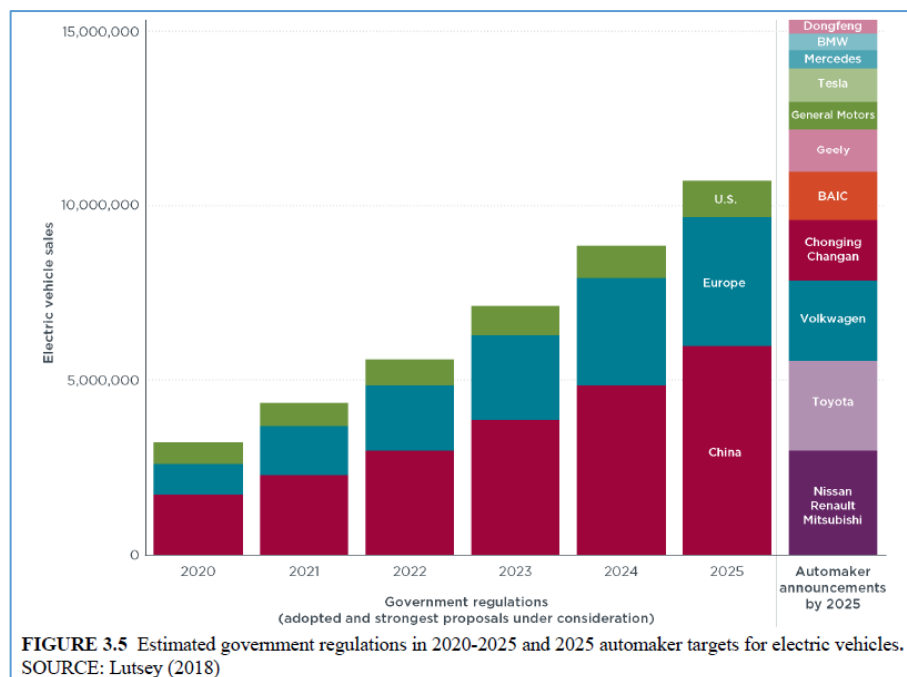
Global EV Outlook: Technology and Market Assessment

National Academies of Sciences, Engineering, and Medicine 2021. Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2021-2023¹

The NASEM report indicates that automakers expect tens of millions of zero-emission vehicles (ZEVs) will be rolled out globally during the 2025-2035 period, "aiming to achieve at least 50%-100% ZEV sales by 2030-2035 in leading jurisdictions." The report authors noted: "We believe these are coming very fast now. They will become the dominant type of new vehicles sold [globally] by 2035." Figure 1 shows that China and the European Union are currently leading the demand for EVs.

The NASEM report contains forecasts for near-, mid- and long-term technology advancement as well as cost projections. The report states, "incremental engineering and manufacturing improvements to current [battery] chemistries will result in a roughly 7% annual cost reduction through 2030." The report forecasts the price of battery electric vehicles (BEVs) will match internal combustion engine (ICE) vehicles around 2025-2030. Price parity could occur sooner by reducing battery cost and improving charging infrastructure.

Figure 1. Global policies driving EV demand and manufacturing targets



The NASEM reports that fuel cell electric vehicles (FCEVs) may become cost competitive with ICE vehicles and BEVs in 2025- 2035, particularly in larger vehicles and vehicles with heavier use such as taxi fleets. Honda, Hyundai and Toyota have introduced light-duty FCEVs for sale or lease in California, Japan and Germany. FCEVs may have an advantage in heavier vehicles or vehicles with higher vehicle miles

¹ Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2021-2023. National Academies of Sciences, Engineering, and Medicine. 2021. <https://www.nap.edu/catalog/26092/assessment-of-technologies-for-improving-light-duty-vehicle-fuel-economy-2025-2035>

traveled such as delivery trucks, municipal vehicles and other fleets that require fewer refueling locations or one centrally located refueling station.

FCEVs are also being tested to extend the range of BEVs in fleets. Some larger commercial electric vehicles are being produced with both battery and hydrogen fuel cell technology. Hydrogen cell technology provides greater range and faster refueling.

