EXECUTIVE SUMMARY

HYDROGEN FUEL CELL SYSTEMS

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 transformational growth and development of the advanced mobility industry in the 11-county Detroit Region. GEM and its strategic partners are working together to create a smart, secure, and sustainable advanced-mobility industry in the Detroit Region. GEM's efforts were made possible by a U.S. Economic Development Agency Build Back Better Regional Challenge grant award in 2022.

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.

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.

HYDROGEN FUEL CELL SYSTEMS INTRODUCTION

Although still early in consumer adoption, hydrogen fuel cell systems hold significant potential for market growth and job creation. Fuel cells have been in operation for stationary power purposes and for vehicles ranging from submarines to spacecraft for decades. Due to cost and a lack of appropriate hydrogen infrastructure hydrogen fuel cell propulsion has not yet made significant inroads into conventional vehicle mobility sectors. As a result of a variety of recent advancements, their application appears closer than ever, presenting the Detroit Region with an opportunity to lead in the development and mass deployment.

The Detroit Region's deep experience in the development, engineering, and production of conventional vehicle powertrain technologies has positioned it well to benefit from the growing adoption of hydrogen fuel cell systems. The wide deployment of fuel cell systems to mobility sectors such as medium and heavy-duty vehicles and maritime applications, as well as stationary power applications, also brings to the region significant potential for continued growth beyond the light vehicle sector.

KEY TAKE AWAYS

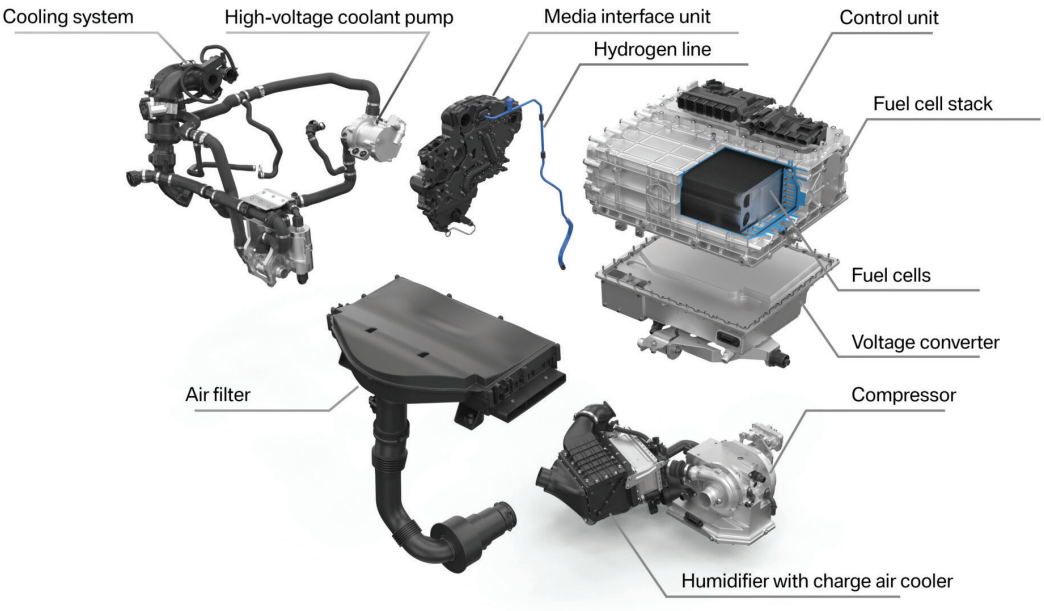
Hydrogen-based vehicle powertrains fall into two general categories: fuel-cell systems and hydrogen Internal Combustion Engine (ICE) technologies. While both have market growth potential, hydrogen fuel cells are widely seen as the more likely of the two approaches for long-term adoption and are therefore the chief focus of this research.

Hydrogen fuel cell systems generate electricity by combining hydrogen with oxygen, producing water and heat as the only byproducts. This powers an electric motor in hydrogen fuel cell vehicles, offering a clean, efficient, and zero-emission alternative to traditional engines. A high-pressure storage tank, together with the fuel cell stack, are the two chief components of a hydrogen fuel cell system. Other key components include a cooling system and compressor.

