



Washington
**Green
Transportation
Program**



Initial Research Review for Workforce Development

Phase 1

Section 2: Labor & Occupation Statistics

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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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Section 2: Labor and Occupation Statistics

Traditional labor market information (LMI) is published by public sources for standardized industries and occupations. The most frequently used data is published by the Bureau of Labor Statistics (BLS), the U.S. Census and the Bureau of Economic Analysis. These traditional data sources measure current and historical trends but are not detailed or timely enough to inform rapid transformations such as we see in the EV industry today. Traditional LMI shows recent and historical *demand* for labor. It is useful for revealing trends over time and reflects actions taken in a labor sector. These data sources do not provide information on the *supply* of labor available in any industry, in particular, one in the midst of rapid change when many new businesses are entering the field and technology is rapidly evolving.

While LMI focuses on high-level industry sectors and trends, *occupational* data collected and reported by BLS and other sources reveals the specific skills employers seek. The following section begins with LMI and the automotive sector, followed by a review of existing occupational data and other sources that may yield information about changes in EV-related jobs.¹

The existing LMI for the transportation sector is centered on the dominant legacy of internal combustion technology. This excerpt from *Amping Up* describes this challenge for the EV manufacturing sector:²

Existing labor market data does not track the businesses and jobs in electric motor vehicle manufacturing. More specifically, the standard classification system for businesses and jobs in the U.S., the North American Industry Classification System (NAICS), does not distinguish between the manufacturing of traditional cars and electric cars; or the manufacturing of electric and traditional light trucks and utility vehicles; or the manufacturing of electric and traditional heavy-duty trucks. As a result, the classification does not allow us to analyze the labor force involved in electric motor vehicle manufacturing. The lack of labor market data complicates the analysis of current workers in the sector and this, in turn, makes it difficult to predict future trends.

This statement is also true for sales and maintenance automotive sector labor market information.

Automotive Sector Labor Market Information

According to the BLS, 56% of U.S. automotive sector jobs are in sales, 22% are in maintenance and 22% are in manufacturing. Table 1 shows BLS automotive sector employment.³ The Retail Trade category includes vehicle and parts dealers, sales and support staff, financing, parts experts and mechanics who provide repair and maintenance services for retailers. Sales of capital or durable non-consumer goods, such as medium- and heavy-duty trucks, are included in wholesale trade.⁴

¹ The BLS is overhauling their occupational data collection and reporting. The new methodology (<https://www.bls.gov/oes/>) was expected to be implemented in May 2021 with new data released spring 2022. We did not have time in this document to determine what this new methodology may reveal about the EV workforce.

² *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

³ BLS. <https://www.bls.gov/iag/tgs/iagauto.htm>

⁴ Complete definition available here: <https://www.census.gov/naics/?input=441&year=2017&details=441>

Table 1. BLS U.S. Automotive Sector Employment

	2020 all employees, in thousands, not seasonally adjusted, annual average	Percent to automotive employment	NAICS
Motor vehicles and parts manufacturing	871.8	22%	3361, 2, 3
Wholesale Trade (motor vehicle and parts wholesalers)	343.3	9%	4231
Retail Trade (motor vehicle and parts dealers)	1,907.60	47%	441
Automotive repair and maintenance	901	22%	8,111 (see additional detail in Table 2)
<i>Total</i>	<i>4,023.70</i>		

