EXECUTIVE SUMMARY

PROPULSION BATTERIES

GLOBAL EPICENTER OF MOBILITY
REVOLUTIONIZING THE DETROIT REGION

Detroit Regional Partnership

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IN THIS SUMMARY

The Global Epicenter of Mobility (GEM), a signature program of the Detroit Regional Partnership (DRP), is designed to enable growth and development of the advanced mobility industry in the 11-county Detroit Region. GEM and its strategic partners work together to create a smart, secure, and sustainable advanced mobility industry in Southeast Michigan. GEM's efforts were made possible by a four-year U.S. E.D.A. Build Back Better Regional Challenge grant award.

As part of its work, GEM provides its grant partners and regional stakeholders with key mobility sector research, data, and insights. In 2024, GEM commissioned a study with S&P Global Mobility to identify five to seven technologies that present the Detroit Region with the largest opportunities for transformational growth. The Future Mobility Technology Study (FMTS) is a comprehensive report of the seven advanced mobility technologies with the strongest mid-term growth potential in the Detroit Region. Together, with supporting data from other key sources, the findings from the study serve as the foundation of The Road to 2030.

This website covers the key insights from the FMTS, as well as other reports and key sources. Our content includes an executive summary of opportunities stemming from each of the seven technologies covered in the FMTS. The executive summaries, as well as a corresponding section of the Road to 2030 website, will be released over the course of the year. This executive summary, the second in our series, is focused on vehicle propulsion batteries.

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PROPULSION BATTERY INTRODUCTION

Vehicle propulsion batteries are the largest, heaviest, and most expensive components of electric vehicles. In Battery Electric Vehicles (BEVs), they serve as the sole source of power to move the vehicle forward. In plug-in and conventional hybrid vehicles, they work together with an internal combustion engine to propel the vehicle more efficiently than would be the case with an internal combustion engine alone.

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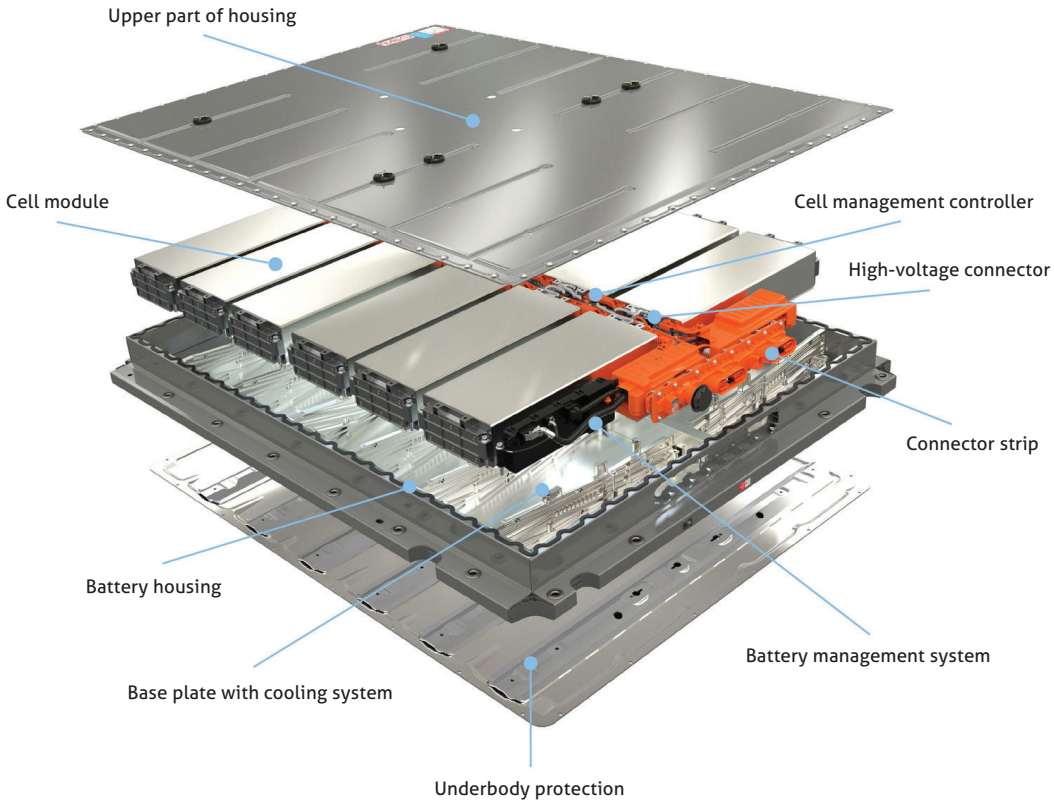
Figure 1:

