BUSES

1 Introduction

The number of COVID-19 infections case, a disease that had been in the spotlight since January 2020, kept fluctuating, with the number of new cases reaching almost 100,000 people per day in early February 2022, and a record 250,000 by the end of August. However, the medical knowledge accumulated over the previous two years and changes in the lifestyle habits of the general public played a role in initiating social activities aimed at coexisting with COVID-19 based on the mindset that the pandemic was starting to come to an end. The bus industry, hard struck by the severe drop in users caused by policies that limited the movement of people and prevented crowding, has been taking definite steps to prepare for the post-COVID era. Demand for transit buses relies in large part on commutes to work or school, but the recovery in work commuting, especially in urban areas where working from home has become widespread, has been limited to between 70 and 80%. Bus operators are coming to terms with the fact that demand will not return to pre-pandemic levels. In contrast, the charter bus industry, in which buses remained out of operation for a long time, has been able to plan measures in anticipation of a resurgence in visitors to Japan. However, the two-year period of inactivity pushed some operators into bankruptcy, and there are concerns that supply will fail to meet demand in the early stages of recovery to pre-pandemic levels.

Irrespective of these trends in demand, the bus industry is showing interest in making electric buses more widespread, and the number of trials has been increasing. There are also high expectations placed on the automated driving trials conducted all over Japan. The lack of driver is also an urgent issue, particularly in the charter bus industry, where many drivers changed careers to trucking or other industries, further aggravating the labor shortage. In addition, it was discovered in April that Hino had been cheating in the emissions certification process for years, and bus operators have been affected by the halt in sales of heavy-duty sightseeing buses equipped with the affected engines. This article looks back on those topics and trends in the bus industry in 2022.

2 The Japanese Bus Industry in Statistics

2. 1. Passenger numbers

The total number of bus passengers in 2021 was 3.47 billion people, with transit bus ridership comprising 3.31 billion people, and charter bus ridership comprising 160 million people (Fig. 1), representing a 6.4% increase over the previous year. However, one year before that in 2020, the number of passengers had decreased significantly by almost 30% relative to 2019. Compared to the drastic drop caused by the pandemic, the pace of recovery is sluggish. Work and school commuting demand, which constitute a large share of transit bus ridership, fell considerably. In large cities or regions where major corporations are based, the significant changes in working style exemplified by telecommuting have led to a pronounced decrease in work commuting demand that is unlikely to return to pre-pandemic levels.

At the same time, despite showing signs of recovery,

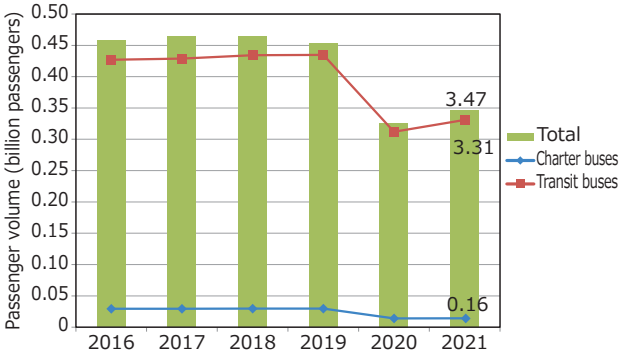


Fig. 1 Passenger volume (number of passengers)