Table 2. NAICS 8111: U.S. Automotive Repair and Maintenance Sector Definitions⁵

NAICS Code	NAICS Definition
8111	Automotive Repair and Maintenance: This industry group comprises establishments involved in providing repair and maintenance services for automotive vehicles, such as passenger cars, trucks, and vans, and all trailers. Establishments in this industry group employ mechanics with specialized technical skills to diagnose and repair the mechanical and electrical systems for automotive vehicles, repair automotive interiors, and paint or repair automotive exteriors.
81111	Automotive Mechanical and Electrical Repair and Maintenance: This industry comprises establishments primarily engaged in providing mechanical or electrical repair and maintenance services for automotive vehicles, such as passenger cars, trucks, and vans, and all trailers. These establishments may specialize in a single service or may provide a wide range of these services. Cross-References.
811111	General Automotive Repair: This U.S. industry comprises establishments primarily engaged in providing (1) a wide range of mechanical and electrical repair and maintenance services for automotive vehicles, such as passenger cars, trucks, and vans, and all trailers or (2) engine repair and replacement. Illustrative Examples: Automobile repair garages (except gasoline service stations) General automotive repair shops Automotive engine repair and replacement shops Cross-References.
811112	Automotive Exhaust System Repair: This U.S. industry comprises establishments primarily engaged in replacing or repairing exhaust systems of automotive vehicles, such as passenger cars, trucks, and vans. Illustrative Examples: Automotive exhaust system replacement and repair shops Automotive muffler replacement and repair shops Cross-References.
811113	Automotive Transmission Repair: This U.S. industry comprises establishments primarily engaged in replacing or repairing transmissions of automotive vehicles, such as passenger cars, trucks, and vans. Cross-References.
811118	Other Automotive Mechanical and Electrical Repair and Maintenance: This U.S. industry comprises establishments primarily engaged in providing specialized mechanical or electrical repair and maintenance services (except engine repair and replacement, exhaust systems repair, and transmission repair) for automotive vehicles, such as passenger cars, trucks, and vans, and all trailers. Illustrative Examples: Automotive brake repair shops Automotive radiator repair shops Automotive electrical repair shops Automotive tune-up shops Cross-References.
81112	Automotive Body, Paint, Interior, and Glass Repair: This industry comprises establishments primarily engaged in providing one or more of the following: (1) repairing or customizing automotive vehicles, such as passenger cars, trucks, and vans, and all trailer bodies and interiors; (2) painting automotive vehicle and trailer bodies; (3) replacing, repairing, and/or tinting automotive vehicle glass; and (4) customizing automobile, truck, and van interiors for the

⁵ Source: Bureau of Labor Statistics

NAICS Code	NAICS Definition
	physically disabled or other customers with special requirements. Illustrative Examples: Automotive body shops Automotive paint shops Automotive glass shops Automotive windshield repair shops Cross-References.
811121	Automotive Body, Paint, and Interior Repair and Maintenance: This U.S. industry comprises establishments primarily engaged in repairing or customizing automotive vehicles, such as passenger cars, trucks, and vans, and all trailer bodies and interiors; and/or painting automotive vehicles and trailer bodies. Illustrative Examples: Automotive body shops Automotive body conversion services Automotive upholstery shops Automotive paint shops Cross-References.
811122	Automotive Glass Replacement Shops: This U.S. industry comprises establishments primarily engaged in replacing, repairing, and/or tinting automotive vehicle glass, such as passenger car, truck, and van glass. Cross-References.
81119	Other Automotive Repair and Maintenance: This industry comprises establishments primarily engaged in providing automotive repair and maintenance services (except mechanical and electrical repair and maintenance; transmission repair; and body, paint, interior, and glass repair) for automotive vehicles, such as passenger cars, trucks, and vans, and all trailers. Illustrative Examples: Automotive air-conditioning repair shops Automotive tire repair (except retreading) shops Automotive oil change and lubrication shops Car washes Automotive rustproofing and undercoating shops Cross-References.
811191	Automotive Oil Change and Lubrication Shops: This U.S. industry comprises establishments primarily engaged in changing motor oil and lubricating the chassis of automotive vehicles, such as passenger cars, trucks, and vans. Cross-References.
811192	Car Washes: This U.S. industry comprises establishments primarily engaged in cleaning, washing, and/or waxing automotive vehicles, such as passenger cars, trucks, and vans, and trailers. Illustrative Examples: Automotive detail shops Mobile car and truck washes car washes
811198	All Other Automotive Repair and Maintenance

Government fleet managers, operator and maintenance workers would not be reported as auto industry workers. Additional research is needed to identify how public entities are reported in BLS data.