The demand for FCEV technology is also increasing and there will be workforce development needs specific to it. However, as mass production of EVs has converged around BEVs, the workforce is expected to be larger and the need to address those workforce issues are more pressing at this time.

The NASEM report recommends that Congress, the U.S. Department of Transportation and the U.S. Environmental Protection Agency grow the role of ZEVs, stating: “The agencies should use all their delegated authority to drive the development and deployment of zero-emission vehicles (ZEVs).” Additional recommendations are included in the report, including the following, which related to workforce and training needs:

- The vehicle maintenance industry will require repair technicians and aftermarket parts manufacturers to be highly trained in BEV design and specific safety concerns.
- Transportation of vehicles will require additional care to avoid damage to the battery pack. Tow trucks drivers need to be familiar with BEV design and safety concerns.
- Emergency responders will need to quickly identify BEVs and be trained to handle the unique hazards of BEVs, such as how to safely quench a lithium-ion battery fire.
- Roadside assistance services will need to prepare for emergency remote charging of lithium-ion batteries and towing.

EV Policy Drivers and Outlook

Governments around the world are mandating a transition to greener vehicles to help address climate change. A variety of EV targets are intended to push growth in the coming decades. Many industry leaders are also setting ambitious targets to push adoption of EVs in their fleets.

Available research and projections for fleets are limited; more systematic data is needed to understand the implications of fleet electrification on employment, workforce development, education and training needs for fleet-reliant organizations.

International EV Targets²

- **China** has set a target of 7 million EV sales by 2025 and has discussed developing a timeline for banning gasoline and diesel-powered vehicles.
- **European Union** has set the goal of halving the use of ICE vehicles in cities by 2030 and phasing them out of cities entirely by 2050.
- **France** aims to end the sale of gas- and diesel-powered vehicles by 2040.
- **Germany** has set a target of 1 million EVs on the road by 2020 and is spending over \$300 million to support the installation of 15,000 charging points by 2020.
- **Norway's** Parliament has set a nonbinding goal that by 2025 all new cars should be EV, hydrogen fuel cell or plug-in hybrids.

² *Taking the High Road: Strategies for a Fair EV Future*. United Autoworkers Union Research Dept. <https://uaw.org/wp-content/uploads/2019/07/190416-EV-White-Paper-REVISED-January-2020-Final.pdf>

- **India’s** National Electric Mobility Mission Plan has set the goal of selling 6 to 7 million hybrids and EVs by 2020. India’s Minister of State for Power and Renewable Energy has set the goal of selling only EVs in India by 2030.

U.S. EV Policies and Targets

White House Fact Sheet: The American Jobs Plan³

President Biden is proposing a \$174 billion investment to support the EV market. His plan will enable automakers to spur domestic supply chains from raw materials to parts, retool factories to compete globally, and support American workers to make batteries and EVs. It will give consumers point-of-sale rebates and tax incentives to buy American-made EVs, while ensuring that these vehicles are affordable for all families and manufactured by workers with good jobs. It will establish grant and incentive programs for state and local governments, and the private sector to build a national network of 500,000 EV chargers by 2030, while promoting strong labor, training and installation standards. His plan also will replace 50,000 diesel transit vehicles and electrify at least 20% of our yellow school bus fleet through a new Clean Buses for Kids Program at the U.S. Environmental Protection Agency, with support from the U.S. Department of Energy. These investments will set us on a path to 100% clean buses, while ensuring that the American workforce is trained to operate and maintain this 21st century infrastructure. Finally, it will utilize the vast tools of federal procurement to electrify the federal fleet, including the U.S. Postal Service.

White House Fact Sheet: Securing America’s Critical Supply Chains⁴

White House directs an immediate 100-day review across federal agencies to address vulnerabilities in the supply chains of four key products, three of which are necessary components of EVs: critical and rare earth minerals, semiconductors and large-capacity batteries.

