

# TRACKING THE STATE OF U.S. EV MANUFACTURING

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# Executive Summary

## **The United States is seeing rapid growth in domestic electric vehicle (EV)**

**manufacturing:** In September 2024, EVs made up ten percent of all new light-duty vehicle sales [1]. A domestic supply chain is emerging to meet growing EV demand. From 2000 to the end of September 2024, companies announced \$208.8 billion of investments in EV manufacturing corresponding to an estimated 240,000 announced jobs [2]. More than 50 percent of these investments have been announced since the passage of the Inflation Reduction Act in August 2022. While these investments are spread across the country, 80 percent of all announced investments will go to just ten states: Michigan, Georgia, North Carolina, Tennessee, Indiana, South Carolina, Nevada, Ohio, Kentucky, and California. Nationwide more than three-quarters of all investments are either under construction or operational, as of October 2024.

**This supply chain build-out is due in part to federal support:** Much of the build-out has been driven by both the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law, and the Inflation Reduction Act. These two laws have created new programs, tax incentives, additional loan authority, and grants to invest in manufacturing and updated existing programs to incentivize EV purchasing and charging. Companies have noted the importance of these tax credits in disclosures. Albemarle, a critical minerals mining company, mentioned that the Inflation Reduction Act is “a prime example of how subsidies can incentivize the build out of the EV supply chain.” Through programs such as the U.S. Department of Energy’s Advanced Vehicle Technology Manufacturing loan program, the Battery Materials Processing and Battery Manufacturing and Recycling program, and the Qualifying Advanced Energy Project Credit program (in partnership with the U.S. Department of the Treasury), the U.S. government has awarded over \$28 billion in grants, tax credits, and loans for EV and battery manufacturing. Elsewhere, the federal government is supporting manufacturing directly through other tax credits and indirectly through tax credits incentivizing EV adoption. As part of program implementation, federal agencies are requiring companies to develop and implement plans to meaningfully support the surrounding communities and build partnerships with key stakeholders in ways that increase the likelihood of project success. Company efforts range from targeted hiring from underserved communities, providing high quality jobs with competitive wages and benefits, and ensuring benefits accrue to disadvantaged communities.

**Despite the significant domestic EV supply coming online, gaps remain, particularly for critical minerals:** Companies are heavily investing in the U.S. EV supply chain, particularly in areas like cathodes, anodes, and additives, where manufacturing capacity is currently

limited or moderate. Additionally, downstream manufacturers are becoming increasingly concerned about critical mineral supplies. Major automakers such as General Motors and Ford have begun to forge agreements with mining companies to address this constraint.

**Job quality matters, and the U.S. government is placing an emphasis on increasing quality jobs in EV manufacturing:** Labor considerations are important to EV production, particularly if EV jobs replace existing jobs manufacturing internal combustion engine (ICE) vehicles. The U.S. government considers that the elements that make up a “good job” include competitive pay, comprehensive benefits, predictable scheduling, a safe, healthy, and accessible workplace, and on-the-job skill development. Labor unions have utilized collective bargaining to improve job quality at these facilities. As of September 2024, about 12,000, or 12 percent, of EV manufacturing jobs are at unionized facilities. Wages for those with collective bargaining agreements are higher than non-unionized counterparts and union members are more likely to have better job security and reliable healthcare [3].

**Apprenticeship programs supporting EV manufacturing are currently limited but will be key to developing the skills of current and future auto manufacturing employees:**

Apprenticeships are training programs combining on-the-job and classroom components that are sponsored by unions, manufacturers, educational institutions, and others, to bring new workers into the industry. While apprenticeship models are commonly used in the building and construction trades, they are less frequently applied to manufacturing occupations. With the rising demand for EV manufacturing, sectoral workforce development helps bring together key stakeholders to identify challenges and opportunities and implement solutions for the industry's needs. The Battery Workforce Initiative (BWI), launched in 2022, exemplifies this approach. It brings together government, manufacturers, unions, and educational institutions to create training models that address both industry and worker needs, creating a federally-certified nationwide apprenticeship program specifically for battery manufacturing. Other nationally accredited programs can provide workers with transferable skills between ICE vehicle and EV manufacturing or general electronics and EV battery manufacturing. Six companies have EV-manufacturing-specific registered apprenticeship programs. Additionally, continuous training can ensure that new and existing workers in the industry have the skills they need, reducing workforce gaps. Automakers often partner with universities or technical colleges to provide training programs, although these tend to be unpaid.

Public and private investment in EV manufacturing will continue to drive new production. These investments will shape the future of auto manufacturing workers and communities across the United States and ensure the build out of a reliable domestic manufacturing base.

# Introduction

The electric vehicle (EV) transition in the United States is well underway. The transition can be seen in EV sales figures that continue to climb. Through September 2024, 5.8 million new light-duty EVs (including plug-in hybrid and battery electric vehicles) have been sold in the United States [1]. The share of EVs among total vehicle sales has steadily climbed from 1.8 percent in 2019 to 9.8 percent in 2024 (through September 2024).

The speed of the transition can also be seen in the deployment of EV chargers around the country. Although 80 percent of EV charging happens at home [4], public charging is key for long trips and for those without reliable access to home or work charging. As of September 30, 2024, there were over 46,000 direct current fast-charging ports at 11,000 locations across the country and 140,000 Level 2 ports at 57,000 locations [5]. The U.S. government has a goal of installing 500,000 public chargers by 2030 meaning the current network is a third of the way to meeting that target [6].

The growth in facilities around the country to build EVs and the batteries that power them is another way to measure progress. The passage of the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) have marked a new commitment of federal support to build supply chains and create new manufacturing jobs in the United States. The Inflation Reduction Act in particular provided incentives for domestic manufacturing both through direct support for manufacturing facilities and through consumer facing tax credits that drive the purchase of clean vehicles and batteries made in North America [7].

Federal support appears to be paying dividends as manufacturers set up plants in the United States. Per analysis released in August 2024, companies are expected to invest \$312 billion in U.S. EV manufacturing [8]. As these plants are built, communities may look to ensure benefits flow to them through Community Benefits Agreements and Community Benefits Plans. Three facilities in Atlas's EV Jobs Hub dataset currently report legally binding Community Benefits Agreements and many others have Community Benefits Plans developed as part of application for U.S. Department of Energy (DOE) grant and loan funding under the IRA and IIJA.

At the same time, other federal and major state policies can also have a positive impact on EV adoption. In March 2024, the U.S. Environmental Protection Agency (EPA) set tailpipe emissions standards for model years 2027 to 2032, requiring a 50 percent reduction in air pollution from light-duty vehicles by 2032 [9]. While the EPA standards do not specifically require EV adoption, EVs are a cost-effective pathway for automakers to achieve compliance. Accordingly, EPA estimated battery EVs could make up 30 to 56 percent of new light-duty vehicle sales and 20 to 32 percent of new medium-duty vehicle sales from 2030

to 2032. Meanwhile, California, one of the world's largest car markets, finalized a regulation in 2022 that sales of new light-duty vehicles must be zero-emission by 2035 [10].

IIJA and the Inflation Reduction Act both created new or updated incentives for EVs. The IIJA created several programs to help states and localities purchase electric buses and other medium- and heavy-duty vehicles. Meanwhile the Inflation Reduction Act includes support of up to \$7,500 for new light-duty EVs, \$4,000 for used EVs, and 30 percent of the purchase price for commercial EVs including leases (up to \$7,500 for commercial light duty vehicles and \$40,000 for commercial vehicles weighing over 14,000 pounds) [11].

This report lays out the state of the EV transition in the United States with a particular focus on manufacturing and jobs. The report examines federal and state funding for EVs, community benefits built into EV manufacturing investments, strengths and weaknesses of the domestic EV supply chain, and key labor considerations including unionization, job quality, and worker training.

