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Public Acceptance of Hydrogen Fuel Cell Vehicles (HFCVs) and Electric Vehicles (EVs) in Hong Kong: A Comparative Analysis

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ABSTRACT

Achieving carbon neutrality in Hong Kong by mid-century essentially lies in integrating innovative technologies, including hydrogen fuel cell vehicles (HFCVs). This study explores public awareness, perceptions, and acceptance of HFCVs in Hong Kong, using electric vehicles (EVs) as a benchmark. The barriers and opportunities for their widespread adoption are identified. The results show significant differences in public awareness: only 26.0% of the public know about HFCVs, less than half of that of EVs. Despite minimal HFCV driving experience (1.5%), 18% express purchase intent, highlighting latent market potential. However, risk perception and infrastructure gaps remain significant challenges. Forty percent of respondents expressed concerns about the safety issue on the hydrogen. 40% of respondents expressed positive feedback on the local hydrogen refueling station construction. Infrastructure shortages (nearly 50%) are considered as the biggest barrier for wide adoption of HFCVs in Hong Kong. These findings underscore sociotechnical barriers, including limited public understanding of HFCVs' advantages in heavy-duty applications. To bridge this gap, policymakers in Hong Kong are urged to expand infrastructure for hydrogen energy and implementing targeted public engagement strategies to improve public acceptance on HFCVs. This research offers actionable insights to transform Hong Kong's latent HFCV receptivity into tangible progress toward decarbonization.

Keywords: hydrogen fuel cell vehicles (HFCVs), electric vehicles (EVs), public acceptance, public perception

NONMENCLATURE

Abbreviations	
HFCVs	Hydrogen Fuel Cell Vehicles
EVs	Electric Vehicles
GHG	Greenhouse Gas
HFCBs	Hydrogen fuel cell buses
NIMBY	Not In My Backyard

1. INTRODUCTION

To address the pressing challenges of climate change and the need for carbon neutrality, the global transition to sustainable transportation has become increasingly urgent. Hydrogen fuel cell vehicles (HFCVs) and electric vehicles (EVs) have become important alternatives to traditional vehicles using fossil fuel. Noteworthy, Hong Kong's transportation emissions account for approximately 20% of its total greenhouse gas (GHG) emissions. The city's commitment to achieving carbon neutrality by 2050 highlights the urgency of this transition [1]. Hong Kong's policy demonstrates its strong commitment to promoting green mobility. The 2050 Climate Action Blueprint and the 2021 Electric Vehicle Roadmap lay the foundation for recent initiatives to promote sustainable transport solutions [1,2]. Notably, the Hong Kong government allocated HK$240 million in its 2023-24 budget for pilot hydrogen refueling stations [3]. This initiative is designed to complement an existing network of over 7,000 EVs charging points, with a target to increase this network by 50% by 2027 [4]. Furthermore, the introduction of financial incentives, such as First Registration Tax waivers for EVs, coupled with the Administration's initiative to revise the Gas Safety Ordinance (Cap. 51) to provide a legal basis for regulating hydrogen as a fuel, reflects a holistic strategy for advancing clean energy adoption [5,6]. Regulatory measures, including the Clean Air Plan 2035, mandate that 100% of new public buses and 30% of private vehicles must achieve zero-emission status by 2035 [7]. These various plans indicate the ambition of Hong Kong Government in realizing the carbon neutrality and highlights the potential role of hydrogen can play in the transportation sector in Hong Kong.

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Buses are an integral part of Hong Kong residents' daily lives, considering as one of the city's primary modes of public transportation. According to statistics from the Hong Kong Transport Department, over 4 million people take franchised buses every day, accounting for approximately 30% of all public transportation trips [8]. However, the operation of such a large bus fleet also has environmental implications. Research by the Hong Kong Environmental Protection Department indicates that buses contribute to about 30% of roadside nitrogen oxides emissions and a significant portion of GHG emissions from the transport sector [9]. As a result, the government has been promoting the adoption of cleaner and electric buses to mitigate their environmental impact and improve air quality for urban residents. The effective implementation of these policies has been illustrated by Citybus's #MissionZero initiative [10]. This program has successfully introduced Hong Kong's first electric double-decker bus and has pioneered hydrogen mobility with the deployment of Asia's first triple-axle hydrogen double-decker bus. In 2023, Hong Kong commenced trial operations of its first hydrogen-powered double-decker bus, accompanied by the launch of the city's initial hydrogen refueling station. Citybus aims to begin public service in early 2024 and plans to fully transition its diesel fleet to zero-emission buses by 2045. Hydrogen fuel cell buses (HFCBs), with their fast-refueling and comparable range to diesel buses, have received positive feedback from the public and drivers. This development demonstrates Hong Kong's commitment to adopting innovative low-carbon transport solutions [11].