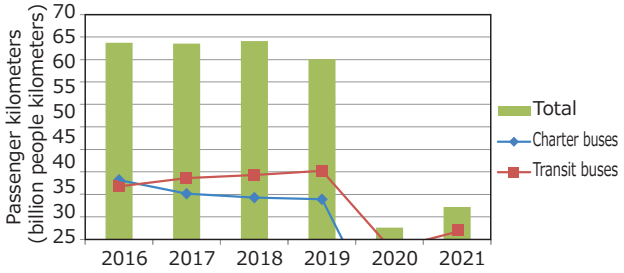
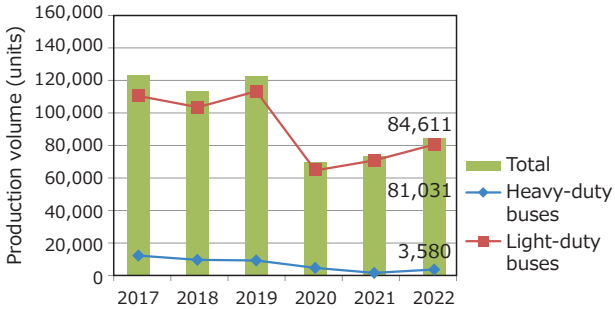


Fig. 2 Passenger volume (passenger kilometers)



*2 Quoted from Ministry of Economy, Trade and Industry dynamic statistical data since 016.

Fig. 3 Bus production in Japan

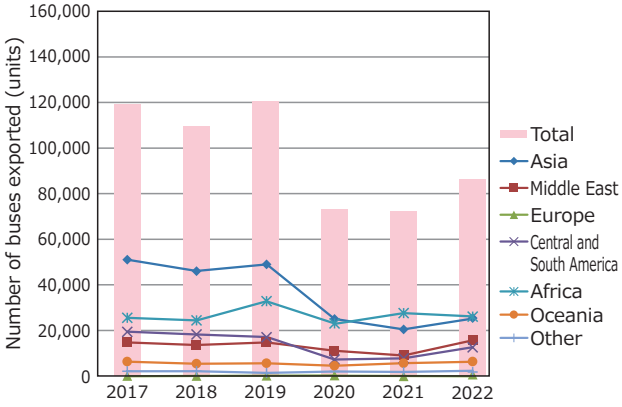


Fig. 4 Main Export Destinations

charter bus ridership in 2020 had nevertheless fallen to practically half of the 2019 level, and demand remains sluggish. For charter buses, there are expectations of recovery in inbound visitors, which account for a certain share of demand. However, as the number of individual travelers is anticipated to rise in the future and increases in the number of group travelers who use charter buses are clouded in uncertainty, the bus industry is instead starting to turn its attention to finding ways to promote bus use in the context of versatile modes of transportation, such as by setting up information services that make it easy for individual travelers to use public transportation.

The number of kilometers actually traveled by bus users in 2021 was 21.74 billion passenger kilometers for transit buses, and 5.22 billion passenger kilometers for charter buses (Fig. 2). Although those figures are an improvement over the posited record lows of 1.82 billion passenger kilometers for transit buses and 4.35 billion passenger kilometers for charter buses recorded in 2020, they still amount to only about 40% of the 640 to 650 billion passenger kilometers recorded in the latter half of the 2010s. In a context where transit buses typically travel short distances while charter buses travel relatively long distances, inter-city expressway buses have been supporting long-distance travel, but the pandemic forced the suspension of many inter-city transportation services, a clear result of government policies urging people to avoid public transportation during the pandemic.

2. 2. Market trends, Production, Exports, and Registration

The extreme drop in the number of passengers did not take long to be reflected in the production volume. Heavy-duty bus production, which hovered around 10,000 vehicles per year in the latter half of the 2010s, dropped significantly to 2,201 vehicles in 2021. That figure is less than 24% of the 2019 production. Light-duty bus production had fallen considerably to 57% of the 2020 level, but has since exhibited signs of recovery, reaching 110% of the previous year's production (Fig. 3).

By usage, heavy-duty bus production breaks down into 70% destined for urban routes, and 30% for private or sightseeing purposes. This reflects the completely stalled demand for charter buses. As already stated, the exhaust emissions regulation scandal preventing Hino and Isuzu from selling their flagship sightseeing buses has also affected production.

