YCP Auctus

Driving the Automotive Shift:

How Component Manufacturers Can Contribute Towards the Rise of Hydrogen Vehicles

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Executive Summary

Support from governments and leading original equipment manufacturers (OEMs) are driving the adoption of hydrogen fuel cell vehicles (HFCVs), creating a market for automotive components and refueling products for HFCVs. Initial adoption will be for commercial vehicles, with growth expected to extend gradually to passenger cars.

While battery-operated EVs (BEVs) have been around for many years, Gasoline-based Vehicles were the unbeatable champions. Now, the adoption of BEVs has increased multi-fold in the last few years. The slow growth in the early phase was due to a lack of environmentally conscious consumers & government bodies, low competitiveness in terms of pricing & unavailability of required infrastructure. This sudden spike in adoption is predominantly due to the realisation that BEVs have a lower carbon footprint in comparison with gasoline vehicles & governments around the world focusing on achieving climate action goals.

As governments worldwide intensify their efforts to meet their emission reduction targets and consumer demand for eco-friendly vehicles is picking up, Hydrogen Fuel Cell Vehicles (HFCVs) are emerging as a complementary alternative to Battery Electric Vehicles (BEVs), further accelerating the green revolution in the automotive sector.

Hydrogen vehicles have several environment-friendly features such as low carbon emissions, no harmful by-product (as water is the only by product) after usage, no environmental harm after usage if the Hydrogen is produced (Green Hydrogen) and stored responsibly. The following are the upsides of adopting HFCVs:

Source: Guinness World Records, US Department of Energy, Fuel Cell Technologies Program, YCP Research and Analysis

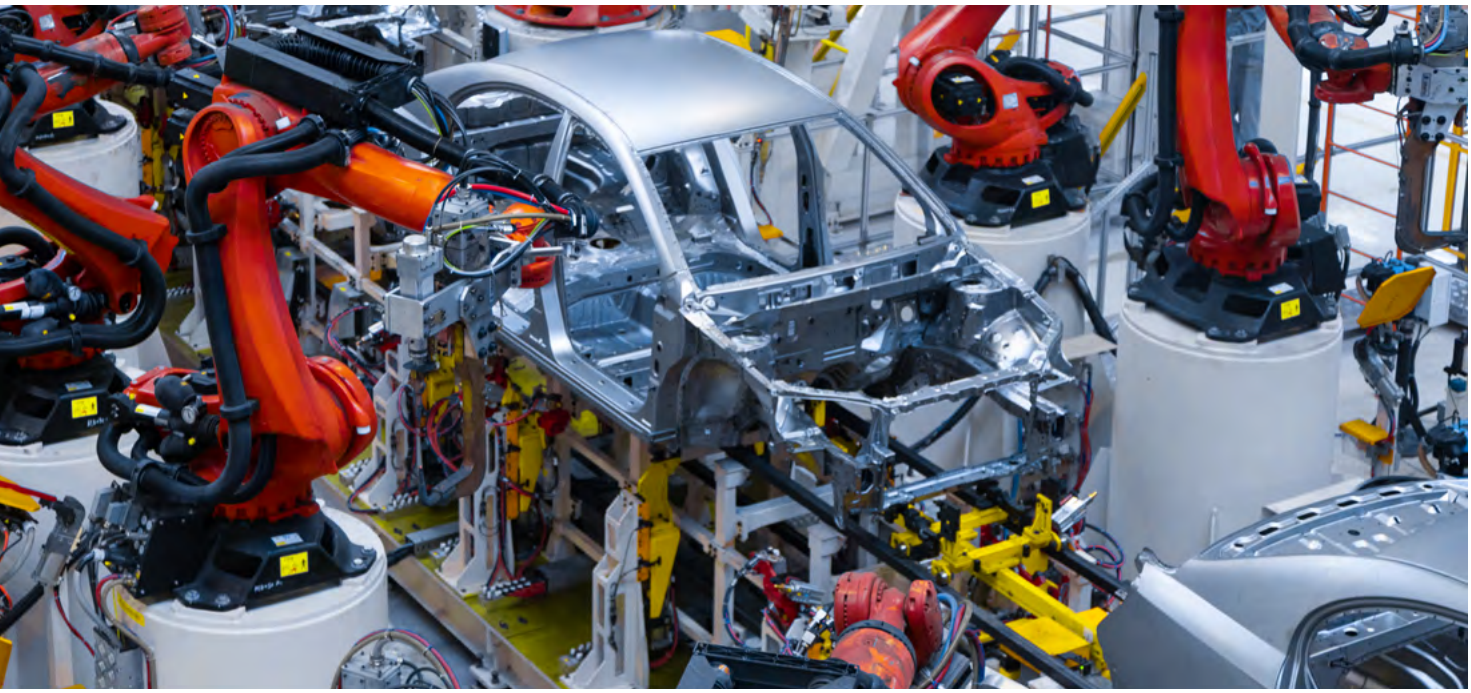
Leading OEMs like Toyota, Foton, Hyundai, and Daimler have already foreseen the growing importance of hydrogen vehicles in the energy transition missions of countries around the world. This presents an opportunity for automotive component manufacturers to quickly ramp up their R&D and actively look to collaborate with leading OEMs and government bodies to produce and innovate essential components for vehicles and refueling stations.