VEHICLE PROPULSION BATTERY COMPONENTS

SOURCE: VOLKSWAGEN AG



Vehicle propulsion batteries are typically modular in construction. Individual battery cells are packaged into modules, which are then assembled within a frame. Thermal management systems and power control electronics are integrated into the assembly to create a flat, slab-like component which is then fitted into the vehicle. In some vehicles, the battery case and frame are constructed to be structural, serving as an integral component of the vehicle body itself. This approach contributes to the rigidity of the body of the vehicle, saving both weight and cost while making the vehicle more structurally sound.

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Figure 2:

TYPICAL VEHICLE PROPULSION BATTERY LOCATION

SOURCE: VOLKSWAGEN AG

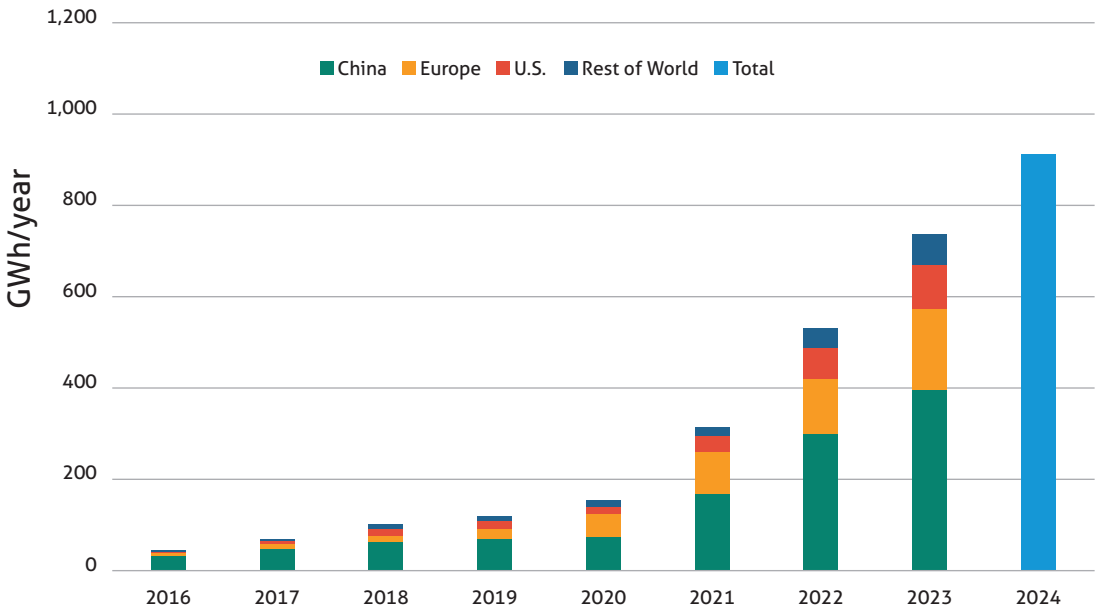
DEMAND AND PRICING FORECASTS

Chart 1:

GLOBAL LIGHT VEHICLE BATTERY DEMAND

SOURCE: INTERNATIONAL ENERGY AGENCY (IEA) GLOBAL EV OUTLOOK 2024 AND 2025

2024 DATA NOT AVAILABLE BY COUNTRY



The light vehicle mobility sector has seen the most intensive usage of propulsion batteries. Global production of batteries for this sector rose nearly sixfold between 2020 and 2024, reaching nearly one terawatt hour per year (a terawatt is an electrical energy storage measurement unit equal to one trillion watt hours). In 2023, U.S. light vehicle battery demand stood at 12.8% of the global total. China remains the world's largest market for electric vehicles, accounting for 54% of global demand in 2023.