Bus exports are gradually recovering after dropping considerably in 2020. By destination, robust exports to the Middle-East, Central and South America, and Asia are compensating for the decrease in exports to Africa (Fig. 4). The Japanese buses in export destinations are primarily basic specification light-duty buses serving as shuttles, a usage linked to the economic environment in regions that are investing in development. Stable economic growth is essential to market expansion, and rivals to Japanese light-duty buses cannot be overlooked in such markets.

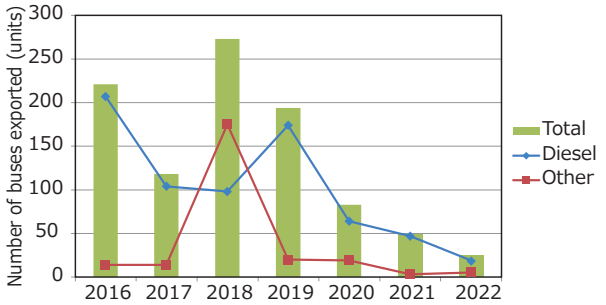


Fig. 5 Number of Imported Bus Registrations

In reflection of bus market conditions, imports are also slow, and continue to center around electric buses, which are few and far between among Japanese-made buses (Fig. 5). However, there is a gap between the number of imported buses and the number of reported import buses actually in operation, possibly due to a delay between clearing customs and vehicle registration.

3 New Bus Launches

There were fewer new buses in 2022 than in a typical year due to Japanese-made buses having completed their adaptations to comply with regulations, as well as to the direct impact of sluggish demand caused by the pandemic. Upgrades to existing production models were made to the Mitsubishi Fuso heavy-duty buses (Aero Star, Aero Queen, and Aero Ace) (Fig. 6), as well as to the Isuzu and Hino medium- and heavy-duty transit bus models. The upgrades themselves consisted of installing automatic lighting before the regulations making it mandatory come into effect in October 2023, and of enhancing the emergency driving stop system (EDSS) that responds to driver emergencies. Upgrades to the EDSS consisted of forcing the accelerator off when the system is active and to continuing to play a warning sound and audio guidance after emergency braking, as well as functionality improvements such as the driver status monitor (DSM: Isuzu/Hino, Fig. 7) that continuously monitors the driver and emits a warning via a seat vibrator in the event of a posture collapse. At the same time, Mitsubishi Fuso adapted all its models to comply with Phase 2 of the driving noise regulations for four-wheeled motor vehicles, while Isuzu/Hino standardized the use of a 6-speed torque converter transmission in their medium-duty models. Moreover, the fuel consumption measurement method has been changed to the new JH25 mode, which follows actual consumption, and the figures in the specifications have been adjusted accordingly.

Fig. 6 Mitsubishi Fuso Aero Queen

Fig. 7 Driver Monitoring System (DMS)

Fig. 8 EV Motors Japan 8.8 m Sightseeing Bus

The paucity of new models or added specifications among Japanese-made buses has made the addition of primarily electric imported buses stand out.

The Chinese BYD, whose lineup includes the K9 12 m heavy-duty route bus, the K8 10.5 m and K7 9 m medium-duty route buses, and the J6 7 m light-duty bus, has continued to increase deliveries to operators throughout Japan.

EV Motors Japan, which entered the market with a 7 m light-duty bus, unveiled the 8.8 m long, 3.45 m tall high deck F8 series6-Coach sightseeing bus at the Bus Tech in the Tokyo metropolitan area event held in November (Fig. 8). The bus is an 8-row, 35-seat front-door bus equipped with a 210 kWh capacity lithium titanate ion battery. Its selling point is the low electricity consumption provided by the precise control achieved by the active inverter developed by the manufacturer, which has announced a cruising range of 280 km on a single charge. In a world where electric buses are perceived as vehicles

Fig. 9 Karsan e-Jest Left-Hand Drive Demo Bus

Fig. 10 Nishi-Nippon Railroad Retrofit Electric Bus (assembled in Taiwan)

for urban areas with a fixed driving range, it constitutes a rare type of vehicle that was probably influenced by organizer plans to limit transportation for visitors to the Expo 2025 venue to fuel cell or electric buses.