Washington State EV Policies

Washington State Energy Strategy – Includes a recommendation to accelerate the conversion of public and private fleets to EVs.⁵

“To accelerate the adoption of EVs in public fleets, the state should update and expand the existing targets for new EV purchases for state-owned vehicle fleets, including trucks and off-road vehicles, with the goal of achieving 100% EV purchases: (1) by 2025 for light-duty vehicles; and (2) by 2030 for all other vehicle types.”

E2SHB 1287 “Clean Cars 2030” – In April 2021, the Washington state legislature passed groundbreaking legislation⁶ that sets a target for all model-year 2030 or later passenger and light-duty vehicles sold in Washington to be EVs. The new law establishes the most aggressive state goal in the U.S. for moving to an all-electric future and puts Washington five years ahead of California’s 2035 target.

WA State Electrification Assessment of Public Vehicles in Washington, 2020 – excerpt:

³ White House Briefing, March 2021: <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>

⁴ White House Briefing, Feb 2021: <https://www.whitehouse.gov/briefing-room/statements-releases/2021/02/24/fact-sheet-securing-americas-critical-supply-chains/>

⁵ *Energy Strategy—Appendix C*. WA Dept. of Commerce. https://www.commerce.wa.gov/wp-content/uploads/2021/01/Appendix-C_Supplementary-Materials-to-Transportation.pdf

⁶ E2SHB 1287 <http://lawfilesexext.leg.wa.gov/biennium/2021-22/Pdf/Amendments/Senate/1287-S2.E%20AMS%20ENGR%20S2584.E.pdf>

This study sought to establish a baseline for the size and current electrification status of the public vehicle fleet in Washington. To accomplish this, the study team collected data from multiple sources across Washington to create an inventory that includes 56,080 vehicles belonging to the public fleets studied including 12,987 state agency vehicles, 9,222 public transit agency vehicles, 10,838 school buses, and an estimated 23,033 city and county vehicles. These vehicles were separated by their weight class as light-, medium-, or heavy-duty with each weight class representing approximately one-third of the total fleet.

To ensure a comprehensive inventory and collect sufficient data for a total cost of ownership (TCO) analysis, the study team requested data on vehicle make, model, year, fuel type, weight class designation (1-8), odometer readings, duty cycles, location, daily use range, maintenance costs, replacement plans, and Vehicle Identification Number (VIN). **These data were not available for cities and counties** and the study team relied on less detailed information from alternative fuels reporting data and a fleet questionnaire from a representative set of cities and counties across varying population sizes and locations.

In total, detailed vehicle data was collected for 28,913 vehicles, including all types of light-duty vehicles and a wide range of medium- and heavy-duty vehicles, which were included in the TCO analysis. A lack of detailed data for city and county fleets prevented their inclusion in the analysis, though the makeup and electrification potential of these fleets is likely similar to that of state agencies.

- Recommendation: The study team recommends the state consider standardized tracking of key data fields, such as fuel type, across state and/or local government entities, and establish requirements for public agencies to notify the Department of Licensing about all vehicles removed from public fleets or exempt plates that are transferred to other vehicles. The study team also recommends Washington consider standardizing data collection related to duty cycles or operations, including typical average and peak miles traveled and miles traveled per year by vehicles, via telematics systems or otherwise.
- Recommendation: The state should consider developing a roadmap to swiftly increase the share of EVs in the public fleet between 2020 and 2035 to achieve billions in fleet cost savings.

Other State Targets

- **California** has set the goal of 5 million ZEVs on its roads by 2030 and 250,000 charging stations by 2025.
- **Colorado** has set the goal of having nearly 1 million EVs on the roads in Colorado by 2030.

