

# Overview of Fuel Cell Vehicles

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## 2-3. Overview of Fuel Cell Vehicles

### Fuel Cell Vehicles

A fuel cell vehicle (FCV) is a vehicle powered by electricity generated through an electrochemical reaction in a fuel cell system. The fuel used in a FCV is high-purity hydrogen or hydrogen rich gas produced from fuels containing hydrogen via the process of reforming. Electricity generated through an electrochemical reaction of the hydrogen fuel in the cell stack and oxygen is used to power the motor. The power created by the motor drives the mechanical transmission of the vehicle, thereby powering the vehicle to run.

Fig1: Typical Structure of a FCV

Subject to the limitations of the fuel cell, such as slow power response, poor cold start performance, and failure to recover energy, FCVs usually adopt a hybrid system using fuel cells and auxiliary power unit to provide power. The core components of a FCV include: fuel cell engine (fuel cell stack, air compressor, hydrogen cylinder, etc.), auxiliary power unit (power battery, supercapacitor, etc.), motor system (motor, controller, DC converter, etc.), transmission system (gearbox (single stage), reducer, etc.).

Fig 2: Hybrid Systems Using Fuel Cell and Auxiliary Power Unit

Comparison of fuel cell vehicles, pure electric vehicles and internal combustion engine vehicles:

Table 1: Comparison of three types of vehicles

	Fuel Cell Vehicles	Pure Electric Vehicles	Internal Combustion Engine Vehicles
Power System	Fuel cell hybrid	Lithium battery	Internal combustion engine
Fuel	Hydrogen	Nil	Fossil Fuel
Efficiency	High (60%)	High	Low
Driving Range	Long (>750km)	Short	Long
Energy Supply	3 minutes	A few hours	3 minutes
Noise	Small	Small	Loud
Environmental Friendly	Water emission only	Problem with recycling lithium batteries	Exhaust gas pollution
Refueling	In shortage	Only available in major cities	Popular
System Cost	High	Medium	Comparatively low

Compared with traditional vehicles, the main advantage of FCVs is the use of environmentally friendly hydrogen fuel; while compared with pure electric vehicles, the charging time of FCVs is short, the driving range long, and the low temperature performance good. At present, there are still room for improvement for the supporting facilities for filling of hydrogen. With the commercialisation of FCVs, this situation will be greatly improved.

## Recent Development of FCVs in the Mainland and Other Countries

South Korea: With the highest number of FCVs in the world. As of 2020, there are 10 707 FCVs. NEXO is the second generation FCVs produced by Hyundai Motor Company in South Korea. Compared with the previous generation ix35, the system efficiency of NEXO has been increased to 60%, and the total output power of the power battery system to 135kW (95kW for the stack; 40kW for the power battery). The 156.6L hydrogen tank can hold a maximum of 6.33kg hydrogen. The NEDC cruising range exceeds 800km, its maximum speed can reach 179km/h, and the 0-100km/h acceleration time is 9.7 seconds.

The United States: With the second highest number of FCVs in the world. As of 2020, there are 8 931 FCVs. The United States has the world's largest fuel cell forklift manufacturer, Plug Power, which has produced more than 20 000 fuel-cell forklifts and performed over 6 million hydrogen refueling operations. At present, there are 67 hydrogen refueling stations in the United States, and FCVs account for 14% of the annual liquid hydrogen market demand.

