

**For discussion on
24 June 2024**

**LEGISLATIVE COUNCIL
PANEL ON ENVIRONMENTAL AFFAIRS**

**THE STRATEGY OF
HYDROGEN DEVELOPMENT IN HONG KONG**

PURPOSE

This paper briefs Members on the Strategy of Hydrogen Development in Hong Kong announced by the Government on 17 June 2024.

BACKGROUND

2. Combating climate change is an important issue across the globe. To align with our country's commitment to reach the peak of carbon emissions before 2030 and achieve carbon neutrality before 2060, Hong Kong would strive to reduce carbon emissions by half (from the 2005 level) before 2035 in order to achieve carbon neutrality before 2050. To achieve carbon neutrality, the Government has been proactively developing low-carbon energy sources.

3. Hydrogen is a secondary carrier of energy. It can be produced from renewable energy (such as solar energy and wind energy) through electrolysis, and transported through compressed storage, refrigerated storage or pipeline to provide clean energy to users. It is highly energy-efficient and less polluting, and would be reduced to water only after combustion without emissions. It can be used as a fuel for transportation, heating and power generation, etc. Progressive switching to the use of green hydrogen is one of the most impactful measures that can help achieve the global carbon neutrality goal. Hydrogen energy has been gaining traction internationally for its potential to drive low-carbon and green transformation, and is also an important component of our country's national energy system in the future. Although hydrogen energy has yet

to be widely adopted as its cost is higher than that of the traditional fossil fuels, the momentum behind the emerging development of hydrogen economy around the world is still strong.

4. In Hong Kong, to keep pace with the development trend of hydrogen as fuel, the Government set up in June 2022 an Inter-departmental Working Group on Using Hydrogen as Fuel (the Working Group) to coordinate preparatory work of the bureaux and departments for the local use of hydrogen as fuel. The Working Group explores the development and commercialisation pathways of various hydrogen technologies and promote the use of hydrogen locally via various trial projects. As at May 2024, the has given agreement-in-principle to 14 applications of hydrogen trial projects, involving hydrogen fuel cell (HFC) double-deckers, hydrogen fuelled light rail vehicles, hydrogen tube trailer, hydrogen filling facilities, hydrogen power generation at construction sites, and hydrogen production from landfill gas, etc. Amongst these projects, the first HFC double-decker had already commenced trial in November 2023, and commenced passenger service in February this year. Trials of the first public hydrogen filling station and the first batch of three HFC street-washing vehicles are also expected to commence within this year. In addition, the Working Group also advises on the development of best practices, codes, standards and regulations for safe local use of hydrogen energy, as well as related matters. Following consultation with the Working Group and the industry, the Electrical and Mechanical Services Department (EMSD), has developed safety guidelines for hydrogen vehicles and repair workshops, safety guidelines for hydrogen refuelling stations, and application guidelines for the quantitative risk assessment of hydrogen installations. These guidelines have been applied to the trial projects on hydrogen fuel technology.

CHALLENGES OF HYDROGEN ENERGY DEVELOPMENT

5. To prepare Hong Kong for the wider application of hydrogen energy, the Chief Executive announced in last year's Policy Address that the Strategy of Hydrogen Development in Hong Kong (the Strategy) would be formulated. The full text of the Strategy is attached at **Annex** for reference, and has been uploaded to the Environment and Ecology Bureau (EEB) Carbon Neutrality and Sustainable Development website

(https://cnsd.gov.hk/strategy-of-hydrogen-development-in-hong-kong_booklet_en.pdf). In the course of formulating the Strategy, EEB consulted different stakeholders to seek their views on the development of the hydrogen energy industry in Hong Kong. Our assessment based on the views collected from the consultations, as well as the global development of hydrogen energy, shows that we would face the following challenges when promoting local application of hydrogen energy:

- (a) **Safety:** To build public confidence in the local application of hydrogen energy, ensuring the safe use of hydrogen fuel is of paramount importance. At present, there is no dedicated legislation in Hong Kong to regulate the safe application of hydrogen as fuel. We need to establish a clear, transparent and sustainable regulatory mechanism and legal framework to ensure the safety of local application of hydrogen fuel in the future;
- (b) **Suitable technologies:** As far as Hong Kong is concerned, hydrogen energy is particularly relevant to the green transformation of the transport and construction sectors. We need to conduct in-depth technical assessment and comparison of various possible scenarios for the local application of hydrogen energy, so as to ascertain the pathway for technology development and the formulation of relevant standards that are appropriate for the local environment and needs;
- (c) **Infrastructure:** The success of hydrogen energy application requires the support of appropriate infrastructure, e.g. hydrogen extraction facilities, storage systems, as well as distribution network. We need to plan early for adequate and appropriate infrastructure in a forward-looking and prudent manner;
- (d) **Cost-effectiveness:** At present, the cost of using hydrogen energy is significantly higher than that of fossil fuels, and poses challenges to the commercial viability and market competitiveness of hydrogen energy. We need to keep in view technological innovation and the scaling up of the production and supply of blue and green hydrogen which will enhance the cost-effectiveness of hydrogen energy, before promoting its commercialisation and popularisation;

- (e) **Capacity building:** As the level of hydrogen application in Hong Kong is limited at present, practitioners in the R&D of hydrogen technology and the relevant the supply chain are limited. We need to provide professional training to relevant local practitioners; and
- (f) **Public acceptance:** The popularisation of hydrogen application requires general acceptance of and support from the public. We need to step up publicity and education on hydrogen as an emerging energy source, and raise public awareness and understanding of hydrogen in order to win public support.

HYDROGEN DEVELOPMENT

6. As green hydrogen is highly regarded by our country and the international community as a new, clean and low-carbon energy source, we have formulated four major strategies to address the challenges of hydrogen development as outlined in paragraph 5 of this paper, with a view to providing the support in infrastructure and the system that is conducive to the development of hydrogen energy in Hong Kong, while retaining flexibility in the scale and pace of its development in the future. The key points are set out below:

(A) Improving legislations

7. At present, a comprehensive set of regulations (i.e. the Gas Safety Ordinance (GSO) (Cap. 51)) has been established to regulate the safe importation, manufacture, storage, transport, supply and use of gas including town gas, natural gas and liquefied petroleum gas, but the ordinance currently does not cover hydrogen used or intended to be used as fuel. The Government plans to introduce an amendment bill into the Legislative Council (LegCo) in 2025 to provide a legal basis for regulating hydrogen used or intended to be used as fuel under the GSO. The legislative amendments will cover the entire hydrogen fuel supply chain, hydrogen filling stations, as well as the fuel systems and maintenance personnel of hydrogen fuelled vehicles and the safety of maintenance workshops, to support the future application of hydrogen fuel in Hong Kong.

8. To prepare for the relevant legislative amendments, EMSD published a consultation paper on the proposed amendments of the GSO and consulted the industries from 20 February to 19 March 2024, during which briefing sessions were organised to listen to the views of about 300 representatives of the vehicle maintenance trade and various professional bodies, followed by meetings with various stakeholders to understand whether the proposed amendments would have an impact on the business environment. The outcome of the consultation shows that the industry is very supportive of the relevant legislative amendments to ensure the availability of a legal framework for compliance, and to strengthen public confidence in the safety of hydrogen energy, which is an integral part of the efforts to promote the hydrogen industry. The proposal would have a positive impact on the business environment.

(B) Establishing standards

9. The industry chain of hydrogen technology involves multiple aspects, including hydrogen supply, storage, transportation and application, etc. We will establish comprehensive safety standards suitable to Hong Kong's urban development and natural geographical environment to ensure that the hydrogen energy industry meets the safety requirements, and to provide the industry with the necessary safety guidelines. To tie in with the development of the hydrogen energy industry, we will regulate HFC vehicles, supply chain of hydrogen as fuel, HFC vehicle mechanics and the safety of maintenance workshops, and conduct inspection and enforcement action. We will also keep the relevant technical guidelines and safety requirements under review.

10. On the other hand, EMSD has engaged expert consultants to study the risks involved in the use of tunnels by HFC vehicles with reference to the relevant regulations in the Mainland and overseas countries, having regard to the design storage capacity, operating pressure and various safety devices of the HFC vehicles. The outcome of the study shows that the risk of HFC vehicles using tunnels is comparable to that of LPG vehicles and other fossil fuel vehicles. We would therefore recommend allowing HFC vehicles to travel in tunnels if they comply with the relevant guidelines. On the other hand, the study does not cover conveyance

vehicles that transport hydrogen in bulk (such as tube trailers). In general, similar to other vehicles carrying dangerous goods, vehicles conveying hydrogen should not be allowed to use tunnels, but may use the sea route instead.

11. To strive for carbon neutrality in Hong Kong, the use of zero-carbon green hydrogen shall be our goal. While there is currently no common approach to certify green hydrogen internationally, we note that some countries and organisations have established guidelines in this regard to promote hydrogen development. For instance, the International Organization for Standardization has established a Technical Specification for measuring carbon emissions across a hydrogen value chain, and will continue to explore the possibility of transforming the specification into a set of international standards. We will closely monitor the relevant developments as well as the development of standards and systems for low-carbon hydrogen energy certification in the Mainland and overseas, so as to explore the approach of certification suitable to Hong Kong, with a view to promoting the long-term development of green or low-carbon hydrogen application in Hong Kong.

(C) Aligning with the market

12. In Hong Kong, hydrogen energy is currently more applicable to land transport. Therefore, we will enhance liaison with the Mainland and overseas HFC vehicle manufacturers to explore the introduction of more HFC vehicle models suitable for trial in Hong Kong. The Government will also support trial projects for HFC double-deck buses and heavy hydrogen vehicles with the New Energy Transport Fund (NET Fund).

13. To prepare for the future development of hydrogen energy, we will study the feasibility of establishing hydrogen filling facilities in different districts, including converting existing petrol filling stations or LPG filling stations into integrated energy stations equipped with hydrogen filling and charging facilities.

14. Apart from land transport, hydrogen is also suitable for application to port facilities and mobile machinery at construction sites. The Government will step up liaison with relevant stakeholders of the industry (e.g. the Construction Industry Council), and explore the adoption of hydrogen equipment in works projects.

15. Capacity building is particularly important to the long-term development of hydrogen energy. We will work with training institutions to provide suitable professional training to practitioners. As hydrogen technologies are still being developed, we are fully aware of the importance of encouraging local research and development in hydrogen technologies through the provision of policy and financial support. We will continue to support suitable green technology and innovative research and development (R&D) projects through the Green Tech Fund and the NET Fund. We will also actively promote and encourage innovations in hydrogen technology, products, application and commercialisation, with a view to breaking through the current technological bottlenecks, and enhancing the stability and competitiveness of the supply chain of the hydrogen industry in general.