Automotive Industry EV Targets

The following section provides a glimpse of growth targets set by various businesses related to the EV industry. New growth targets are announced regularly. The following section is an excerpt from *Taking the High Road: Strategies for a Fair EV Future*.⁷

⁷ *Taking the High Road: Strategies for a Fair EV Future*. <https://uaw.org/wp-content/uploads/2019/07/190416-EV-White-Paper-REVISED-January-2020-Final.pdf>

Key Stakeholders See Opportunity

AUTOMAKERS

Major automakers are setting ambitious EV product and sales targets and they are backing up those targets with billions in investment commitments. By January 2019, global automakers had pledged over \$300 billion in spending on electrification. Automakers have also set ambitious goals to introduce new EV models, the impacts of which will be in seen in the near future. Just through model year 2022, it is estimated that the U.S. market will see the launch of 53 new EV models and 150 models with some form of hybrid powertrain.

- **General Motors** announced that it will begin making a profit on EVs by 2021, introduce 20 new electric and fuel cell vehicles globally by 2023, and sell 1 million EVs globally by 2026.
- **Ford** announced it will spend over \$11 billion by 2022 on electrification of its fleet and introduce 40 electrified vehicles and 16 full electric vehicles globally.
- **Fiat Chrysler** announced it will invest \$10.5 billion on electrification of its fleet through 2022 and introduce EV or hybrid versions of more than 30 models through 2022.
- **Volvo** announced that starting in 2019, all new models will be EVs, plug-in hybrids, regular hybrids or mild hybrids, including five new fully electric models between 2019 and 2021. Volvo has targeted 1 million electrified car sales by 2025.
- **Volkswagen** announced it will spend \$50 billion on EVs, AVs, and mobility services by the end of 2023, produce EVs at 16 production sites by 2022, sell 1 million EVs by 2025, and offer an electric version of all its models by 2030.
- **Toyota** announced plans to introduce 10 new EVs globally by the early-2020s, offer an EV or hybrid version of every Toyota and Lexus model by 2025, and sell over 1 million EVs and hydrogen fuel cell vehicles by 2030.
- **Daimler** announced it will spend \$11 billion on EV development and develop 10 EVs by 2025.
- **Nissan** announced plans to develop 8 EVs, sell 1 million EVs and hybrids annually by 2022, and have 20% to 30% of its U.S. sales in EVs and hybrids by 2025.
- **Changan** announced a \$15 billion plan to launch 21 EVs and 12 plug-in hybrids by 2025 and phase out its production of gasoline engine vehicles.
- **Great Wall Motor** plans to spend between \$2 and \$8 billion over the next 10 years on new EV models.

AUTO SUPPLIERS

Automotive suppliers see significant business opportunities in the EV shift and are determined to demonstrate to investors that they will be ready for it with investments in new EV components.

- **American Axle** estimates it has over \$2,500 in content opportunity per vehicle in hybrids and EVs for its powertrain and driveline components and will sell up to \$200 million in EV components by 2021.
- **BorgWarner** projects that by 2023, the company will have \$3.8 billion in revenue from powertrain components for EVs and hybrids.
- **Magna** estimates there is \$2,300 in per vehicle content opportunity in EVs and \$2,900 in per vehicle content for hybrids for the company's products.
- **Delphi** estimates there is around \$1,500 in content opportunity per vehicle for the company in EVs and \$1,800 in content opportunity per vehicle for plug-in hybrids.

- **Continental** projects that the company's addressable market in vehicle electrification will be worth €100 billion by 2025.
- **Panasonic** projects that its automotive battery and power supply sales will increase by 88% between 2017 and 2019, up to nearly \$7 billion.

INVESTORS

Venture capital investment has turned its sights, and its investment dollars, toward the shift to EVs. According to a January 2019 Reuters analysis, venture capital has invested over \$20 billion in 250 start-ups related to vehicle electrification.

Private-Sector Targets

Many corporations with large fleets have announced aggressive plans to transition to EVs, including Amazon, DHL, IKEA North America, AT&T, Lime, Siemens, Direct Energy, Clif Bar, Consumers Energy, LeasePlan and Genetech.⁸ Additional research would likely reveal many additional private-sector fleet targets.