## Scope of Data

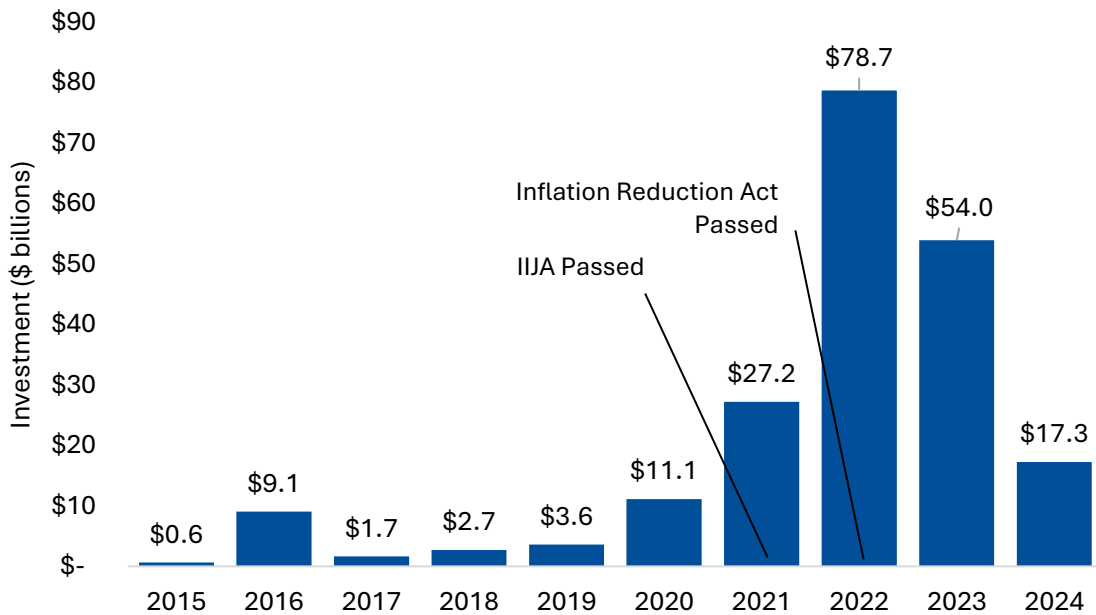
The data included in this report is predominantly sourced from EV Jobs Hub [2]. The Hub, built by Atlas Public Policy in partnership with the BlueGreen Alliance Foundation, tracks the EV manufacturing supply chain including vehicle assembly, critical minerals processing, EV batteries, EV charging, battery recycling, and vehicle parts. Batteries in this report include only those that will go into EV production, and so does not include stationary storage batteries or batteries used in personal devices like mobile phones. Additionally, critical mineral extraction is not included. Investments are tracked by announcements.

The data does not include facilities producing “fuel-agnostic” components that can go into EVs or internal combustion engine (ICE) vehicles like wheels, doors, etc. A facility is only included in the dataset once it is known where the facility will be built. The data draws on announcements from companies and other public statements. The data in this report includes announcements from 2000 and is valid through September 2024. Some additional developments related to the U.S. Department of Energy are updated through December 2024. The data excludes any facility that was withdrawn or closed before Q3 2023. For more information on the data collection methodology, visit EV Jobs Hub at <https://evjobs.bgafoundation.org>.

# The State of U.S. EV and Battery Manufacturing

This section distills insights into EV manufacturing and supply chain facilities from the EV Jobs Hub. EV Jobs Hub has tracked a total of \$208.8 billion in investment, and 240,500 jobs announced from 2000 through September 2024. Of those investments, \$157.3 billion and 163,700 jobs were announced after the passage of IIJA in November 2021 (see Figure 1).

Figure 1: EV and Battery Investment by Announcement Year Since 2015

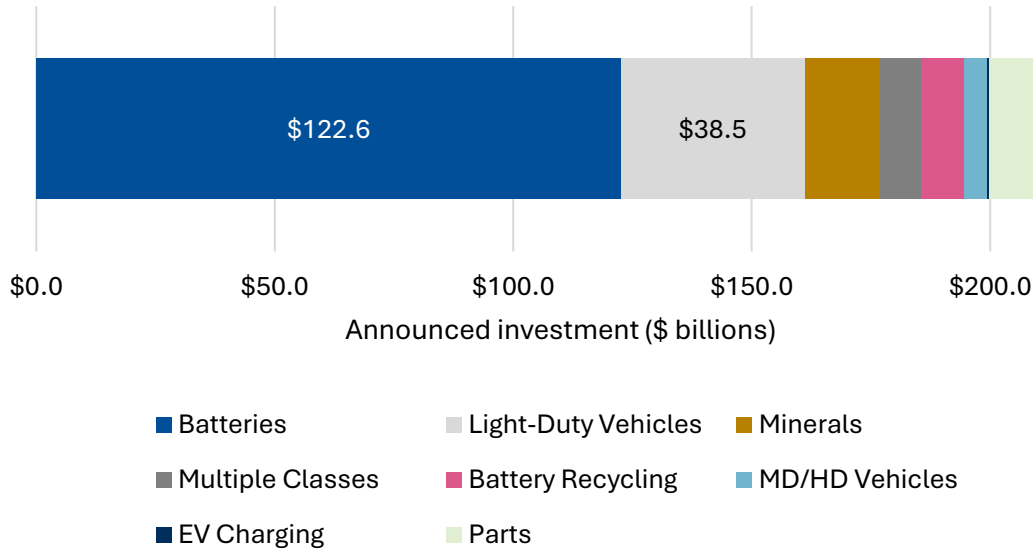


The data in this figure includes private investment in EV and Battery manufacturing and does not include federal support or investments in non-manufacturing sectors. Data through September 30, 2024.

Source: EV Jobs Hub [2]

As of the end of September 2024, most facilities announced were either operational or under construction (see Figure 3). A total of \$49.6 billion has gone into new manufacturing facilities that are now operational around the country, benefiting communities and creating employment. Of the total announced investments, 23.5 percent has gone to currently operational facilities, 53 percent to new facilities under construction, and the remaining 23.5 percent to projects still in the planning stage. For announcements that are currently planned or under construction, 64 percent of investments are set to be completed by 2025.

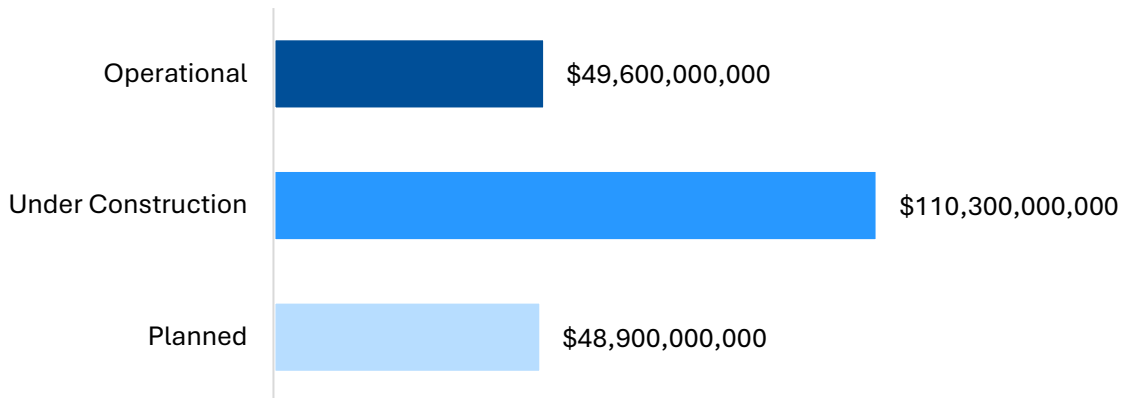
Figure 2: Announced Investment by Manufacturing Sector since 2000



The data in this figure includes private investment in EV and battery manufacturing. Data through September 2024.

Source: EV Jobs Hub [2]

Figure 3: Manufacturing Investment by Operating Status of Announcement since 2000



The data in this figure includes all facilities announced through September 2024 and their status as of October 31, 2024.

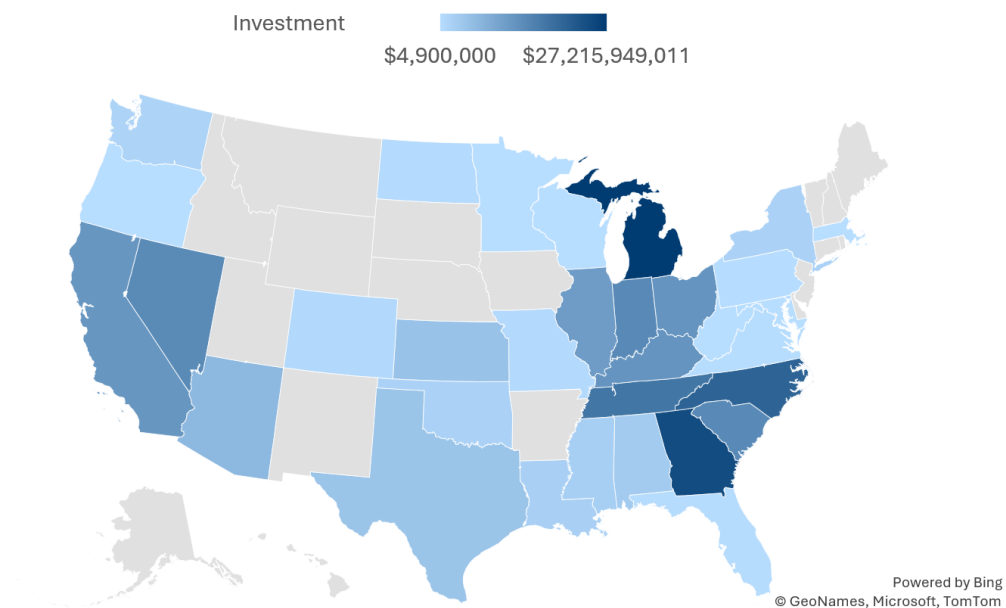
Source: EV Jobs Hub [2]



## Geography of EV Investments

Total announced investments are geographically concentrated, with 80 percent of all announced investments going to just ten states (in order from largest announced investment): Michigan, Georgia, North Carolina, Tennessee, Indiana, South Carolina, Nevada, Ohio, Kentucky, and California. Around the country, 54 counties will each see more than 1,000 EV manufacturing jobs [2].