The *Amping Up* report contains the following details about NAICS codes, focusing on which codes are likely to include (but are not exclusive to) EV manufacturing and production.⁶

Consultations with industry experts suggest that the NAICS codes for electric commercial vehicle production resemble those of EV production. As with electric cars, the supply chains of electric trucks and buses are still developing. In fact, the Director of Product Planning at Kenworth, one of the main truck manufacturers globally, describes the supply base for all electrified components as “relatively immature.” The increasing mass production of electric cars does not translate directly to the manufacturing of trucks, as the electrified components of cars cannot be simply applied to trucks. Consequently, truck manufacturers must work with their suppliers to develop electrified components and build up the production of those components. For example, Kenworth is currently ordering components from suppliers and integrating them into the chassis in-house but, at the same time, it is working towards a more vertically integrated supply chain, aiming to build the components in-house at the lowest price possible.

⁶ *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

Table 3. EV Manufacturing NAICS Codes⁷

Component	NAICS code
Battery Cell	335911 – Storage Battery Manufacturing
Battery Management	335912 - Primary Battery Manufacturing (for fuel cell technology)
Battery Pack	
Battery Charger	335999 - All Other Miscellaneous Electrical Equipment and Component Manufacturing
Electric Motor	335312 - Motor and Generator Manufacturing
Gearbox	336350 - Motor Vehicle Transmission and Power Train Parts Manufacturing
Power Distribution Module	336320 – Motor Vehicle Electrical and Electronic Equipment Manufacturing
Inverter	334419 - Other Electronic Component Manufacturing
DC/DC Converter	334413 – Semiconductor and Related Device Manufacturing, 335999 - All other miscellaneous electrical equipment and component manufacturing
Thermal Management	336390 - Other Motor Vehicle Parts Manufacturing
Connections/Wiring	336390 - Other Motor Vehicle Parts Manufacturing

Source: Hummel P, Lesne D, Radlinger J, et al. *UBS Evidence Lab Electric Car Teardown-Disruption Ahead*. SJI’s research.

The *Amping Up* report discusses the challenges of attempting to differentiate between electric motor vehicle and internal combustion vehicles in the NAICS data.⁸

Analysts often point out that electric cars are mechanically less complex than traditional cars and, for that reason, the production of electric cars is less labor intensive. This is predicted to disrupt the workforce in the traditional auto industry. Unfortunately, since the NAICS codes do not distinguish production of electric motor vehicles from production of traditional motor vehicles, the data does not allow us to tease out the impacts of electrification of transportation on the workforce in more detail. However, the Pacific Northwest should be somewhat insulated from this trend. This is because the industries that include the traditional auto manufacturing – Manufacturing of Motor Vehicles, Motor Vehicle Bodies, and Motor Vehicle Parts – are relatively small employers in the Pacific Northwest. Their share of the workers in the region is 20%, compared to the remaining 80% employed in the industries identified as exclusive to the EV supply chain. Moreover, the outlook for job growth between 2019 and 2025 is better for the exclusively EV-related industries: those jobs are predicted to grow in the region at an average rate of 1.7%, compared to a 1.7% average decline in jobs in the traditional auto manufacturing industries.

This report predicts the following changes in job in EV-related industries.

⁷ *Amping Up Electric Vehicle Manufacturing in the PNW*. p 13.

⁸ *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

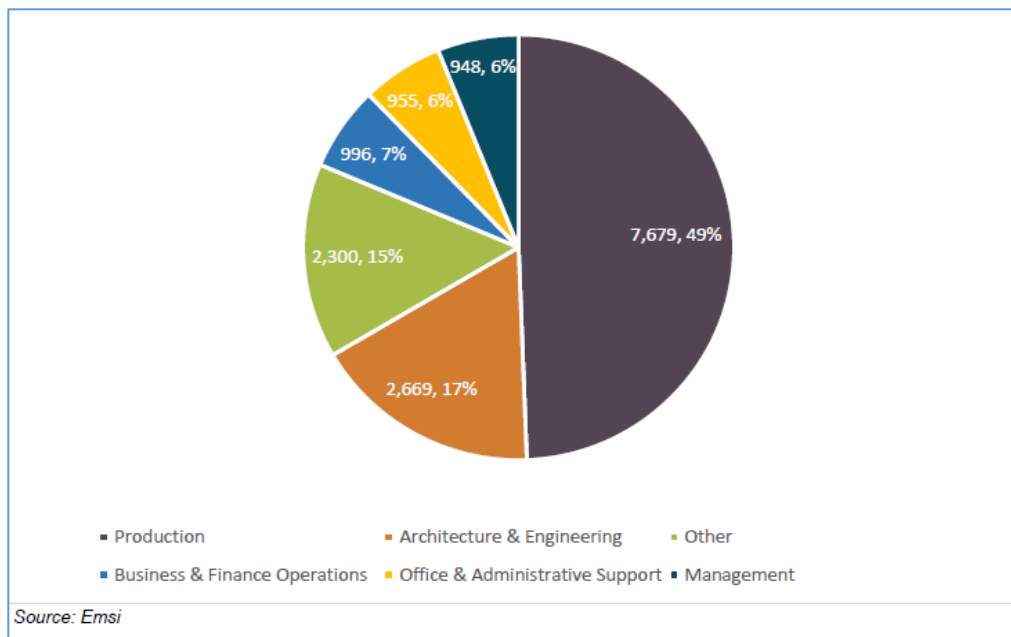
Table 4. Predicted Change in Jobs in EV-Related Industries from 2019 to 2025 (supply-chain)⁹