Pacific Northwest and Seattle Area EV Assessments

City of Seattle Transportation Electrification Blueprint⁹

The City of Seattle Office of Sustainability and Environment, Seattle City Light, Seattle Department of Transportation and the Office of Economic Development collaborated to incorporate a wide range of expertise in climate policy, innovation, infrastructure, transit, mobility, economic development and workforce development. The Transportation Electrification Blueprint calls for the city to take immediate action to plan for the policy changes, infrastructure investments, and partnerships that will be required to meet these 2030 goals.

This work included consulting with the Environmental Justice Committee and community leaders, and is centered on community-identified priorities of expanding electric transit and mobility options, making charging more reliable and accessible, and connecting workforce opportunities to communities that need them the most.

- **100% of shared mobility is zero emission:** As shared mobility services like bikes, scooters, taxis, Uber, Lyft, car-share services and others continue to expand in Seattle, the city will ensure those options are electric and emissions free.
- **90% of all personal trips are zero emission:** To reach climate goals, by 2030 nine out of ten trips must be taken by walking, biking, electric transit or in an EV (or avoided all together).
- **30% of goods delivery is zero emission:** As more of the goods we buy and the food we eat are purchased online, congestion and pollution from transportation are growing. This goal is aimed to spur the transition of private fleets to EVs, following the same goal for personal vehicles, over the next 10 years.
- **100% of city fleet is fossil-fuel free (Executive Order 2018-02):** Seattle will operate a large municipal fleet with zero fossil fuels by 2030.
- **One or more "Green & Healthy Streets" in Seattle:** Seattle will ensure a major area of the city will have zero emissions from transportation, including streets or blocks that are closed to cars and promote walking, biking, electrified transit, and electric goods delivery and services.

⁸ BlastPoint. https://blastpoint.com/wp-content/uploads/2020/02/BlastPoint-2021-EV-Outlook_Report.pdf

⁹ City of Seattle Transportation Electrification Blueprint. March 2021. <https://greenspace.seattle.gov/2021/03/seattles-blueprint-for-an-electrifying-future/#sthash.3E91bS80.dpbs>

- **Electrical infrastructure** required to stay ahead of Transportation Electrification adoption is installed and operational.
- **Infrastructure investments** will enable a rapid transition to an electrified transportation system. Seattle City Light will work strategically to make sure the grid is reliable and built out to enable rapid adoption for emerging electric transportation technologies and vehicles.

A Closer Look at Seattle

Seattle Jobs Initiative

The Seattle Jobs Initiative (SJI)¹⁰ has produced a useful report called *Amping Up Electric Vehicle Manufacturing in the PNW* on the topic of EVs and workforce across the PNW.¹¹ The report looks closely at EV manufacturing supply chain jobs and workforce issues. While the manufacturing sector includes many high-wage jobs, this study does not look closely at sales or maintenance jobs, which comprise the vast majority of jobs in the existing automotive industry. SJI predicts a decline in some EV supply chain jobs due to automation and offshoring, but an increase in some highly skilled jobs such as engineering and computer science. The occupations with disproportionately high shares of women and people of color tend to have a more negative outlook in the manufacturing sector. Attention to this will be needed to inform upcoming education and training initiatives. President Biden’s American Jobs Act focuses on developing the American supply chain, which may reduce the impact of offshoring jobs.

The PNW has an opportunity to expand into the auto manufacturing industry as the industry becomes increasingly reliant on advanced technology. However, the manufacturing sector represents only 22% of jobs in the auto industry. The remaining 78% of auto industry jobs are in wholesale sales (9%), retail and parts sales (55%) and maintenance (9%) (Table 1). Additional research is needed to investigate job growth opportunities in the sales and maintenance sectors.

Key findings excerpted from *Amping Up Electric Vehicle Manufacturing in the PNW*:

Supply chains are developing, making room for new businesses. The production of EVs, including passenger and commercial fleets, is undergoing dramatic changes due to technological innovations and new business models in the field. Many of the main components of EVs are not among the key competencies of traditional car manufacturers. Consequently, the barriers to entry to EV manufacturing are low, and new small- and medium-sized companies that have been excluded from the traditional car supply chain have more room to enter the market.