Figure 4: Announced EV Manufacturing Investment by State since 2000



The data in this figure includes all-time announced investment for EV manufacturing supply chain by state, through September 2024.

Source: EV Jobs Hub [2]

Of announced jobs, 70,100 (31 percent) are in census tracts deemed as Justice40 disadvantaged communities per the Climate and Economic Justice Screening Tool (CEJST) [12]. CEJST identifies a community as disadvantaged if it is above a certain threshold in environmental and socio-economic burdens.

Investment is also flowing into energy communities—those formerly reliant on oil, gas, and coal industries [13]. Of the announced jobs, 27,500 (12 percent) are in energy communities [14]. These are jobs opportunities for communities that have experienced considerable economic hardship with the decline in fossil-fuel industries.

## Indirect and Induced Jobs

In the EV Jobs Hub dataset, through September 2024, there were more than 240,000 announced permanent jobs in EV manufacturing, which includes vehicle assembly and battery and components manufacturing. Direct employment in EV manufacturing in turn drives the creation of indirect jobs further down in the supply chain and induced employment, which are jobs supported by the spending of earnings from direct and indirect workers [15], such as new restaurant or grocery store workers. This induced employment can be significant via a particularly strong industry multiplier effect [16]. Part of automaking's high multiplier effect in certain areas is a function of manufacturing jobs being high quality jobs, with above average pay and substantial benefits [17]. Often there are considerably more indirect and induced jobs than direct jobs.

## Investments by Company

A small number of auto and battery manufacturing firms account for a considerable share of announced investment, with the top five companies accounting for nearly 40 percent of all announced investments in the United States (see Table 1).

Domestic companies are investing the most, followed by parent companies headquartered in South Korea, Japan, Germany, the Netherlands, and China (see Figure 5). This reinforces the findings from an analysis produced by the Council of Economic Advisors in the White House released in June 2024, which examined U.S. clean energy investment from domestic and foreign sources [18]. While their analysis included other technologies as part of a broader analysis of Foreign Direct Investment, they found similarly that Japanese and South Korean companies trail only the United States for investment in the United States.

Table 1: Top 10 Largest Announced Investments by Parent Company since 2000

<b>Company</b>	<b>Announced Investment Total</b>	<b>Announced Jobs Total</b>
<b>LG Corporation</b>	\$18.9 billion	10,300
<b>Toyota</b>	\$18.6 billion	9,200
<b>General Motors</b>	\$17.6 billion	8,900
<b>Tesla</b>	\$15.2 billion	46,000
<b>Ford</b>	\$11.1 billion	12,600

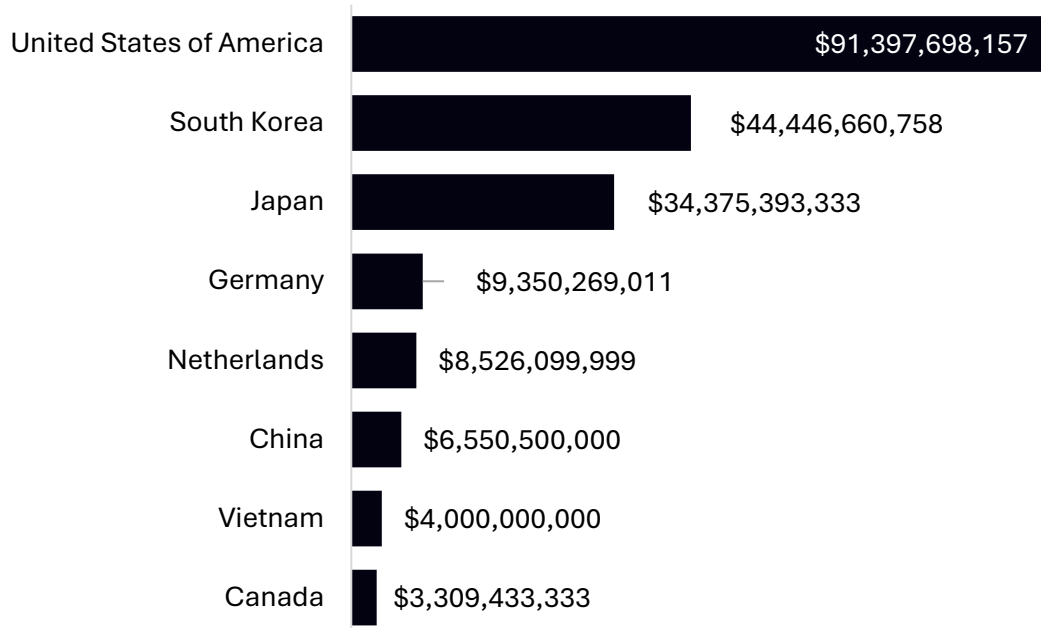
## Tracking the State of U.S. EV Manufacturing

Company	Announced Investment Total	Announced Jobs Total
<b>SK</b>	\$10.9 billion	10,400
<b>Rivian</b>	\$9.0 billion	14,300
<b>Hyundai</b>	\$8.6 billion	11,400
<b>Stellantis</b>	\$8.5 billion	5,200
<b>Redwood Materials</b>	\$7.0 billion	3,100

The data in this table includes the largest announced investment in the United States by company through September 2024. Jobs totals are rounded to the nearest 100. These investments include joint ventures in which case the investment and jobs are split evenly between partners unless otherwise stated.

Source: EV Jobs Hub [2]

Figure 5: Top Eight Announced Investment in the U.S. by Location of Parent Company's Headquarters since 2000



The data in this figure includes announced manufacturing investment in the United States by companies based on the location of the parent company headquarters. This list includes the eight highest investments by country. Data as of September 30, 2024.

Source: EV Jobs Hub [2]

Investment announcements are not always realized as initially expected or announced. The EV Jobs Hub has tracked upticks and declines in EV manufacturing investments, as some companies have delayed construction, retracted, or reduced production goals, or pushed back production timelines. One prominent example of a company's response to changes in consumer demand is the drop in production estimates for Ford's F-150 Lightning after sales did not meet the automaker's expectations [19]. Ford is now reassessing its EV strategy, moving toward electrifying smaller vehicles, and focusing on lowering production costs [20]. To support this goal, Ford finalized a \$9.6 billion loan in December 2024 with the DOE to manufacture batteries in a joint venture with SK [21]. Still, EV sales in Q3 2024 were the highest ever in the United States [1].

## Federal Government Support

The IIJA and Inflation Reduction Act included significant provisions to build EV supply chains in the United States. The IIJA, signed into law in November 2021, created or expanded several programs to support EV manufacturing, which are detailed in the *Federal Programs in Support for EV Manufacturing* section below. The Inflation Reduction Act, signed into law in August 2022, contained several key tax credits to support EV uptake. Detailed information on the uptake of these tax credits is harder to source than other federal support such as grant or loan programs, particularly for manufacturing tax credits. To better understand how companies are positioning themselves and accessing these tax credits and other support from the laws, this report relied on mentions of the legislation in company 10-K forms and public statements.

## Federal Programs in Support for EV Manufacturing

This section focuses on the seven programs that are directly supporting the manufacturing of EVs and batteries (see Table 2).

The Advanced Technology Vehicles Manufacturing (ATVM) loan program is administered by the Loan Programs Office (LPO) [22]. While ATVM existed before the enactment of IIJA and the Inflation Reduction Act, the legislation amended the scope and the funding available to the Office. IIJA changed the loan authority to include medium and heavy-duty vehicles and other clean transportation technologies, while the Inflation Reduction Act increased the program's size, including appropriating \$3 billion in credit subsidy to enable approximately \$40 billion in loans [23]. The Inflation Reduction Act also removed the \$25 billion cap in ATVM loan authority. Additionally, the total funding amount includes loans that have been

announced but are still in negotiations and are subject to change. ATVM loans are currently supporting facilities with a total of more than 31,000 announced jobs [2].

The Battery Materials Processing and Battery Manufacturing Recycling program is administered by DOE and has granted \$4.3 billion across 35 facilities [24]. The program was established in the IIJA. The largest of the grants was \$480 million to Ascend Elements in Kentucky. The program is currently supporting facilities with a total of 5,695 announced EV and battery jobs.