The November 2022 Bus Tech in the Tokyo metropolitan area exposition also featured a Turkish-made left-hand drive light-duty Karsan e-Jest demo bus (Fig. 9). The Jest light-duty bus launched by Turkish manufacturer Karsan (see the 2015 edition of this Journal) offers a non-step floor with standing space bringing capacity to over 20 passengers in a 5.68 m one-box design van-sized vehicle. With few competing models even on a global scale, the Jest has recorded sales exceeding 7,000 units, and the electric variant is also doing well, posting sales of approximately 500 units. The e-Jest is equipped with an electric drivetrain and 88 kWh lithium-ion battery both made by BMW, and has a cruising range of 210 km on a single charge. The arrival and full deployment of the left-hand drive modelin the Japanese market has been announced for 2023, setting expectations for nationwide local authorities operating community buses, as well as for generating new demand in cities.

However, plans announced in 2022 for the deployment of the English Switch Mobility heavy-duty electric bus in the Japanese market were scuttled without a public release despite actual vehicles landing in Japan in the summer of 2022 following a three-year period of preparation. While the decision was attributed to uncertainty about Japanese bus operators accepting elements such as the vehicle price point, factors such as the timing of the complete redesign of the heavy-duty bus are also thought to have played a role.

Bus operators are also looking outside new bus models and showing interest in electric buses remodeled from aged vehicles (retrofitted or converted). That interest is sparked by the high price of newly manufactured electric buses, even after factoring in subsidies, as well as–given that the average service age in Japan suggests the battery will have to be replaced during the lifetime of the bus–by the idea that aged vehicles can be operated as electric buses for the remaining of their lifetime if aged diesel buses that have operated for 10 years are remodeled into electric buses.

Although Nishi-Nippon Railroad attempted to remodel buses using Japanese technology in 2019, the attendant cost was higher than anticipated. Therefore, they sent used heavy-duty buses to Taiwan, where they were equipped with mass-produced motors and batteries, and then shipped back to Japan (Fig. 10). The buses began operation in 2022, and the first remodeled bus featured improved battery performance that brings cruising range on a single charge up to a commercially viable level. Building on the experience provided by that vehicle, Nishi-Nippon Railroad is now looking at importing electric drivetrains from Taiwan and performing the remodeling in Japan for the next remodeled buses, with plans to complete the vehicles, start operation, and further increase the number of units in 2023.

There are other examples of remodeling aged diesel buses into electric buses in Japan, but most of them target pilot projects that come to an end as soon as the transition to the next fiscal year is made. Consequently, they do not provide useful data to bus operators interested in change over time.

In that context, Northern Iwate Transportation Inc. remodeled a 2005-model diesel bus into an electric bus in 2012, and revamped the battery, motors, and other components of the drivetrain 10 years later in 2022. Validation is being carried out under the auspices of a Ministry of the Environment performance evaluation demonstration project, which has shown that there was little increase in internal resistance, and that performance was maintained even with the pre-conversion battery. The next steps will be to develop devices to diagnose the

Fig. 11 Northern Iwate Transportation Remodeled Electric Bus

degradation of the installed battery, and to validate the potential and challenges of secondary and tertiary battery uses.

While such steps represent means of raising the rate of adoption of electric buses remodeled using Japanese technology, existing vehicles undeniably present drawbacks in terms of weight compared to exclusively designed newly manufactured models. Eyes will be turned toward whether remodeled buses can establish an advantage with respect to operator total cost of ownership (TCO), including the vehicle lifecycle cost.

4 Building an Environment for Electric Buses

With the government of Japan defining the realization of a carbon-free society as an important goal, the automotive industry, which had founded its advances on internal combustion engines, is now facing an unprecedented technological turning point. For Japan, which had been the global forerunner in the development of clean diesel, the shift to electric vehicles has caused a dramatic replacement of the leading role. Even as reform is expected in the wide-ranging automotive industry, the arrival of newcomers sensing a business opportunity has been standing out.