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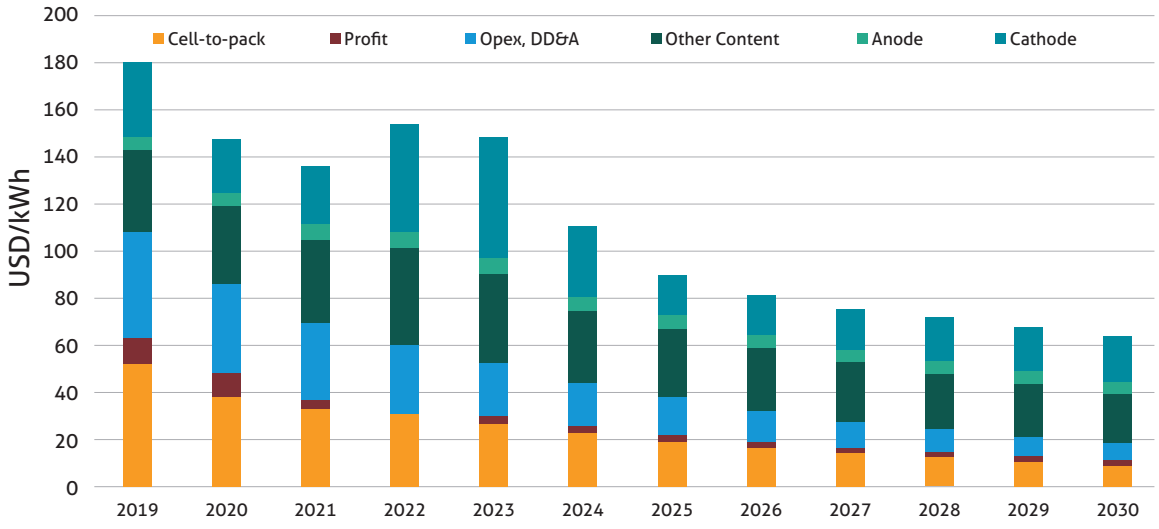
Chart 2:

GLOBAL AVERAGE BATTERY PACK PRICES

SOURCE: GOLDMAN SACHS, OCTOBER 2024



The costs of battery materials and production have been steadily decreasing since 2019, and further cost reductions are forecast for the remainder of the decade. In 2019 battery costs were reported at a high of $180 and are expected to be just under $64 by 2030, a reduction of over 64%. While anode and cathode costs are expected to fall by about 40% between 2019 and 2030, the largest cost reductions are expected in manufacturing and operational efficiency gains.

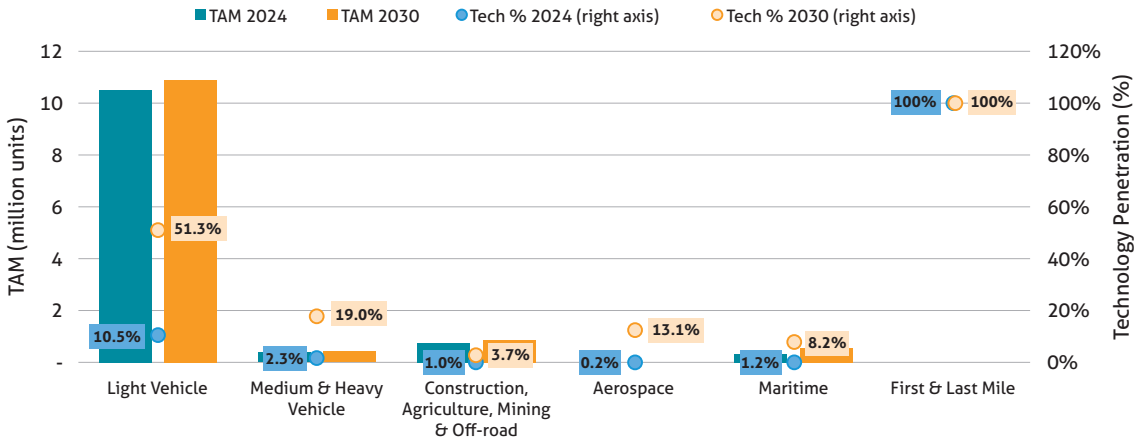
Cell-to-pack assembly costs, for example, are forecast to decrease by nearly 83% and operating and related expenses are forecast to drop by nearly 85% over the same period. These cost reductions will enable automakers and other mobility companies to electrify a greater range of less expensive vehicles, making them more accessible to consumers and driving continued production gains.