For instance, automotive component manufacturing brands and suppliers like Cummins, Voith, Freudenberg, etc. have already started working on providing customized component offerings to hydrogen vehicle manufacturers. It is projected that in the short term, the adoption of HFCVs will be concentrated towards commercial vehicles and gradually extend to passenger cars. HFCVs are known for features such as fuel efficiency, long-distance coverage, and faster refueling, which are most attractive for long-haul transportation.

This trend can be noticed in leading markets around the world. In 2023, the global Hydrogen-Fuel Cell Vehicles market reached US$ 1.6 Billion with APAC region holding the maximum share. The sales volume is expected to near 23K units in 2024 & is expected to reach 353K units by 2034 at a CAGR of 28.3%. In the APAC region, while most countries saw a downward trend, China saw a significant uptake in hydrogen vehicle adoption. This growth was primarily driven by the growth in sales of Commercial Vehicles. For instance, Chinese hydrogen truck maker Foton saw an 81.1% YoY growth rate in 2022-23.

All of these point out one significant opportunity in the industry that is waiting to be addressed: the automotive and refueling components market which is growing with limited players. As the supply of vehicles increases, the required components for making them and the components for refueling infrastructure to complement them will grow rapidly. Automotive component manufacturers venturing into this space in the next few years will be able to capture the benefits of being an early entrant.

Source: YCP Research and Analysis



The Current State of the HFCV Market & Pathways to Sustainable Growth

Categorization Based on Technology

Hydrogen Vehicles

Fuel cell electric vehicles: Fuel cell electric vehicles (FCEVs), or hydrogen fuel cell vehicles (HFCVs), generate electricity using a hydrogen-powered fuel cell instead of a battery. The fuel cell creates electricity through an electrochemical reaction between hydrogen and oxygen (from the air), producing only water vapor and heat as byproducts. This allows FCEVs to operate efficiently and cleanly.

Compressed H_2 Gas

These vehicles are powered by compressed hydrogen gas, which feeds into an onboard fuel cell stack and then into an electro- chemical cell that powers the electric motor.
Level of purity: 99.99% (Grade 4)
Examples: Toyota Mirai, Hyundai Nexo
Benefits: Zero emissions, fast refuelling, high efficiency, fewer moving parts which lead to smoother and quieter driving experience
Problems: High manufacturing cost, low storage capacity, lack of infrastructure, sensitivity to hydrogen purity

Liquid H_2

These vehicles are fueled with liquified hydrogen that feeds into a liquid hydrogen fuel tank system and later into the electro- chemical cell that powers the electric motor.
Level of purity: 99.99% (Grade 4)
Example: Mercedes-Benz GenH2 truck
Benefits: Zero emissions, fast refuelling, high efficiency, fewer moving parts, and long range
Problems: Storage in cryogenic tanks, untimely evaporation, energy used for liquification, sensitivity to hydrogen purity

Hydrogen Internal Combustion Engine Vehicles: HICEVs are like typical internal combustion engine vehicles, but they make use of hydrogen instead of diesel or petrol. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to run.

Compressed H_2 Gas

These vehicles are fueled with compressed hydrogen gas into a fuel tank system and is combusted, thus powering the electric motor.
Level of purity: Tolerant towards impurities
Example: Toyota Corolla Cross H2 Concept
Benefits: Easy to adopt and manufacture, fast refueling, less sensitive to hydrogen purity
Problems: Lower efficiency (fundamental limitations), NOx emissions, short range, lack of lubrication

Liquid H_2

These vehicles are fueled with compressed hydrogen gas into a fuel tank system and is combusted, thus powering the electric motor.
Level of purity: Tolerant towards impurities
Example: Toyota Corolla Cross H2 Concept
Benefits: Easy to adopt and manufacture, less sensitive to hydrogen purity
Problems: Storage in cryogenic tanks, lower efficiency, NOx emissions, energy used for liquification, lack of lubrication

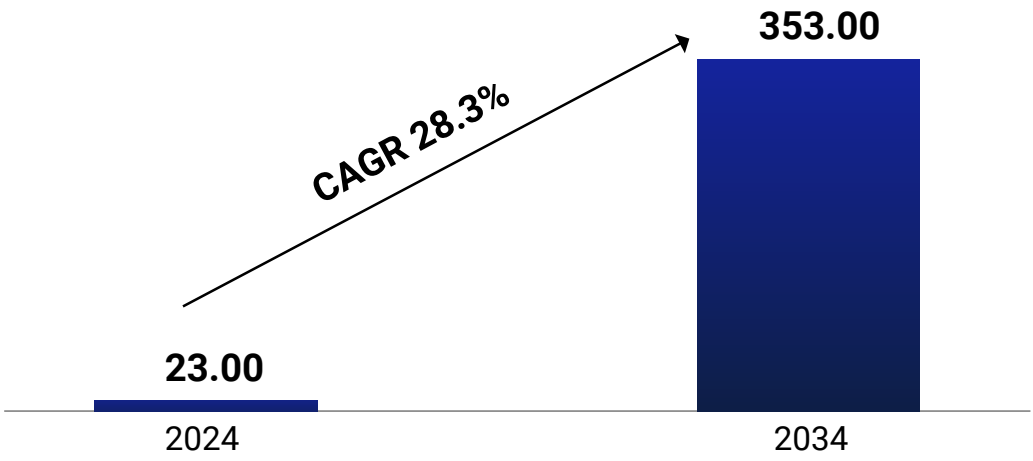
Source: YCP Research and Analysis

Commercially available or in testing phase

Market Overview

The global hydrogen fuel cell vehicle market, valued at 1.6 billion US dollars in 2023, is projected to grow from nearly 23,000 units in 2024 to 353,000 units by 2034, with a CAGR of 28.3%. The overall growth is driven by factors such as net zero commitment goals, environmental awareness created through the BEV boom, and an overall commitment from all the stakeholders including OEMs, government, and suppliers to accelerate the adoption of HFCVs.

