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Fuels of the future: Hong Kong's adoption strategy for hydrogen and LNG

Ir Eric PANG, JP, Director, EMSD

Greeting

1. Good morning, distinguished guests, ladies and gentlemen. It's my great pleasure to join the Singapore International Energy Week today, and I'd like to thank the Singapore Energy Market Authority for giving me this interactive platform to share with you innovative ideas and technological advancement on energy use.

Carbon neutrality

2. Like other cities, Hong Kong is affected by climate change and facing problems such as rising temperatures and more extreme weather phenomena.
3. Last month, Hong Kong recorded the heaviest hourly rainfall on record, causing major flooding in many districts, triggering landslides, damaging properties and resulting in two deaths and more than 140 injuries. This, so called a "once in 500 years" rainstorm, just came a week after Super Typhoon Saola struck the city, bringing the city to a standstill. Furthermore, we had the hottest July day on record last year, while July this year also recorded one of the hottest temperatures ever.
4. All these events sent a strong signal that extreme weather events are becoming the norm. It underscores that climate change is one of the biggest challenges facing our planet today. We must altogether make a bigger push to reduce carbon emission.

China's Pledge in Carbon Neutrality

5. At the 75th session of the United Nations General Assembly in September 2020, China made a carbon reduction pledge to strive for her carbon dioxide emissions reaching the peak before 2030 and to achieve carbon neutrality before 2060.

HK's Decarbonisation Strategies

6. In response to this important commitment of our country to combat climate change, the Chief Executive of the Hong Kong Special Administrative Region announced in his 2020 Policy Address that Hong Kong would strive to achieve carbon neutrality before 2050 and reduce Hong Kong's total carbon emissions from the 2005 level by half before 2035.
7. We have promulgated in our climate blueprint, namely the "Hong Kong's Climate Action Plan 2050", four major decarbonisation strategies, which are "net-zero electricity generation", "energy saving and green buildings", "green transport" and "waste reduction". To achieve the ambitious targets set under each strategy, the Government has been actively exploring the use of new zero-carbon energy and keeping abreast of high-end global development of new decarbonisation technologies.

Government Incentives on Carbon Neutrality

8. Our ambitious target to achieve carbon neutrality before 2050 will undoubtedly bring the need for huge financial resources. But it will also open up new opportunities for Hong Kong. Over the last decade, the Government of Hong Kong SAR has allocated HK\$47 billion (about USD \$6 billion) to implement measures to reduce carbon emissions and combat climate change. In the next 15 to 20 years, the Government of Hong Kong SAR will devote about HK\$240 billion (about USD \$31 billion) to take forward measures to combat climate change, including energy saving, renewable energy, green transport, waste-to-energy facilities, coastal enhancement and upgrading of drainage works, etc. It will also create investment opportunities in related industries to achieve low-carbon transformation.

Green Transport

9. Transport is Hong Kong's second-largest source of carbon emissions. It contributes to 18 per cent of the city's total emissions, after the electricity generation sector's 66 per cent. Introducing clean transport equipment is the key if we are to reach our goals of halving Hong Kong's carbon emissions by 2035 from our 2005 level, and becoming carbon neutral by 2050.

10. To promote green transport, the Government has injected HKD \$11 billion (USD \$1.4 billion) into the New Energy Transport Fund to subsidise the transport trade to conduct trials and promote the wider use of innovative green transport technologies. A total of 300 trial projects have been approved, including various types of electric commercial vehicles and vessels. We subsidise the trade to directly procure technologies that have been proven to be relatively mature and suitable for local adoption, as well as the trial of electric taxi, hydrogen fuel cell double-deckers, heavy vehicles and electric ferries.

11. In 2021, the Government announced 3 major plans, which are the Hong Kong Roadmap on Popularization of Electric Vehicles, Clean Air Plan for Hong Kong 2035, and Hong Kong's Climate Action Plan 2050, covering policy directions and future targets in different areas to promote the adoption of new energy transport technologies, so as to guide Hong Kong towards zero vehicular emissions before 2050 and attain carbon neutrality within the same timeframe.