PRODUCTION GROWTH FORECASTS

Chart 3:

U.S. BATTERY TOTAL ADDRESSABLE MARKET (TAM) AND PROPULSION BATTERY PENETRATION RATES

SOURCE: S&P GLOBAL LV/ MHCV/OFF-HIGHWAY PRODUCTION FORECASTS, S&P GLOBAL ANALYSIS WITH INDUSTRY SOURCES (GAMA, NMMA, FAA, AUVSI)



While the light vehicle mobility sector remains the largest opportunity for propulsion battery applications through 2030, other sectors are also expected to experience significant growth in electrification.

Medium- and heavy-duty vehicles, Aerospace, and Maritime sectors are all expected to experience significant growth in electrification.

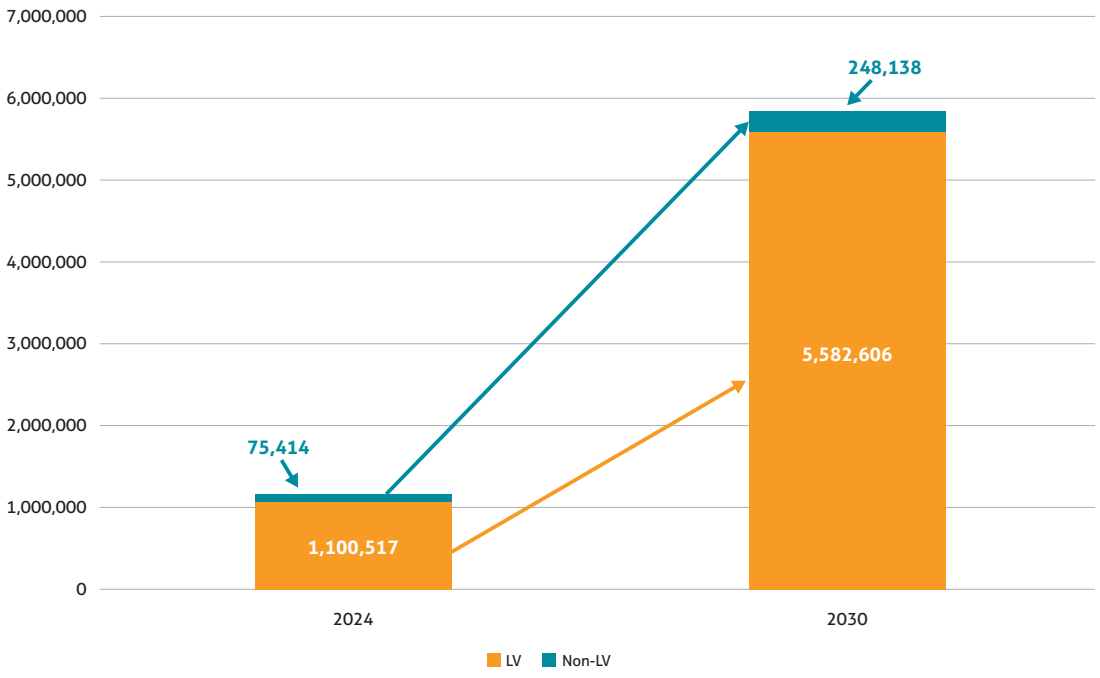
- **Medium- and heavy-duty vehicles:** Propulsion battery adoption is projected to rise from 2.3% in 2024 to 19% in 2030.
- **Aerospace:** Although total unit volumes remain relatively low—just over 4,000 units by 2030—the electrification penetration rate is expected to grow from 0.2% in 2024 to 13.1% in 2030. In June 2025, the Trump Administration announced several executive orders intended to advance U.S. development and production of drones and electric Vertical Takeoff and Landing (eVTOL) aircraft. The executive orders are intended to "accelerate the development, testing, and scaling of American drone technologies, including advanced air mobility and autonomous operations" and may further accelerate battery production for the Aerospace sector.
- **Maritime:** Battery application is forecast to increase from 1.2% in 2024 to 8.2% in 2030.