Chinese electric vehicles have a strong presence at the international market scale, and Chinese-made electric urban route buses, which have a fixed cruising range, notably boast overwhelming sales. This means that current electric bus options for bus operators in Japan consist almost exclusively of Chinese-made completed vehicles. Consequently, high expectations are placed on Japanese-made electric buses announced for launch in 2024. Vehicle reliability is the most important factor for bus operators. Looking at the many cases of modern Japanese-made buses remaining in operation for 20 years or longer, bus operators are viewing the durability and reliability of Chinese-made completed vehicles, which are designed with about eight years of operation in mind, as an unknown.

At the same time, early adopters of electric bus operation among bus operators have gained a shared awareness of the importance of addressing factors external to the vehicle, such as charging methods and the details of contracts with power companies, in addition to the choice of bus model. The previous edition of this yearbook presented an overview of the 2021 survey of route bus operators in Japan conducted by Busrama International. That survey identified community buses, for which subsidies are easy to obtain, as the starting point for wider electric bus adoption. However, actual community buses generally have long operating times, and there is a possibility that the need to accommodate charging times will require increasing the number of vehicles in use after replacing diesel buses with electric buses. Charging time, which wasn't a concern with diesel buses, is a major issue coming to the fore in a bus industry wrestling with a shortage of staff. Securing the electric power required to operate electric buses is also a social challenge, shining a spotlight on unavoidable issues in electric bus operation, including changes to contract fees due to the charging method, or the need for cubicles (voltage transformers).

In addition, the characteristics of electric buses make it difficult to secure sufficient air conditioner performance, particularly for heating. Cold regions in Europe generally rely on the concurrent use of pre-heaters, but the difficulty of achieving both zero emissions and heating performance in extreme cold has led some operators to give up on adopting electric buses. There is also a growing understanding among bus operators that electric bus adoption is subject to geographic restrictions.

Policies to replace the heavy-duty buses that constitute the primary urban route buses with electric buses on an individual operation center basis are under assessment. The importance of energy management systems (EMS) covering factors such as accounting for charging time in vehicle operation or the need for backup vehicles, is being recognized. As the number of electric buses increases, the placement of chargers in the limited available depot space is presenting a challenge. The installation of a pantograph to charge buses from the roof in the Kanden Tunnel Electric Bus suddenly turned "that thing in faraway countries" into a locally accessible concept.

Although Japan chose the CHAdeMO protocol as its

Fig. 12 Renewable Diesel Trial Bus

Fig. 13 JR East BRT Promoting Advances in Automated Driving

Fig. 14 A Special Paint That Guides Automated Vehicles Has Been Developed

rapid charging standard for international competitiveness purposes, ease of use considerations are leading operators to call for a higher voltage and faster protocol to recharge buses equipped with a high capacity battery.

Fuel cell buses which, along with electric buses, are a promising key player in decarbonization, became more numerous in Tokyo thanks to the Olympic and Paralympic Games. However, there are no reports of how their technology differs from that of currently operating buses. Given the 100 million yen price tag tied to a 6-year lease, in conjunction with issues surrounding the refueling infrastructure, bus operators continue to view fuel cell buses as a limited option. Current bus usage in Japan calls for durability and reliability lasting far longer than six years.

At the same time, reluctance to part with the ease of use of diesel buses is spurring pilot projects to test reformed fuels. In 2022, Seibu Bus carried out a trial using renewable diesel (RD) (Fig. 12). That fuel, which is derived from waste cooking oil and animal oils, makes it possible to use existing vehicles and facilities at the same level of performance. It is also estimated to reduce greenhouse gas emissions by 90% compared to diesel because it does not involve extraction and refinement processes. A five-year practical evaluation is planned. A price equivalent to diesel will be a prerequisite to the widespread adoption of reformed fuel.