16. Enhancing regional and international cooperation in key areas such as hydrogen and equipment supply, R&D and cost control would also contribute to the healthy development of the market. We will strengthen our communication with cities in the Greater Bay Area, and discuss with the Mainland authorities on the strategies to promote new energy vehicles, research on the relevant technologies and the provision of supporting facilities for cross-boundary vehicles, etc., with a view to exploring cooperation opportunities. Considering the natural constraints on the production of renewable energy in Hong Kong, we also need to consider, from the strategic perspective, importing hydrogen from the Mainland and other countries and regions, including working with cities in the Greater Bay Area to explore collaboration in connection with the supply network.

(D) Advancing with prudence

17. In view of the uncertainties surrounding the future development of hydrogen energy, we will continue to promote demonstration of hydrogen technology innovation and industrial application in a proactively and orderly manner. We will take the lead in providing policy and financial support through the GTF and the NET Fund to incentivise research institutions to conduct R&D projects, and encourage enterprises to capitalise on the market momentum to conduct demonstration of various hydrogen applications and their supporting facilities in an orderly manner.

18. As the technology and market of hydrogen mature, and as Hong Kong is gradually establishing suitable models of hydrogen application, we will actively promote regularisation of the management of hydrogen energy-related services and the development of the industry, including the formulation of technical standards for hydrogen supply, storage, transport, use, and the diversified applications of hydrogen. As blue and green hydrogen have yet to be widely adopted, we will first carry out trial projects with grey hydrogen. We will facilitate transition to blue and green hydrogen as their market gradually matures. Our objective is to adopt a step-by-step approach in adopting clean hydrogen supply and transport options suitable for Hong Kong, in order to maintain flexibility in the scale and pace of hydrogen development in the long run.

WAY FORWARD

19. On the basis of the above four major strategies, the Strategy outlines the direction for the development of hydrogen energy in Hong Kong and proposes an action timetable in five areas, i.e. legal framework, establish standards and certification systems, supporting facilities, regional cooperation, and capacity building. These include the introduction of legislative amendments into the LegCo next year to provide a legal basis for the regulation of the safe use of hydrogen; the promulgation of the relevant codes of practice and technical guidelines in accordance with the legislation upon completion of the legislative amendment exercise; providing supporting facilities and promoting capacity building; and enhancing cooperation and communication with cities in the Greater Bay Area, etc.

20. We will join hands with the trades to promote the development of the industry and productivity, and expand the functions of the Working Group to implement the Strategy, with a view to promoting the healthy development of hydrogen energy in Hong Kong in a prudent and orderly manner, and leading Hong Kong towards carbon neutrality. We anticipate that the development of hydrogen energy in Hong Kong will help accelerate the low-carbon transformation of Hong Kong's economy and the development of new quality productive forces.

ADVICE SOUGHT

21. Members are invited to note the content of the Strategy, and provide comments.

Environment and Ecology Bureau
June 2024

JUNE 2024

THE STRATEGY OF HYDROGEN DEVELOPMENT in Hong Kong



**Environment and
Ecology Bureau**

The Government of the
Hong Kong Special Administrative Region
of the People's Republic of China

碳中和
Carbon Neutrality



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Foreword



Climate change and global warming are challenges facing the world today. Hong Kong recorded 54 Very Hot Days and 56 Hot Nights last year, which is an increase of around nine and two times respectively compared to 30 years ago. We can still vividly recall the damages caused by super typhoon Mangkhut in 2018 and the extensive floods arising from the record-high precipitation in September last year. The impact of climate change and extreme weather on our lives is indeed intensifying. To mitigate global warming, the international community has reached a consensus on the need to join hands to reduce carbon emissions.

Our country attaches great importance to combating climate change, and has set the “dual carbon” targets for the reduction of carbon emissions. Hong Kong’s carbon emissions reached the peak in 2014, with its current carbon emissions reduced by about a quarter as compared with the peak. Our per capita carbon emission in 2021 is about 4.62 tonnes CO₂-e, which is a quarter of that of the United States and 60% of that of the European Union¹. On this basis, Hong Kong is striving to reduce the total carbon emissions by 50% before 2035 from the 2005 level in order to achieve the goal of carbon neutrality before 2050.

In pursuit of carbon neutrality, green transformation will become a global trend in the coming decades, triggering tremendous demands for green energy and various low-carbon technologies. Hydrogen energy is a promising new energy source with a wide range of application. The world is expediting the development of hydrogen economy and application. The development of hydrogen energy can also encourage technological innovation and research and development, giving impetus to the provision of relevant technologies and facilities, creating job opportunities, and boosting economic growth. Though the scarce land resources and dense population have rendered it difficult for Hong Kong to develop into a major manufacturing base for green energy, we can still promote green transformation by leveraging hydrogen energy in our attempt to strive towards carbon neutrality. As an international city, Hong Kong can also serve as a demonstration platform for green and low-carbon technologies, and facilitate the export of technologies and products developed in the Mainland and Hong Kong. As an international financial centre, Hong Kong can even help provide green financing and professional services for the green transformation in different areas and regions.

To help Hong Kong capitalise on the opportunities arising from the development of hydrogen economy and potential contribution of the application of hydrogen energy towards carbon neutrality, the Environment and Ecology Bureau, in collaboration with 12 relevant bureaux and departments, set up the Inter-departmental Working Group on Using Hydrogen as Fuel in 2022 to jointly formulate the best practices, regulations, standards, etc. for the safe applications of hydrogen energy in the local context, and actively study the development and commercialisation pathways of various hydrogen energy technologies through promoting trial projects on the local application of hydrogen energy, having regard to the development needs of Hong Kong.

However, hydrogen energy is still at an early stage of development internationally, and the scale and speed of its future development will depend on whether it is more cost-effective than other green and low-carbon technologies. Although the cost of green hydrogen and related products will gradually decrease in the future, the cost of other green and low-carbon technologies is also decreasing. It is therefore uncertain whether the cost of green hydrogen will become competitive in the future. Therefore, in formulating a strategy for the development of hydrogen energy in Hong Kong, it is necessary to retain flexibility in the scale and pace of its future development.

In view of the opportunities and challenges of hydrogen energy development, the Chief Executive announced in last year’s Policy Address to formulate a hydrogen development strategy for Hong Kong. The Strategy of Hydrogen Development in Hong Kong (the Strategy) does not only prepare Hong Kong for the wider application of hydrogen energy in the future, but also signifies the Government’s capability to move with the times as well as its unrelenting efforts and attempts to lead Hong Kong towards carbon neutrality. We hope that through the four major strategies proposed in the Strategy, namely “Improving legislations”, “Establishing standards”, “Aligning with the market” and “Advancing with prudence”, we can create a local environment conducive to the development of hydrogen energy in a prudent and orderly manner, so that Hong Kong would be able to capitalise on the environmental and economic opportunities brought about by the development of hydrogen energy, and expand our cooperation with the Greater Bay Area and the rest of the world, so as to integrate into the country’s overall development and foster new quality productive forces.

Mr Tse Chin-wan
Secretary for Environment and Ecology
June 2024

¹ Derived from the data from the United Nations Climate Change Greenhouse Gas Inventory Data webtool (https://di.unfccc.int/indicators_annex1)

Chapter 1

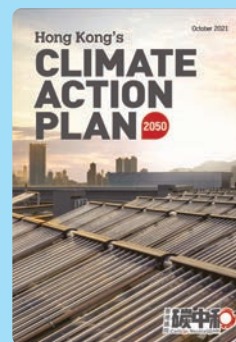
VISION AND MISSION



Chapter 1

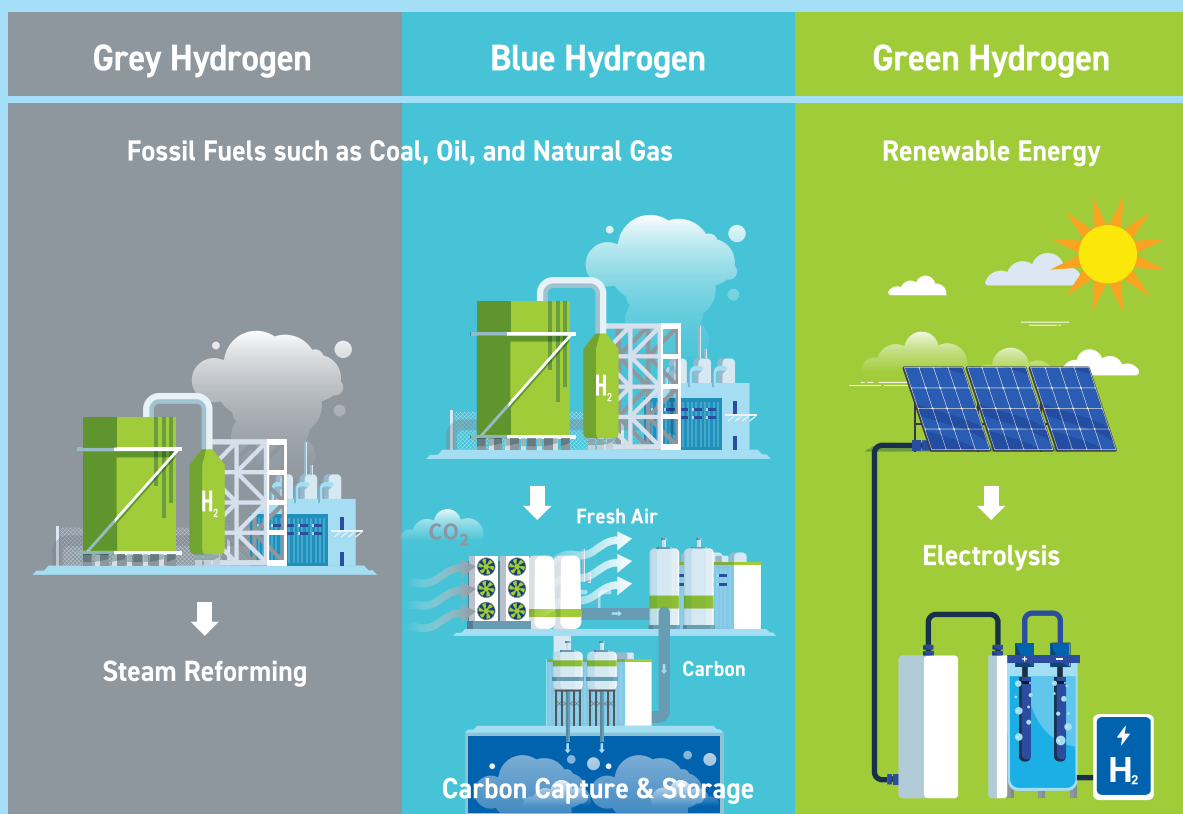
Vision and Mission

- 1.1 Extreme weather caused by climate change threatens human life and the sustainable development of the society. Human activities produce greenhouse gases and contribute to global warming at a rate faster than at any time in the past two thousand years. In particular, the burning of fossil fuels (such as coal and natural gas, etc.) releases a large amount of carbon emissions. Such emissions are the dominant cause of global temperature rise and have brought about more extreme weather events.
- 1.2 To align with the country's "dual carbon" goals², the Government published in October 2021 the Hong Kong's Climate Action Plan 2050 and has set the targets to reduce carbon emissions by 50% before 2035 from the 2005 level in order to achieve the goal of carbon neutrality before 2050. To achieve our decarbonisation goal, it is imperative for us to strive to phase out fossil fuels and actively develop new low-carbon energy sources that are clean and efficient, in order to tackle the issue of carbon emissions at source. In the pursuit of carbon neutrality, the promotion of hydrogen energy is gaining traction internationally, and the development of new energy transport has become a growing trend.
- 1.3 Hydrogen is a secondary carrier of energy. It can be produced from renewable energy (such as solar energy and wind energy) through electrolysis, and transported through compressed storage, refrigerated storage or pipeline to provide clean energy to users. It is highly energy-efficient and less polluting, and would be reduced to water only after combustion without emissions. It can be used as a fuel for transportation, heating and power generation, etc. In the field of transportation, compared to pure electric vehicles, hydrogen fuel cell (HFC) vehicles require less batteries, and the batteries are smaller and lighter. That being the case, hydrogen energy can help reduce the demand for battery disposal in future and support wider application to heavy vehicles. Hydrogen has been regarded as one of the key energy sources and industries that countries around the world are focused on developing. Our country promulgated in March 2022 the Medium and Long Term Plan for the Development of Hydrogen Energy Industry (2021-2035) (the National Hydrogen Plan) which states that hydrogen would be an important component of the national energy system in the future.