Industry	Oregon	Washington	United States
Motor Vehicle Mfg (3361)	-7%	10%	9%
	(791 and 733)	(1,353 and 1,489)	(238,287 and 259,350)
Motor Vehicle Body and Trailer Mfg (3362)	4%	2%	7%
	(3,569 and 3,694)	(797 and 813)	(165,133 and 176,878)
Motor Vehicle Parts Mfg(3363)	-3%	2%	5%
	(1,604 and 1,551)	(2,412 and 2,460)	(601,655 and 630,203)
Semiconductor and Other Electronic Component Mfg (3344)	0%	-1%	-2%
	(29,897 and 29,943)	(6,954 and 6,910)	(373,151 and 365,065)
Electrical Equipment Mfg (3353)	4%	10%	1%
	(658 and 686)	(3,183 and 3,500)	(142,396 and 143,212)
Other Electrical Equipment and Component Mfg (3359)	-8%	-13%	7%
	(1,369 and 1,265)	(1,128 and 983)	(147,842 and 158,757)

Source: Emsi

Keeping in mind the *Amping Up* report looks primarily at the manufacturing and supply-chain sector of the automotive industry, they state both Washington and Oregon show production occupations are the most common occupations: in Oregon, they form 39% and in Washington 49% of the total workforce connected to these industries.¹⁰

Figure 1. EV-Related Industries in Washington



Their analysis illustrates that Washington and Oregon have industries connected to the EV supply chain, and the growth in production of EV components outpaces that of the traditional auto industries. Jobs are expected to increase 1.7% in the former and decrease 1.7% in the latter. This analysis is tentative, because the absence of industry codes prevents a more detailed analysis of EVs and parts. The *Amping*

⁹ SJI report Table 5, p 22.

¹⁰ *Amping Up Electric Vehicle Manufacturing in the PNW*. <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

Up analysis offers reason for some optimism: some of the workforce necessary for the electrification of transportation already exists in the Pacific Northwest, and jobs in some of the industries connected to EV supply chain are projected to grow. ¹¹

EV Occupations

Job titles and occupations are constantly shifting, particularly in a rapidly evolving sector. Workers' roles and responsibilities may not easily be defined in the federal Standard Occupational Classification system, and their responsibilities may change rapidly. Jobs requiring similar skillsets can have different titles between industries, further supporting working closely with employers.

Just like wind and solar, EV charging station contractors must have a licensed electrician lead perform all electrical installation work in Washington. There is a shortage that is likely to be exacerbated as journey-level electricians retire. The Washington Employment Security Department (ESD) has projections for state electricians, which generally show that the vast majority of employment openings for electricians through 2028 will be based on replacing existing workers rather than new job growth in the occupation. ¹²

Excerpt from *SJI-Amping Up* regarding EV manufacturing sector occupations:¹³

A closer look at the occupations suggests that there is wide variation in the projected demand. Among the occupational groups, the Computer and Mathematical Occupations and the Construction and Extraction Occupations (including only Electricians) are expected to grow the fastest in both states. The lowest growth rates are predicted for Production Occupations: a 2% decrease in Washington and a 1% decrease in Oregon. However, there is a significant variation within the different Production Occupations as well: in both states, Computer-Controlled Machine Tool Operators will be in demand, whereas the number of jobs for Electrical, Electronic, and Electromechanical Assemblers are expected to decrease. This decrease in jobs for Electrical, Electronic, and Electromechanical Assemblers may seem surprising at first, but the trend is a part of a wider decline in manufacturing labor force, caused by offshoring and automation.