What advantages do electric buses offer over diesel buses offering a wealth of accumulated experience, ease of use, and high energy density diesel fuel? Finding the answer to that question is not the responsibility of the bus industry alone, and must involve the appropriate provision of information by governments seeking to realize a carbon-free society. In 2022, subsidies for the introduction of electric buses increased tenfold over the previous year, contributing to wider adoption. However, if extensive adoption is the goal, might it not be more necessary and effective to offer information detailing a transportation environment and operational methods that take advantage of electric bus characteristics, rather than just subsidizing the purchase of vehicles and facilities?

5 IT and AI Targeting Commercialization

5. 1. State of Automated Driving

Automated driving field operation tests were carried out throughout Japan in 2022.

Each new test takes a step closer to actual operation carrying people on public roads, and tests in 2022 moved to more advanced content such as an extended operating range (26 km in Fukaya) or higher speeds (60 km/h for the East Japan Railway Company Kesennuma BRT line, Fig. 13). Many tests apply to Level 2 automated driving, in which the driver can intervene in the event of an emergency, but tests targeting Level 4 functionality, which does not require a driver, were also conducted. Magnetic markers were set in road surfaces of blind spots between buildings, under roadside trees, or in tunnels, which cannot be covered by satellite positioning, while systems that work in conjunction with detectors in facilities were put to use in areas were objects ahead cannot be seen. In addition, a special paint for optical guidance road markings that use road paint to guide vehicles, which is invisible to the human eye and reflects laser beams that are recognized by an on-board radar,

Fig. 15 Robot Roll Call That Has Begun Commercialization

Fig. 16 Example of Device to Prevent Leaving Someone Behind on the Bus (Switch)

has been developed and used in field tests.

5. 2. Labor-Saving and Safety-Enhancing Technologies

Robots, which have entered our day-to-day lives in response to the desire to reduce labor, have been used in roll calls of drivers starting or ending their shifts. This is limited to having humanoid robots perform some of the roll call tasks because current legislation is based on humans making the roll call. It seems likely that the legislation will have to be revised to anticipate technological trends. Actual bus operation is likely to change significantly if automated driving becomes sufficiently advanced to enable driverless operation (Fig. 15).

5. 3. Use of AI to Attract New Demand

From the standpoint of the spread of IT technologies, there is growing interest in on-demand buses operating on optimized routes generated by AI based on demand. The decrease and aging of bus users is driving that interest, and new businesses built around enabling communication between users and operators via smartphones are starting up nationwide. The municipality of Takahagi provides an example of successfully increasing ridership by operating existing regular routes in the mornings and evenings, and switching to on-demand operation that can flexibly respond to demand during the day.

5. 4. Proactive Accident Prevention Technologies

In the EDSS that automatically stops the vehicle in an emergency such as a driver illness, switch activation by the driver him- or herself, a passenger, or a tour guide has been complemented and enhanced with functionality that monitors the driver's gaze or change in posture and activates the EDSS if something is wrong. The system is not only installed on new vehicles, but also being retrofitted to a growing number of models.

The tragedy of a small child getting left alone inside the kindergarten shuttle bus prompted the development of devices to ensure no one is left alone in the vehicle. Such devices include the installation of a switch at the very rear of the bus to ensure the driver makes a full inspection (Fig. 16), sensors that detect movement inside the vehicle when it is stopped, and various other functions. Subsidies have also been provided, and these systems are urgently being adopted.