² National commitment to reach carbon peak before 2030 and achieve carbon neutrality before 2060.

- 1.4 Currently, the international community generally classifies hydrogen energy according to its production methods and environmental impact. It is typically divided into grey hydrogen, blue hydrogen and green hydrogen. Grey hydrogen is mainly produced as a by-product of the oil refining process or by steam reforming using natural gas or other fossil fuels as raw materials. This hydrogen production method is currently the most mature and cost-effective, though it produces carbon emissions. It can be used to support trial projects for accumulating experience and providing reference for the wider use of hydrogen in Hong Kong in the future. As a transitional measure to achieve the carbon neutrality goal, the



use of blue hydrogen provides a more environmentally-friendly option. While it is also produced by steam reforming, it utilises carbon capture and storage technology to offset carbon dioxide emissions. Green hydrogen is produced by the electrolysis of water powered by renewable energy such as solar or wind power, with zero-carbon emission throughout the entire course of production. Although green hydrogen has significant advantages in terms of environmental protection and the quest for carbon neutrality, there will be enormous challenges for promoting its wide adoption in Hong Kong at this stage. Its market price is much higher than that of traditional fossil fuels due to its limited supply globally. Nevertheless, the cost of green hydrogen³ is expected to drop as its supply increases over time in tandem with global technological advancement and the scaling up of green hydrogen production. To seize the opportunities for decarbonisation and developing low-carbon and green economy arising from the development of hydrogen energy, it is necessary for Hong Kong to be well-prepared for the development of hydrogen economy and application, including the establishment of relevant legislation and standards, the provision of supporting infrastructure and capacity building, as well as and the accumulation of operational experience, etc.

³ According to the estimation from International Renewable Energy Agency (IRENA), the current production cost of green hydrogen is approximately US\$6/kg, and is expected to drop to US\$2/kg in 2030, and will further decrease by 2050.

- 1.5 Currently, many new technologies of hydrogen production, transportation and application are still at the research and development (R&D) stage, and have yet to be developed into mature, reliable and price-competitive options. However, in view of the imminent threat of climate change and the adverse impact of extreme weather events, we must act quickly to replace fossil fuels with new low-carbon energy that is clean and energy-efficient. With the global efforts in planning for and commencing projects on the production of low-carbon hydrogen⁴ and the development of technologies and products using hydrogen energy, such as vehicles and other equipment, we need to actively explore and test out new technologies suitable for local application in order to seize the opportunity to promote the wider adoption of hydrogen energy in Hong Kong when the relevant technologies become more mature, and the prices of blue and green hydrogen become more competitive.
- 1.6 The vision of the Government is to help Hong Kong overcome the bottlenecks in regulation, technology development and application, and human capital through the adoption of the four core strategies, i.e. “**Improving legislation**”; “**Establishing standards**”; “**Aligning with the market**”; and “**Advancing with prudence**”. These strategies would enable Hong Kong to grasp the opportunities arising from the future development of hydrogen energy production and application technologies when the time is right, expediting the low-carbon transformation in Hong Kong.

Hong Kong's Four Core Strategies for Hydrogen Development



⁴ The International Energy Agency (IEA) estimates that the annual production of low-carbon hydrogen will reach 38 million tons by 2030, which represents a significant growth from the mere 1 million tons produced in 2022.

Chapter 2

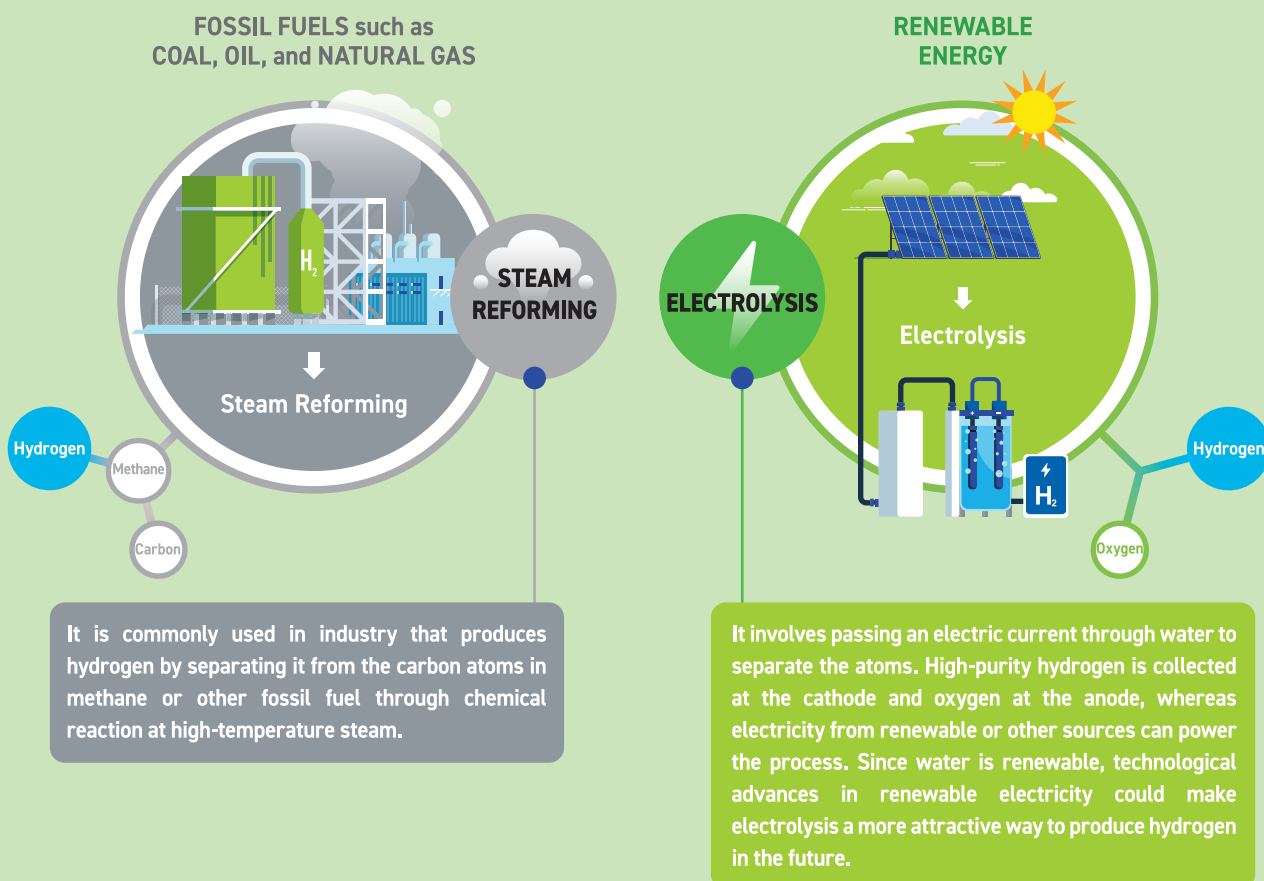
OVERVIEW OF HYDROGEN ENERGY DEVELOPMENT AROUND THE WORLD



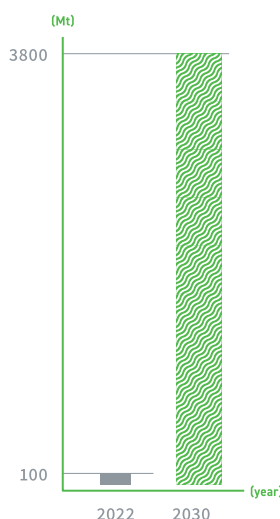
Chapter 2

Overview of Hydrogen Energy Development around the World

2.1 Currently, hydrogen gas is often produced in two ways:



Annual Low-Carbon Hydrogen Production



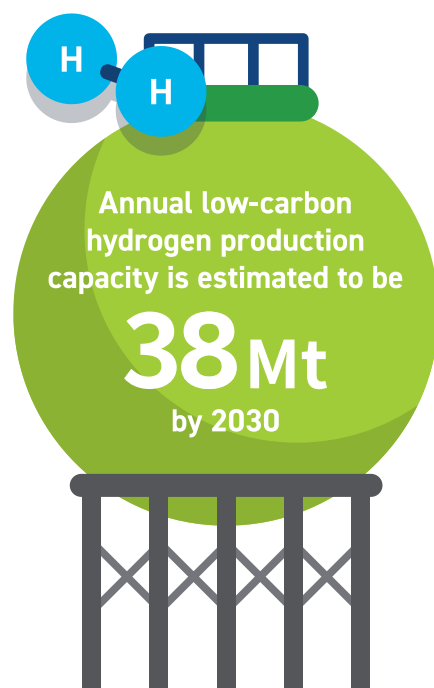
2.2

To tackle the challenge of climate change, the world is striving to phase out fossil fuels and accelerate the energy transition. Hydrogen energy is regarded as a low-carbon energy with development potential, and countries around the world are actively promoting the development of the hydrogen energy industry. According to Global Hydrogen Review 2023 released by the International Energy Agency, global hydrogen production reached 95 million tonnes (Mt) in 2022, and its application has been expanded to heavy industries and long-distance transport. Furthermore, the report indicates that many countries have announced low-carbon hydrogen (produced from fossil fuels with carbon capture or renewable energy electrolysis) production projects, with an annual low-carbon hydrogen production capacity estimated to be 38 Mt by 2030. Given such a significant increase compared to the mere 1 Mt produced in 2021, the market size will grow from USD 1.4 billion in 2023 to USD 12 billion by 2030. Over 40 countries and regions worldwide have formulated long-term hydrogen energy development strategies, encompassing relevant standards, technology development and international cooperation, and have outlined the overall directions.