Table 2: Federal Support for EV and Battery Manufacturing (in select technologies)

<b>Program</b>	<b>Facilities</b>	<b>Funding Awarded</b>	<b>Funding Type</b>	<b>Announced Jobs</b>
<b>Advanced Technology Vehicles Manufacturing (EV and battery loans only)</b>	17	\$22.1 billion	Loan	31,053
<b>Battery Materials Processing and Battery Manufacturing and Recycling</b>	35	\$4.3 billion	Grant	5,695
<b>Domestic Manufacturing Conversion Grant Program</b>	11	\$1.4 billion	Grant	4,642
<b>Qualifying Advanced Energy Project Credit 48C (EV and battery technology only)</b>	8	\$565 million	Tax Credit	3,500
<b>Advanced Energy Manufacturing and Recycling Program</b>	1	\$100 million	Grant	282
<b>Electric Drive Vehicle Battery Recycling and Second Life Applications</b>	5	\$39 million	Grant	51

Program	Facilities	Funding Awarded	Funding Type	Announced Jobs
<b>Advanced Manufacturing Production Credit (45X)</b>	Unknown	Up to \$35 per kilowatt-hour for battery cells	Tax credit	Unknown

Facilities and funding refer to funding awarded for EV and battery supply chain facilities that are in scope of EV Jobs Hub. Some facilities receiving Battery Materials Processing and Battery Manufacturing and Recycling grants manufacture batteries for both vehicles and grid storage, so not all the \$4.3 billion will go solely to EV batteries. Loans from the U.S. DOE Loan Programs Office are from 2009 through the end of September 2024 and therefore include loans that have been paid back as well as “conditional commitments.” Other program totals in the table include all award announcements from November 2021 through September 30, 2024. In some instances, program totals differ from DOE totals where facilities that received DOE awards are not in scope for the EV Jobs Hub methodology. Note: This report tracks investments in a more limited set of technologies than are covered by the DOE programs above (see methodology described in the *Scope of Data* section). Accordingly, the number of facilities and funding totals listed here may be lower than the total funding/facilities awarded under these programs.

Source: EV Jobs Hub [2]

The Domestic Manufacturing Conversion Grant Program is administered by DOE and is meant to provide funding to facilities to transition from producing components for ICE vehicles to producing components for zero-emission vehicles. In July 2024, the DOE announced \$1.7 billion in grant funding for the conversion of ICE vehicle manufacturing facilities, specifically shuttered or at-risk facilities, to EV manufacturing facilities [25]. This money from the Domestic Manufacturing Auto Conversion Grants went to eight companies to retool/convert 11 facilities. The largest grant, for \$500 million, went to a General Motors facility in Lansing, Michigan.

The Qualifying Advanced Energy Project credit (48C) was established in 2009 and is an allocated investment tax credit to expand U.S. clean energy manufacturing capacity with a cap of \$10 billion [26]. According to its authorizing legislation, forty percent of the allocation must go to energy communities. The first awards were announced in March 2024, and as of September 2024, eight facilities in the EV manufacturing supply chain have disclosed that they received approximately \$565 million in total tax credits and support 3,500 announced jobs. There are almost certainly more facilities that have received the credit and are in scope of this report and data methodology but have not self-reported. The 48C credit has existed since 2009 but was expanded with an additional \$10 billion appropriated in the Inflation Reduction Act. The current list of projects, and subsequent reported 48C funding

amount, comes from Round One of program award recipients that have self-disclosed since the Inflation Reduction Act passed. The IRS and DOE reported a total of \$4 billion granted in credits for FY2023 from this first round, of which \$1.5 billion (38 percent) went to facilities in energy communities. The IRS and DOE also recently announced \$6 billion in tax credit allocations for the second round of the 48C program (note: the projects from round two are not included in the total 48C figures of this report) [26].

The Advanced Energy Manufacturing and Recycling Program was established in the IJJA and focuses on grant funding for small and medium-sized manufacturers [27]. It has so far announced two rounds of funding with the first-round awarding \$275 million to seven projects. The second round of awards for \$425 million was announced in October 2024 and so is after the cut off for this analysis [28]. Of the first-round awardees, only the \$100 million grant for Microporous (also known as MP Assets) in Virginia is for an EV manufacturing facility tracked on EV Jobs Hub. This facility supports an announced 282 manufacturing jobs.

The Electric Drive Vehicle Battery Recycling Program is a \$200 million program established in the IJJA and administered by DOE [29]. The program focuses on demonstrations of secondary applications for EV batteries, including for reuse in energy storage systems and materials recycling. DOE chose ten total awardees in its first round, of which five are for EV manufacturing supply chain facilities. These facilities received a total of \$39 million.

Finally, the Advanced Manufacturing Production Tax Credit (45X) covers the production of various energy components, including batteries and applicable critical minerals [30]. For battery cells, the credit is \$35 per kilowatt-hour capacity produced. DOE estimated that in 2023 the cost of an electric vehicle lithium-ion battery pack for a light-duty vehicle was \$139 per kilowatt-hour, meaning the credit covers approximately a quarter of production costs [31]. In the case of critical minerals, the credit is set at 10 percent of the cost of production. Facilities cannot receive both the 45X and 48C tax credit.

Many of the programs outlined above require applicants to submit Community Benefit Plans that outline how the facility will engage community and labor stakeholders, create quality jobs and career pathways, impact and support the local community, and how the company will enhance economic, employment, and environmental benefits, particularly for underrepresented workers and communities. Further discussion of community benefits plans can be found in *Community Benefits*.

## Other Federal Support for EV Uptake

There are several non-manufacturing-focused federal programs designed to encourage the uptake of EVs and the construction of EV infrastructure. These include tax credits created or

reformed by the Inflation Reduction Act as well as programs from several agencies, including the DOE, Department of Transportation, Environmental Protection Agency, and the Department of Agriculture [32]. Notable is the clean vehicle tax credit (30D), which offers a tax credit of up to \$7,500 to consumers purchasing vehicles provided they meet certain criteria [33]. Vehicles that qualify for 30D must be assembled in North America and meet critical mineral and battery component requirements that grow increasingly stringent over time. In October 2024, the IRS announced \$2 billion in uptake at the point of sale between this credit and the Used Clean Vehicle Credit (25E), a credit of up to \$4,000 for a qualifying used EV, helping more than 250,000 consumers purchase new EVs and 50,000 purchase used EVs [34] [35]. Likewise, several key programs from the two laws will indirectly support manufacturing through supporting charging that is vital in the uptake of electric vehicles including notably the National Electric Vehicle Infrastructure Program and the Alternative Fuel Vehicle Refueling Property Credit (30C).

## Filings from Companies Indicate the Benefits from Federal Support

Vehicle and battery manufacturers have noted in their 10-K forms<sup>1</sup> that their recent investment announcements are influenced by support from grants, loans, and tax credits provided through federal provisions from the Inflation Reduction Act. Table 3 includes statements from the seven largest companies by announced EV investment on the role of federal support in their operations in the United States.

Table 3: Company 10-K Filings Related to the Inflation Reduction Act for the Largest Public Companies by Announced EV Investment

Company, Category, Investment	Inflation Reduction Act Measures Mentioned
<b>General Motors [36]</b> Vehicle assembly and battery manufacturing \$17.6 billion	“IRA benefits, including credits and lower material costs, are expected to materially affect net income in the future... We are also entitled to certain advanced manufacturing production credits under the IRA.”

<sup>1</sup> All publicly traded companies must publish a 10-K form annually. The audited form discloses pertinent information for investors about a public company.



Company, Category, Investment	Inflation Reduction Act Measures Mentioned
<b>Tesla [37]</b>	Tesla drivers may access 30D. Further, standalone energy storage may be eligible for tax credits under Sections 48, 48E, and 25D. The company also stated that production costs were reduced by the Inflation Reduction Act manufacturing credits.
Vehicle assembly and battery manufacturing \$15.2 billion	
<b>Ford [38]</b>	Ford expects 45X to “improve the financial performance of domestic battery manufacturers, including the new operations at our upcoming facility in Michigan and BlueOval SK’s facilities in Kentucky and Tennessee.” The company’s investment strategy in the United States hinges on its vehicles being eligible for 30D, 25E, and 45W: “[a]utomakers that better optimize eligibility for their vehicles, as compared to their competition, will have a competitive advantage.”
Vehicle assembly and battery manufacturing \$11.1 billion	
<b>Rivian [39]</b>	Rivian intends to submit applications for their Normal, Illinois, facility, and Stanton Springs North Facility for energy communities 48C credit. Rivian was able to take advantage of the 45X module assembly credit in 2023. Rivian is also able to benefit from the 30D, 45W and 30C tax credits and noted “[t]he unavailability, reduction or elimination of government and economic incentives could have a material adverse effect on our business, prospects, financial condition, results of operations, and cash flows.”
Vehicle assembly and battery manufacturing \$9 billion	
<b>QuantumScape [40]</b>	Lists 30C, 30D, 48C, and 48X, but unclear if the company seeks to access them. “These incentives may expire on a particular date, end when the allocated funding is exhausted, or be reduced or terminated as a matter of regulatory or legislative policy. Any other reduction in rebates, tax credits or other financial incentives could materially reduce the demand for EVs, which could adversely impact the battery demand for EVs, or materially reduce the amount of incentives available for the manufacture of our products and have an adverse impact on our business.”
Battery manufacturing \$2 billion	
<b>Albemarle [41]</b>	

<b>Company, Category, Investment</b>	<b>Inflation Reduction Act Measures Mentioned</b>
Mineral extraction and processing  \$1.7 billion	“Many governments have helped by offering grants and tax breaks, with the Inflation Reduction Act (IRA) a prime example of how subsidies can incentivize the build out of the EV supply chain.”
<b>FREYR [42]</b>  Battery manufacturing  \$1.3 billion	“The IRA will likely drive significantly lower battery costs and prices in the U.S., potentially leading to a surge in domestic [energy storage system] activity.” The company may also try and seek “U.S. Department of Energy (“DOE”) Title 17 Clean Energy Financing Program” loans.