Oregon and Washington have existing EV business and the potential for growth. This report draws from existing work and original research to identify 39 companies in Oregon and Washington in the EV field. The companies include large multinational corporations, such as Daimler in Oregon and Paccar and its subsidiary Kenworth Trucks in Washington, and smaller businesses such as custom car producers Arcimoto in Oregon and Commuter Cars Corporation in Washington. The number of companies identified with explicit connections to the EV supply chain does not fully reflect the region’s potential to EV manufacturing, however, because the region hosts well-established tech and aerospace industries, which offer potential synergies in the EV field.

¹⁰ Seattle Jobs Initiative. <https://www.seattlejobsinitiative.com/>

¹¹ *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

Jobs in EV supply chains are predicted to grow, though the predicted growth varies across occupations. With the increasing electrification of transportation, jobs in the EV supply chain in the region are growing. Oregon is predicted to have 6% more jobs in occupations most closely related to the EV supply chain in 2025 than in 2019, and the predicted growth in Washington is 7%. There are differences between occupations, however. For example, jobs for electricians, software developers, and operations research analysts—the highest growing occupations in both states—are expected to grow at an average of 13.4% in Oregon and 15.0% in Washington. At the same time, the occupations with most negative outlook, electronic equipment installers and repairers for motor vehicles; and electrical, electronic, and electromechanical assemblers are predicted to decline at an average of 8.0% in Oregon and 9.3% in Washington.

Seattle Drive Clean Program

The Seattle Drive Clean Program published a study called *Connecting Disadvantaged Communities to Quality Jobs in the Transportation Electrification Sector: An Initial Assessment*,¹² which looked closely at social equity and access to EV jobs. The following is excerpted from the key findings from this study.

1. Significant numbers of local net new jobs are concentrated in two subsectors: electric vehicle service equipment (EVSE) installation and shared mobility fleet services.
 - a. Electrical work is high wage and requires significant training. Quality jobs can best be supported with investment in training programs and career pathways, and by linking jobs standards to EVSE permitting and procurement.
 - b. Fleet services is low wage work with low barriers to entry. The subcontracting-reliant business model puts fleet services work at risk for precarious employment practices. Quality jobs in this subsector can best be supported by creating a level playing field for high road contractors who meet or exceed the requirements of the current labor standards ordinances.
2. Local public agencies can support quality job creation in other regions by procuring bus and municipal fleets from manufacturers who have committed to high road job policies. LA Metro’s commitment to purchase zero-emissions busses from manufacturers who participate in the U.S. Employment Plan is a good model.
3. Other important auto and transportation-related occupations, like automotive service technicians and dealership salespeople, will see transitions in the nature of their work, but will not experience significant new job growth due to transportation electrification.
4. IT, management and sales jobs are growing and relatively high wage in the EV sector, but these jobs are relatively few in absolute numbers, and concentrated in the headquarters cities of EV/EVSE companies.
5. Seattle has existing programs, policies and practices that could be applied directly or could be adapted to support high road job creation in transportation electrification.
6. Additional data is needed to craft and evaluate policy in this arena. Seattle should partner with public- and private-sector actors to improve the collection and centralization of job quantity, quality and access data.

¹² *Connecting Disadvantaged Communities to Quality Jobs in the Transportation Electrification Sector: An Initial Assessment*. <https://www.seattle.gov/Documents/Departments/OSE/ClimateDocs/TE/Drive%20Clean%20Seattle%20EV%20Jobs%20Report%20Final.pdf>

EV Growth Impacts Equity

Transportation electrification is an important new sector that could deliver critical social benefits. To date, much of the focus for those benefits has been on greenhouse gas emissions reductions. Voices are increasingly focused on the impacts of transportation electrification on community health and transportation equity. Focusing on how transportation electrification can contribute to solving economic inequality is an important next step for policymakers, the private sector and community advocates. The early stage of the industry, as well as the extraordinary confluence of public and private sector support, create an important opportunity to combine racial, economic and environmental justice strategies.