2.3 With a solid foundation for developing the hydrogen energy industry, our country has stated clearly that hydrogen would be an important component of the national energy system in the future, and has established goals for various stages of the development of the hydrogen energy industry. In fact, China is currently the world's largest hydrogen producer, with an annual hydrogen production of around 33 Mt, of which 12 Mt have met the industrial hydrogen quality standards. Mainland China's hydrogen energy industry has established a sound foundation for major technologies and production processes in the areas of production, storage and transportation, refuelling, fuel cells and system integration, and is even in the lead in some areas.

2.4 Hydrogen energy technologies and application have experienced rapid development in Mainland China in recent years, with Foshan Municipality in the Guangdong-Hong Kong-Macao Greater Bay Area (Greater Bay Area) establishing a Hydrogen Valley to promote the hydrogen energy industry. To maintain sustainable economic development and international competitiveness, Hong Kong should also formulate as early as possible strategies to support the future development of hydrogen energy in order to grasp the opportunities.



Chapter 3

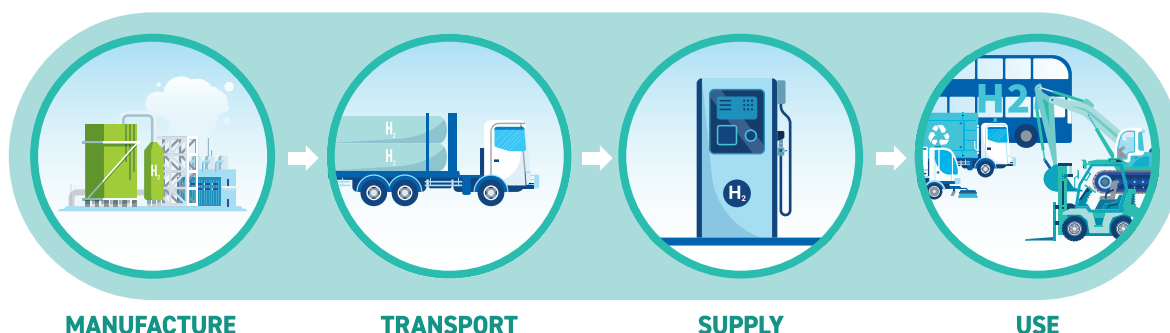
HYDROGEN APPLICATION IN HONG KONG: OPPORTUNITIES AND CHALLENGES



Chapter 3

Hydrogen Application in Hong Kong: Opportunities and Challenges

Overview: Industry Chain



3.1 The upstream and midstream of the hydrogen industry chain covers the entire process of hydrogen production, transportation, supply and application. For Hong Kong, hydrogen can be extracted from town gas pipelines or imported from the Greater Bay Area. As for transportation, hydrogen can be transported on land by tube trailers at present. In the future, the use of marine and pipeline transportation may also be considered. In terms of supply and application, filling service for HFC vehicles (e.g. buses and heavy vehicles) can be provided through the establishment of hydrogen filling stations. It would also be possible to promote the use of hydrogen at construction sites, as propulsion fuel for non-road mobile machinery and for electricity generation from HFCs to replace the more polluting diesel and to fill any electricity supply gaps. Further down the industry chain, specialised hydrogen fuelled vehicle maintenance workshops may be established to provide maintenance and repair services for such vehicles. As for capacity building for the hydrogen industry, to ensure maintenance quality and efficient operation of hydrogen fuelled vehicles, it would be possible to require hydrogen filling stations and other hydrogen installations, as well as hydrogen fuelled vehicle maintenance workshops, to be managed by professionally trained personnel. A registration scheme for hydrogen fuelled vehicle mechanics may also be established.

3.2 To keep pace with the development of hydrogen fuel, the Government set up in 2022 the Inter-departmental Working Group on Using Hydrogen as Fuel (the Working Group), comprising representatives from the Environment and Ecology Bureau (EEB), Transport and Logistics Bureau, Development Bureau, Security Bureau, Environmental Protection Department, Electrical and Mechanical Services Department (EMSD), Fire Services Department, Transport Department, Marine Department, Planning Department, Lands Department, Buildings Department and Architectural Services Department. The Working Group provides technical advice on the launch of trial projects to test out the application of hydrogen energy, and seeks to remove obstacles before the establishment of a dedicated regulatory framework, in a bid to prepare for the future popularisation of hydrogen energy in Hong Kong. The current terms of reference of the Working Group include:

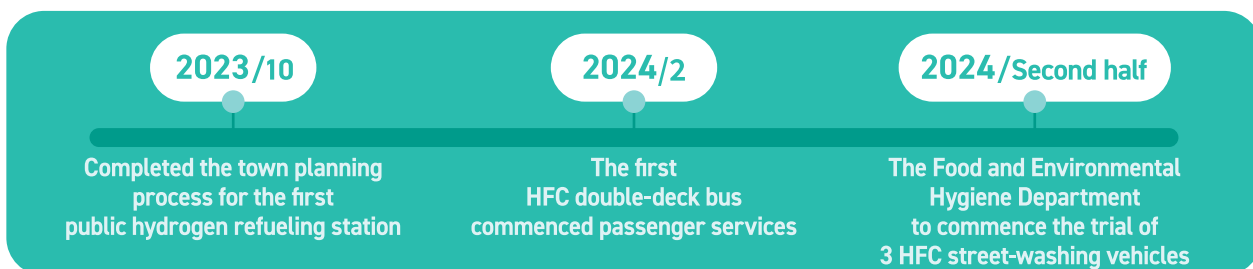
- (1) To identify potential local uses of hydrogen as fuel with a view to helping Hong Kong to achieve carbon neutrality before 2050;
- (2) To co-ordinate efforts made by bureaux and departments (B&Ds) with regard to preparation and adoption of hydrogen as fuel locally; and
- (3) To advise B&Ds on the development of best practices, codes, standards and regulations for safe and efficient use of hydrogen as fuel, as well as related matters.

Opportunities for Local Hydrogen Application

3.3 With technological advancement, cost reduction, and international community's growing interest in striving for carbon neutrality, green hydrogen and blue hydrogen have the potential to replace the vast majority of fossil fuels (e.g. diesel or natural gas) in the future. In the short to medium term, hydrogen has clearer potential for use in areas such as transport as well as electricity supply for mobile machinery and remote areas. The scale and pace of the development of hydrogen energy in the long term depend on how quickly the cost can be reduced, and the relative cost-effectiveness and competitiveness of green hydrogen and blue hydrogen compared to other green energy sources in the future. In addition, the successful introduction and wider application of hydrogen energy would require synchronisation between supply of and market demand for hydrogen energy to support the healthy and sustainable development of the market.

3.4 **Transport** - Compared to traditional fuel-propelled vehicles, hydrogen vehicles offer the advantages of zero emission, high energy efficiency, long driving ranges and minimal noise pollution, etc. As Hong Kong is a compact city, the daily travel distance of most of the vehicles is relatively short. Taking into account the direction of hydrogen transport development in the Mainland and the development of new energy transport in Hong Kong, it would be more appropriate for Hong Kong to focus on exploring the development of more fuel intensive heavy hydrogen vehicles and hydrogen vehicles for cross-boundary passenger and freight services.

3.5 The first local HFC double-deck bus had already commenced services in early 2024, and the first three HFC street washing vehicles will commence an 18-month operational trial later in 2024. In addition, the MTR Corporation Limited plans to conduct a test run of a hydrogen fuelled light rail vehicle without carrying passengers within 2024 to explore the feasibility of applying such technology in Hong Kong. We will explore with the transport trade the introduction of other heavy hydrogen vehicles suitable for local use.

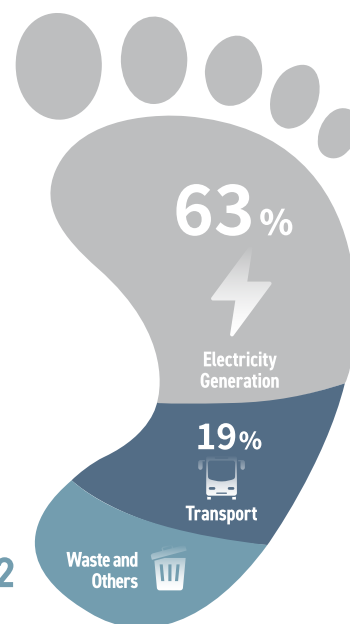




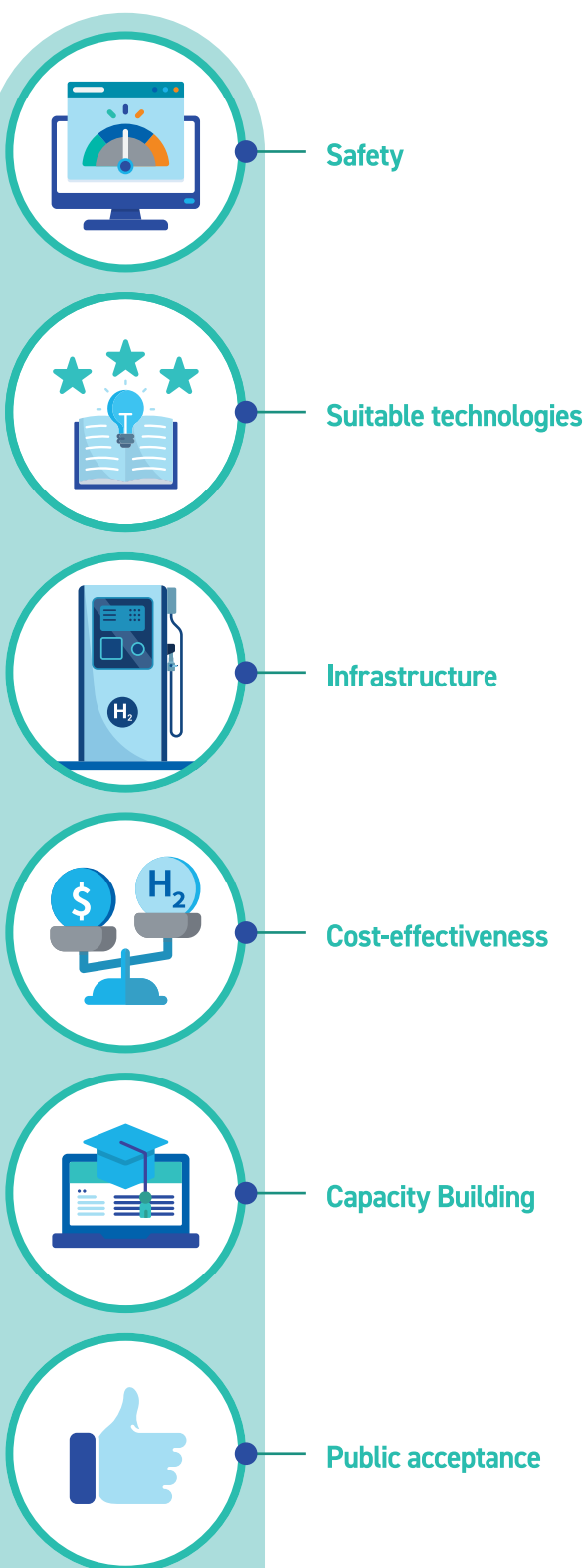
3.6 **Mobile Machinery** - Hydrogen energy, being transportable and highly energy-efficient, is suitable for application in areas such as mobile machinery, including vehicles used at construction sites. The construction industry in Hong Kong has already started to explore the feasibility of distributed electricity supply using hydrogen to replace traditional diesel generators to supply electricity to offices and machinery at construction sites in remote areas without access to adequate electricity supply, including large-scale construction sites in new development areas. With reference to Mainland's and overseas experience, we can explore the use of hydrogen fuelled mobile machinery at the airport, major port facilities and container terminals, as well as large-scale construction sites. Among the local trial projects on hydrogen application examined by the Working Group, there are already several projects involving the use of hydrogen energy to supply electricity to electrical machinery and offices at construction sites.