These forecasts include both fully battery-powered vehicles and hybrid or plug-in hybrid models that incorporate internal combustion engines.

Chart 4:

U.S. PROPULSION BATTERY PRODUCTION BY MOBILITY SECTOR

SOURCE: DRP/GEM ANALYSIS OF DATA FROM S&P GLOBAL AUTOMOTIVE

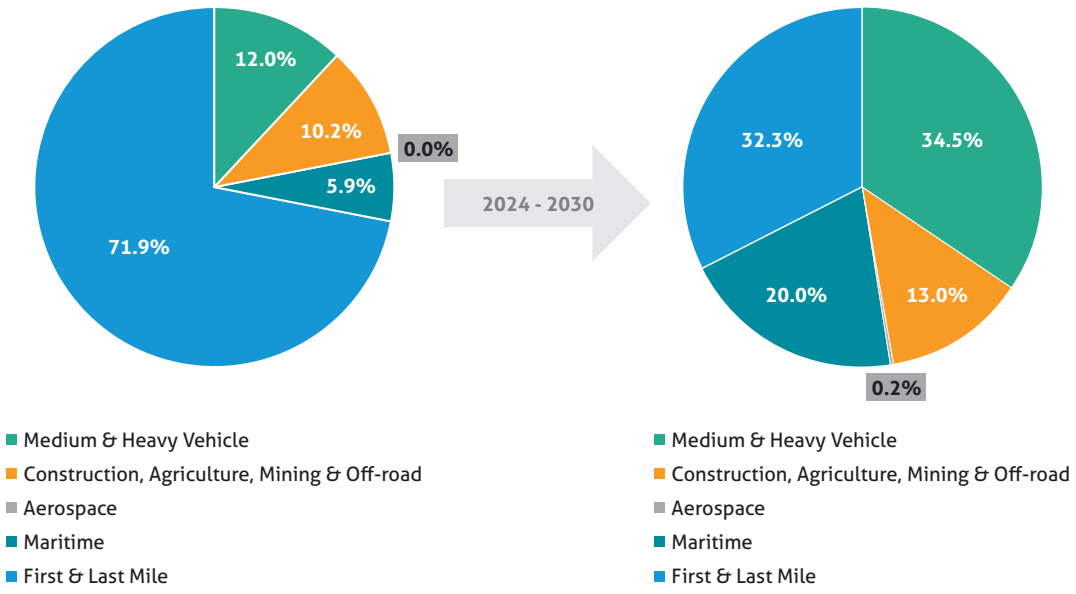


U.S. production of propulsion batteries for all mobility sectors is expected to experience fourfold growth by increasing from 1.8 million in 2024 to nearly 6 million in 2030. Over this time frame battery production for light vehicles will be dominant, with 93.6% of total battery production slated for light vehicle applications in 2024 and 95.7% in 2030.

Chart 5:

NON-LIGHT VEHICLE BATTERY SHARE FORECAST

SOURCE: DRP/GEM ANALYSIS OF DATA FROM S&P GLOBAL MOBILITY



While the light vehicle mobility sector remains the largest opportunity for propulsion battery applications through 2030, other sectors are also expected to experience significant growth in electrification.

- **First & last mile vehicles (e.g., commercial drones):** Share of battery applications is expected to decline from nearly 72% in 2024 to just over 32% in 2030, as other sectors expand.
- **Medium- and heavy-duty vehicles:** Forecast to see the largest share increase, rising from 12% in 2024 to nearly 35% in 2030.
- **Maritime:** Projected to grow from just under 6% in 2024 to 20% in 2030, reflecting expanded electrification across marine applications.

Although aerospace applications are expected to grow in penetration, lower production volumes will limit their share to just 0.2% of non-light vehicle battery applications by 2030.