China: Ranking third among the countries with the highest number of FCVs in the world. As of 2020, there are 7 355 FCVs. China has not maintained any sales figures on fuel cell private passenger vehicles, and the hydrogen fuel cell vehicle market are mainly for commercial vehicles. In recent years, the national policies place more attention on FCVs. In the “Development Plan for the New Energy Vehicle Industry (2021-2035)” released by the Ministry of Industry and Information Technology, it is stated that technological innovation through research and development of “pure electric vehicles, plug-in hybrid (including extended range) vehicles, and fuel cell vehicles”, referred to as the “three verticals” will be deepened. At the same time, as the world's major economies attach great importance to the development of hydrogen energy represented by FCVs, our country has also formulated relevant strategic plan. In October 2020, the Ministry of Industry and Information Technology released the “Technology Roadmap for Energy Saving and New Energy Vehicles 2.0”, pointing out that in respect of FCVs, the development of hydrogen fuel cell commercial vehicles will act as a breakthrough in the entire hydrogen fuel cell industry, with passenger cars and urban logistics vehicles serving as an entry point. The focus is on promoting medium and large passenger cars and logistics vehicles in areas rich in hydrogen from renewable source and industrial by-products, and gradually expanding to medium and heavy trucks, tractors, container trailers and passenger vehicles with large carrying capacity and long travelling distance. In September 2021, the five Ministries and Commissions jointly issued the “Notice of Launching Demonstration Applications of Fuel Cell Vehicles”, stating that Beijing, Shanghai and cities in Guangdong Province will be selected as demonstration city clusters for launching demonstration application of FCVs. Method of “reward instead of subsidy” will be adopted for the demonstration city clusters.

Japan: Ranking fourth among the countries with highest number of FCVs in the world. As of 2020, there are 4 838 FCVs. Toyota started the sale of Mirai in 2014 after 22 years of development and testing of FCVs. By the end of 2020, a total of 12 015 Mirai had been sold worldwide. The new generation Mirai is equipped with two 70MPa hydrogen storage tanks, which can hold a total of 5.6kg hydrogen, and can travel about 750 kilometers with a single hydrogen refueling. The maximum output power of the stack is 128 kilowatts, and the power density 3.1 kilowatts per liter. 140 Mirai vehicles have recently been launched in China and will provide transportation services for the Beijing 2022 Winter Olympics Games.

## 4-5. How to Properly Treat and Discharge Effluent

To promote green messages to the trade in an innovative and interesting way, the Environmental Protection Department (EPD) has created a series of five videos which will be introduced in this newsletter. The second video presented is about effluent discharged from vehicle repair workshops, which is also one of the most common types of complaints. Industrial wastewater discharged by vehicle repair workshops mainly comes from cleaning the workshops and from cleaning the vehicle exteriors, engines, mechanical parts, air conditioners and other parts of vehicles.

As shown in the picture above, storm drains and sewers operate independently in Hong Kong to enable separate treatment of sewage and rainwater. Upon collection by sewers, effluent will be conveyed to sewage treatment plants for treatment and then for disposal to the sea for dilution and dispersion through submarine outfalls. If the sewer of a vehicle repair workshop is wrongly connected to the storm drain, or the effluent arising from carwash is discharged to the roadside or the sewer outside the building, the effluent will flow directly into the river and the harbour, thereby polluting the water body, disturbing the ecological balance, producing odours, and affecting the environment. In fact, doing so may have committed offences.

How should effluent be properly treated? Please scan the QR code below to watch the video:



As seen from the video on treatment of effluent, trade practitioners should pay attention to the following points:

Build suitable drainage systems in the workshop to avoid flooding of wastewater

Set up intercepting facilities around the workshop, such as kerbs or collection channels, to avoid egress wastewater

Install wastewater treatment facilities, such as petrol interceptors, sedimentation tanks, etc., to reduce pollutants discharged

Discharge treated effluent to sewer

Please visit the following link for more relevant information at the EPD's dedicated webpage "Green Garage" : <https://www.epd.gov.hk/epd/english/greengarage/index.html>.



Environmental Protection Department

The Government of the Hong Kong Special Administrative Region

## 6-7. Latest Updates of Vehicle Maintenance Registration Unit

### Transport Department's Revised "Engine Change Application Form"

Good news! At the 34th meeting of the Management and Review Sub-committee of the Vehicle Maintenance Technical Advisory Committee (VMTAC) held in August last year, the Vehicle Maintenance Registration Unit (VMRU) proposed to the Transport Department (TD) to revise the "Engine Change Application Form" by including the registered number of vehicle maintenance workshop and vehicle mechanic under the name of the vehicle maintenance workshop and vehicle mechanics for engine replacement with a view to enhancing the recognition of the Registration Scheme for Vehicle Maintenance and further promoting the two voluntary registration schemes. It will also strengthen vehicle owners' confidence in the engine replacement work being carried out. Members of the meeting agreed to the recommendation.