Finally, we also examined the regional variation in future occupational needs in the electric motor vehicle related occupations. Perhaps the most striking regional difference is in the demand for Electricians. The predicted increase in these jobs is 18.4% in the Portland metropolitan area, defined as the Portland- Vancouver-Hillsboro OR-WA metropolitan statistical area by the U.S. Census Bureau. The predicted growth for electricians is smaller in Oregon overall, 13.7%, and it is significantly lower in the Seattle metropolitan area, defined as the Seattle-Tacoma-Bellevue area, at 6.4%.

¹¹*Amping Up Electric Vehicle Manufacturing in the PNW.*

¹² WA EDS. <https://esd.wa.gov/labormarketinfo/projection>

¹³ *Amping Up Electric Vehicle Manufacturing in the PNW.* <https://webuildgreencities.com/wp-content/uploads/2020/05/READ-THE-EV-REPORT-HERE.pdf>

Table 5. EV-Related (supply-chain) Occupations in Washington¹⁴

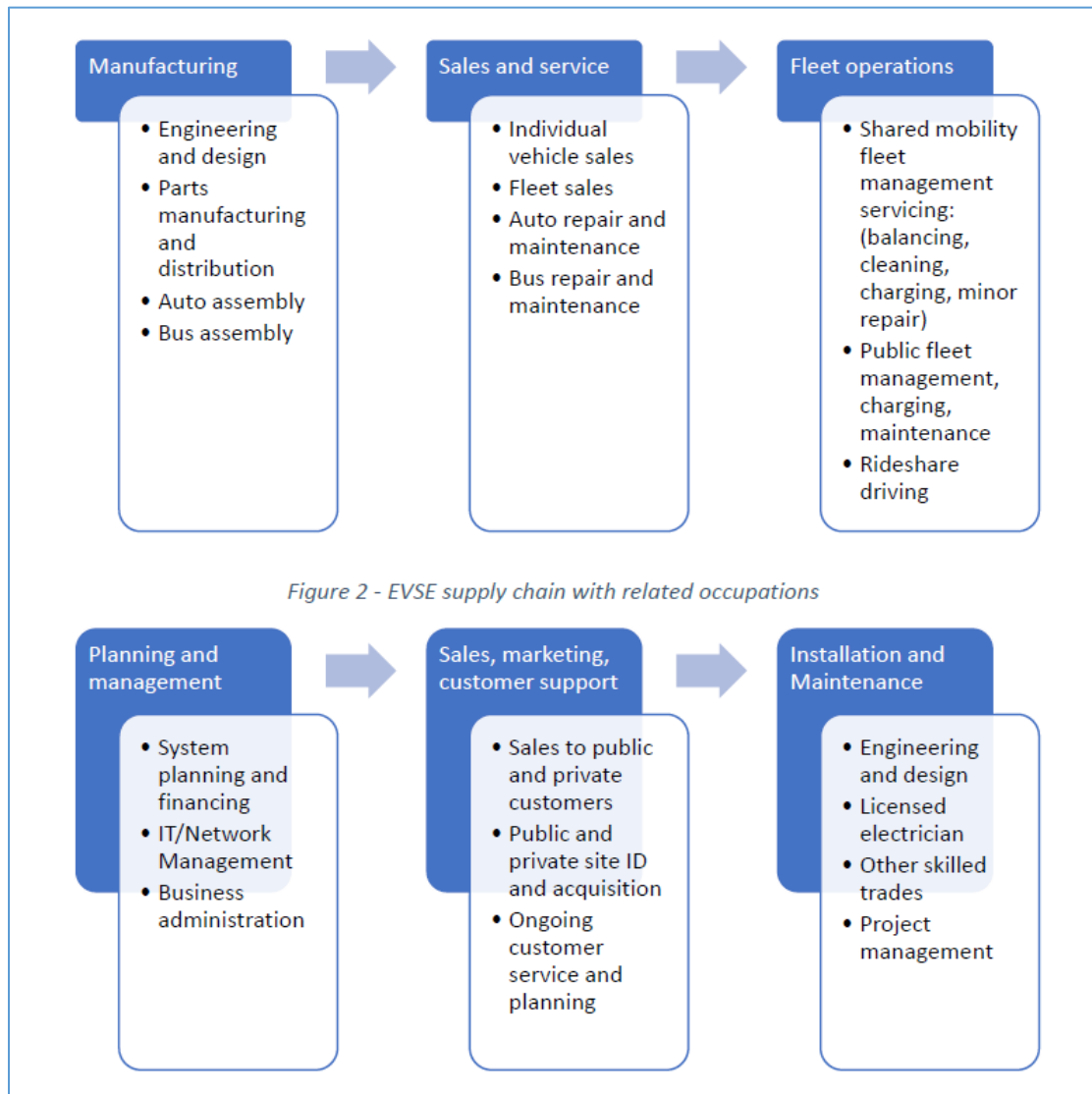
Occupation Group	Occupation	2019 Jobs	Annual Openings (incl. new jobs & retirements)	2019 - 2025 % Change	Median Hourly Earnings	COL Adjusted Median Hourly Earnings
Architecture & Engineering Occupations	Chemical Engineers	629	45	2%	\$48.29	\$42.36
	Computer Hardware Engineers	1,701	130	7%	\$57.95	\$50.83
	Electrical Engineers	5,794	403	2%	\$53.71	\$47.11
	Electronics Engineers, Except Computer	3,338	229	2%	\$51.40	\$45.09
	Industrial Engineers	7,082	531	5%	\$50.11	\$43.96
	Materials Engineers	1,024	77	0%	\$51.87	\$45.50