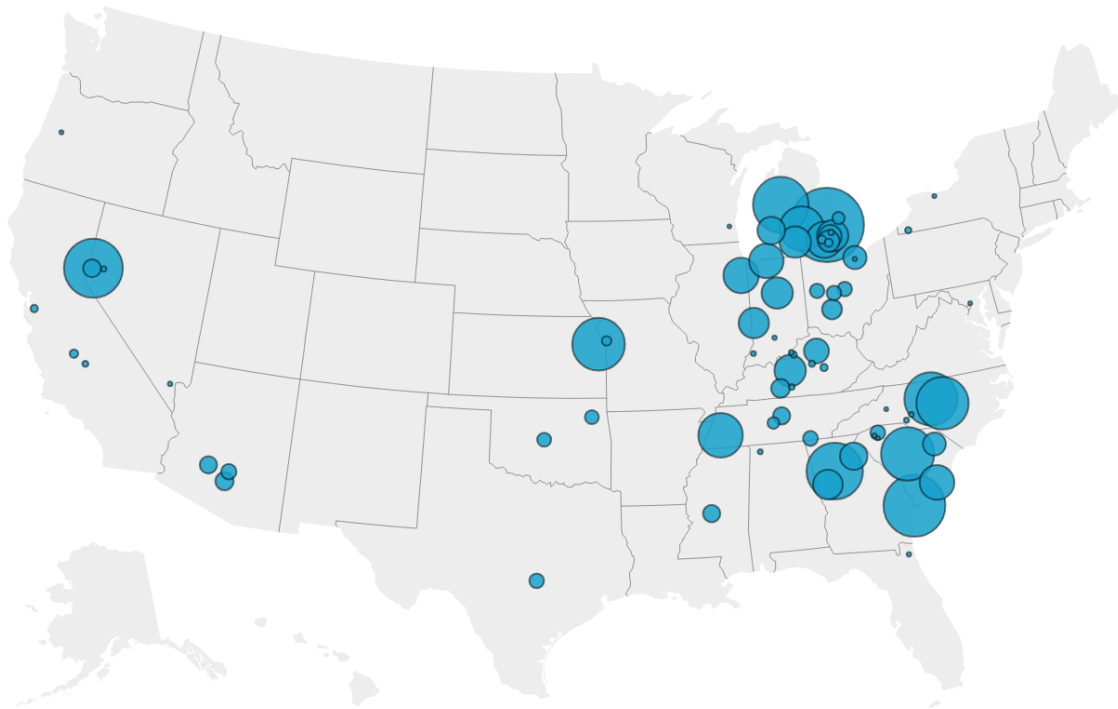
The data in this table comes from 10-K forms for the seven largest companies by announced EV investment where the form is available. Companies are listed in order of the size of the announced investment. The 10-K form is from the fiscal year ending December 31, 2023.

In their 10-K filings, automakers, battery makers, and mining companies have been clear about the significant impact of the tax credits from the Inflation Reduction Act. Companies were clear about the importance of these tax credits to their business model and the risk to their operations if the tax credits were no longer available. Ford noted that its investment strategies hinge upon the tax credits, “the degree of success of some of our investment strategies depends upon Inflation Reduction Act tax credit eligibility and for those credits to continue to remain available through the currently contemplated expiration.”

## State and Local Government Support

State and local governments have a long history of offering incentives to companies to locate in their jurisdiction, often interested in securing jobs, increasing tax revenues, and establishing themselves as industry hubs [43]. Along with federal policy, states and localities are increasingly offering incentives for EV manufacturers to site plants in their jurisdictions. As of the end of July 2024, 76 EV manufacturing facilities received state and local incentives including grants and tax abatements across the United States, equivalent to \$24 billion [2].

Figure 6: Manufacturing Facilities Receiving State and Local Subsidies by City since 2000



Created with Datawrapper

The size of the circles indicates the level of state and local subsidy by city. Data is through July 2024.

Source: EV Jobs Hub [2]

Half of the \$24 billion in state and local support was pledged to battery plants, 32 percent went to light-duty vehicle assembly, and the remainder went to assembly of multiple vehicle classes, parts manufacturing, battery recycling plants, medium- and heavy-duty vehicle assembly, or minerals. Seven projects have been promised over \$1 billion in state and local subsidies: four vehicle assembly plants, two battery plants, and one plant that makes EV drive units.<sup>2</sup> Table 4 details the seven projects that received the most state and local subsidies.

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<sup>2</sup> EV drive units consist of the electric motor, power electronics, and gearbox.

Table 4: State and Local Subsidy Packages Valued at Over \$1 Billion for EV Manufacturing

Company	Facility State	Subsidy Amount	Details on Subsidies
<b>Hyundai</b>	GA	\$1.8 billion	<ul style="list-style-type: none"> <li>• \$669 million in local property tax abatements through 2048</li> <li>• \$478 million in state sales tax exemptions on machinery</li> <li>• \$223 million in state income tax breaks over five years</li> <li>• \$210 million for road upgrades</li> <li>• \$175.6 million for water and sewer upgrades</li> <li>• \$112 million from state and local governments for site purchase and preparation</li> <li>• \$53 million state grant for project development</li> <li>• Largest incentive package in state history [44]</li> </ul>
<b>General Motors</b>	MI	\$1.76 billion	<ul style="list-style-type: none"> <li>• \$937 million in water subsidies over 20 years from the Lansing Board of Water and Light</li> <li>• \$666 million in economic development grants from Strategic Outreach and Attraction Reserve Fund</li> <li>• \$158 million in tax incentives over 18 years from state/local Renaissance Zones program</li> <li>• 15-year abatements from Orion Township (value unknown)</li> </ul>
<b>Rivian</b>	GA	\$1.48 billion	<ul style="list-style-type: none"> <li>• 25-year property tax abatements deal estimated at \$700 million (Rivian would pay \$300 million in lieu of taxes on it)</li> <li>• \$196.9 million in Mega Job Tax Credits over 5 years</li> </ul>

Company	Facility State	Subsidy Amount	Details on Subsidies
			<ul style="list-style-type: none"> <li>• \$105 million in sales tax exemptions</li> <li>• \$111 million state grant payable to the local authority for land acquisition and preparation</li> <li>• \$62.5 million state grant for a Quick Start Training Center</li> <li>• \$51.5 million for road infrastructure</li> <li>• \$26.9 million state grant for workforce development training</li> <li>• Before Hyundai, was the largest incentive package in Georgia and the largest incentive package to an auto plant in the country [45]</li> </ul>
<b>Scout Motors</b>	SC	\$1.3 billion	<ul style="list-style-type: none"> <li>• \$400 million grant for site construction</li> <li>• \$650 million for highway, road, and infrastructure improvements</li> <li>• \$200 million loan for soil stabilization</li> <li>• 40-year tax abatements via FILOT and SSRC</li> <li>• \$25 million for Midlands Technical College training center</li> <li>• Largest incentive package in state history [46]</li> </ul>
<b>Tesla</b>	NV	\$1.29 billion	<ul style="list-style-type: none"> <li>• \$725 million in sales tax abatements over 20 years</li> <li>• \$332 million in real and personal property tax abatements over 10 years</li> <li>• Modified business tax abatements worth \$27 million over 10 years</li> <li>• Transferable tax credit of \$12,500 per job for up to 6,000 jobs</li> <li>• \$120 million in investment tax credits</li> <li>• Largest incentive package in state history [47]</li> </ul>

Company	Facility State	Subsidy Amount	Details on Subsidies
<b>Panasonic</b>	KS	\$1.27 billion	<ul style="list-style-type: none"> <li>• \$829 million from the state, including investment tax credits, payroll reimbursement, sales tax exemptions on construction materials, and workforce training and relocation reimbursement for 10 years</li> <li>• \$402.6 million for project development</li> <li>• \$26 million in road improvements from the state Department of Transportation</li> </ul>
<b>VinFast</b>	NC	\$1.25 billion	<ul style="list-style-type: none"> <li>• \$450 million in upfront money approved by the state legislature will pay for the site preparations, water and sewer infrastructure build-out, and road updates</li> <li>• \$400 million in county tax abatements from Chatham County</li> <li>• \$316 million through Jobs Development Investment Grant over 32 years</li> <li>• \$50 million grant from the Golden Leaf Foundation grant</li> <li>• \$38 million for worker training via the community college systems</li> <li>• Largest incentive package in state history [48]</li> </ul>

The data in this table includes state and local subsidy packages worth over \$1 billion. Details only include support valued at over \$25 million. Timeframes noted where available.

Source: EV Jobs Hub [2], Subsidy Tracker [49]

Six states and their counties have collectively committed to investing over \$10 billion to entice companies to build EVs, batteries, or other EV components to their states. Much of this comes in the form of tax abatements, economic development grants, and infrastructure improvements around project sites. While two companies are major automakers with several decades of operation in the United States, the other five are either newer to the automotive industry or newer to the United States. In each case, state and local

governments are forgoing future tax revenues in exchange for the promise of economic growth from the facilities, from surrounding businesses along with the potential for new businesses to locate nearby.