After discussion with the VMRU, the TD accepted the recommendation and included the name and the registered number of the vehicle maintenance workshop and the vehicle mechanic for engine replacement in the "Engine Change Application Form" in end November last year. For details, please visit the website of the TD via the following links:

Chinese version QR Code

[https://www.td.gov.hk/filemanager/tc/content\\_4808/guide%20to%20replacement%20of%20engine%20all%20rev4%202021%20chi.pdf](https://www.td.gov.hk/filemanager/tc/content_4808/guide%20to%20replacement%20of%20engine%20all%20rev4%202021%20chi.pdf)



English version QR Code

英文版連結 : [https://www.td.gov.hk/filemanager/en/content\\_4808/guide%20to%20replacement%20of%20engine%20all%20rev4%202021%20eng.pdf](https://www.td.gov.hk/filemanager/en/content_4808/guide%20to%20replacement%20of%20engine%20all%20rev4%202021%20eng.pdf)



Please note that applicants applying for engine replacement should fill in the application form and submit relevant information in accordance with the relevant regulations of the Transport Department. In addition, registered vehicle maintenance workshops and vehicle mechanics are also required to abide by the "Practical Guidelines for Vehicle Maintenance Workshops" and "Code of Conduct for Registered Vehicle Mechanics", as well as the prevailing laws and regulations concerned when carrying out vehicle maintenance work.

To facilitate registered workshops and mechanics to understand the revised form, the revised section of the "Engine Change Application Form" is enlarged for reference.

Registered workshops and mechanics, please remember to fill in your information!

## 8-9. Snapshots of Paper-based Continuing Professional Development and Technical Seminars on Vehicle Maintenance

### Snapshots of Paper-based Continuing Professional Development

To cater for registered vehicle mechanics (RVMs) who encountered difficulties in online self-learning, the Vehicle Maintenance Registration Unit (VMRU) held a paper-based continuing professional development (CPD) course at the Electrical and Mechanical Services Department (EMSD) Headquarters in the evening of 6 November 2021 (Saturday), with a view to offering CPD opportunities for RVMs who have not participated in online self-learning and lack CPD hours. The course received overwhelming responses with the participation of a total of 117 RVMs and newly registered RVMs on the day.

All CPD certificates have been sent to eligible participants in late December 2021. The VMRU hopes that this arrangement will enable more VMs to earn the required CPD hours for application for registration or renewal of registration as a RVM. Nevertheless, in view of the dire epidemic situation and the need to implement social distancing measures, as well as the government efforts to encourage increased use of innovative technology in all sectors, the VMRU is committed to promoting wider use of the online self-learning CPD platform in the industry and will render our full assistance to RVMs in learning the use of the online self-learning CPD platform as soon as practicable.

Entry registration of VMs

Participants packed the venue and stayed concentrated during the course

### Snapshots of Technical Seminars on Vehicle Maintenance

The Institute of the Motor Industry Hong Kong (IMIHK) has been commissioned by the VMRU to organise 8 webinars for the industry starting from December 2021 to early 2024, covering latest developments of the voluntary registration schemes, latest equipment and technology in the industry, application of safety equipment, safety precautions in the repair of new vehicle types including electric vehicles and hybrid vehicles, etc. Each participant is eligible to earn 3 CPD hours.

The first webinar was held in the evening of 18 December 2021 (Saturday). Apart from introducing the voluntary registration schemes for both vehicle mechanics and workshops, the webinar also covered the environmental, health and safety requirements related to vehicle maintenance, as well as vehicle body refurbishment (welding and painting) techniques. Mr WM YUEN, Mr KW YEUNG and Mr Albert CHAN were invited to deliver professional presentations, with a view to giving participants a better understanding and knowledge of the professional development and skills upgrading of the industry.

The second webinar will be held in the evening of 26 March 2022 (Saturday) and will cover the environmental, health and safety requirements related to vehicle maintenance, vehicle air-conditioning system and electronic infrastructure, as well as the handling of chemical waste and the control of paint odour emission. For details and registration method, please refer to the information on the right page.