	Mechanical Engineers	7,875	541	3%	\$43.52	\$38.18
	Mechanical Drafters	2,040	182	1%	\$38.23	\$33.54
	Electrical and Electronics Engineering Technicians	2,404	227	4%	\$34.58	\$30.33
	Electro-Mechanical Technicians	150	14	1%	\$42.31	\$37.11
	Mechanical Engineering Technicians	980	88	(-2%)	\$30.89	\$27.10
	Total Jobs, Openings, and % Change; Median Earnings		33,018	2,463	3%	\$48.29
Computer & Mathematical Occupations	Computer Systems Analysts	18,196	1,436	8%	\$45.12	\$39.58
	Computer Programmers	9,723	620	(-2%)	\$63.23	\$55.46
	Software Developers, Applications	56,467	5,435	17%	\$61.63	\$54.06
	Software Developers, Systems Software	16,718	1,309	8%	\$58.40	\$51.23
	Network and Computer Systems Administrators	8,839	679	8%	\$43.00	\$37.72
	Operations Research Analysts	3,021	271	16%	\$44.15	\$38.73
	Total Jobs, Openings, and % Change; Median Earnings		112,964	9,751	12%	\$51.76
Construction & Extraction Occupations	Electricians	18,992	2,457	9%	\$31.56	\$27.68
	Total Jobs, Openings, and % Change; Median Earnings		18,992	2,457	9%	\$31.56
Installation, Maintenance & Repair Occupations	Automotive Service Technicians & Mechanics	13,452	1,349	4%	\$22.88	\$20.07
	Electric Motor, Power Tool, & Related Repairers	340	37	6%	\$26.33	\$23.10
	Electronic Equipment Installers & Repairers, Motor Vehicles	221	20	(-17%)	\$25.64	\$22.49
	Telecommunications Equipment Installers & Repairers, except Line Installers	4,924	526	(-2%)	\$32.22	\$28.26
	Total Jobs, Openings, and % Change; Median Earnings		18,938	1,932	(-2%)	\$25.99

¹⁴ SJI Table 7.