Hydrogen as Fuel

12. To pursue the city's zero vehicular emission goal, the transition from fossil fuel to hydrogen fuel cell vehicles, with zero roadside emissions, will certainly play a pivotal role. The change is indeed happening both worldwide and locally in Hong Kong.

China Vision in Hydrogen Development

13. The Mainland China, being the largest hydrogen producer with about 33 million tonnes of annual production, has also revealed its vision towards

hydrogen in the 14th Five-Year Plan. It affirmed that clean hydrogen is an important step in the country's stride towards its climate goals.

14. According to the Long-Term Development Plan for Hydrogen Industry (2021-2035) announced in March 2022, China would produce 100,000 to 200,000 tonnes of renewable-based hydrogen annually, and will have a fleet of 50,000 hydrogen-fueled vehicles by 2025. When this target is achieved, it is estimated that the country's carbon emission will be reduced by one to two million tonnes annually.

HKSAR Policy in Hydrogen Development

15. To align with our national goal, the Hong Kong Government has committed in the Climate Action Plan to collaborate with the franchised bus companies and other stakeholders to test hydrogen fuel cell buses and heavy-duty vehicles within three years. The Government would also formulate a roadmap for the use of new energy public transport by 2025.
16. Today, the city is poised to entering in the hydrogen fuel era. In less than two months' time from now, the first tri-axle hydrogen powered double-decker bus, along with the first hydrogen filling station, are set to commence into services for trial operations. The double-decker bus was produced in mainland China, while some core equipment, like the fuel cell unit, the hydrogen tanks, are sourced from prominent suppliers around the globe. Further, hydrogen fuel cell street washing vehicles are now being procured by the Government and will be put on road-test in the first half of next year.
17. The trial would give us valuable data and experience as to their driving range, fuel economies, most importantly, operational safety in a local context. All these insights are crucial for us to pave a more concrete way for upscaling and commercializing the use of hydrogen bus on the path forward.
18. To incentivize the transport trade to take part in trial projects, the government have set aside \$200 million under the New Energy Transport Fund for subsidising relevant costs of the trial projects such as the costs for procurement,

construction, renting and operation of hydrogen vehicles and hydrogen refilling facilities.

Challenges and Difficulties

19. Introducing a new energy vehicle into our city's long established transport network from ground up is not without its challenges.
20. The fast emergence of new hydrogen technologies and the strong demands for their wider uses seems to have outpaced the regulatory development. Like other countries venturing into the world of hydrogen economy, Hong Kong has yet to have specific legislations, governing the hydrogen supply chain and its applications in a comprehensive and holistic way. But this has not deterred the Government from taking steps to test out this promising zero-emission fuel.

IWGUHF

21. In 2021, the Government established an Inter-departmental Working Group on Using Hydrogen as Fuel (IWGUHF), comprises of thirteen government policy bureaux and departments. It serves to steer the on-going hydrogen development, and to fill up the regulatory gaps before a new legislation comes into force. This Working Group will drive and promote the trade's participation in different trials for testing different segments of the supply chain and various application scenarios. It also acts as the de-facto regulator to endorse trial applications and to supervise their safe and orderly roll-out in the lack of legislation.

Safety and Technical Guidelines

22. Last month, the Working Group has released a series of technical and safety guidelines, covering hydrogen buses, hydrogen filling stations, and quantitative risk assessments for hydrogen facilities. These guidelines are a prerequisite for the safe and orderly implementation of the trials. They will also greatly facilitate the rapid development of the hydrogen fuel in the years to come.
23. While these guidelines make reference to international and mainland standards

and research studies, it takes a lot of customization to fit in the city's needs. Hong Kong is densely populated, packed with busy road networks and heavy traffic, and with very limited land availability. Finding a right place for siting a hydrogen filling station with enough safety separation with neighbouring populations can be particularly challenging. In deciding our local requirements, we need to strike a right balance between risk acceptability and best use of scarce land resource without over-limiting the future development potential of this clean energy fuel. To this end, we have put tons of effort in scientifically and systematically assessing the potential hazard distances caused by all possible failure scenarios identified, using the state-of-the-art risk modelling software, in order to formulate our risk control mechanism custom-made to the Hong Kong situation.