The low-carbon energy transformation presents an opportunity to address long-standing inequalities in the transportation sector. Approximately half of all U.S. households that face energy insecurity—that is, the inability of a household to adequately meet energy consumption needs—are African American.¹³ Mobility justice studies raise issues stemming from an emphasis on privately owned vehicles and access to the higher cost of low-emission vehicles.¹⁴

The Washington State Clean Energy Transformation Act requires the state Department of Commerce and utilities to assess energy assistance available to low-income households across the state. This work is generating very useful county-level data on household energy burdens.¹⁵

The following is an excerpt from *Mobility Justice in Low Carbon Energy Transitions*.

Energy justice has three core tenets. The first, **distributional justice**, refers to how the distribution of benefits and burdens falls across populations, and seeks to ensure that some populations do not receive an inordinate share of the burdens or are denied access to the benefits. The second, **procedural justice**, focuses on who is included in energy decision-making processes and seeks to ensure that energy procedures are fair, equitable and inclusive of all who choose to participate. The third, **recognition justice**, requires an understanding of historic and ongoing inequalities, and prescribes efforts that seek to reconcile these inequalities. Some add a fourth tenet, **restorative justice**, which advocates for using government or other intervention to avoid injustices related to distribution, recognition, or procedures; or to correct for them. Pulling from these objectives, a comprehensive energy justice framework can be said to include energy availability and access, affordability, due process, accountability and transparency, and both inter- and intra-generational equity.

The following excerpts are from the Key Findings of Seattle Jobs Initiative *Amping Up* report.¹⁶

Women and people of color in the EV-related workforce are particularly vulnerable to economic trends. The different growth rates of occupations most closely related to the EV supply chain have dramatic implications for the workforce because the demographics of the workforce varies across occupations. In particular, the share of women is much higher in the occupations that are expected to see a decline in jobs, 33%, than in the occupations with expected growth, 16%. For comparison, the overall share of women in the field in the Pacific Northwest is 19%. Similarly, the share of

¹³ Sanya Carley and David M. Konisky. *Nature Energy Journal*, “Justice and Equity Implications of the Clean Energy Transition.” June 2020. <https://www.nature.com/articles/s41560-020-0641-6>

¹⁴ Caroline Mullen, Greg Marsden. *Mobility justice in low carbon energy transitions*. University of Leeds, UK, 2016. <https://www.sciencedirect.com/science/article/pii/S2214629616300615>

¹⁵ Washington State Department of Commerce CETA page. <https://www.commerce.wa.gov/growing-the-economy/energy/ceta-2/>

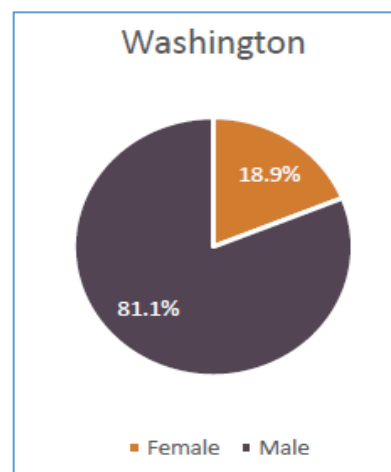
¹⁶ *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

people of color is higher in the occupations with a negative outlook: 36% of the workforce in the declining occupations are people of color, compared to the 31% in the occupations with predicted growth. Overall, people of color are 33.5% of the workforce in the field in the Pacific Northwest. The demographics vary greatly between occupational groups and occupations, however. For example, the share of Asian and Asian American workers is particularly high in many Architecture and Engineering Occupations (19% of the workforce in Oregon and 18% in Washington) and Computer and Mathematical Occupations (21% of the workforce in Oregon and 39% in Washington), thus driving up the overall share of people of color in the field and in the EV-related occupations with a positive outlook. For comparison, the share of Asian and Asian American workers in the overall workforce in the Pacific Northwest is 8.0%.

Figure 2 shows the share of female and male workers in the EV manufacturing industry in Washington.