State and local incentives often come with requirements to create new jobs in their communities. For example, Hyundai's 2023 deal with Georgia requires the company to create 8,500 jobs by 2031 [50]. If the facility does not meet 80 percent of its job creation target, the state will require Hyundai to pay back a portion of its incentives. Other states are choosing to incentivize companies with tax breaks that materialize when new jobs are created. Tesla's 2014 incentive package from Nevada, for example, promised a transferable \$12,500 tax credit for each job created at the factory up to 6,000 jobs [51].

The packages, just like the investments, are commitments and are subject to change. In 2023, Ford received a \$1.7 billion incentive package from the state of Michigan to build an EV battery plant [52]. However, in early 2024, the company announced it would downsize its plans [53]. As a result, the state shrank its incentive package by 60 percent [54].

Other subsidies include requirements to ensure that jobs will be created as part of the agreements. Honda and LG Energy Solution announced a partnership in February 2023 to create 2,527 new jobs at a new Jefferson Township, Ohio battery plant [55]. The companies secured \$237 million in funding from JobsOhio, the state's economic development corporation. The funding comes from a performance-based tax credit that scales with the amount of payroll going to new hires [56]. Elsewhere, in early 2024, Davidson County, North Carolina agreed to provide Dai Nippon Printing up to \$1.85 million as a performance-based grant for a new lithium-ion battery pouch factory so long as the company meets its goal of investing \$276 million in the project and creating 300 jobs at an average wage of \$50,300 per year over the next seven years [57].

## Community Benefits

Benefits from these manufacturing facilities go beyond direct employment opportunities and include both indirect and induced jobs and broader community benefits. These benefits contribute to the overall economic health of the community where a facility is located and create additional opportunities for economic growth. Congress included requirements and incentives in IIJA and Inflation Reduction Act programs to help ensure that funding to support clean technology investments—such as the EV manufacturing and supply chain investments described in this report—creates enhanced economic, employment, and environmental benefits.

Many federal and state awards that support companies to build EV manufacturing and supply chain facilities encourage the engagement with and benefits to the community. For example, DOE requires that companies seeking funds must submit plans on how their project will benefit local workers and the surrounding community.

## Plans and Agreements

CBPs are required for most applications to the DOE for IIJA or Inflation Reduction Act funding, and in most cases make up 20 percent of the technical merit review of proposals, split equally into four intersecting sections that work together to support project success, the efficient and effective use of taxpayer funds, timely implementation of projects, and the acceleration of private sector uptake in projects [58]. The DOE identified four core risk mitigation categories for a CBP [59]:

1. Engagement with communities and labor
2. Investing in quality jobs
3. Support for diversity, equity, inclusion, and accessibility through recruitment and training
4. Efforts to ensure benefits flow to disadvantaged communities.

DOE encourages implementation of these plans through enforceable, negotiated workforce and community agreements. There are several types of formal workforce and community agreements. Community Benefits Agreements, for example, are legally binding contracts between a company and a local entity, or group of local entities. These agreements can include any stipulations agreed upon, including those to hire local workers; they can also include other benefits such as funding educational programs or improving local infrastructure.

Workforce agreements, such as project labor and collective bargaining agreements, are another key type of agreement utilized in major construction and manufacturing projects and operations. While not mandated by DOE, such agreements align with the CBP's objective of delivering substantial benefits to workers and communities. They also mitigate common workforce-related risks and contribute to project success [60].

A Collective Bargaining Agreement (not to be confused with a Community Benefits Agreement) is a negotiated agreement between an employer and unionized employees that lays out the conditions of employment, such as wages and benefits, and may include time off policies, health and safety protections and training provisions [61]. These agreements may also include other priorities such as local hire provisions. Good collective bargaining



agreements create the infrastructure through which companies and workers can navigate workplace issues.

Workplaces with Collective Bargaining Agreements tend to have higher wages, lower worker turnover, and higher productivity than their non-union counterparts [3] [62] [63]. Collective Bargaining Agreements are legal documents enforced by the National Labor Relations Board, making them a strong form of worker protection. Both parties are committed to upholding their end of the agreement, or risk legal, financial, and other repercussions.

## Taking Stock of Community Benefits

The DOE tracks community benefits for many of the projects it supports to consolidate resources and promote greater transparency and accountability [64]. For example, in July 2024, DOE's Loan Programs Office announced a conditional commitment to provide a \$1.2 billion loan to ENTEK to build a battery manufacturing facility in Terre Haute, Indiana. As a part of the loan application process, ENTEK developed a Community Benefits Plan laying out the company's ongoing collaboration with local community and labor stakeholders, and its partnerships to ensure a locally-hired workforce, invest in training and education programs, and prioritize workers displaced from manufacturing industries [65]. In October 2024, DOE's Loan Program Office also published the first set of Community Benefit Plans, including the CBP for CellLink [66].

States can also include stipulations in contracts or agreements to achieve a similar purpose as a Community Benefits Plan. For example, Michigan approved a \$715 million incentive package for a Gotion EV battery component facility that was conditional on hiring local residents, meeting investment thresholds, and meeting timeline, job creation, and investment milestones [67].

Among the companies included in the EV Jobs Hub data, only three have operating Community Benefits Agreements: New Flyer in California and Alabama, BYD in Lancaster, California, and Jeep (Stellantis) in Detroit, Michigan. The New Flyer CBA demonstrates the potential of a CBA. The contract is between New Flyer, an electric bus manufacturer, and the Jobs to Move America coalition and spans Alabama and California. The CBA focuses on labor provisions, including job training and equal opportunity hiring practices [68]. It specifically requires that 45 percent of new hires and 20 percent of promotions be from historically disadvantaged groups [69]. This agreement was signed in May 2022 and is notable because the workers at New Flyer in Alabama were not unionized. Workers have since unionized, ratifying a contract in May 2024 [70]. The Community Benefits Agreement came out of a settlement between the company and Jobs to Move America after the company was accused of paying employees less than it had agreed to in a contract and

“submitting false information to L.A. Metro about worker benefits” [71]. There are numerous other companies pursuing community benefits in the context of DOE Community Benefits Plans.

## Labor and Training

Alongside investing in domestic EV manufacturing, there is a need to foster a strong and secure pipeline of manufacturing workers who are equipped to build the vehicles of the future, while ensuring that the jobs are desirable, family-sustaining jobs.

### Job Quality and Why It Matters

There are numerous efforts underway to ensure that the auto jobs of the future are high-quality, family-sustaining jobs. Job quality is a critical determinant of not only employee satisfaction and productivity but also broader social and economic outcomes. As the U.S. Department of Labor notes, “[g]ood jobs are the foundation of an equitable economy that lifts up workers and families and makes businesses more competitive globally” [72]. Research shows that high-quality jobs have been linked to improved mental and physical health, improved economic mobility, lower turnover rates, and enhanced organizational performance, benefiting the workplace, societal well-being, and economic stability [73] [74]. As such, understanding and improving job quality is essential for fostering sustainable and inclusive economic growth in the EV sector and beyond.

Recent efforts have sought to hone a shared understanding of job quality. The Good Jobs Principles, developed by the U.S. Department of Labor and the U.S. Department of Commerce, offer a framework for key elements of a good job. The framework includes eight core principles covering recruitment and hiring, benefits, diversity equity, inclusion and accessibility, empowerment and representation, job security and working conditions, organizational culture, pay, and skills and career advancement [72]. The DOE, as part of its commitment to supporting the creation of high-quality jobs through its implementation of IIJA and Inflation Reduction Act investments, has drawn from these principles to craft a standard for good jobs. According to the DOE, a good job [58]:

1. “provides fair, transparent, and equitable pay that exceeds the local average wage for an industry.
2. delivers basic benefits (e.g., paid leave, health insurance, retirement/savings plan, access to affordable, reliable, and high-quality childcare/long-term care for loved ones, and transportation).

3. provides workers with an environment in which to have a collective voice.
4. helps the employee develop the skills and experiences necessary to advance along a career path.
5. provides predictable scheduling, and a safe, healthy, and accessible workplace devoid of hostility and harassment.
6. has employees properly classified with the limited use of independent contractors and temporary workers.
7. protects workers' statutory right for a free and fair choice to join a union under the National Labor Relations Act (NLRA)."

This framework offers a strategic approach to enhancing job quality, with emphasis on the importance of fair wages, stable schedules, career development, protecting worker voice, and a supportive work environment. Integrating these principles into diverse organizational contexts can help foster sustainable and inclusive economic growth.

## Unionized Facilities

Labor unions enable workers to negotiate with their employer, including for higher wages, better hours and training, and workforce development. Without unions, workers who are dissatisfied with their working conditions must advocate as individuals. Unions offer formal pathways by which workers can make demands to improve their working conditions and draw attention to issues in their workplaces without risk of retaliation.