Figure 1:

HYDROGEN FUEL CELL SYSTEM COMPONENTS

SOURCE: BMW GROUP



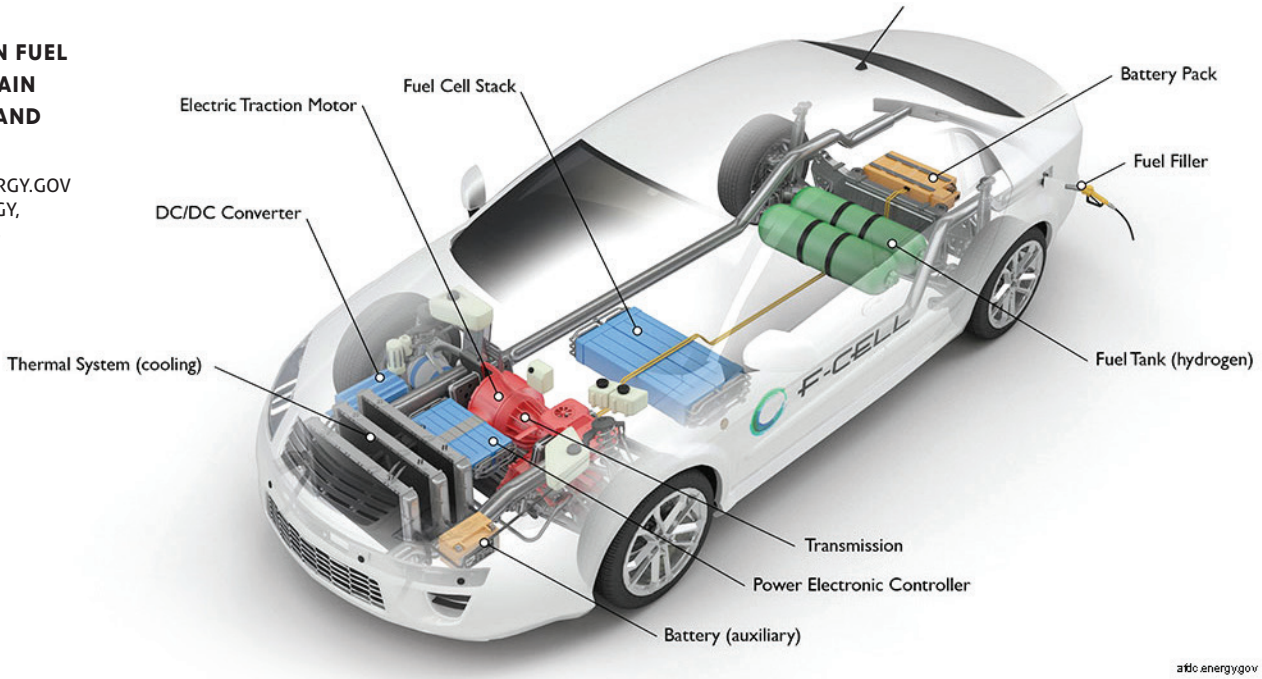
KEY TAKE AWAYS (CONT.)

The typical location of the fuel cell stack, hydrogen tanks, and other key components in a hydrogen fuel cell-powered vehicle is conveyed in Figure 2 below.

Figure 2:

KEY HYDROGEN FUEL CELL POWERTRAIN COMPONENTS AND LOCATION

SOURCE: AFDC.ENERGY.GOV U.S. DEPT. OF ENERGY, ALTERNATIVE FUELS DATA CENTER.



Hydrogen fuel cell systems offer range and refueling performance comparable to that of conventional vehicles. The range offered in fuel cell-powered light vehicles is typically 300-400 miles. Likewise, the typical time to refill the hydrogen tank(s) is around three to five minutes, mirroring conventional vehicle usage more closely than battery recharging, which can take hours depending on the capabilities of the vehicle and charging infrastructure.

Hydrogen can also power a vehicle through the use of Hydrogen Internal Combustion Engine (ICE) technology. Hydrogen ICE powertrains use hydrogen to fuel an internal combustion engine that works on the same general principles as conventional ICE engines powered by gasoline and other fuels. The use of hydrogen eliminates the emissions caused by traditional fossil fuels.