24. These guidelines do not only laid down the minimum safety standards of the equipment or vehicle itself, but also set out the standard hydrogen-specific methodologies, assumptions and risk acceptability criteria used in conducting QRA for hydrogen facilities. This enables a sound and consistent study approach to be adopted by different specialist consultants, and is instrumental in ensuring a reliable result for informed decisions. In fact, this challenge is not completely new to us. In early 2000s, we devised new QRA techniques for the siting and controlling the land-use of sites adjacent to LPG filling stations when the LPG taxi scheme was initiated to replace diesel taxi. This would certainly help the coming transition from fossil fuel to hydrogen.

Hydrogen Vehicles Safety in Tunnels

25. Apart from controlling the risks from fixed hydrogen installations, another critical safety issue we're looking into is whether hydrogen vehicles should be allowed to go through tunnels. Tunnels are indispensable parts of the city's busy road networks, linking up islands, passing through mountains. Any major blaze or explosion involving a hydrogen vehicle inside a tunnel could be life-threatening, and at its worst may bring the city's road traffic into a standstill, causing immeasurable economic damages to the city. Though our recent literature review showed that there is no aligned approach in applying tunnel restrictions to hydrogen vehicles in different counties, we tended to adopt a

cautious approach in dealing with this issue. We have already engaged a specialist consultant to research into the hydrogen release scenario and the explosion overpressure effects due to a leakage from hydrogen vehicles in tunnel. The results are expected to be released by the end of this year. This would allow us to better appreciate, and most importantly mitigate, the tunnel risk such that an informed decision backed by scientific evidence can be formed.

Legislation on Hydrogen

26. Though the safety guidelines issued can serve as a stop-gap measure, they lack the legal backing for effective enforcement. So, we need to expedite the hydrogen legislation to fill the legal vacuum in the long run to keep up with the pace of hydrogen development. On this front, we have already kick-started the initial preparation work, and we target to put the new legislation in force in 2025.
27. Hong Kong has proven track records on fuel gas safety over the last thirty years and more. This can be mostly attributable to the Gas Safety Ordinance under the law of Hong Kong, which set up a robust regulatory framework, governing the production, import, storage, transport supply and use of fuel gases in Hong Kong. I believe that we have the edge and determination to quickly put in place a thorough legislation for hydrogen, riding on the success of our established and robust regulatory framework for fuel gas safety.

Hydrogen Supply Chain

28. A reliable and robust supply chain is a prerequisite for upscaling the use of hydrogen fuel in green transport to a commercial scale and conducive to motivating the trade into exploring new application scenarios.

Hydrogen Importation from Mainland

29. In the short to medium term, Hong Kong enjoys privileged geographical advantages of being located close to the China's southern Guangdong Province, where plenty supply of hydrogen is readily available particularly as a by-product of chemical plants. Hydrogen can be transported in bulk from

mainland to Hong Kong on roads using tube trailers in around two hours. This is within an economical delivery distance. Further, Guangdong Province is one of the major centers for the development of hydrogen vehicles in mainland China, where a well-established hydrogen supply chain coupled with a wide range of application scenarios are already there. We can surely leverage on mainland to jump start the hydrogen adoption in Hong Kong.

30. Besides, the use of hydrogen powered heavy-duty trucks become increasingly popular in the Greater Bay Area as spurred by the national policy. We should actively explore the possibility of building strategically located refilling stations in Hong Kong to enable the use of cross-border heavy-duty trucks transiting between the places to further deepen our regional collaboration.