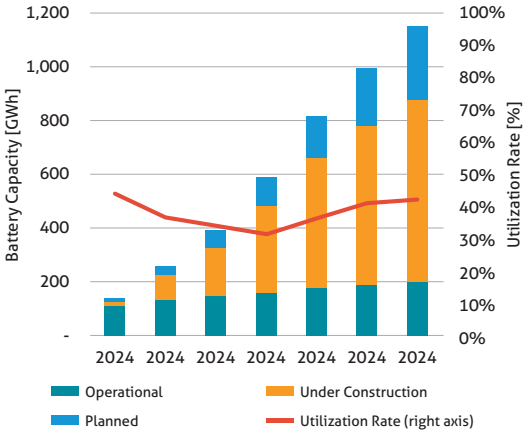
CAPACITY AND UTILIZATION

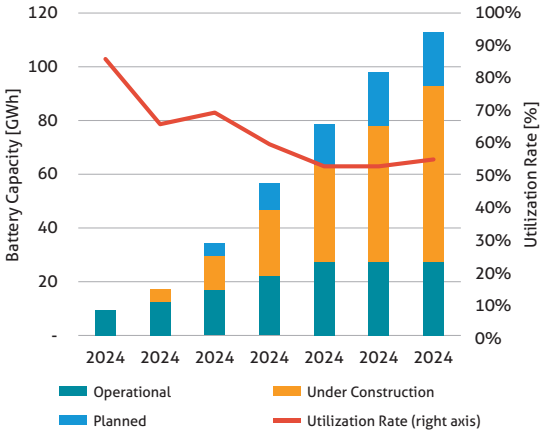
Chart 6:

U.S. & MICHIGAN BATTERY PRODUCTION CAPACITY AND UTILIZATION RATES

SOURCE: S&P GLOBAL CLEAN ENERGY TECHNOLOGY ANALYTICS

NOTE: BATTERY CAPACITY LV AND MHCV SECTORS ONLY; UTILIZATION RATE IS REFERENT TO TOTAL CAPACITY (OPERATIONAL + UNDER CONSTRUCTION + PLANNED)





To meet the significant growth forecast for electric vehicle production, vehicle manufacturers and battery producers have announced significant investments in production facilities. Nationally, total battery production capacity for light and medium and heavy-duty vehicles is expected to reach nearly 1,200 gigawatt hours by 2030. Battery production capacity for these mobility sectors in Michigan is forecast to approach 120 gigawatt hours by 2030, or about 10% of the national total. Capacity utilization at the national level, however, is expected to remain at about 40% through the forecast window. While capacity utilization rates have been higher in Michigan than for the United States overall, rates are expected to fall from about 70% in 2025 to just over 50% by 2030 as anticipated battery production capacity comes online at a rate faster than forecast growth in electrified vehicle production and sales.

In Michigan, battery production capacity for light- and medium-duty mobility sectors is forecast to approach 120 gigawatt hours – about 10% of the national total by 2030.

EMPLOYMENT IMPACTS AND FORECASTS

U.S. battery employment, including all battery types, has more than doubled between 2014 and 2024. Vehicle propulsion batteries have been the main driver of this growth. Over the same timeframe, battery manufacturing employment in Michigan has nearly quadrupled from 632 workers in 2014 to 2,512 in 2024 – a growth rate nearly triple the national average. The Detroit Region was home to 547 of these jobs in 2024, comprising about 22% of the state total.