3.7 **Low-carbon Electricity Generation** - Electricity generation is the largest source of carbon emissions in Hong Kong, accounting for over 60% of the total emissions. It is important to promote low-carbon transition in electricity generation. At present, the technology for using green hydrogen to replace fossil fuels for power generation on a large scale is still at the exploratory stage. If the development of hydrogen energy technology and market enables green hydrogen to become a safe, reliable, environmentally friendly, affordable and cost-effective fuel for power generation, adding green hydrogen to the fuel mix for power generation to replace fossil fuels will help Hong Kong reduce carbon emissions and strive towards carbon neutrality. The power generation sector is also exploring the feasibility of adding hydrogen to natural gas for electricity generation in future, and will closely monitor the relevant technological development in the Mainland and overseas.

Hong Kong Carbon Emission Sources@2022

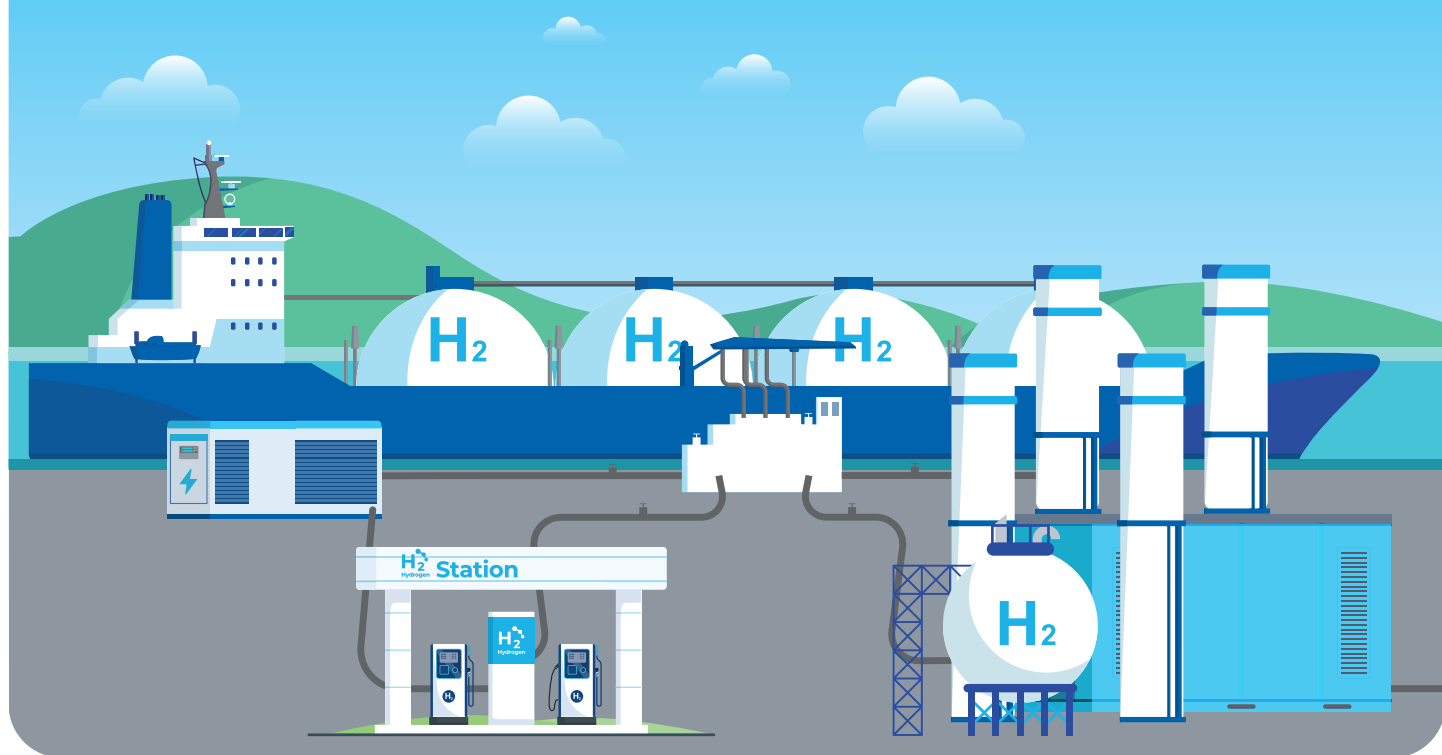


Challenges of Hydrogen Energy Development



3.8 To prepare for the formulation of local hydrogen development strategies, the Government has engaged in dialogues with stakeholders in the relevant industries to understand their views and concerns on hydrogen energy development. Our assessment based on the views collected, as well as the development of hydrogen energy around the world and in Hong Kong, shows that we will face the following challenges when promoting hydrogen energy locally:

- (a) **Safety** - At present, there is no specific legislation in Hong Kong to regulate the safe application of hydrogen as fuel, which makes it difficult to conduct research and trials relevant to hydrogen application in Hong Kong. On the other hand, we need to step up the collection of data on local hydrogen application in order to formulate strategies and regulations that are appropriate for Hong Kong's situation. To overcome these challenges, we have set up the Working Group whereby all relevant B&Ds would, according to their respective areas of expertise, examine the applications for trial projects submitted by the industry. For example, the Lands Department and the Planning Department review the applications of trial projects from the land use and planning perspectives; the Transport Department conducts evaluation based on the existing vehicle specifications; EMSD assesses the design and safety of the relevant hydrogen installations with reference to Mainland and overseas experience, etc. The above mechanism enables Hong Kong to conduct various hydrogen trial projects and accumulate data and experience before a dedicated legislation on hydrogen energy is in place.



Many hydrogen energy application scenarios (such as transportation) are closely connected to the daily lives of the public. Ensuring the safe application of hydrogen energy application is our top priority. We need to establish a clear, transparent and sustainable regulatory mechanism and legal framework to ensure the safety of local application of hydrogen fuel in the future. This will enable the hydrogen energy industry to develop steadily in Hong Kong, and strengthen public confidence in the safe adoption of this new energy. The above tasks involve comprehensive assessment and risk management of hydrogen production, storage, transportation and application. It is also necessary to establish a comprehensive and effective regulatory regime to monitor day-to-day operation to detect and respond to potential safety risks in a timely manner. Hydrogen is currently classified as dangerous goods under the Dangerous Goods Ordinance (Cap. 295), but the ordinance does not govern the use of hydrogen as fuel. As there is currently no comprehensive legislation governing the safety of hydrogen as a fuel, local stakeholders would like to see the formulation of relevant legislation to regulate the manufacture, storage, transport, supply and use of hydrogen used or intended to be used as fuel in Hong Kong.

(b) **Suitable technologies** - Identifying suitable technologies for “production, storage, transportation and application” is the key to the development of hydrogen energy. We need to conduct in-depth technical assessment and comparison of various possible scenarios for the local application of hydrogen energy, taking into account different sources of hydrogen (e.g. importing ready-to-use hydrogen energy, methane and methanol, etc.), storage and transportation technologies (e.g. compressed hydrogen, liquid hydrogen, bulk or pipeline transportation, etc.) and innovative technologies in hydrogen application. As many of the innovative hydrogen technologies around the world are still at the development stage, we need to assess these new technologies by testing them out in local application scenarios through trial projects, so as to ascertain the pathway for technology development and the formulation of relevant standards that are appropriate for the local environment and needs.



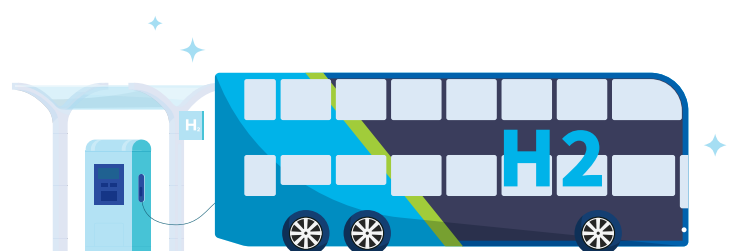
(c) **Infrastructure** - To prepare for the wider application of hydrogen energy, we need to plan early for adequate and appropriate infrastructure. This includes facilities for importing, producing or extracting hydrogen, storage systems, hydrogen filling stations, and the corresponding supply and distribution networks. This requires forward-looking investment and prudent long-term planning to seamlessly connect the supply, storage, transportation and application aspects of hydrogen energy.

(d) **Cost-effectiveness** - Currently, the cost of using grey hydrogen as energy is about twice as expensive as diesel. The cost of using hydrogen energy being significantly higher than that of fossil fuels poses challenges to the commercial viability and market competitiveness of hydrogen energy. We need to keep in view future technological advances that can help scale up the production and supply of blue hydrogen and green hydrogen and enhance their cost-effectiveness, before we are in the position to promote the commercialisation and popularisation of hydrogen energy.

(e) **Capacity Building** - Due to the limited local application of hydrogen energy, practitioners in the R&D of hydrogen technology and the relevant the supply chain are currently limited. We need to be forward-looking and provide professional training to local practitioners. We should at the same time establish a platform for collaboration among the academia, the industries and the Government to promote knowledge exchange and technological innovation.

(f) **Public acceptance** - The popularisation of hydrogen application requires general acceptance of and support from the public. While it is important to raise public awareness and understanding of hydrogen energy, the difficulty of building deep understanding of and confidence in hydrogen application cannot be underestimated, as hydrogen energy has yet to be widely adopted. We need to step up publicity and education efforts in promoting hydrogen energy, proactively respond to the public's concerns, and establish a transparent communication mechanism to win public participation and support.

3.9 Internationally, the economic benefits associated with the application of hydrogen energy will be a major determinant of the scale and pace of future hydrogen development. Grey hydrogen, which is less costly, can only be used for transitional purpose in the development of hydrogen energy. Green hydrogen which is our ultimate goal of zero-carbon energy is currently in short supply, and is two to three times more expensive than grey hydrogen. Although the international community generally expects the cost of green hydrogen and related products to gradually decrease in tandem with the scaling up of production around the world, there is still considerable uncertainty about the relative price competitiveness of green hydrogen and other zero- or low-carbon fuels. Therefore, in formulating a local hydrogen energy development strategy, it is necessary to retain flexibility in the scale and speed of its development in future.