Global Market Size of Hydrogen-Powered Vehicles
By sales volume ('000's), (2024-34)



Note: APAC Region holds the maximum market share (>70%) in HFCVs in 2023
Source: Markets and Markets

Factors driving market growth:

Net zero commitments	Governments around the world are banking on hydrogen fuel to achieve carbon neutrality by 2050. Key initiatives that support hydrogen vehicle manufacturers include the formation of the Hydrogen Economy Committee, and the Korean New Deal (to strengthen climate action and realize a green economy) by the Korean government.
Environmental awareness	The battery-operated electric vehicles (BEVs) boom has significantly heightened global awareness regarding the environmental impact of traditional fossil fuel vehicles. Consequently, individuals are increasingly motivated to consciously research and choose environmentally sustainable modes of transportation.
Increasing advocacy towards HFCVs	Leading players like Toyota, Honda, and Daimler and governments worldwide are advocating for hydrogen vehicle adoption. They are increasing awareness, investing in R&D and infrastructure, and partnering with various bodies around the world to accelerate it.

Source: YCP Research & Analysis and IMARC

Precursors to Sustained Growth

While the market is expected to grow at an impressive rate, certain precursors should be met to achieve the growth projections. These include ramping up infrastructure, technology, commercialization efforts, and public-private collaborations.

Infrastructure Development

- Storage, transportation, and refueling stations are the most crucial developments required for the successful future adoption of HFCVs
- The logistical infrastructure requires pipelines, storage tanks, trucks, compressors, and dispensers at refueling stations

Commercialization

- Although HFCVs have several advantages like eco-friendliness, faster refueling, and long-range coverage, the cost of producing these vehicles is currently not competitive enough
- There are several raw materials and components (such as green hydrogen and fuel cells) across the HFCV production value chain that are expensive
- Stakeholders like component manufacturers and OEMs need to undertake R&D initiatives to innovate cost-effective production

Technological Advancements

To ensure hydrogen uptake, technological advancements are needed where it is not yet mature. Some areas where technological development is essential include:

- Improving fuel-cell stack technology and further optimizing fuel efficiency to compete with BEVs
- Economic vehicle production for better scalability

Public-Private Collaboration

- To achieve each of the other three aspects—i.e., infrastructure development, technological advancements and commercialization—high level of investment, policy and regulatory changes are required
- As governments have the resources and ability to invest and regulate and corporates have the capabilities to innovate and implement, public-private collaboration will ensure the smooth implementation of the three other goals and the successful growth of the hydrogen fuel cell vehicles market

Source: YCP Research and Analysis

Key Recent Advancements

Recent advancements in the hydrogen vehicles market provide a positive outlook towards the future of the industry, as they are moving in the right direction by addressing the key bottlenecks that currently exist.

Advancements	Description
 Improved Fuel Cell Stacks	• Fuel cell stacks, which are one of the most crucial components of HFCVs suffer from problems such as low output voltage, insufficient durability, and high-cost catalysts (e.g. noble metals). Several initiatives have been taken to solve these roadblocks. • For instance, Hyundai Motor and Kia signed an agreement with Gore to co-develop polymer electrolyte membrane (PEM) for hydrogen fuel cell systems. They aim to develop an advanced fuel cell system for commercial vehicles, increasing durability and performance.
 Low-Cost Green Hydrogen Production	• As cost is a barrier to commercializing hydrogen-based products, many companies are developing electrolyzer technology to reduce the production costs of green hydrogen. Notable players include Hysata, Stiesdal, Electrogenos, Hydrogen Systems Australia, and Electric Hydrogen. • For instance, a novel electrolyzer technology that uses supercritical water to produce green hydrogen is under development in Spain. It is expected to maximize energetic efficiency, improve circularity, and enhance lifetime, resulting in more competitive green hydrogen production.
 Infrastructure Development	• Infrastructure like refueling stations and green liquid hydrogen supply are required for a smooth transition and pickup of HFCVs. • While many governments are working on developing this for customers and corporates, private companies like the BMW Group are already working on the development of a hydrogen fuel infrastructure (initially in Germany) through the clean energy partnership, as they believe that an international hydrogen network is a prerequisite for launching their HFCVs to their customers.
 Commercial Deployments	• For HFCVs to become popular in commercial deployment, they should be capable of fuel-efficient long-haul road transportation coupled with fast refueling capabilities. • Companies are continuously working on improving both these aspects. For instance, following extensive testing on public roads, Daimler's trucks have advanced to a stage ready for deployment in initial customer fleets. Starting mid-2024, companies such as Amazon and Holcim will participate in first customer trials on specific routes in Germany to garner important primary experience.

Source: YCP Research and Analysis, Kia, Hyundai Motors, BMW Group, Daimler Truck, Hydrogen Insight

How are APAC Countries Leading the Hydrogen Vehicles Revolution?

Market Size Breakdown
By Region

While the adoption of hydrogen fuel vehicles is expected to experience a boom in regions like America, Europe, and the Asia Pacific, the APAC region is poised to become the clear leader with the highest market share and growth rate.