6 Issues Faced by Buses in Japan

6. 1. Body Printing

Mitsubishi Fuso Bus Manufacturing has proposed body printing as a method of applying new paint designs. Film wrapping is generally used to realize special designs, such as photographs or pictures, in addition to ordinary painting. However, body printing relies on an ink jet nozzle using the same principle as common household jet printers to applying prints directly onto the vehicle body. A printer capable of applying printing to a full size bus has been installed in the main Mitsubishi Fuso Bus Manufacturing plant. Designs are converted to data in a computer, and applying them directly significantly reduces task time and work hours compared to wrapping, resulting in a major cost advantage. Since its original application to the side of truck trailers, more complex designs have become possible, and the technique can also be applied to bodies manufactured by other companies (Fig. 17).

6. 2. Vintage Bus Restoration

Over the last few years, special edition charter buses featuring luxury-oriented interiors with limited passenger capacity had garnered attention. However, the sluggish market environment has been pushing them into the background, and the focus has shifted to the resurgence of old style buses as subsidies are revitalizing the tourism industry. Asahikawa Denkikidou has restored a

Fig. 17 Proposed New Paint Design—Body Printing

Fig. 18 1963 Mitsubishi Fuso MR430 Restored by Asahikawa Denkikidou

Fig. 19 Mercedes-Benz eCitaro

Fig. 20 BYD for European Markets

Mitsubishi Fuso MR430 heavy-duty bus that was first purchased by the now-defunct Asahikawa Bus as a new vehicle in 1963 and operated until 1978. The company spent a year and four months fully restoring the bus, which had been exposed to the elements for 45 years after being decommissioned, to its in-service form, and then acquired a vehicle inspection certificate. The bus, a front twin-axle 12-meter high passenger capacity route bus developed for a market that saw the number of passengers continue to rise, is a rare vehicle as only 12 units were sold. The use of two axles and four wheels at the front brings its capacity to 110 passengers. It is also of interest because it preceded trucks with respect to the development of a front twin-axle vehicle for Mitsubishi Fuso at the time. The bus has been registered as a charter bus to qualify for subsidies, giving it a capacity of 44 passengers as standing is not allowed while the bus is moving. Among older models, cab-behind-engine buses used on sightseeing routes or for events or other activities have also gained popularity. Such older models represent a culture-based reappraisal of buses that were longstanding fixtures of day-to-day life.

7 Buses outside Japan

7. 1. Buses in EU Markets

Buses outside Japan offer much to discuss, but this section will focus on describing conditions in the EU markets. The COVID-19 pandemic made its impact felt not only in Japan, but also worldwide. The number of newly registered buses in Europe in 2022 was 15,557 units, a 24% decrease compared to 2019. The decline was 15% for urban buses, and a precipitous drop of 55% for sightseeing buses. Nevertheless, society has continued to move steadily toward decarbonization, and over 60% of newly registered urban buses are powered by electricity, hydrogen fuel cells, or natural gas, with a proportionately higher decrease for diesel buses.

In 2022, new registrations of electric buses driven by a vehicle-mounted battery reached 4,152 units, a 26% increase compared to 2021. There is already an established range of manufacturers supplying electric buses in the various EU countries, with 2022 sales led by the Chinese Yutong, at 479 units, closely followed by BYD ADL at 465 units and Mercedes-Benz (Fig. 19) at 405 units, with the remaining units sold by makers such as Iveco, VDL, Solaris, and BYD (Fig. 20). Manufactures are fiercely vying to gain ground despite the repercussions of supply chain disruptions and other obstacles caused by COVID-19 or the Russian invasion of Ukraine.

The VDL and Solaris independent bus body manufacturers were the market leaders when electric buses became more widespread in the latter half of the 2010s, but

Fig. 21 MAN Lion's City

Fig. 22 Trial Solaris Converted to Hydrogen Fuel Using German Technology

the number of electric buses from diesel engine manufacturers such as Mercedes-Benz, Iveco, MAN (Fig. 21), and Volvo Bus has been rising over the last several years. In 2019, electric buses already accounted for the majority of new urban buses, and observers agree that the number of diesel buses will never exceed the number of zero emission vehicles (ZEVs) again.