The recent increase in union organizing activity across the United States has not bypassed the EV manufacturing industry [75]. New leadership at the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) has harnessed a growing awareness of the power of organized labor. UAW's organizing campaign spans across 14 automakers from the Detroit Big Three American automakers (Ford, GM, and Stellantis) to the major foreign autos to the new EV "startups" [76]. The contracts that the UAW recently negotiated with these automakers made significant gains to support incumbent and future auto workers. The contracts secured significant hourly wage increases and the cost-of-living adjustments that the companies had forgone since the automotive industry crisis in 2008. For tenured and retired auto workers, UAW secured major pension and retirement benefits, including restoring annual bonuses for retirees for the first time in 15 years. For new entrants to the auto industry, UAW eliminated the wage tier system and ensured that workers at the Detroit Three's Joint Ventures with battery manufacturing companies would have a clear path to join the UAW as well [77].

The process of organizing a workplace can be lengthy and challenging. Workers seeking unionization can face resistance, including at times from their employer. Even if employers

are fined for breaking labor laws, fines imposed by the Fair Labor Standards Act and the National Labor Relations Act are often not strong enough to discourage them [78]. The maximum fee for unwilful (or plausibly accidental) violation of the Occupational Safety and Health Act, for example, is less than \$14,000 per incident. Meanwhile, companies that violate pay and overtime laws, or unlawfully fire employees, only must pay “make-whole” penalties through backpay to the injured employee for the period of unemployment, or reinstatement of the fired employee.

As of September 30, 2024, considering only operational facilities, 12 percent of announced EV and EV battery manufacturing jobs—or about 12,000 workers—are at unionized facilities. This number covers only manufacturing workers and therefore does not include employees who may be in another union (e.g., onsite medical staff). Of those workers, more than half (7,500) are employed by either the Detroit Three automakers or GM’s battery manufacturing joint venture with LG, Ultium Cells.

Nearly 4,000 of these unionized jobs are in Michigan alone. One notable example outside of Michigan is Volkswagen’s plant in Chattanooga, Tennessee, which employs about 5,500 ICE and EV workers and where more than 70 percent of employees voted to unionize in April 2024 [79] [80]. Next door, the United Steelworkers organized workers at a Blue Bird electric school bus manufacturing facility in Georgia and in Alabama the International Union of Electrical Workers-Communications Workers of America was successful in organizing at a New Flyer transit bus manufacturing facility [81] [70].

As noted in *Federal Programs in Support for EV Manufacturing*, the federal government is offering funding to facilities for converting from traditional vehicle production to EV production, and many of those facilities are unionized. All 11 of the facilities awarded Domestic Manufacturing Conversion Grants from DOE are unionized with Collective Bargaining Agreements, and they promise to add close to 2,700 jobs while retaining their existing workforces [25].

Union benefits at these plants typically include regular guaranteed wage increases, healthcare, paid time off, and retirement benefits [82]. Specifically for EV manufacturing workers, the UAW contract with the Detroit Three automakers in the Fall of 2023 included provisions to expand union benefits to battery workers in some facilities and allow workers to transfer between ICE vehicle and EV plants [83]. In September 2024, Atlas Public Policy released analysis about the Ultium Cells facility in Warren, Ohio, where an agreement was recently ratified with the UAW raising starting wages by 63 percent and including transfer provisions [84].

Workers and organizers can face opposition from employers and/or policymakers. However, there have been instances of unionization success even in places with a history of opposition. For example, in April 2024, workers at a Volkswagen manufacturing plant in

Chattanooga, Tennessee, voted to join the UAW after their third organizing drive since 2014 [85]. The success reflected growing support for unions as an important tool to ensure good jobs, wages, and benefits. Earlier attempts failed in part due to tactics described above, although they were employed by state politicians rather than Volkswagen, which remained neutral and reportedly offered some support for the union drive [86]. Ultimately, organizers and workers suggested that unionization could be attributed to the energy and optimism generated by the UAW's national organizing campaign and shifting workforce attitudes [87].

Negotiating a first contract, where union leaders and company representatives agree on new conditions for workers, is an immediate challenge after agreeing to unionize a facility. If a contract is not reached within one year, the company may challenge the union's right to represent workers at the workplace. This creates a perverse incentive for companies to delay negotiations [88]. Unions can file unfair labor practice charges with the National Labor Relations Board (NLRB) if these delays are done so in bad faith.

## Apprenticeships for an EV Ready Workforce

Apprenticeship programs are earn-and-learn training models with on-the-job training and classroom components that are sponsored by unions, manufacturers, educational institutions, and other institutions. These programs are registered with and approved by the U.S. Department of Labor or a state agency that oversees apprenticeships [89].

The apprenticeship model has been long-established in the building and construction trades but can also play an important role in industrial and manufacturing contexts. For EV and battery manufacturing, apprenticeship programs may help to equip the incumbent auto manufacturing workforce, as well as the future EV manufacturing workers, to meet growing demand for clean and electric vehicles. Apprenticeship programs for EV and battery manufacturing are beginning to take shape across the country, with partnership among government, private companies, organized labor, and training institutions.

As of July 2024, six companies have EV-applicable apprenticeship programs for their workers, of which three are union-affiliated (see Table 5). These programs are nationally accredited, focus on manufacturing, and are known to be applied to EV or EV battery production because they are internal automaker company programs. Ford and General Motors have UAW-partnered national apprenticeship programs designed for internal upskilling that can help to rapidly build their workforces as they invest in the EV transition [90] [91]. Additionally, as discussed further below in *Training Programs and Educational Institution Investments*, many companies establish training partnerships with community and technical colleges close to their manufacturing facilities to build up a local workforce.

Table 5: Registered EV Manufacturing Apprenticeship Program by Affiliate Company

<b>Company</b>	<b>Number of Locations</b>	<b>Union Affiliation</b>
<b>General Motors [92]</b>	10	UAW
<b>Ford [93]</b>	8	UAW
<b>Siemens [94]</b>	1	None
<b>BYD [95]</b>	1	SMART Local 105
<b>VW [96]</b>	1	None
<b>Rivian [97]</b>	2	None

This table includes nationally accredited registered apprenticeship programs focusing on manufacturing that are known to be applied to EV and EV battery production and tied to EV manufacturing facilities. This includes operational and announced apprenticeships. Data is through September 2024.

Other than EV-specific apprenticeships, there are existing apprenticeships that train workers for ICE vehicle manufacturing that can also help workers prepare for EV manufacturing. There are various programs in these categories that can provide workers with transferable skills between ICE vehicle and EV manufacturing or general electronics and EV battery manufacturing.

The federal government is also supporting apprenticeship programs. Notably, in partnership with the DOL, the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) Working for America Institute, Li-Bridge alliance members, and other organizations, DOE launched the Battery Workforce Initiative (BWI) in December 2022 [98]. The Initiative was formed to address the increasing demand for a highly skilled workforce in the growing battery manufacturing industry by convening government, manufacturers, organized labor, and educational institutions to develop industry-recognized credentials to fast-track the development of highly skilled workers in the battery manufacturing supply chain. In March 2024, the Initiative also announced DOL-certified National Guideline Standards for battery machine operators, which will be tested in pilot training programs by battery manufacturers for wider industry dissemination [99]. The pilot feedback will be utilized to improve the training curriculum, which consists of both on-the-job training and

classroom components for industry stakeholders to establish registered apprenticeship programs [100].

When opening new EV manufacturing facilities, incentives exist to incorporate good labor practices and workforce development into construction procurement. Companies can quintuple credit incentives from the Inflation Reduction Act by meeting prevailing wage and apprenticeship requirements for construction and EV charging installation, encouraging a greater focus on quality jobs and workforce training as part of newly funded projects [101].

## Training Programs and Educational Institution Investments

Equipping new and existing auto manufacturing workers with the skills needed to build the clean and electric vehicles of the future is an essential part of securing a rapid and equitable transition, uninterrupted by labor shortages and supply chain issues. Training programs are important to ensure that workers of all backgrounds—from experienced auto manufacturing workers to new workforce entrants—are equipped with the skills needed to fill roles across the full EV supply chain, from chemical processing to assembly.

There are many similarities between the manufacturing processes for building EVs and ICE vehicles; both require components like metal bodies, seats, air bags, wheels, axels, and tires. Workers building these “fuel agnostic components” are unlikely to see significant disruptions to their existing processes. The same is true for workers currently building engines and transmissions for ICE vehicles. A comparative analysis of the skills needed to build EVs and ICE vehicle powertrains finds significant overlap; “most of the skill requirements for manufacturing battery electric vehicle powertrain components lie within the range of skill requirements for ICE vehicle powertrain components” [102]. Conversely, workers making the components of EV batteries, such as anodes, cathodes, and electrolytes are engaged in processes that are much more akin to chemical manufacturing and processing, rather than the mechanical processes associated with the rest of vehicle manufacturing. This requires a different skillset and, crucially, specialized safety training.