Sourcing Hydrogen from Town Gas

31. As for local supply, Towngas, the city's dominant supplier of piped gas has successfully tested the extraction of hydrogen from its gas supply network. Town gas comprises around 49 per cent hydrogen in its composition. The hydrogen can be separated and processed to 99.9 per cent purity at a quality suitable for hydrogen fuel cell vehicles' use and ready to supply Hong Kong's bus operators.
32. Towngas owns a network of more than 3,600 kilometres of pipelines that serve over 85% of households and businesses in Hong Kong, reaching almost every place in the city. Hydrogen can be conveniently tapped from the town gas network right at the hydrogen refilling stations, and ready to fill up the hydrogen vehicles. This saves us lot of time and effort in building up the infrastructure needed for the hydrogen supply network. From a safety perspective, this piped supply option will get rid of the risk posed by the road transport of hydrogen in bulk quantity in Hong Kong's busy traffic network. This is the edge of Hong Kong in jump starting our hydrogen journey.

Long-term Green Hydrogen Supply

33. For topographical reasons, Hong Kong has limited capacity in producing green hydrogen itself using renewable energy, and is unlikely that Hong Kong

will be able to become completely self-sufficient in green hydrogen. For a longer-term solution, we have to look for hydrogen supplies outside Hong Kong, such as from mainland China and overseas. China is currently the world's largest producer of hydrogen and its green hydrogen production is on the rise in the past few years as propelled by the national strategy. In June this year, the Chinese company, Sinopec commissioned a green hydrogen production plant powered by a 300MW solar farm in Xinjiang, which outranks the plant in Ningxia as the world's largest. I believe there is a huge potential for Hong Kong to source green hydrogen from mainland China and worldwide in the not-too-distant future.

34. In early 2022, Australia exported the world's first shipment of liquefied hydrogen to Japan. This bulk transportation of 1,250 m³ of super-cooled liquid hydrogen is indeed a technological breakthrough in hydrogen transportation, and is expected to boost up the international trade of hydrogen. In Hong Kong, it is definitely sensible for us to explore the use of liquid hydrogen technologies, which would greatly facilitate the importation, bulk storage and transport of hydrogen in larger quantity to meet the soaring demands brought about by the wider use of hydrogen as fuel.
35. Besides, Hong Kong has many reservoirs of a considerable size, which have the potential for installing floating solar panels for green hydrogen production. We initially estimate that, by using some 10% of the surface area in our largest reservoir for solar-to-hydrogen production, it would provide enough hydrogen generation capacity to serve almost 300 double-decker buses. This technology is surely worth investigating further.

LNG importation – security of supply

36. Like many metropolitan cities, Hong Kong has relatively modest potential for developing large-scale zero-carbon energy projects due to geographical and environmental constraints such as scarce land and natural resources. On the pathway to achieving carbon neutrality before 2050, we will strive to ensure our community enjoying a reliable and safe energy supply at reasonable prices.

To stabilise electricity tariffs in the long term and further reduce reliance on fossil fuels for electricity generation, the Government of Hong Kong SAR is exploring various measures, including enhancing regional co-operation, developing a diversified fuel mix and increasing the use of zero-carbon energy.