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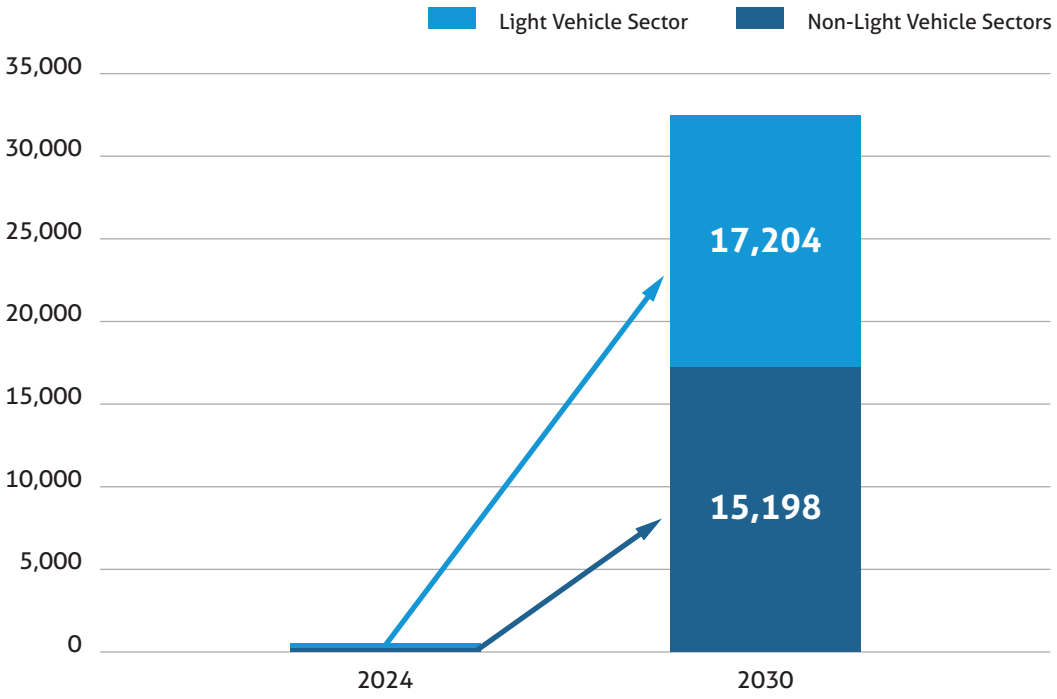
Because Hydrogen ICE powertrains use most of the components of traditional ICE engines, they serve as a bridge technology on the path to increased fuel cell adoption. In many cases, Hydrogen ICE systems can be retrofitted into existing vehicles powered by gasoline or diesel ICE engines. This flexibility makes Hydrogen ICE systems a valuable hedge in an environment of uncertain regulatory developments, allowing for deployment strategies to adjust to new policies. The deep development, engineering, and production capability of traditional ICE engines found in the Detroit Region therefore serve as a key advantage.

PRODUCTION AND EMPLOYMENT GROWTH FORECASTS

Chart 1:

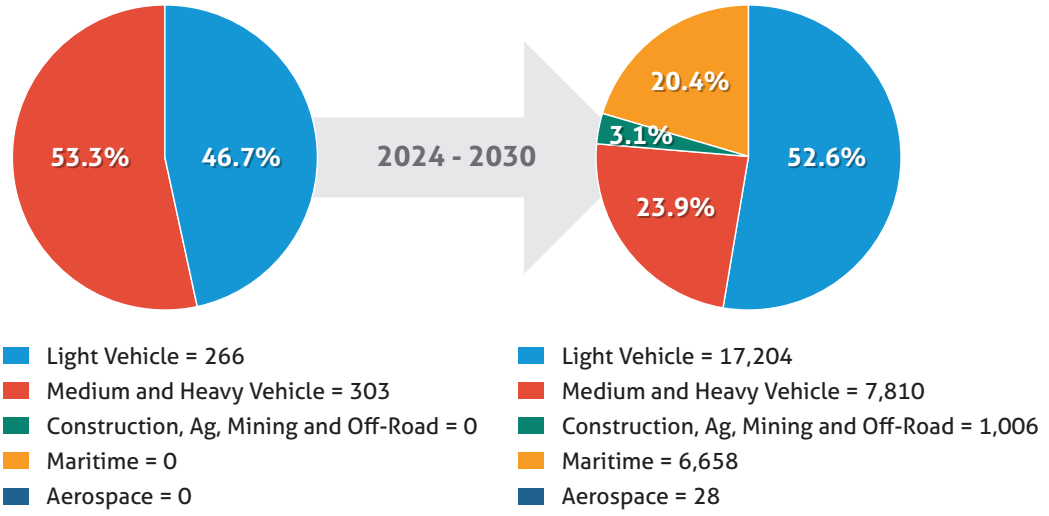
HYDROGEN FCEV UNIT PROJECTED GROWTH BY MOBILITY SECTOR



U.S. hydrogen fuel cell systems production is expected to grow 56-fold by 2030, from 569 units to over 32,000—53% for the light vehicle segment and 47% for other mobility sectors. As the adoption of hydrogen fuel cells accelerates, the U.S. is forecast to become a key producer of the fuel cell stacks and hydrogen tanks that serve as they key components of these powertrains. U.S. production of fuel cell stacks is projected to rise from 266 units in 2024 to nearly 9,000 units in 2030. This growth will result in U.S. share of global fuel cell stack production rising from 1.9% in 2024 to 8.4% by 2030, a nearly 345% gain. By 2030, the U.S. is also expected to rapidly ramp up hydrogen tank production, increasing its global share of production from 0% to 10.2%.