Global Market Size: Hydrogen-Powered Vehicles
By Sales Volume, 2023

Country / Region	No. of HFCVs (2023)	% Market Share
USA	2,992	20.70%
Europe	773	05.35%
China	**5,600**	**38.75%**
Korea	**4,631**	**32.05%**
Japan	**424**	**02.93%**
Rest of the world	31	0.21%
Total	14,451	100%

Source: Statista, SNE Research
Note: South Korea and Japan have the highest number of passenger cars running on hydrogen fuel cell technology

APAC region emerges as the leading market for Hydrogen vehicles and the growth is driven by:

- Automotive OEMs from those regions, like Toyota (Japan), Honda (Japan), and Hyundai (South Korea), with first mover advantage
- Increasing investments from various stakeholders (such as Automotive OEMs) in this space to ramp up advancements
- Government interest towards leveraging hydrogen to achieve net zero commitments and the resultant policies that encourage the adoption of hydrogen fuel vehicles

Source: YCP Research and Analysis

Sales within the APAC region

By Country

While South Korea and Japan faced a decline in HFCV sales, China witnessed massive growth predominantly due to an increase in the sale of commercial vehicles, the government's support, and the gap in the market to address the 2025 hydrogen vehicle goal of the government. This points out a trend that the immediate growth of hydrogen vehicles will be predominantly contributed by commercial vehicles.

HFCV Sales Comparison of APAC Countries

Country	2022	2023	Growth Rate	2022 Market Share	2023 Market Share
	10,336	4,631	-55.20%	49.90%	32.00%
	5447	5600	2.80%	26.30%	38.80%
	846	424	-49.90%	4.10%	2.90%

Source: Statista, SNE Research

The sale of commercial vehicles contributes to the growth rate in China:

- While the rest of the countries saw a slight degrowth, the Chinese HFCV market experienced a nominal growth, increasing its market share. This growth was predominantly contributed by the sale of hydrogen commercial vehicles, which continued to upturn
- It is important to note that Chinese makers with a focus on commercial vehicles are experiencing an upward trend, and sales of fuel-cell cars like Toyota are experiencing a year-on-year (YoY) decline in 2022-23
- For instance, Foton, a Chinese hydrogen truck maker, saw an 81.1% year-over-year growth rate over the same period

Government support and the gap in the market to address the 2025 HFCV goal of the government is driving up sales in China:

- From ~18,000 units of HFCVs in 2023, the Chinese Government targets to bring 1 million hydrogen fuel-cell vehicles on the road by 2030
- Dedicated support from the government and the rising demand in the market for the industry are influencing the growth of HFCVs in China. The government is supporting
    - Subsidies to cities for producing and promoting hydrogen vehicles to meet targets such as refueling infrastructure
    - Subsidies companies to encourage research in fuel cells, fuel-cell vehicles, and hydrogen refueling

What will drive the positive growth of commercial HFCVs?

- Regulatory authorities worldwide are implementing rigorous emission regulations for commercial vehicles. For instance, the EPA (Environmental Protection Agency) has recently tightened emission standards for commercial vehicles in the US. One rule said 30% of “heavy-heavy-duty vocational” trucks would need to be zero-emission by 2032
- Companies are shifting to HFCVs which are vehicles with zero tailpipe emissions and offer better fuel efficiency and longer driving range- features that are most attractive to long-haul travel
- For instance, the average driving range of BEVs is around 200-250 miles with a fully charged battery, which can take hours to charge. On the flip side, HFCVs can be refueled in as little as five minutes and some can go up to 1,000 km (600 miles) on one tank of hydrogen fuel

Source: YCP Research and Analysis, Hydrogen Insight, Fuel Cells Work, CAAM

Leading APAC Countries

Though there has been a slight degrowth in certain APAC countries, the government initiatives and interest from private bodies provide a positive outlook. Governments have set ambitious targets to put millions of hydrogen vehicles on the road by the end of the next decade and are taking necessary steps to make it conducive for sellers and buyers.

 1 Million Hydrogen Vehicles on road by 2030 and 2,000 Refueling Stations by 2035	 2.75 Million Hydrogen Vehicles on road by 2040 and 1,200 Refueling Stations by 2040	 800,000 Fuel Cell Vehicles in service by 2030 and 1,000 Refueling Stations by 2030
Current & future market scenario: • China leads globally in hydrogen production (35.33 million tons in 2022), consuming over 1/3 of the world's total, driven by government support • From just ~18,000 vehicles in 2023, most of which came from commercial vehicles, China has set a target to have more than 50,000 in 2025, and 1 million FCVs in service by 2030 • With ~400 hydrogen refueling stations in 2023--China had the largest number of refueling stations worldwide	**Current & future market scenario:** • South Korea aims for 1/3 of their energy to be clean hydrogen (93% green) by 2050 • From ~34,200 vehicles on the road in 2023, South Korea plans to have HFCVs account for over 11.18% of registered vehicles by 2040 • With 160+ hydrogen refueling stations in 2023- South Korea had the third largest refueling stations worldwide and continues to improve hydrogen infrastructure	**Current & future market scenario:** • Japan leads the way in hydrogen tech, aiming for 12 million tons of annual usage by 2040, solidifying its position as a clean energy pioneer • Japan's infrastructure investments aim to boost HFCVs from 7,500 in 2023 to 800,000 by 2030, including 5,000 heavy-duty trucks • Japan, with ~169 stations in 2023, held the 2nd largest hydrogen refueling network globally, and aims to build 1,000 by 2030
Investments and Incentives: • The government offers tax reductions and subsidies ranging from USD 3,200 to USD 7,900 for hydrogen vehicles • Foreign companies are entering the Chinese hydrogen market, partnering with local firms. Examples include Hyundai and Toyota on fuel cell projects, and Cummins and Siemens on hydrogen production	**Investments and Incentives:** • South Korea offers subsidies for hydrogen vehicles. For instance, currently, it provides a subsidy of USD 16,875 per car • Private players like SK, POSCO, and Hyundai are pouring billions into the Korean hydrogen ecosystem	**Investments and Incentives:** • Japan subsidizes FCEV purchases by USD 12,700 and covers half the cost of building hydrogen stations • Japan will invest USD 19.2 billion in Contract for Difference subsidies to bridge the cost gap between clean hydrogen and fossil fuels