Preparing for the technical webinars

A group photo of the VMRU with IMIHK representatives

Technical webinars

A group photo of online participants

## 10.Latest Developments of the Registration Schemes

1. Registered vehicle mechanics who have switched to work in another vehicle maintenance workshop should notify the VMRU by e-mail (vmru@emsd.gov.hk) or fax (3968 7646) the name, address and telephone number of the new workshop.

2. If there is any change in the information of the vehicle maintenance workshop (such as name of the workshop, registration number of the workshop, address, contact number and business registration certificate, etc.) or alteration in the type of workshop being registered, the person-in-charge of the workshop must, within 14 working days of such change, notify the VMRU of the change in writing, and submit the relevant documents for processing.

### Information on the Voluntary Registration Scheme for Vehicle Mechanics:

Total number of vehicle mechanics	10 303 Note1
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Number of registered vehicle mechanics (as at end-January 2022)	8 265
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### Information on the Voluntary Registration Scheme for Vehicle Maintenance Workshops:

Total number of vehicle maintenance workshops	2 783 Note 2
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Number of registered workshops (as at end-January 2022)	2 065
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Note1:2019 Manpower Survey Report (updated on 13 January 2020) by the VTC and the Automobile Training Board

Note2:Database of the VMRU (updated in July 2019)

If you wish to help protect our environment by receiving the electronic version of RVM Newsletters and leaflets, please send us the completed reply slip by e-mail: vmru@emsd.gov.hk or WhatsApp: 9016 3185. We will contact you by means of e-mail or mobile communication as far as possible.

#### Reply Slip

I/My company would like to receive the RVM Newsletters and other information leaflets by  
 e-mail /  WhatsApp

Please provide the relevant contact details for the above selected means of communication:

Name: \_\_\_\_\_ Vehicle Mechanic Registration No.: VM\_\_\_\_\_

E-mail address: \_\_\_\_\_ WhatsApp: \_\_\_\_\_

The electronic version of the RVM Newsletter is also available on the EMSD website:[https://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/registration\\_scheme\\_for\\_vehicle\\_maintenance/publications\\_and\\_circulars/rvm\\_newsletter/index.html](https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html)



#### Note

Starting from 15 July 2018, new application for registration as Type Four workshop (i.e. a workshop situated at a residential building or a composite building with domestic part) is no longer accepted. Furthermore, requests for conversion from a registered Type One, Type Two or Type Three workshop to a Type Four workshop will not be entertained.

## Online Self-learning Continuing Professional Development Platform

The VMRU will be upgrading the existing platform to provide a better self-learning experience for vehicle mechanics. To facilitate the upgrade, the online self-learning test will be suspended from 11:59pm on 31 January 2022. Other services will remain unaffected. Please accept our apologies for any inconvenience caused. The new platform will be launched in the first quarter of 2022 and details will be announced through the existing platform and email.

Please visit the following website or scan the QR code to access the CPD platform for latest news or announcements

<https://sites.google.com/view/vmru-cpd>



## 11. Prize Quiz Issue No.36

Q1. Which of the following is the correct order of the top four countries having the highest number of fuel cell vehicles in the world?

- A. China > Japan > Korea > The United States B. Korea > The United States > China > Japan  
C. Korea > Japan > China > The United States D. The United States > China > Japan > Korea

Q2. A fuel cell vehicle is a vehicle powered by electricity generated through an electrochemical reaction in a fuel cell system. What kind of fuel does it use?

- A. Oxygen B. Nitrogen  
C. High-purity hydrogen or hydrogen rich gas produced from fuels containing hydrogen via reforming D. Carbon dioxide

Q3. What is the main advantage of fuel cell vehicles compared to traditional vehicles?

- A. Use environmentally friendly hydrogen fuel B. Require long charging time  
C. Short driving range D. Poor low temperature performance

Q4. Which of the following licenses should be applied by workshops before discharging commercial wastewater?

- A. Waste disposal licence B. Environmental permit  
C. Effluent discharge licence D. Chemical waste producer license

Q5. Which of the following measures should not be carried out when washing vehicles in a vehicle repair workshop?