At the same time, major bus operator actions include many cities setting clear targets, such as London, which owns 9,300 buses, planning to shift entirely to ZEVs by the end of 2034, and Geneva intending to switch entirely to electric bus ZEVs by the end of 2030. This rapid adoption is underpinned by a wide range of options, as well as the strong involvement of component supplier in battery, motor, and drivetrain technologies.

In September 2022, the transportation events returned to the International Motor Show Germany, the world's largest commercial vehicle exhibition, for the first time in four years. However, the InnoTrans fair, which originally focused on railway technologies, was held at about the same time, with many bus manufacturers presenting exhibits in the public transportation category. Exhibitors were likely torn in deciding which event to attend as both rode the same wave of transition to ZEVs, bringing out a range of new electric bus and fuel cell bus models.

Startups and other companies have been manufacturing electric and fuel cell buses, and manufacturers presenting them on a global stage gives a sense of their power and potential. Mellor in England, Rampini in Italy, Safra in France, NesoBus in Poland, Güleryüz in Turkey, Quantron in Germany are just some examples of brands around the world using the transition to ZEVs as a springboard for steady growth.

Although hydrogen fuel cells are recognized for their extremely low-polluting properties, their use of platinum and requirement for high purity hydrogen present hurdles to their durability as commercial vehicles. In Europe, comparatively inexpensive pure hydrogen is often used in fuel cells intended for widespread adoption, and that adoption is promoted through the use of already developed components. At the same time, research on hydrogen combustion using existing diesel engines as a base is also being carried out (Fig. 22).

Fig. 23 Stylish Trams Are Becoming More Common

7. 2. Urban Bus Design

In light of the growing emphasis on style in recent EU buses, this section will touch on styling design for Japanese-made buses. As noted in previous editions of this yearbook, all Japanese-made buses currently have designs dating back years to their last complete redesign. However, given the public nature of buses and the role they play as part of the community landscape, the times call for them to present an attractive appearance while in motion. In passenger cars, design constitutes a major aspect of product appeal, and the large number of manufacturers results in sparing no effort on design even for commercial vehicles used in familiar everyday situations. More recently, additional prodding provided by the broad adoption of low floors in trams has also led to bringing models that blend in nicely with the urban landscape in European cities (Fig. 23). After all, there can be no justifications for buses alone to cling to their old form.

If buses are viewed as a part of the infrastructure that reduces social costs, their style should appeal to, and resonate with, many people rather than just their users.

Changing the style of current Japanese-made buses will also require a shift in perception on the part of the bus operators who purchase them. While accepting that operators emphasize vehicle reliability above all else, there also needs to be a recognition that bus styles do not belong only to the bus operators, but also constitute an element of the urban landscape. They have value as an asset that draws the attention of people seeing them driving around. Japanese-made urban buses have also incorporated low floors, square proportions, and sleek body outer panels while enhancing functionality. However, failing to move away from the use of pockets for the middle doors, for example, ruins the appearance of the exterior design. Similar issues affect the handling of stanchions and seat attachment methods. Although buses such as those exhibited at motor shows some 20 years ago have featured numerous proposals from designers, none have found their way into actual use. It's the same old story of bus staff voicing opposition to changing current bus specifications, followed by concerns over a detriment to safety. However, looking at the steady evolution of buses around the world, makes it clear that making buses both stylish and safe is not an issue (Fig. 24).

Fig. 24 Karsan (Turkey) e-ATA 12 m Electric Bus Winner of the Sustainable Bus of the Year award in the Urban category. A fuel cell model has also been announced. This bus presents a practical and fresh front design.

A Japanese-made electric bus is reportedly going to be released in 2024, and this period of innovation in components presents a golden opportunity to showcase a revolutionary design. At the same time, the expanded interior space offered to passengers as a result of the changes in components should bring out new possibilities. It would be refreshing to see proposals that present both a functional layout and a design worthy of praise.

References

・Sustainable Bus
・Chatrou CME Solutions