Source: CAAM, Hydrogen Insight, China Daily, East Asia Forum, New Zealand Ministry of Foreign Affairs & Trade, S&P Global

Navigating Present Realities:

OEMs & Component Manufacturers Investing in HFCV Market

Key Players & Future Plans

The top automotive OEMs such as Toyota, Hyundai, Foton, etc. in the Hydrogen vehicle market are from APAC Regions and some of them are at the forefront of the Hydrogen revolution as they enjoy first mover advantage from being pioneers in this space and their plans for the coming years look very promising.

Top Brands	HQ	Vehicle Type*	Stance	Future Plans
TOYOTA		Cars, CVs**		Plans to continue development of new models of trucks and vans independently through partnerships and refinement of their existing models
HYUNDAI		Cars, CVs**		Plans to release a new version of their Nexo and expand the production of its fuel cell bus, Elec City, by six folds.
HONDA		Cars, CVs**		Ceased the production of Clarity in 2021 and leased till 2022, plans to re-enter the market with CR-V e:FCEV 2025, co-developed with GM, available from late 2024.
FOTON		CVs**		To meet its 2050 carbon neutrality goal, FOTON has set ambitious targets to have more than 50% of its total sales coming from new energy vehicles
DONGFENG		Cars, CVs**		Has formally launched its hydrogen fuel cell business, Dongfeng Qingzhou, and collaborated with Nissan to test Venucia V-Online Qing Jing cars.
BMW		Cars		BMW is currently testing a hydrogen-powered iX5 SUV with a pilot fleet of 100 vehicles globally to gauge user experience about large SUVs running on hydrogen.
DAIMLER TRUCK		CVs**		Focused on commercial vehicles, such as trucks as they believe HFCVs are suitable for heavy-duty and long-distance. Hence, testing trucks suitable for long-distance

Top brands with vehicles launched or in testing phase	TOYOTA, HYUNDAI, NIKOLA, DAIMLER TRUCK, HONDA, RAM, GILLIG, BMW, SAIC, DONGFENG, FOTON, YUTONG
Top brands with concept cars	AUDI, KIA, LAND ROVER

Companies headquartered in the APAC Region

Chinese Brands focussed on Commercial Vehicles- Chinese hydrogen vehicle market consists of numerous brands focussed on producing Commercial Vehicles.

**Vehicle type includes cars launched for commercial usage and in the testing phase*
***CVs are commercial vehicles which include buses, trucks, etc.*

Source: YCP Research and Analysis

Component Manufacturers

Component manufacturers like Cummins, Dana, Voith, Weh, etc., are some of the leading players in the Hydrogen automotive and refueling component manufacturing space. They are optimistic about the pick-up of Hydrogen in the coming years and have been building expertise over several years. This will give them an edge as they will be several cycles ahead of other players in terms of technical expertise, industry connections, product penetration, and market intelligence.

Company	Types of Products*	Current & Future Plans
	• Hydrogen ICEs • Electrolysers	• A joint venture between Cummins and TATA inaugurated its first manufacturing facility in India for hydrogen internal combustion engines (ICEs) for medium- and heavy-duty transport in March this year. • Its facility in Herten, Germany, plans to expand in the future to support fuel cell stack refurbishment. • Last year, Cummins projected a USD 400 million revenue for hydrogen-related products by 2025, and USD 6-13 billion by 2030. • They believe that hydrogen engines and fuel cells are complementary technologies and plan to invest in both.
	• Fuel cell stack bipolar plates • Balance of plant and hydrogen reformer components	• Dana has installed the largest production line for metallic bipolar plates in Europe at its German facility. • Additionally, it is also running a smaller line with a capacity of 800,000 plates a year.
	• Plug & Drive H2 Storage System • Carbon4Tank • Composites	• Voith's current focus is on developing and launching the "Plug & Drive H2" storage system for heavy-duty commercial vehicles. • Voith collaborated with KEYOU to develop a prototype hydrogen-driven city bus and signed a strategic cooperation agreement with Weifu Group to develop and promote high-pressure hydrogen storage systems. • HySTech GmbH is Voith's newly formed company for hydrogen storage systems.