- A. Set up wastewater intercepting facilities B. Build suitable drainage systems to avoid flooding of wastewater  
C. Install wastewater treatment facilities D. Connect all drainage pipes to storm drains

## How to participate (Issue No.36)

Please scan the QR code and submit the answers directly on the following website



<https://forms.gle/3m7ougkpWqU8QvcR7>

Vehicle mechanics may also complete the form below, circle the correct answers, and send it to the VMRU by fax (3968 7646) or e-mail (vmru@emsd.gov.hk).

Deadline: 30 April 2022

Question	Answer			
Q1	A	B	C	D
Q2	A	B	C	D
Q3	A	B	C	D
Q4	A	B	C	D
Q5	A	B	C	D

Name:

Vehicle Mechanic Registration No.: VM

E-mail Address:

Contact Tel. No.:

- Participants who answer all the questions correctly will earn one CPD hour and be notified by the VMRU individually.
- Only registered vehicle mechanics with valid registration may participate, each not more than once in each quiz.
- If there are duplicate submissions, only the last answers submitted before the deadline will be accepted.
- The decision of the VMRU on the quiz will be final.
- The correct answers will be announced in the next issue of the RVM Newsletter.

The answers for RVM Newsletter Issue No. 35 are as follows:

Question	1	2	3	4	5
Answer	A	D	C	D	A

## 12. Training Institutes

Providing Continuing Professional Development Courses for Vehicle Mechanics (in random order)

Name of Training Institute	Website/Contents	Enquiry Tel. No.	QR Code
Traffic Services Employees Association	<a href="http://www.facebook.com/tseahk">http://www.facebook.com/tseahk</a>	2575 5544	
Pro-Act Training and Development Centre (Automobile)	<p><a href="https://www.proact.edu.hk/proact/html/en">https://www.proact.edu.hk/proact/html/en</a>                      The Certificate in Vehicle Mechanical Repair programme# run by the Pro-Act Training and Development Centre (Automobile) may serve as another means for qualifying as registered vehicle mechanics. Mechanics who are interested in enrolling in the above programme may visit the Centre's website.                      # For details and latest developments of the programme, the information issued by the Pro-Act Training and Development Centre shall prevail.</p>	2449 1310	
The Institute of the Motor Industry Hong Kong	<p><a href="http://www.hkimi.org.hk/en/">http://www.hkimi.org.hk/en/</a>                      The Institute of the Motor Industry Hong Kong (IMIHK), formerly known as the Institute of the Motor Industry (IMI) - Hong Kong Branch, brings the mission and vision of the IMI to the Hong Kong automobile industry. After the handover in 1997, the IMI - Hong Kong Branch applied to be renamed the IMIHK in Hong Kong. Eligible members of the trade are welcome to join the IMIHK or enrol in its courses or talks.</p>	2625 5903	
Hong Kong Vehicle Repair Merchants Association Limited	<a href="https://www.facebook.com/HKVRMA/">https://www.facebook.com/HKVRMA/</a>	2399 7977	
Hong Kong Vehicle Repairing Industry Employee General Union	<a href="http://www.vrunion.hk">http://www.vrunion.hk</a>	2393 9955	
Occupational Safety and Health Council	<p><a href="http://www.oshc.org.hk">http://www.oshc.org.hk</a>                      The Safety Handling of Chemicals course aims to provide employees with basic knowledge of the safe handling of chemicals. The course content includes hazards of chemicals, labelling of chemicals, safety precautions, personal protective equipment, emergency procedures, etc. For more course details, please contact the Occupational Safety and Health Training Centre.</p>	2311 3322	
The Society of Operations Engineers (Hong Kong Region)	<a href="http://www.soe.org.hk">http://www.soe.org.hk</a>	2617 0311	
Qualifications Framework recognised courses	<a href="http://www.hkqr.gov.hk">http://www.hkqr.gov.hk</a>	2836 1700	

## Gentle Reminder

The contents in each issue help you catch up on the development of the registration schemes and enhance the quality of service. Please stay tuned! Each issue is available for downloading on the EMSD website:



[https://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/registration\\_scheme\\_for\\_vehicle\\_maintenance/publications\\_and\\_circulars/rvm\\_newsletter/index.html](https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html)

For enquiries on the contents of the RVM Newsletter, please contact the VMRU of the EMSD.

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Tel. No.: 2808 3545

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