Whether supplying the basic “shop” skills needed across all vehicle manufacturing, or equipping workers with specialized chemical training to build EV battery components, good training programs are in high demand. Automakers, technical colleges, universities, community colleges, labor unions, and other training providers across the country are training workers in the advanced manufacturing techniques throughout the EV supply chain. Many of these training programs are funded by conglomerates of automakers, are located at local community or technical colleges or other non-company sites and provide a general education and training for production work in the EV supply chain. From

conversations with unions engaged with battery and EV manufacturing, there is a perception that these tend to be unpaid training programs, where students pay out of pocket and are not guaranteed a job upon completion. Automakers have developed other programs that are hosted onsite. These programs provide paid training to students who are guaranteed a job at the end of their training.

Meeting growing demand for domestically manufactured EVs requires both major industrial investments, and corresponding training to ensure that new facilities are staffed by workers with the knowledge, skills, and safety training they need. Training programs must also lead to good quality jobs and be truly accessible to a broad population such that these jobs benefit the communities they are in and secure a sufficiently large workforce. One example is the DOE award to the UAW made in August 2024, which will support the UAW’s Center for Manufacturing a Green Economy, in partnership with Sparkz, a battery manufacturer in Oakland, California [103]. This award will train workers and prioritize opportunities to implement “efficient and energy-saving manufacturing practices.” Further the award will “build a robust and diverse recruitment pipeline for young people, women, communities of color and underserved communities; provide pre-employment supports including stipends and wraparound services; and implement a skills-based apprenticeship for green manufacturing production workers, building on the foundations of the registered Industrial Manufacturing Technician model and the DOE Battery Workforce Initiative.” UAW’s intention is for this initiative to scale for other battery manufacturers.

## Managing Risks and Project Delays

Looking ahead, the significant investments in EV manufacturing and the corresponding supply chain face some uncertainty due to changes in market conditions, public policy priorities, and other factors.

## Automakers Get More Involved in the Supply Chain

The United States is seeing massive investments in the EV supply chain. As shown in *The State of U.S. EV and Battery Manufacturing*, \$208.8 billion has flown into EV manufacturing and supply chains in the United States since the passage of the IRA and IIJA, with federal incentives playing a direct role in stimulating private sector investment. Many of these investments have supported manufacturing components identified by BlueGreen Alliance as having critical or moderate gaps in the domestic supply chain, including anodes, cathode materials, and electrolyte additives [2] [104]. Secure supply chains are critical to



the success of EV manufacturing. So long as many of these investments are closely linked to federal incentives, changes to those incentives could pose risks to secure supply chains.

Automakers are forging agreements with individual suppliers to secure their upstream raw materials and midstream components, especially for lithium-ion battery production [105]. Historically, automakers have outsourced much of the supply chain, reliant on suppliers to support production [106]. This approach is shifting with the EV supply chain as automakers work more closely with mining companies due to concerns about the supply of critical minerals [107].

Domestically, Thacker Pass in Nevada contains one of the largest deposits of battery-quality lithium in the country [108]. Lithium Americas, owner of the mine, has entered into an agreement with GM. In exchange for a \$650 million equity investment into Lithium Americas announced in January 2023, GM will receive “exclusive” rights to Thacker Pass’ first phase of lithium and lithium carbonate production, which is expected in 2027, as well as a right of first offer on its second phase [109] [110].

Ford pursued a similar route with four long-term contracts, two domestic and two foreign, lasting through 2034. As of May 2023, U.S.-based Ford operations will receive lithium hydroxide produced by the Albemarle Corporation from either the United States or a country with whom the U.S. has a Free Trade Agreement, to retain 30D tax credit eligibility [111]. Ford will also receive lithium hydroxide produced by EnergySource Minerals at its Project ATLiS facility in California’s Imperial Valley (expected to begin operations in 2025). Internationally, Ford will rely on lithium products and lithium hydroxide from Quebec, Canada refined by Nemaska Lithium as well as lithium carbonate and lithium hydroxide from SQM in Santiago, Chile. Finally, Ford signed a deal in June 2022 with Australian company Liontown Resources, which is currently supplying lithium products to Ford [112]. These agreements depend on the progress of suppliers’ projects, which can be delayed by local conditions. For instance, Ford signed an agreement for lithium carbonate to be extracted and refined in Utah by Compass Minerals (beginning 2025) however in November 2023, Compass Minerals halted their Great Salt Lake lithium project [113].

## Managing Project Delays

Manufacturing announcements often include job commitments, but delays, cancellations, or operational issues can prevent these jobs from materializing. Companies may promise jobs that are not created in the quantity or quality projected, even if the project happens. A project cancellation impacts more than just the direct jobs; other community investments made in anticipation of the project may also be affected by delays or cancellations.

Rivian’s facility in Georgia provides an example of project delays. In 2021, the state awarded Rivian \$1.5 billion in incentives to build a new vehicle assembly plant in the state, including incentives that were contingent on the company producing 80 percent of its jobs and investment targets by 2028 [114]. If the company does not meet its employment goal, it would need to provide a “pro-rata repayment of the total [Joint Development Authority] property, state property, and state land improvements, and estimated real and personal property tax savings [115].” After a legal battle over the size of the incentive package, in September 2023, the state and the manufacturer agreed to extend the timeline for the incentives to 2030 to ensure the company has more time to keep its commitments [116].

In February 2024, Rivian announced it was pausing construction on the facility for an unannounced length of time and focusing on expansion at its existing facility in Illinois [117]. The company stated in April 2024 that it will build the facility, and the LPO made a conditional commitment in November 2024 to provide a loan of up to \$6.6 billion to help [118] [119]. Meanwhile, suppliers and local businesses expecting benefits from the Rivian facility will see delays. Likewise, Ford did not meet job growth targets at its Rouge Electric Vehicle Center in Dearborn, Michigan. Consequently, the Michigan Strategic Fund board revoked a \$100 million grant tied to that goal [54].

The federal government includes performance requirements in its awards as well. The Qualifying Advanced Energy Project tax credit pays up to 30 percent of investment costs in clean energy manufacturing projects including battery manufacturing [120]. If a tax credit claimant attests to meet prevailing wage and apprenticeship requirements and does not follow through at any time during the following two years, it must pay \$50 per labor hour for which the apprenticeship requirement is not met, pay workers back pay to meet prevailing wage with interest, and pay \$5,000 for each worker to the U.S. Secretary of Labor [121]. If the project is not put in service within two years of approval for the tax credit, it becomes void, and the company cannot claim the tax credit.

## Managing Trade Risks

Offshoring represents an additional risk factor to a comprehensive domestic supply chain for EVs and batteries. Companies may choose to locate new manufacturing facilities (for both internal combustion engines and EVs) in other jurisdictions, facilitated by trade policies that may incentivize them to do so [122].

Alongside the United States’ low 2.5 percent most-favored nation tariff on passenger vehicles, various provisions established by the United States-Mexico-Canada Agreement (USMCA) have contributed to an imbalance in the United States with respect to foreign direct investment and vehicle production. This imbalance can result in fewer jobs in the

United States for vehicle manufacturing and supply chain facilities [123] [124]. To illustrate, Mexico saw investment of \$13.5 billion by U.S. companies within the first nine months of 2023, predominantly in the manufacturing, services, and mining sectors. This investment accounted for 41 percent of all foreign direct investment in Mexico during that period, making the United States its top foreign investor [125].

The UAW has highlighted the risk of these policies and their potential to discourage investment in domestic auto production and workers resulting in the offshoring of these jobs to Mexico and Canada, including EVs [126]. To encourage greater EV manufacturing investment in the United States and discourage offshoring, the UAW has recommended a range of changes to the language in the USMCA to increase compliance with the automotive rules of origin for North American content requirements [127]. They also recommended reworking the provisions of the agreement related to the labor value content and the Rapid Response Mechanism to substantially raise wages and protect labor rights in Mexico [126].

## Conclusion

The EV transition can be measured in many ways, including the uptick in vehicle sales, the proliferation of charging, and the rapid growth of a domestic EV manufacturing sector. The passage of the Infrastructure Investment and Jobs Act followed by the Inflation Reduction Act catalyzed \$157.3 billion in private investment in domestic manufacturing, leading to more than 163,000 new, announced manufacturing jobs. Federal benefits, principally tax credits, loan programs, and grant funding have contributed to the onshoring of manufacturing facilities, motivating automakers to establish their EV and battery production in the United States. Excluding tax credit estimates, federal support for EV and battery manufacturing via grants and loans totals more than \$28 billion through the end of September 2024.

As the domestic industry continues to grow, labor and supply chain considerations will remain critical. To ensure that benefits flow to workers and communities, there will need to be sustained efforts to ensure that new jobs are good jobs, are safe, and pay fair wages. Supply chain reliability, particularly in areas like critical mineral production, will also be essential for continued growth and stability in the EV production sector.

Continued federal support that catalyzes domestic private manufacturing investment can unlock benefits for workers and communities, as EV demand from consumers grows. Though challenges remain to creating a robust EV manufacturing sector, the United States is positioned well to be a global leader in this vital part of the economy.

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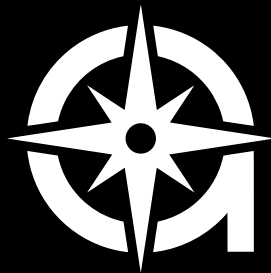
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