Chapter 4

THE STRATEGY OF HYDROGEN DEVELOPMENT



Chapter 4

The Strategy of Hydrogen Development

4.1 The National Hydrogen Plan sets out four basic principles for the development of the hydrogen energy industry: First, innovation-driven development and self-reliance: actively promote innovation in technology, products, application and business models; focus on breaking through the technological bottlenecks of the hydrogen energy industry; and enhance the stability and competitiveness of the supply chain of the industry. Second, safety first and adoption of clean and low-carbon energy: strengthen the prevention and control of major risks in the entire hydrogen energy industry chain; and build a clean, low-carbon, low-cost and diversified hydrogen production system which focuses on promoting the use of renewable energy and strictly controlling the use of fossil fuels in hydrogen production. Third, market-led with government guidance: give full play to the market's decisive role in resource allocation, explore the paths for commercialising hydrogen energy utilisation, and give better play to the Government's role in guiding the orderly development of the industry. Fourth, prudent application led by demonstration: make overall planning of the supply capacity, industrial base, market space and level of technological innovation of hydrogen energy; launch demonstration cases of hydrogen energy technology innovation and industrial application in an active and orderly manner; and refrain from blindly drawing up development plans and flocking to develop hydrogen energy at the local level.

4.2 As an international commercial city, Hong Kong relies on importation for much of its resources and products. It would not be practicable to pursue complete independence in the development and use of hydrogen energy. On the other hand, our country's proactive development and strengths in the hydrogen energy industry could provide opportunities for Hong Kong. Our country's basic principles for the development of the hydrogen energy industry have provided very useful reference for Hong Kong in overcoming the challenges that we face in developing hydrogen energy. Based on these basic principles, we have formulated four major strategies for developing hydrogen energy in Hong Kong, with a view to making early preparation for the wider application of hydrogen energy in the future.

The Medium and Long Term Plan for the Development of Hydrogen Energy Industry (2021-2035)

Four basic principles for the development of the hydrogen energy industry



Innovation-driven development and self-reliance



Safety first and adoption of clean and low-carbon energy



Market-led with government guidance



Prudent application led by demonstration

(a) Improving legislations

4.3 At present, a comprehensive set of regulations (i.e. the Gas Safety Ordinance (GSO) (Cap.51)) has been established to regulate the importation, manufacture, storage, transport, supply and use of gas including town gas, natural gas and liquefied petroleum gas (LPG) for the purpose of ensuring safety. Since more than 20 years ago, the GSO has been regulating LPG suppliers, as well as the design and safe operations of LPG filling stations. However, the GSO currently does not cover hydrogen used or intended to be used as fuel. To effectively regulate the study and application of hydrogen energy, it is necessary to review and amend the existing legislation to establish an appropriate legal framework to regulate the local development and application of hydrogen energy, so that we can capitalise on the development of hydrogen fuel. In this connection, we have commissioned a consultancy study on the possible amendments to the GSO to include hydrogen used or intended to be used as fuel, and to study how the introduction of legislative amendments (or maintaining the status quo) would affect our business environment.

4.4 The Government plans to introduce an amendment bill into the Legislative Council in 2025 to provide a legal basis for regulating hydrogen used or intended to be used as fuel under the existing GSO which regulates the safety of natural gas, town gas and LPG. The legislative amendments will cover the entire hydrogen fuel supply chain, hydrogen filling stations, as well as the fuel systems and maintenance personnel of hydrogen fuelled vehicles and the safety of maintenance workshops, to support the future application of hydrogen fuel in Hong Kong. We may also propose, if necessary, consequential amendments to the Dangerous Goods Ordinance and its subsidiary legislation, as well as other relevant legislation.



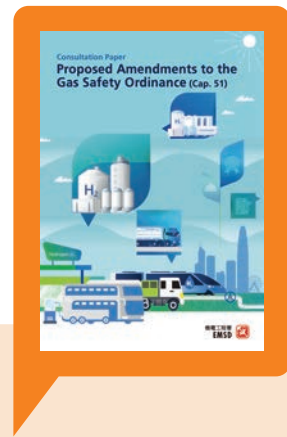
Extraction of hydrogen from town gas in Tai Po



Hydrogen fuelled light rail vehicle



Hydrogen fuel cell street washing vehicle



AMENDMENTS TO THE GSO

Purpose:

Amendments to the GSO aim to provide an appropriate regulatory environment for activities in manufacture, storage, transport, supply and use of hydrogen used or intended to be used as fuel in Hong Kong, to facilitate the healthy development of the trade.

Proposed Amendment Framework:

It is proposed to amend the definition of Gas under the GSO to include hydrogen which is used or intended to be used as fuel, and introduce new subsidiary legislation specifically for regulating hydrogen used as fuel. The scope of the regulation covers hydrogen quality, registration of hydrogen supply companies, construction and use of hydrogen installations, type approval of hydrogen containers, use of hydrogen systems, permits for hydrogen conveyance vehicles and registration of hydrogen vehicle mechanics, etc. The use of hydrogen as fuel is an emerging technology and hence the safety requirement in the mode of operation would have to be continuously updated in tandem with technological developments. Therefore, the safety requirements of hydrogen as fuel shall be laid down by the Gas Authority in the codes of practice to be published by gazette under the amended GSO. This approach provides the flexibility for the relevant safety regulations to be updated in line with the latest developments in technologies and the hydrogen market.

Consultation with the Industry:

EMSD published a consultation paper on the proposed amendments of the GSO and consulted the industries from 20 February to 19 March 2024, during which briefing sessions were organised to listen to the views of about 300 representatives of the vehicle maintenance trade and various professional bodies, followed by meetings with various stakeholders to understand whether the proposed amendments would have an impact on the business environment.

Consultation Outcome:

The outcome of the consultation shows that the industry is very supportive of the relevant legislative amendments to ensure the availability of a legal framework for compliance, and to strengthen public confidence in the safety of hydrogen energy, which is an integral part of the promotion of the hydrogen industry. The proposal would have a positive impact on the business environment.

4.5 Clear legislation is conducive to innovation. In the interim, we will continue to, through the Working Group, encourage relevant industries to conduct local trial projects on hydrogen fuel technologies with safety as the prerequisite. Operation of Hong Kong's first hydrogen filling station and test run of the world's first tri-axle HFC double-deck bus commenced successfully in November 2023, with the bus officially put into passenger service in February 2024. We will plan for the hydrogen supply and the relevant infrastructure (including the approach for importing hydrogen energy, as well as transportation and storage facilities for hydrogen energy) on the basis of the trial projects on hydrogen fuel technologies. By capitalising on the experience of gaseous fuel application in Hong Kong's urban environment, we will, having regard to the local unique conditions, including the use of clean energy and gas pipeline network, continue to actively explore and properly promote new technologies for hydrogen supply, storage, transportation and application through the planning for trial projects.

4.6 After amending the GSO, we will issue or approve the necessary codes of practice under the amended legislation to provide practical guidelines, in order to support the future development of hydrogen energy in Hong Kong.



The world's first tri-axle HFC double-deck bus

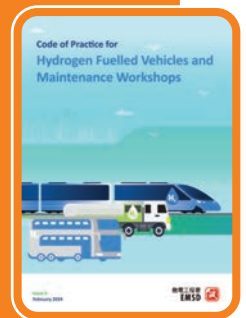


(b) Establishing standards

- 4.7 The industry chain of hydrogen technology involves multiple aspects, including hydrogen supply, storage, transportation and application, etc. It is necessary to establish comprehensive safety standards suitable to Hong Kong's urban development and natural geographical environment to ensure that the hydrogen energy industry meets the safety requirements, and provide the industry with the necessary safety guidelines.
- 4.8 We have, through the Working Group, conducted safety assessment in areas such as the operation of hydrogen filling stations, arrangements for replenishing hydrogen filling stations and the use of HFC vehicles on roads, etc. A series of studies have also been completed to lay the foundation for the establishment of a comprehensive system of safety standards. With reference to hydrogen safety standards and technical guidelines around the world and our discussion with various stakeholders, we have formulated safety guidelines for hydrogen fuelled systems for HFC vehicles and hydrogen filling stations, as well as the technical guidelines for the quantitative risk assessment of hydrogen filling stations, with a view to paving the way for future promulgation of the relevant codes of practice under the amended GSO. In addition, EMSD has developed "Guidance Note for Quantitative Risk Assessment Study for Hydrogen Installations in Hong Kong".
- 4.9 As at June 2024, the Working Group has examined and given agreement-in-principle to 14 hydrogen trial projects, including HFC double-deck buses, refuse collection vehicles and street washing vehicles, hydrogen fuelled light rail vehicle, hydrogen filling facilities, on-site hydrogen electricity supply at construction sites, and landfill gas-to-hydrogen energy, etc. Details are set out in the table on Page 23. The Working Group will also closely monitor and follow up on the safety performance of the trial projects, and continuously review and update the relevant guidelines in line with new developments.

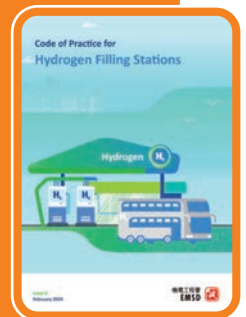
Code of Practice for Hydrogen Fuelled Vehicles and Maintenance Workshops

It specifies the requirements for the design and equipment safety, operation and maintenance of the fuel system of hydrogen fuelled vehicles and maintenance workshops.



Code of Practice for Hydrogen Filling Stations

It specifies the requirements for the design and equipment safety, safe distances between facilities and from nearby buildings, as well as operation and maintenance of hydrogen filling stations.



Guidance Note on Quantitative Risk Assessment Study for Hydrogen Installations in Hong Kong

It sets out the factors that should be taken into account in conducting the relevant risk assessment and to ensure compliance with the risk guidelines under the Hong Kong Planning Standards and Guidelines.



The relevant codes of practice and technical guidelines have been published on the Carbon Neutrality and Sustainable Development website (<https://cnsd.gov.hk/en/inter-departmental-working-group-on-using-hydrogen-as-fuel/#p5>). EMSD will continue to update and refine the relevant codes of practice and technical guidelines in the light of the operational data and experience accumulated from the trial projects.