Figure 2. Gender representation in EV-related occupations

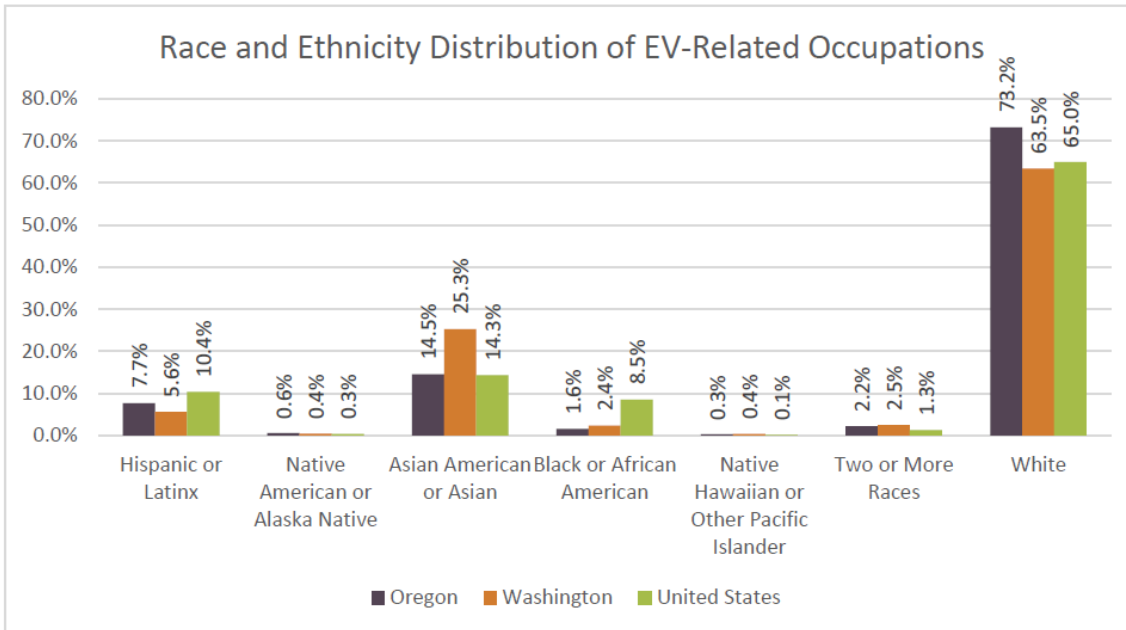
Figure 3 shows the race and ethnicity of the EV workforce. The *Amping Up* report recommends designing and implementing training initiatives directed at underserved populations. Their report highlights a lack of diversity in certain EV-related occupations and economic trends with negative implications for women and people of color. The report also highlights the I-BEST programs in Washington that provide educational access to individuals who have traditionally struggled in college-level occupational programs, including adult basic education and English-as-a-second-language students.



Transportation electrification is expected to increase the number of jobs in heavy-duty EV manufacturing, the EV-charging infrastructure, and EV maintenance and repair.¹⁷ With the right job training and hiring efforts, vehicle electrification can be a catalyst to boost economic opportunity in underserved communities and help overcome racial inequities in wealth and employment. Few job-training pipelines target underserved communities. To ensure that the EV sector develops in a diverse, equitable way—and sooner rather than later—targeted job training programs aimed at overcoming electrical-skill gaps in underserved communities must be created.

¹⁷ Union of Concerned Scientists “Delivering Opportunity: Assessing Electric Vehicle Jobs and Workforce Training in California” 2016 https://www.ijstor.org/stable/resrep17234.10?seq=1#metadata_info_tab_contents

Figure 3. Race and ethnicity representation in EV-related occupations



Source: Emsi

Summary: EV Industry Trends and Equity Concerns

Technology advancements, strong public policies and industry leadership are paving the way for rapid growth in the EV industry. This moment provides unprecedented opportunities for advancing critical social benefits. Women and people of color in the EV-related workforce are particularly vulnerable to economic trends and will need targeted programs to ensure access to training and education programs. While strong support for EV industry growth exists at all levels of industry and government, little is known about EV industry growth in Washington.