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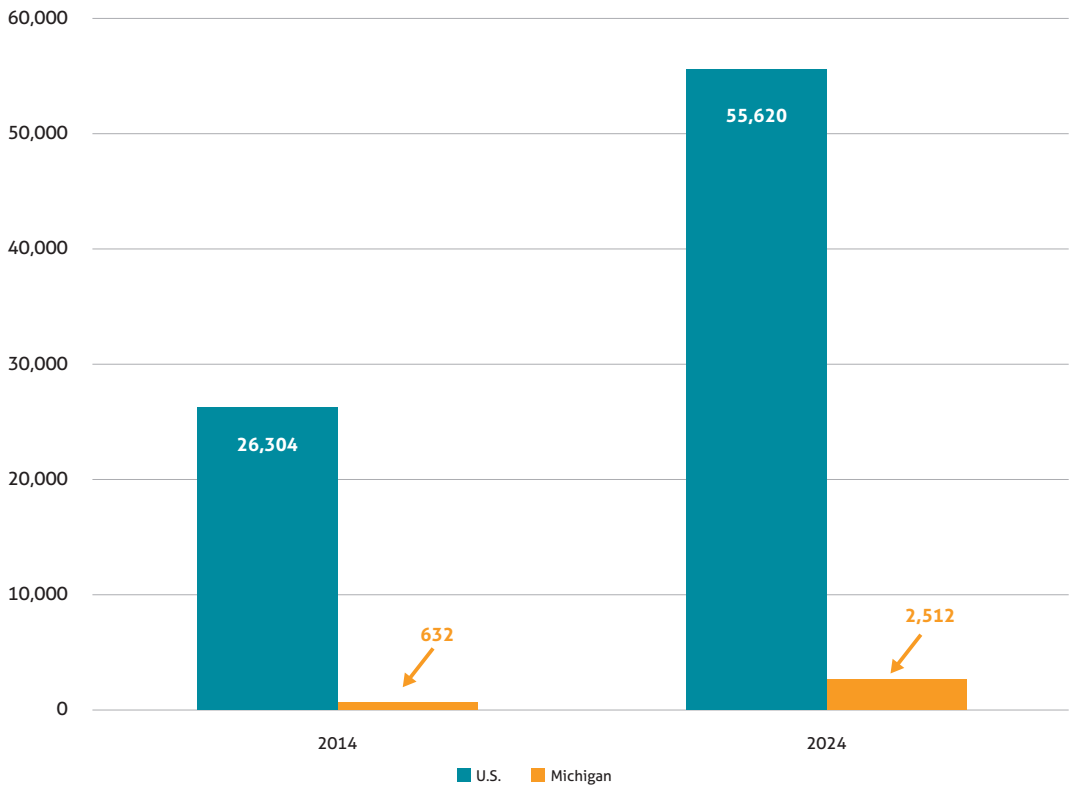
Chart 7:

U.S. AND MICHIGAN BATTERY PRODUCTION EMPLOYMENT

SOURCE: U.S. BUREAU OF LABOR STATISTICS (BLS) DATA FOR NAICS 33591

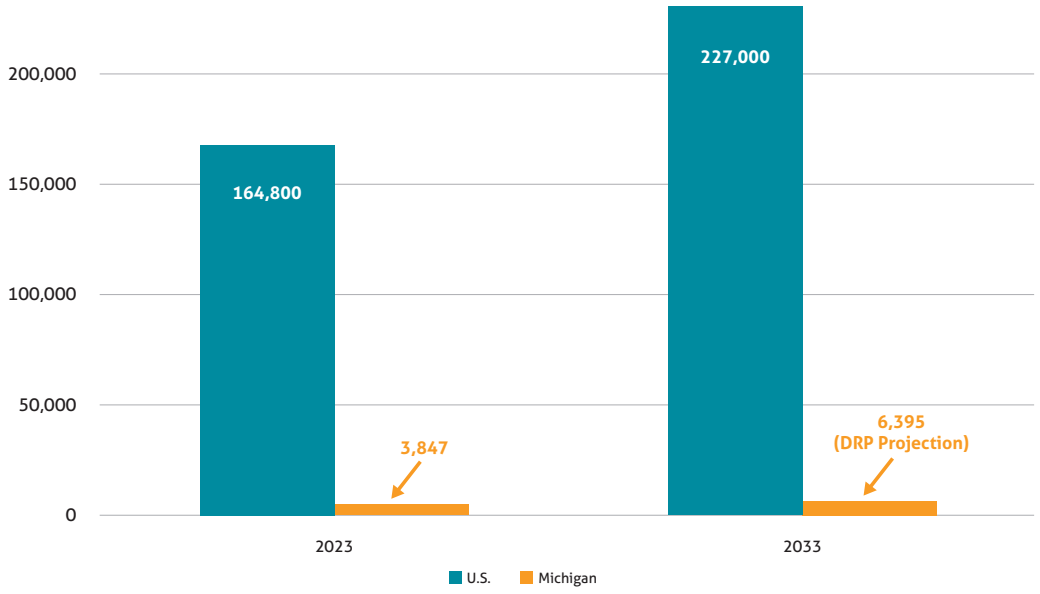


The U.S. Bureau of Labor Statistics (BLS) includes battery manufacturing in the broader category of Other Electrical and Component Manufacturing in its Industry and Occupational Employment Projections. The BLS forecast for this category calls for U.S. employment to grow from 164,800 workers in 2023 to 227,000 in 2033 – an increase of nearly 38%. If Michigan growth in this category continues at its most recent state level five-year pace, state employment will reach 6,395 in 2033 (DRP projection).

Chart 8:

U.S. OTHER ELECTRICAL EQUIPMENT AND COMPONENT MANUFACTURING EMPLOYMENT

SOURCE: U.S. BUREAU OF LABOR STATISTICS (BLS) DATA FOR NAICS 335900



BATTERY WORK ACROSS THE DETROIT REGION

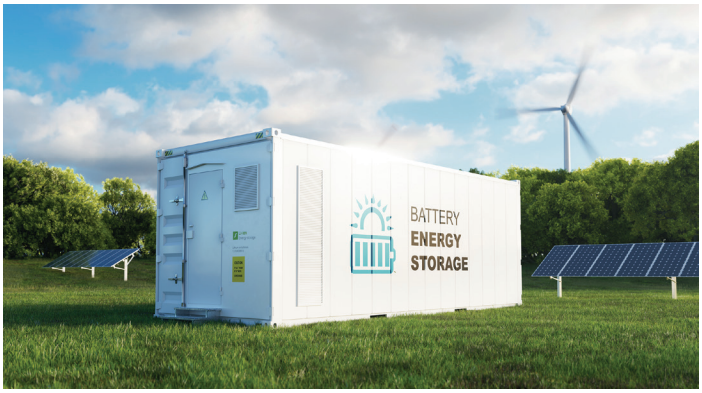
The Detroit region is a global leader in battery and electric vehicle development and production. According to the Center for Automotive Research (CAR), automakers and suppliers announced about $19 billion in electrification investments in the Detroit Region between 2000 and 2024. These investments represent over 15% of the total announced in the U.S. over that period.

Perhaps the best example of propulsion battery investments in the Detroit Region is the announcement by Australian company Fortescue of a new facility to produce batteries and other electrification-related components in Detroit. The investment involves the conversion of an old manufacturing facility to a modern plant serving multiple mobility sectors, including off-highway and mining equipment. The company has recently announced that the first batteries built at the facility will be destined for marine applications, providing a clear example of the opportunity for the Detroit region to capitalize on electrification trends to serve non-automotive mobility sectors.

ADDITIONAL OPPORTUNITIES FOR THE DETROIT REGION

STATIONARY POWER OPPORTUNITIES

The Detroit Region's strength in manufacturing batteries for vehicles presents additional opportunities. Global energy storage installations — including residential, commercial and utility scale — account for a growing share of total battery demand, rising from 6% in 2020 to an expected 13% in 2025. While demand for batteries for electric vehicle applications outnumbered stationary applications 15 to 1 four years ago, that ratio has now fallen to 6 to 1. That means stationary storage is now a material part of global battery demand and is growing much faster than the EV segment, presenting the Detroit Region with a critical opportunity to capitalize on its battery-related capabilities and expertise.



CONCLUSION

Vehicle propulsion batteries are at the heart of the electrification transformation of the mobility industry. They present the Detroit Region with a critical opportunity to capitalize on this transformation while maintaining technological and production leadership. More so than was the case with traditional internal combustion engine powertrains, leadership in propulsion battery technology can also better position the Detroit region for growth stemming from stationary power generation and storage applications. The Detroit Region boasts an unequaled combination of assets and capabilities, making it the global center of the automotive industry for over a century. These assets and capabilities are now helping the region attract and host companies from a variety of mobility sectors as electrification continues to transform mobility products and solutions. As a result, propulsion batteries play a vital role in supporting the Region's leadership in mobility initiatives.

To learn more about GEM, please visit us at
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