Hydrogen Trial Projects examined and given agreement-in-principle by the Working Group (As at June 2024)

No.	Applicant(s)	Trial Project
1	Citybus Limited	A hydrogen filling facility at its West Kowloon Depot
2	Sinopec (Hong Kong) Limited	A public hydrogen filling station at Au Tau, Yuen Long
3	Hong Kong and China Gas Company	A hydrogen extraction facility at its Tai Po plant
4	Citybus Limited	A HFC double-deck bus
5	Linde HKO Limited	Use of a hydrogen tube trailer to deliver hydrogen to a hydrogen fuelled light rail vehicle
6	MTR Corporation Limited	A hydrogen fuelled light rail vehicle in Tuen Mun as a non-revenue train
7	Citybus Limited	Five HFC double-deck buses and a hydrogen filling facility at its bus depot in Chai Wan
8	China State Construction Engineering (Hong Kong) Limited, Hong Kong Nation-Synergy International Hydrogen Power Technology Co., Limited, and Sinopec (Hong Kong) Limited	Using hydrogen fuel to supply electricity to a site office at a construction site in Lok Ma Chau
9	Hong Kong and China Gas Company Limited and Hong Kong Padel Academy Limited	Extracting hydrogen from the existing town gas network at a suitable site in Sai Kung to generate electricity for charging electric vehicles
10	Epro Advance Technology Limited	Use of silicon to produce hydrogen for power generation facilities to provide electricity at a public housing construction site in Tung Chung
11	Waihong Environmental Services Limited	Two HFC refuse collection vehicles
12	Food and Environmental Hygiene Department	Three HFC street washing vehicles
13	China State Construction Engineering (Hong Kong) Limited, Hong Kong Nation-Synergy International Hydrogen Power Technology Co. Limited, and Sinopec (Hong Kong) Limited	The use of hydrogen power generation equipment to supply electricity to electric machinery at a construction site in Sheung Shui
14	Veolia Hong Kong Holding Limited	Production of hydrogen by using landfill gas and installation of related hydrogen filling facilities at the South East New Territories Landfill Extension

4.10 To tie in with the development of the hydrogen energy industry, we will regulate HFC vehicles, supply chain of hydrogen as fuel, HFC vehicle mechanics and the safety of maintenance workshops, and conduct inspection and enforcement action. We will also keep the relevant technical guidelines

and safety requirements under review. In addition, we will launch education and publicity programmes for the public and the industry to raise the awareness of the public as well as the practitioners in the hydrogen energy industry and ensure their safety.

4.11 EMSD has engaged expert consultants to study the risks involved in the use of tunnels by HFC vehicles with reference to the relevant regulations in the Mainland and overseas countries, having regard to the design storage capacity, operating pressure and various safety devices of the HFC vehicles. Outcome of the study shows that the risk of HFC vehicles using tunnels is comparable to that of LPG vehicles and other fossil fuel vehicles. We would therefore recommend allowing HFC vehicles to travel in tunnels if they comply with the relevant guidelines. The study does not cover conveyance vehicles that transport hydrogen in bulk, such as tube trailers. In general, similar to other vehicles carrying dangerous goods, vehicles conveying hydrogen should not be allowed to use tunnels, but may use the sea route instead.

4.12 To strive for carbon neutrality in Hong Kong, the use of green hydrogen shall be our goal. While there is currently no common approach to certify green hydrogen internationally, we note that some countries and organisations have established guidelines in this regard to promote hydrogen development. For instance, the International Organization for Standardization has established a Technical Specification for measuring carbon emissions across a hydrogen value chain, and will continue to explore the possibility of transforming the specification into a set of international standards. We will closely monitor the relevant developments as well as the development of standards and systems for low-carbon hydrogen energy certification in the Mainland and overseas, so as to explore the approach of certification suitable to Hong Kong, with a view to promoting the long-term development of green or low-carbon hydrogen application in Hong Kong.





(c) Aligning with the market

4.13 In Hong Kong, hydrogen energy is currently more applicable to land transport. Therefore, we will enhance liaison with the Mainland and overseas HFC vehicle manufacturers to explore the introduction of more HFC vehicle models suitable for trial in Hong Kong. Leveraging the established communication channels with the Guangdong Provincial Government, the Government would seek to discuss with the Mainland authorities on the strategies to promote new energy vehicles, research on the relevant technologies and the provision of supporting facilities for cross-boundary vehicles, etc., with a view to exploring cooperation opportunities for promoting the trial of new energy vehicles, including hydrogen vehicles.

4.14 Technological development as well as on-site trials play a pivotal role in local hydrogen application and development. We have been providing funding support for suitable research projects to encourage innovation in hydrogen energy technologies, products, application and business models. We established the Green Tech Fund (GTF) in 2020 and has injected a total of \$400 million into the Fund. 30 development research projects have been approved, including those associated with hydrogen energy, such as hydrogen storage and release and cost optimisation technologies, etc. We will continue to support research on the local application of hydrogen energy technologies through the GTF. In addition, we will maintain close communication with the trade and actively explore research on the transportation and supply of hydrogen fuel through gas pipelines.

Green
TECH FUND
低碳绿色
科研基金

4.15 In addition, the Government has set aside funding under the New Energy Transport Fund (NET Fund) to support trial projects for HFC double-decker buses and heavy hydrogen vehicles to test out their operational performance in the local environment. We will also explore the use of the NET Fund to support the construction of hydrogen storage and filling centres in order to facilitate the importation of low-carbon hydrogen energy from the Mainland and overseas countries to meet the hydrogen filling needs of local transportation facilities and equipment.

4.16 In the medium term, in view of the rapid development of HFC vehicle technologies, the Government will review the progress of the popularisation of HFC vehicles and development of other new energy vehicles in due course, so as to evaluate and improve the overall strategies and goals. The Government will continue to expand the supporting facilities for new energy vehicles and promote its market development through the provision of subsidies from the NET Fund to support the initial operating costs of various stakeholders in the supply chain of hydrogen vehicles, in a bid to address the financing needs for developing the new energy transport industry, and actively promote the development of various new energy public transport and commercial vehicles.





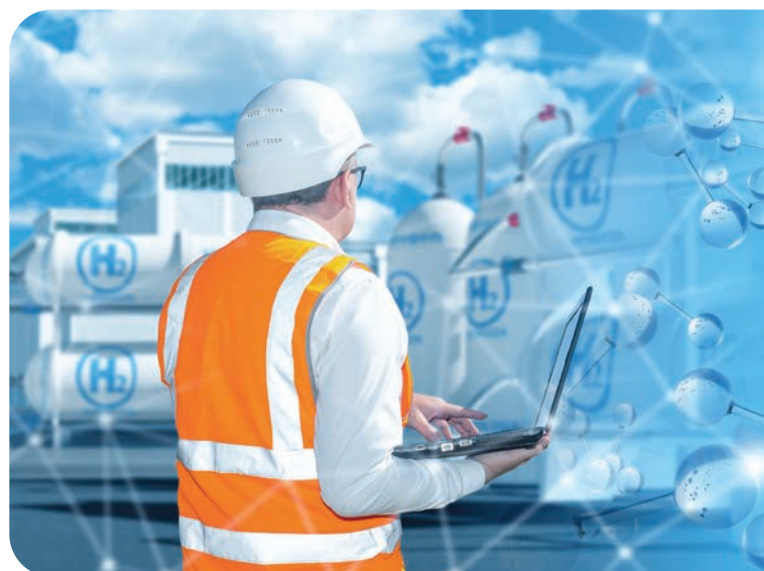
4.17 To prepare for the future development of hydrogen energy, we will study the feasibility of setting up hydrogen filling facilities in different districts, including converting existing petrol filling stations or LPG filling stations into integrated energy stations equipped with hydrogen filling and charging facilities.

4.18 Apart from the transport sector, hydrogen which is easy to be transported and energy-efficient is also suitable for application to port facilities and mobile machinery at construction sites to cater for the development needs of Hong Kong. The Government has been maintaining liaison with relevant stakeholders of the industry (e.g. the Construction Industry Council), and is actively exploring the adoption of hydrogen equipment in works projects, with a view to testing out hydrogen application under different scenarios in Hong Kong.

4.19 On the supply of hydrogen energy, the scarcity of Hong Kong's natural resources renders it difficult to generate sufficient renewable energy for the local production of green hydrogen in a cost-effectiveness manner. In the long run, apart from exploring the feasibility of producing green hydrogen locally through the adoption of advanced technologies, the Government needs to consider, from the strategic perspective, importing low-carbon hydrogen energy from the Mainland and other countries and regions, including working with cities in the Greater Bay Area to explore collaboration in connection with the supply network to strengthen the overall stability and

competitiveness of the supply chain, so as to create an environment conducive to the wider application of hydrogen energy. We would also need to formulate safety standards for relevant infrastructure and examine the scope of their application.

4.20 On capacity building training, based on past experience in promoting the use of LPG vehicles, electric vehicles and their supporting facilities, the training of professionals in new energy application and the industry chain is crucial to the development and safe application of new energies, including hydrogen. We will work with training institutions to ensure that timely and appropriate professional training to practitioners will be provided to tie in with the establishment of the regulatory regime for maintenance and related technical personnel.



(d) Advancing with prudence

4.21 In view of the uncertainties surrounding the future development of hydrogen energy, it is necessary for us to launch the demonstration of hydrogen technology innovation and industrial application in a proactively and orderly manner, having regard to the supply of hydrogen energy, the foundation of the industry, room for market development and the level of technological innovation. The Working Group has already launched trial projects to demonstrate the application of hydrogen in four major areas of the hydrogen industry chain, namely supply, storage, transportation and application, to pave the way for the future development of the hydrogen energy industry in Hong Kong. The Government will take the lead in providing policy and financial support through, for instance, the GTF and the NET Fund to incentivise research institutions to leverage on their strengths to conduct R&D projects. The business sector may capitalise on the market momentum to conduct in an orderly manner demonstration of different hydrogen applications and their supporting facilities.

4.22 As the technology and market of hydrogen mature, and as Hong Kong gradually establishes suitable models of hydrogen application, we will actively promote regularisation of the management of hydrogen energy-related services and the development of hydrogen energy. We will formulate technical standards for hydrogen supply (including imported hydrogen energy), hydrogen storage, hydrogen transportation, hydrogen filling and diversified applications of hydrogen, etc. to underpin our efforts in charting the comprehensive development of “supply, storage, transportation and application” of hydrogen energy. As blue hydrogen and green hydrogen have yet to be widely adopted, we will initiate trial projects by utilising grey hydrogen. We will facilitate the transition from grey hydrogen to blue hydrogen and green hydrogen as the market for blue and green

hydrogen matures. In addition, in pursuing the carbon neutrality goal, we will carefully consider different approaches for overcoming the technological and market barriers, with a view to identifying appropriate options for supplying, storing and transporting clean hydrogen energy in Hong Kong. At the same time, we will step up exchanges and cooperation with the Mainland and international stakeholders on hydrogen policies, and conduct in-depth technical exchanges and experience sharing on all fronts. Moreover, to maintain flexibility for Hong Kong’s new energy development in the long run, we will closely monitor the technological and market developments of other new energy sources through relevant platforms, such as the Working Group and the Council for Carbon Neutrality and Sustainable Development.

4.23 To facilitate on-going implementation of this Strategy, the Government will expand the roles and functions of the Working Group to take forward the various measures set out in the Strategy, including (1) continuing to review and approve trial projects; (2) coordinating the development and continuous enhancement of the relevant technical standards and guidelines for hydrogen application under different scenarios having regard to the local context; (3) advising on the pathway for wider application and commercialisation of the completed trial projects on hydrogen application; (4) providing support for local infrastructure development and manpower training for hydrogen application; (5) assisting in the promotion of the popularisation of hydrogen application; and (6) regularly reviewing progress of implementing the Strategy.