**Not necessarily exhaustive*

Company	Types of Products*	Current & Future Plans
BALLARD	• Air-cooled and liquid-cooled PEM fuel cell stack platforms • 4 different vehicle-specific Heavy-duty power modules designed for vehicles like buses, medium & heavy-duty trucks, and coaches	• Ballard is currently targeting the medium and heavy-duty vehicle segment (trucks, buses) for HFCVs, collaborating with manufacturers like GILLIG. • Ballard has not publicly announced a timeline for entering the passenger car HFCV market, but its overall strategy suggests that it will do so in the future
BAE SYSTEMS	• Electric Drive Systems • Gen3 Power Management Systems	• It will provide its electric drive system to GILLIG and its Gen3 product line solutions for ENC's next-generation hydrogen fuel cell transit buses. • It is actively working with various cities, like New York and Rochester, and transit authorities to implement hydrogen fuel cell buses powered by their electric drive systems. • It has been collaborating with manufacturers of hydrogen fuel cells, like Plug Power, to offer complete electric propulsion solutions for HFCVs.
FREUDENBERG INNOVATING TOGETHER	• Gas Diffusion Layers • Fuel Cell Stack seals • Fuel Cell Filters • Fuel Cell Humidifiers • Fuel Cell Systems	• The Freudenberg Group is investing in hydrogen and fuel cell technologies, along with high-tech components for commercial vehicles. • They are constantly researching and developing new sealing materials that can withstand the harsh operating conditions within fuel cells, such as high temperatures and pressures.
WEH®	Hydrogen Dispensers (Cars and Commercial Vehicles): • Breakaway Couplings • Filters • Nozzles Hydrogen Vehicles: • Receptacles • Check valves	• As per WEH, today, hydrogen fuelling stations and fuel cell vehicles all over the world are almost entirely equipped with WEH Refueling components. • It aims to continuously invest in research and development for solutions in the hydrogen refueling space.

**Not necessarily exhaustive*

Source: YCP Research and Analysis

Market Sentiments

Automobile Manufacturers

Positive:

- Toyota believes that Hydrogen powertrains have a strong future and internal combustion engines too should be modified to adapt.
- Honda India CEO believes that FCEVs will come after the era of [battery] EVs.
- Daimler is trying to figure out the interplay of hydrogen and battery commercial vehicles.

Scope for Improvement:

- Volkswagen will stay away from making hydrogen-powered passenger cars in the next decade and will focus its efforts on further developing EV technology.
- MAN CEO believes that it is impossible for hydrogen to effectively compete with battery electric trucks. The biggest setback is the sustainability of the energy source.
- Stellantis CEO stated that the cost of hydrogen mobility is sky-high and far from being affordable. However, charging is much more convenient but the cost of producing clean energy remains high.

Component Manufacturers

Positive:

- Ballard gains the support of the US Department of Engineering to advance hydrogen and fuel cell scaling, actively developing next-generation automated production processes for MEAs, bipolar plates, and stack assembly.
- PowerCell Sweden's CEO underscores the significance of collaboration with Bosch in accelerating industrial-scale production, with a focus on leveraging less expensive materials and achieving higher power output per cell.
- HnPower's CEO, Inyong Kang, underscores hydrogen extraction and SOFC as pivotal for realizing a true hydrogen society, with expanded portfolio and production capacity aimed at meeting the burgeoning demand alongside SolydEra.
- Philippe Rosier, CEO of Symbio, emphasizes the strategic importance of metallic fuel cell bipolar plates, highlighting Innoplate's role in securing serial production capability, enhancing system performance, and driving cost competitiveness. This initiative showcases Symbio's commitment to technological and industrial leadership in Europe.

Customers and Users

Positive:

- The drive is very smooth, and the Noise, Vibration, and Harshness (NVH) levels are almost non-existent.
- Refueling the vehicle takes very little time, which makes the experience fairly smooth.

Scope for Improvement:

- Infrastructure and Cost: Hydrogen refueling stations are inadequate in number and the fuel is expensive due to a lack of production and low economies of scale.
- Software Malfunctioning: Hydrogen refueling software malfunctions frequently, leading to inoperable pumps and challenges.
- Supply Disruptions: Supply is prone to disruptions due to extraordinary weather events and refinery accidents.
- Refueling Experience: In warm regions with high humidity, condensation forms in the process and frozen nozzles cause refueling delays.

Source: YCP Research and Analysis

Call to Action:

Component Manufacturers Should Invest Now to Gain Later

Call to Action

As governments and OEMs in the APAC region are already actively involved in the hydrogen-powered vehicles market to address the current roadblocks and meet the growth rates, it is essential for component manufacturers to proactively participate and collaborate with key stakeholders to create vehicles that solve issues faced at the industry level. Players venturing into this space in the next few years will have an edge as it is a growing market with limited players.

While hydrogen vehicles show great promise towards green mobility, they suffer from certain roadblocks:

High production costs leading to low competitiveness against other forms of vehicles (BEVs and gasoline-operated vehicles)

Lack of necessary infrastructure, such as refueling stations and mature logistics infrastructure for storage and transportation of fuel

Fuel Cell technology still has a lot of scope for improvement to make it suitable for commercialization.