Chart 2:

U.S. HYDROGEN FUEL CELL UNITS PROJECTED GROWTH BY MOBILITY SECTOR



PRODUCTION AND EMPLOYMENT GROWTH FORECASTS (CONT.)

Between 2024 and 2030, U.S. hydrogen fuel cell production is expected to expand dramatically across mobility sectors, with Light Vehicles, Medium and Heavy-Duty Vehicles, and Maritime leading the growth. Notably, three sectors—maritime, construction/agriculture/mining/off-road, and aerospace—will move from zero production in 2024 to measurable deployment by 2030, signaling a broadening of hydrogen adoption beyond traditional vehicle platforms.

Table 1:

FUEL CELL SYSTEM ADOPTION GROWTH RATES

MOBILITY SECTOR	TOTAL ADDRESSABLE MARKET (TAM, UNITS 2024)	TECH PENETRATION (%) 2024	TECH GROWTH (CAGR) 2024-2030
Light Vehicle	NA: 15.8 Million US: 10.5 Million **MI: 1.7 Million**	NA: 0% US: 0% **MI: 0%**	NA: 111% US: 100% **MI: 303%**
Medium & Heavy Vehicle	NA: 0.65 Million US: 0.40 Million **MI: 0.02 Million**	NA: 0.05% US: 0.10% **MI: 0%**	NA: 88% US: 72% **MI: 0%**
Construction, Agriculture, Mining & Off-Road	US: 0.80 Million	US: 0%	US: 216%
Aerospace	US: 0.003 Million	US: 0%	US: 74%
Maritime	US: 0.37 Million	US: 0%	US: 334%

Even though high-volume hydrogen fuel cell vehicles are in their infancy stage, volumes are forecast to rise rapidly in a variety of mobility sectors. Medium and heavy-duty vehicles are considered to be the mobility sector with the greatest potential for high-volume hydrogen fuel cell system deployment. For these vehicles, the U.S. growth rate for fuel cell application is expected to be 72% for 2024-2030, though only minimal production is currently forecast for Michigan, presenting an opportunity for the state of Michigan and the Detroit Region to attract production to local facilities.

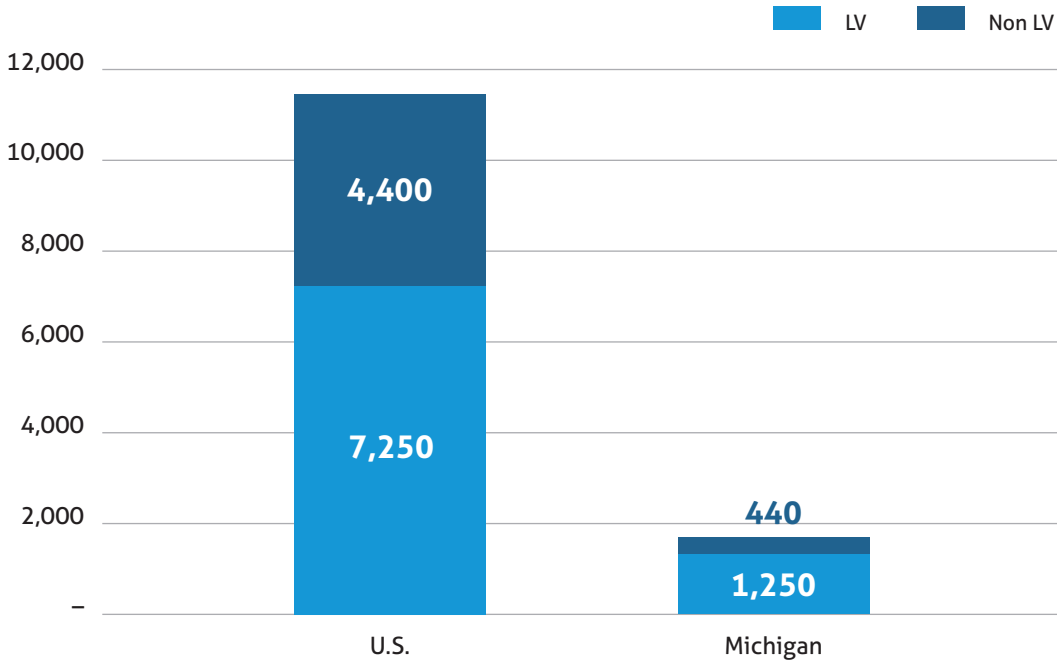
While light vehicles have traditionally not been seen as an equally strong application of hydrogen fuel cell systems in terms of total production and sales volumes, they are forecast to experience a high growth rate of 100% through 2030.