Priorities for Developing the Hydrogen Industry

4.24 Under the "One Country, Two Systems", Hong Kong has the distinctive advantages of enjoying strong support of the Motherland and being closely connected to the world. These advantages give Hong Kong direct access to the huge Mainland market and international connectivity at the same time, and enable Hong Kong to serve as the bridge linking the Mainland and the rest of the world. On the other hand, due to the scarcity of land and a large population, the potential for large-scale production of blue hydrogen and green hydrogen in Hong Kong is relatively limited. To optimise Hong Kong's unique advantages, we will focus on the following initiatives:

(a) Standard setting

4.25 The establishment of standards and certification systems for hydrogen energy plays an important role in facilitating low-carbon transformation and strengthening international cooperation. We will closely engage the relevant stakeholders to stay tuned to global developments in hydrogen energy, and formulate standards and systems that are applicable to Hong Kong with reference to the latest development of standards and systems for hydrogen energy in the Mainland and the international arena, in order to ensure the healthy development of the hydrogen energy industry in the long run.

(b) Regional cooperation

4.26 In view of the limited land resources and renewable energy sources in Hong Kong, it is imperative for us to focus on the overall development of the Greater Bay Area to explore different approaches, including regional cooperation, investment outside Hong Kong, development or importation of low-carbon and zero-carbon hydrogen energy through joint ventures, etc., and to study and promote the development of the hydrogen energy industry in collaboration with our neighbouring regions.

(c) Technological demonstration

4.27 Being one of the core cities in the Greater Bay Area enables Hong Kong to draw reference from the rich experience of our neighbouring cities in applying hydrogen technology. With the Government's policy support and active participation of the industry, Hong Kong had already rolled out trial projects on hydrogen technology, including the first hydrogen filling station and the world's first tri-axle HFC double-deck in 2023. We will continue to leverage on our unique advantages of "enjoying strong support of the Motherland and being closely connected to the world" to facilitate the commissioning of more local hydrogen technology demonstration projects, including public hydrogen filling stations, more HFC double-deck buses and HFC heavy vehicles, to demonstrate more successful cases. Hong Kong will seize the opportunity to actively participate in the development of hydrogen energy in the Greater Bay Area, promote Hong Kong as a base for showcasing national development in hydrogen energy, and facilitate the development of the hydrogen energy industry in the "Belt and Road" region.



(d) Investment promotion

4.28 Apart from showcasing the application of hydrogen technology in Hong Kong, we can capitalise on our roles as “super connector” and a “super value-adder” to attract overseas and Mainland enterprises, organisations and talents to Hong Kong for the development of the hydrogen economy. In addition, our country has made clear that hydrogen energy will be an important component of our country’s national energy system in the future. Hydrogen technology and applications are experiencing rapid development, and Foshan and Yunfu in the Greater Bay Area have already developed a hydrogen energy industrial park and a hydrogen energy base respectively. EEB will, in collaboration with InvestHK and relevant B&Ds, publicise the relevant government policies and Hong Kong’s competitive edges and opportunities to the international community and the Mainland, the Greater Bay Area in particular, with a view to reaching out to potential enterprises and talents to promote Hong Kong’s business opportunities arising from hydrogen energy development.



Chapter 5

ACTION PLAN



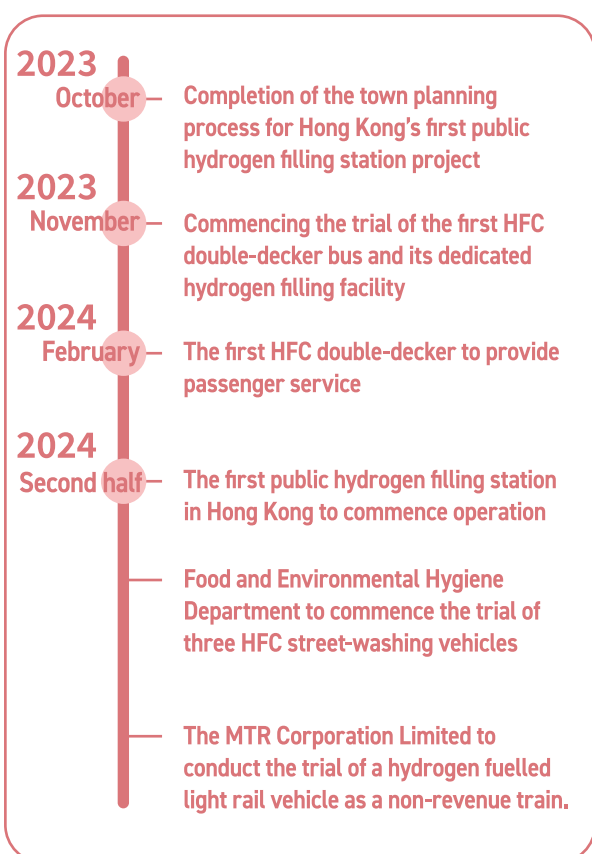
Chapter 5

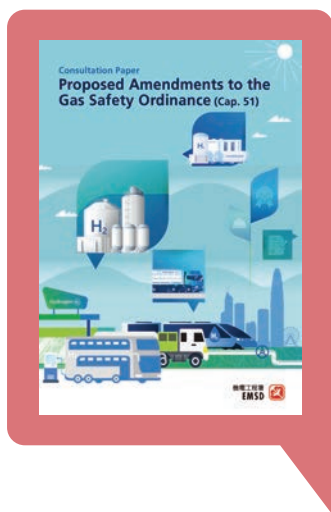
Action Plan

Work Progress

5.1 To prepare for the wider application of hydrogen energy in future, the Working Group has been accumulating practical experience in the application of hydrogen energy in Hong Kong through the promotion of local trial projects. The trial projects that have been reviewed and given agreement-in-principle by the Working Group, and have fulfilled the conditions stipulated by the relevant departments, have commenced progressively. The progress include:

5.2 Following the conduct of consultancy studies, EMSD has also formulated interim standards for the relevant trial projects starting from December 2023. These include the Code of Practice for Hydrogen Fuelled Vehicles and Maintenance Workshops, the Code of Practice for Hydrogen Filling Stations, and the Guidance Note for Quantitative Risk Assessment Study for Hydrogen Installations which have been developed with reference to Mainland's and overseas regulations and standards. EMSD will continue to review and update the guidelines with reference to the development of hydrogen energy technologies and implementation experience accumulated from the trial projects. In addition, the relevant consultancy study on business environment impact assessment is in progress. The above initiatives are conducive to the formulation of relevant guidelines and legislative framework for the application of hydrogen in Hong Kong in the longer term.





- 5.3 EMSD has been making preparation for the exercise to amend the GSO to provide a legal framework for the application of hydrogen fuel in Hong Kong. EMSD conducted a one-month trade consultation on 20 February to 19 March 2024 to explain results of relevant consultancy studies to the trades (including public transport operators and tunnel operators, etc.) and to listen to their views. Feedback from the stakeholders was generally positive.
- 5.4 In order to enhance public understanding of the application of hydrogen energy and development in Hong Kong, we have conducted promotion activities through various channels, including the New Energy Bus Experience Day held in March 2024 and the launch of a thematic webpage (<https://cnsd.gov.hk/en/inter-departmental-working-group-on-using-hydrogen-as-fuel/>) at the Carbon Neutrality and Sustainable Development website to help the public better understand the Government's work in promoting local development of hydrogen energy. The codes of practice and guidance note established by EMSD on hydrogen applications have also been uploaded onto the thematic webpage for public perusal.



Action Timetable

- 5.5 The Working Group has, over the past two years, established a solid foundation for the future development of hydrogen energy in Hong Kong. It will continue to assist the relevant trades in commencing other trial projects, including the use of hydrogen to supply electricity at construction sites, deployment of more hydrogen-powered public buses and heavy vehicles, etc., and to explore and promote new trial projects on hydrogen supply, storage, transportation, and application technologies that are suitable to the local environment. Looking forward, the Government has formulated an action plan and timetable to help Hong Kong seize the new opportunities arising from the development of hydrogen energy.

(a) Legal Framework

- 5.6 In the first half of 2025, we will submit a legislative proposal to the Legislative Council to provide a legal framework for regulating the manufacture, storage, transport, supply and use of hydrogen used or intended to be used as fuel. This framework will cover the entire hydrogen fuel supply chain, hydrogen filling stations, fuel systems of hydrogen fuelled vehicles, as well as the maintenance personnel and the safety of facilities.

(b) Establish standards and certification systems

- 5.7 Upon completion of the amendments to the GSO, the Director of Electrical and Mechanical Services will, in accordance with the GSO, approve and announce the relevant codes of practice for hydrogen fuel safety by gazettal. Additionally, EMSD will continue to issue technical guidelines related to hydrogen fuel safety.



- 5.8 By 2027 or earlier, we will formulate the approach of hydrogen standard certification suitable to the development in and circumstances of Hong Kong, with a view to promoting the development of green or low-carbon hydrogen development in Hong Kong in the longer run.

(c) Supporting Facilities

- 5.9 By 2027 or earlier, we will establish public hydrogen filling stations to cover the Hong Kong Island, Kowloon and the New Territories to support more demonstration projects and trials.
- 5.10 The Government will continuously review the progress of adopting of HFC vehicles and other new energy vehicles to evaluate and improve the overall strategies and goals. We will also assess the market conditions for importing low-carbon hydrogen from both the Mainland and overseas, with a view to exploring collaboration with the Greater Bay Area on the hydrogen supply network.

(d) Regional Cooperation

- 5.11 The Government will strengthen communication and cooperation with the stakeholders in the Mainland on hydrogen energy policy, and will make use of the existing communication channels such as the Hong Kong-Guangdong Joint Working Group on Environmental Protection and Combating Climate Change to commence technical exchanges and experience sharing in 2024.
- 5.12 EEB will, in collaboration with the relevant B&Ds, enhance cooperation with the industry to publicise Government's policy on and Hong Kong's strengths and opportunities in hydrogen energy development through the organisation of seminars (such as the annual Eco Expo Asia) and industry forums to unlock the associated economic opportunities.

(e) Capacity Building

- 5.13 The Government will implement comprehensive publicity and education programmes to raise public awareness of hydrogen energy to further enhance their understanding of the safe adoption of hydrogen as fuel, as well as the strategies and progress made in promoting hydrogen energy development. In the latter half of 2024, we will launch publicity drive to enhance public understanding of the development of hydrogen energy in the Mainland and overseas through online materials, exhibition and promotional videos. We will also explore with the community the potential of developing hydrogen energy in Hong Kong on the basis of the experiences accumulated from the local hydrogen trial projects.
- 5.14 We will also continue to provide financial support (such as the Environment and Conservation Fund, GTF and the NET Fund, etc.) to encourage the academia, the environment trades and the business sector to work together to promote the wider application of hydrogen energy in Hong Kong for the purpose of achieving the carbon neutrality goal.





The Strategy
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Development
in Hong Kong
June 2024