Some of these were also the major reasons for the slower adoption of BEVs during their initial phase. However, the market outlook is positive this time, as:

Government bodies and consumers are already environmentally conscious

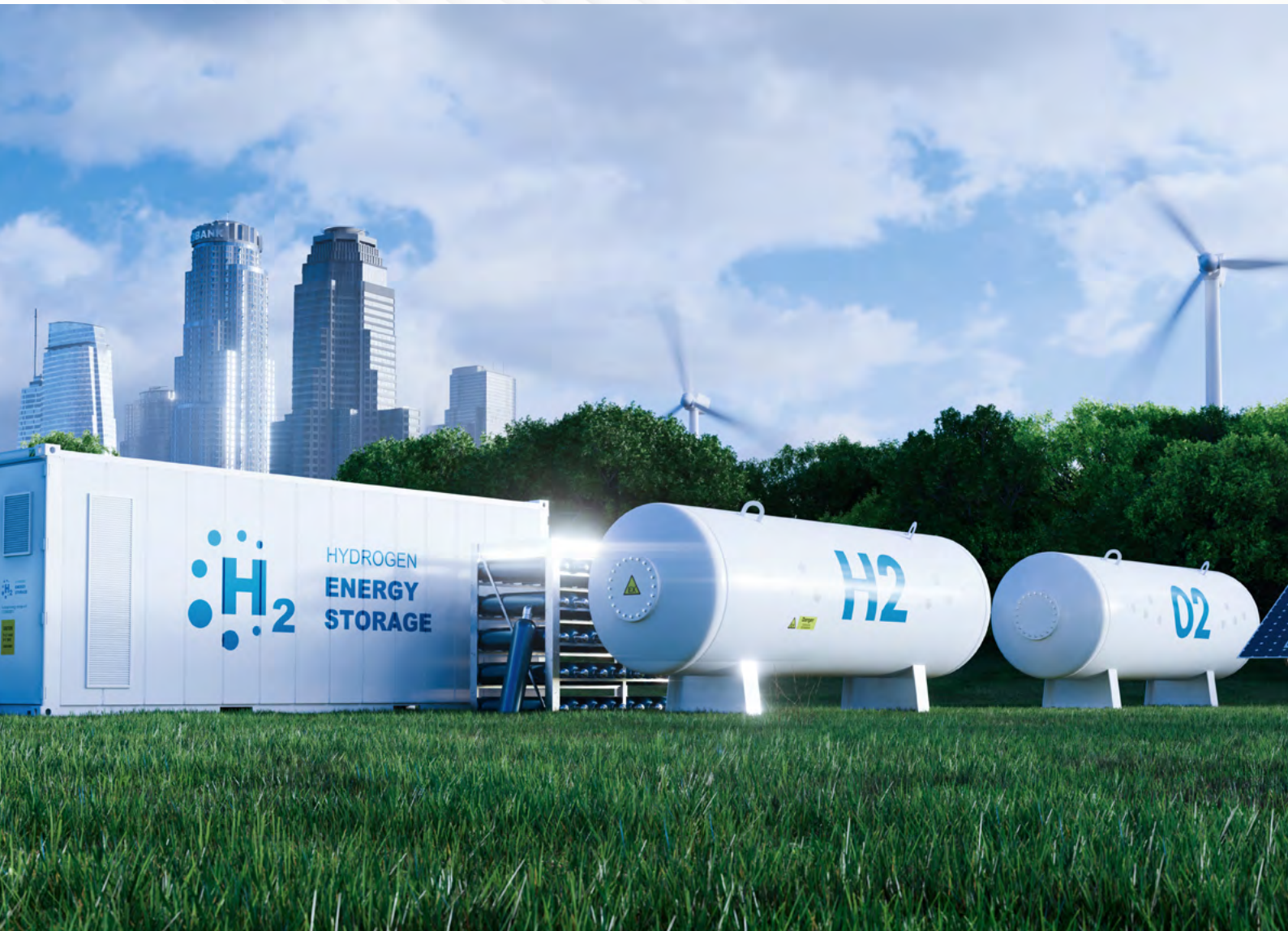
Various public (government) and private (OEMs) bodies particularly in APAC regions, such as China, South Korea, and Japan, have already started investing to build the required infrastructure

Leading luxury and economic car brands, such as Toyota, BMW, and Hyundai, are undertaking various R&D initiatives to make hydrogen vehicles commercially viable

While governments and OEMs in the APAC region are actively working towards the adoption of hydrogen vehicles, it is also vital for component manufacturers to participate in this development and partner with the key stakeholders. For instance, Quantron (HFCV manufacturer) and Ballard (fuel cell engines developer) partnered to develop hydrogen fuel cell electric trucks in 2021. They were able to deliver their first fuel-cell electric vehicles by 2023. This partnership helped them launch it in record time by reducing the overall process from feasibility study to delivery to 18 months. This shows the degree of success that can be achieved through partnerships between OEMs and component manufacturers.

As components manufacturers work alongside key stakeholders to understand challenges and co-create vehicles, their shared expertise will create synergies. This accelerates the launch of commercially viable vehicles by leveraging diverse background knowledge (coming from OEMs and component manufacturers) to address a broader spectrum of issues. Component manufacturers entering this sector in the next few years stand to attain significant advantage as they will gain industry connections, technical expertise, and IP. This unlocks a burgeoning market with limited players that is yet to be fully exploited.

Source: YCP Research and Analysis, Ballard Power



Authors

Pavan Madamsetty

Partner

Pavan is a Partner at YCP Auctus based in Bengaluru, India. He has over 15 years of experience helping Fortune 500 companies enter and grow their businesses in different emerging markets in Asia, including assessing market potential, identifying strategic opportunities and bet strategy, competition benchmarking, channel and distribution strategy, supply chain strategy, and evaluating the selection of acquisitions and partnerships. He has worked extensively with multiple clients in the automotive and auto-component space, helping them enter and grow in key markets in the APAC region. He also has strong experience implementing strategic initiatives, leading a PMO at client locations to ensure the strategic initiatives are put into action. He holds a Bachelor's degree in mechanical engineering and an MBA with Honors from Thunderbird School of Global Management, Arizona, U.S.A.