<i>Occupation Group</i>	<i>Occupation</i>	2019 Jobs	Annual Openings (incl. new jobs & retirements)	2019 - 2025 % Change	Median Hourly Earnings	COL Adjusted Median Hourly Earnings
<i>Life, Physical & Social Science Occupations</i>	Chemists	1,739	171	4%	\$38.73	\$33.97
	Materials Scientists	396	36	0%	\$50.33	\$44.15
	Urban and Regional Planners	2,126	201	7%	\$38.90	\$34.12
	Total Jobs, Openings, and % Change; Median Earnings	4,261	408	5%	\$38.90	\$34.12
<i>Management Occupations</i>	Industrial Production Managers	2,806	221	4%	\$57.59	\$50.52
	Total Jobs, Openings, and % Change; Median Earnings	2,806	221	4%	\$57.59	\$50.52
<i>Production Occupations</i>	Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	4,861	556	(-9%)	\$18.66	\$16.37
	Assemblers and Fabricators, All Other, Including Team Assemblers	16,685	1,931	(-4%)	\$17.22	\$15.11
	Computer-Controlled Machine Tool Operators, Metal and Plastic	2,212	237	3%	\$28.42	\$24.93
	Machinists	10,380	1,108	2%	\$24.09	\$21.13
	Total Jobs, Openings, and % Change; Median Earnings	34,137	3,831	(-2%)	\$21.38	\$18.75
Total Jobs, Openings, and % Change; Median Earnings		225,116	21,063	7%	\$42.55	\$37.42

Source: Emsi

Figure 2. EV Supply Chains with Related Occupations¹⁵



The *Amping Up* report assessed job growth by education level. Projected growth is highest for jobs that require a bachelor’s or a master’s degree. The trend holds for both Oregon and Washington, as well as the Pacific Northwest and the country as a whole: the predicted increase in openings is almost 10% across the regions. In turn, the occupational demand is predicted to grow the slowest in occupations that require only a high school diploma. The exception is Washington, where the predicted growth is slightly slower for occupations that require an associate degree. Table 4 presents these growth rates in more detail.¹⁶

¹⁵ *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>

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

Table 6. Projected Growth in EV-Related Occupations by Level of Education, 2019 to 2025¹⁷

Occupational Group by Education	Change in Jobs, OR and WA	Change in Jobs, OR	Change in Jobs, WA	Change in Jobs, U.S.
<i>HS diploma or postsecondary non-degree award</i>	2.3	3.2	1.7	1.8
<i>Associate degree</i>	2.7	3.9	1.6	5.3
<i>Bachelor or master degree</i>	9.5	8.7	9.8	10

Source: Emsi

Table 7. Share of Women and People of Color in EV-Related Occupations by Expected Growth, 2019 to 2025—Washington and Oregon¹⁸

EV-Related Occupations	Female	People of Color	Asian American and Asian (%)
<i>Growing Occupations (9.1%)</i>	16%	31.10%	23.00%
<i>Declining Occupations (-3.7%)</i>	32.6%	36.00%	17.40%

Source: Emsi

Table 8. Share of Women in EV-Related Occupations by Subgroup, 2019 (job growth in parentheses)¹⁹

EV-Related Occupations	Oregon	Washington	U.S.
<i>Architecture and Engineering Occupations</i>	11.9 (6%)	13.0 (3%)	13.1
<i>Computer and Mathematical Occupations</i>	24.0 (10%)	22.2 (12%)	25.1
<i>Construction and Extraction Occupations</i>	2.3 (14%)	3.1 (9%)	2.7
<i>Installation, Maintenance, and Repair Occupations</i>	3.4 (3%)	4.1 (-2%)	4.1
<i>Life, Physical, and Social Science Occupations</i>	42.3 (8%)	41.2 (5%)	40.8
<i>Management Occupations</i>	15.5 (5%)	17.2 (4%)	17.1
<i>Production Occupations</i>	31.4 (-1%)	27.6 (-2%)	32.4

Source: Emsi

Summary of Labor and Occupation Information

Existing labor market data is lagged and does not measure businesses and occupations unique to the EV sector. Additionally, little is known about the EV sector within Washington. The existing research we identified for Washington’s EV labor markets focused primarily on a limited pool of manufacturing sector jobs. The existing research also extrapolates data from the traditional auto industry, thus limiting knowledge specific to the EV industry and workforce.

¹⁷ SJI Table 9.

¹⁸ SJI Table 12.

¹⁹ SJI Table 10.