37. The Government of Hong Kong SAR is striving to achieve carbon neutrality before 2050 and attain a 50% reduction in carbon emissions before 2035. To diversify the fuel mix, the power companies have not been allowed to build new coal-fired generating units since 1997 and are required to replace coal with cleaner fuels. As a result, the share of coal has dropped to about a quarter of the fuel mix in 2022, substantially lower than its share in 2015 which was about half. For the rest of the fuel mix, about half is natural gas while slightly more than a quarter is nuclear and renewable energy. To further decarbonise our power sector, we have set the target to cease using coal for daily electricity generation by 2035, and only keep it for providing backup support. We are also striving to increase the use of zero-carbon energy and its share in the fuel mix for electricity generation rising to around 60% to 70% before 2035.
38. Hong Kong began using subsea pipeline to import natural gas for power generation as early as 1996. In mid 2023, the two power companies, CLP Power Hong Kong and the Hongkong Electric Company, successfully commissioned the first offshore Liquefied Natural Gas (LNG) terminal in the south-western waters of Hong Kong. The offshore LNG terminal allows the floating storage and regasification unit (FSRU) vessel and LNG Carrier to dock simultaneously. The LNG from the LNG Carrier is unloaded to the FSRU vessel for storage through the offshore LNG terminal. When natural gas is needed, the FSRU vessel re-gasifies the LNG. The natural gas is then transported to the power stations for power generation through subsea pipelines.
39. The FSRU vessel, named Bauhinia Spirit, is the world's largest to date with storage capacity of 263,000 m³. With the offshore LNG terminal, the two power companies can purchase LNG from the international market directly to further increase the proportion of power generation in Hong Kong using

natural gas to reduce carbon emission.

Green Finance

40. As an international financial centre and regional hub for green finance, Hong Kong has also been actively facilitating matching between international capital and quality green projects and the use of our financial platform for raising funds. Statistics of Asia Securities Industry and Financial Markets Association show that in the next 30 years, the Asian region will require USD \$66 trillion in climate investment. This demonstrates the immense demand for green finance.
41. The Government is actively developing Hong Kong as an international green technology and financial centre. The green and sustainable finance market in Hong Kong is thriving. The total green and sustainable debt, including both bonds and loans, issued in Hong Kong increased by over 40% from 2021 to reach USD \$80.5 billion in 2022. Among which, the volume of green and sustainable bonds arranged in Hong Kong accounted for 35% of the Asian green and sustainable bond market.
42. Specific measures include the development of green bond market and carbon market. On the development of green bond market, the Government has successfully issued government green bonds totaling close to USD \$22 billion equivalent since May 2019. In 2022, the Hong Kong's first retail green bonds attracted nearly half a million individual subscribers, demonstrating strong support from Hong Kong investors for the government's green initiatives.
43. We are extending our efforts to build Hong Kong into an international carbon market to connect opportunities across the Mainland, Asia and the rest of the world. Hong Kong Exchanges and Clearing Limited (HKEX) launched an international carbon marketplace Core Climate in October 2022. It is currently the only carbon marketplace that offers Hong Kong Dollar and Renminbi settlement for the trading of international voluntary carbon credits. The Core Climate is a new international carbon marketplace that seeks to connect capital with climate-related products and opportunities in Hong Kong, Mainland

China, Asia and beyond. Core Climate facilitates effective and transparent trading of carbon credits and instruments to support the global transition to Net Zero. Core Climate participants are able to source, hold, trade, settle and retire voluntary carbon credits through the Core Climate platform. Carbon credits on the platform come from internationally-certified carbon projects from around the world, including carbon avoidance, reduction and removal projects. All projects listed on Core Climate are verified against international standards, such as the Verified Carbon Standard by Verra.

44. Looking ahead, the Government and the Hong Kong Stock Exchange will continue to jointly explore opportunities and support the development of the carbon ecosystem, with a view to building Hong Kong into a leading international carbon trading hub.

Concluding remarks

45. With a simple tax regime and business-friendly environment, Hong Kong is a perfect gateway for foreign businesses to access the Mainland market and for Mainland enterprises to go global. Leveraging the position as a highly-connected international city with strong connections with the Guangdong-Hong Kong-Macao Greater Bay Area, the Hong Kong Government will continue to work closely with the industry and stakeholders to promote green transformation and achieve our decarbonisation goals.
46. Building a clean future requires concerted efforts of every one of us. I believe that through active participation and discussions, governments and industries can together forge a path towards sustainable future. Thank you.