Leon Cheng

Partner

Leon Cheng is a Partner at YCP Solidiance with a dual base in the North American and Asia-Pacific offices, leading the firm's global mobility practice. His 12 years of consulting within the automotive and mobility sector encompass strategy, M&A, process improvement, and supply chain optimization. Leon has directed over 100 projects, driving growth for automotive OEMs, suppliers, and service providers throughout the mobility value chain. He holds a Bachelor's degree in management from the University of Finance and Economics of Anhui and an MBA from the University of Science and Technology of China.

Anuramaa Ramachandran

Analyst

Anuramaa is an Analyst based in India. She has two years of experience in the management consulting space. At YCP Auctus, she has worked for multinational clients in the automotive aftermarket industry to build market entry, go-to-market, and growth strategies through in-depth market evaluation, competitor benchmarking, channel, landed cost, and manufacturing location assessment. She has also worked for clients in the logistics industry on operational excellence cases involving root cause analysis, strategy development, and implementation planning. She holds a Bachelor in Commerce (Honours) degree from Shri Ram College of Commerce, Delhi University, India.

About Us

What We Do

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https://www.linkedin.com/company/ycpauctus

Our Services

Backed by years of expertise and knowledge across several industries, our professionals and their services can provide actionable insight and data-driven strategies that deliver high-impact results for your business growth.

- Marketing & Sales
- Operations
- Supply Chain Management
- M&A, Transactions, and PMI
- Strategy
- Digital Transformation
- Public Services
- Sustainability
- Market Research

Our Industries Coverage

Our global network of professionals leverage on their extensive expertise and understanding of various business industries to help our clients strive for growth.

- Aerospace & Defense
- Automotive & Mobility
- Energy & Natural Resources
- Construction & Infrastructure
- Consumer & Retail
- Financial Services
- Healthcare
- Industrials
- Private Equity & Principal Investors
- Public Sector
- Transportation & Logistics
- Technology, Media & Telecommunications

Our Offices

Global Headquarters Singapore
20 Collyer Quay Level 12-06
Singapore 049319
+65 6910 2604

Japan
Shin-Aoyama Building East 10F,
1-1-1 Minami Aoyama,
Minato-ku, Tokyo, Japan
+81 3 5772 2785

China - Shanghai
Room 2711, Hong Kong New World Tower, No. 300 Middle Huaihai Road, Huangpu District, China
+86 21 63906936

China - Hong Kong
46-133, 46/F, 33 Hysan Avenue, Lee Garden One, Causeway Bay, Hong Kong
+852 3643 1100

Taiwan
10F-1, No.209, Sec. 1, Civic Blvd., Datong Dist., Taipei City, Taiwan
Tel: +886 2 2181 1662

Indonesia - Jakarta
Satrio Tower
22nd Floor – Unit C2
Jl. Prof. Dr. Satrio, Kav C4
Kuningan Timur - Setiabudi
South Jakarta
+62 21 2598 2120

Indonesia - Surabaya
YCP Solidiance Digital Studio,
Revio Space, 1st Floor,
Jl. Kaliwaron No.58, Gubeng,
Surabaya 60285

Malaysia
The Horizon, Avenue 3, Tower 3, Unit 1-1 Bangsar South, Kuala Lumpur 59200, Malaysia
+60 11 231 92352

Philippines
28/F Tower 2 The Enterprise Center, 6766 Ayala Avenue corner Paseo de Roxas, Makati City, Metro Manila 1200, Philippines
+63 9171 5089 46

Thailand
63 Athenee Tower, 15th Floor, Unit 1507/1, Wireless Road, Lumphini, Pathumwan, Bangkok, Thailand
+66 2233 3816

Vietnam
Suite 704, Satra Dong Khoi Building, 58 Dong Khoi Street, District 1 Ho Chi Minh City, Vietnam
(+84 28) 3521 8639

India - Bengaluru
WeWork, Princeville Block, Embassy Golf Links Business Park, Domlur, Bengaluru - 560071, India
+91 80 46916777

India - Gurgaon
Level 18, One Horizon Center, Golf Course Road
DLF Phase–5, Sector 43,
Gurgaon, Haryana 122022, India
+91 124 668 8200

India - Mumbai
WeWork, Enam Sambhav, BKC C-20, G Block, Bandra-Kurla Complex, Mumbai - 400051, India
+91 22 44451100

India - New Delhi
Innov8 Coworking, Pride Plaza Hotel, H43F+ 65, Aerocity, Delhi, New Delhi - 110037, India

United Arab Emirates
Business Center Logistics City Dubai Aviation City, 390667, Dubai, U.A.E
+91 965 006 1119

USA - Canada
Suite 900, 1959 Upper Water Street Halifax, Nova Scotia B3J 3N2
+1 647 507 5152

USA - San Diego, CA
9920 Pacific Heights Blvd. Suite 150 San Diego, California 92121
+1 858 212 4706

France
Society Opera 2 Rue Des Italiens 75009 Paris, France
+ 33 1 56 76 76 02

Netherlands
Keizersgracht 482, 1017EG Amsterdam
+31 20 2441 798

YCP Auctus