The growth rate for the adoption of hydrogen fuel cell systems in the U.S. for 2024-2030 is forecast to be 216% in the construction equipment and agricultural sector and 334% in the maritime vehicle sector, providing the Detroit Region with a key opportunity to apply its mobility technology products to mobility sectors beyond automotive.

EMPLOYMENT GROWTH OPPORTUNITIES

Chart 3:

HYDROGEN FUEL CELL PRODUCTION EMPLOYMENT GROWTH



By 2030, hydrogen fuel cell production for light vehicles is expected to create 7,250 new jobs in the United States and about 1,250 in Michigan. Production for non-light vehicle mobility sectors is expected to create up to 4,400 new jobs nationwide by 2030. If a conservative 10% of that production takes place in Michigan, the state would see an additional 440 new jobs added as a result.

HYDROGEN PRODUCTION AND INFRASTRUCTURE

The U.S. is on track to reach its national hydrogen production capacity goal of 10 million metric tons annually by 2030. Reaching the target capacity would not only accelerate the adoption of hydrogen-based vehicle propulsion technologies - but it could also create up to 100,000 net new direct and indirect jobs related to new capital projects and infrastructure and an additional 120,000 jobs related to operations and maintenance by 2030 (Pathway to Commercial Liftoff Factsheet, US DOE).

The availability of hydrogen and the lack of a hydrogen infrastructure continue to serve as barriers preventing higher adoption levels of related technologies. In addition to limiting total production volumes of vehicles that use hydrogen for propulsion, this factor also has the impact of limiting likely applications of hydrogen technology to propulsion sectors as commercial vehicles, which can refuel at the same central facility on a permanent basis. New initiatives and fuel cell technology breakthroughs in the Detroit Region, in tandem with work being conducted around the country, will increase the volume and decrease the cost of hydrogen production leading to wider adoption in the future.

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HYDROGEN FUEL CELL WORK ACROSS THE DETROIT REGION

The unrivaled mobility ecosystem in the Detroit Region has resulted in multiple initiatives both in the private and public sector involved in the development and deployment of hydrogen fuel cell technology. Three of these initiatives are highlighted here.

Fuel Cell System Manufacturing LLC (FCSM) in Brownstown is a joint venture effort between General Motors and Honda. The two companies have collaborated on fuel cell technology as far back as 2013. The Brownstown facility produces fuel cell power units for the Honda CR-V e:FCEV fuel cell electric vehicle. As of April 2025, the effort has resulted in an investment of $86 million and created more than 80 new jobs.

The Flint Mass Transit Authority (MTA) is working to completely replace all their diesel buses with ones powered by zero-emission hydrogen. The Flint MTA is also strengthening its reliance on clean energy by implementing a hydrogen supply chain in Flint. This effort is a key example of hydrogen technology vehicle deployment in the region and will be complemented by similar efforts in other Detroit Region communities.

The Hydrogen Heavy Duty Vehicle Industry Group at NextEnergy was formed in 2019 with the goal of addressing hydrogen fueling hardware challenges. The Group is involved in a number of initiatives, including the development of a new hydrogen refueling system that will significantly reduce the amount of time needed to refuel a hydrogen-powered vehicle. By making fuel cell-powered vehicles easier to deploy, this technology helps support the adoption of a variety of related technologies, presenting the Detroit Region with an opportunity to lead in the deployment.

CONCLUSION

Even though hydrogen fuel cell systems are in the early stages of transitioning from specialized to high volume applications, they present the Detroit Region with a significant opportunity for leadership in this critical technology. The forecast in our analysis calls for the addition of nearly 1,700 jobs related to this technology in Michigan by 2030. If the region is successful in deploying the right programs and initiatives to host the companies who will develop and produce these products in the long run, it will stand to benefit in the post-2030 era, as hydrogen fuel cell volumes continue seeing increased acceptance and even higher production levels.

To learn more about GEM, please visit us at
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