Furthermore, Hong Kong's EV market has also experienced significant growth. For example, by April 2025, there will be approximately 119,000 EVs in Hong Kong, representing approximately 13.1% of the city's total vehicle population. The government aims to have all new private cars be electric by 2035, supported by initiatives such as first registration tax concessions and the One Car One Replacement Scheme [12]. These policies and incentives are crucial to driving the adoption of EVs and expanding the market share of electric vehicles in Hong Kong [13].

Considering Hong Kong's unique urban properties, in-depth research on public acceptance is crucial to understanding the local residences thoughts on the HFCVs and EVs. Such an understanding will significantly influence the development and application of these technologies. From a government perspective, understanding public attitudes and concerns can generate more targeted and effective policy. For example, infrastructure planning for HFCVs or EVs can be more targeted based on the requirements and expectations of residents. For manufacturers and brands, understanding local consumer acceptance helps tailor product and marketing strategies to the Hong Kong market. They can adjust vehicle models, features, and after-sales services to better meet local consumer needs.

This study aims to compare public acceptance of HFCVs and EVs in Hong Kong, focusing specifically on identifying key barriers to their development, such as cost, safety perceptions, and infrastructure challenges. The findings will provide valuable insights for policymakers and contribute to the broader discussion on sustainable urban transport. This study also highlights the important position of public perception in the widespread adoption of these innovative transportation solutions.

2. LITERATURE REVIEW

Research concerning the social acceptance of HFCVs and EVs within the unique urban context of Hong Kong has garnered increasing attention in recent years. There are two main conceptual approaches in existing literature: the economic approach and the socio-psychological approach [16,17]. The economic approach predominantly utilizes consumer surveys to quantify willingness-to-pay (WTP) for HFCVs and EVs. This approach aims to provide policymakers and automotive industry stakeholders with quantitative insights into local market potential. However, for the socio-psychological approach, it delves into various aspects of public perceptions, attitudes, and risk awareness regarding HFCVs and EVs [18].

HFCVs use fuel cells to generate electrical power via the electrochemical reaction between hydrogen and oxygen, emitting only water vapor as a byproduct. EVs rely on rechargeable batteries to provide electrical power to motors [19]. Recent studies have shown that the operating cost per kilometer of EVs is less than that of HFCVs, which can be attributed to the lower cost of electricity compared to the hydrogen [15]. For example, the estimated operating cost per kilometer for an EV in an urban environment is approximately $0.04 to $0.07, while that for a HFCV can be more than $0.08 [14]. The acceptance of HFCVs and EVs in Hong Kong can be influenced by a variety of factors, including benefits, safety concerns, and the adequacy and reliability of infrastructure. Empirical research consistently identifies

a baseline public receptiveness towards these technologies [20]. However, this positive disposition is frequently counterbalanced by pronounced anxieties regarding safety protocols and the sufficiency of refueling or charging networks. For example, Zhao et al. found that nearly 30% of potential users of HFCVs were deterred by safety concerns, particularly the risk of hydrogen explosion. This safety concern is significantly higher than that for EVs (approximately 18%) [21]

In contrast, while EVs have also faced scrutiny regarding battery fires, public concern appears less acute, possibly due to greater familiarity with battery technologies and more robust safety records [22]. Crucially, establishing public trust in the safety and operational integrity of hydrogen systems emerges as a paramount determinant of societal acceptance within Hong Kong's dense urban environment. The adoption rate of HFCVs is lower than that of EVs, particularly due to the safety concerns of the hydrogen explosion or fire [21]. The keys on realizing successful deployment of HFCVs and EVs in Hong Kong lies on the harmoniously interplay between cost, safety, and infrastructure reliability.

Therefore, the public acceptance of HFCVs and EVs in Hong Kong should have its own pattern, considering local characteristics. This highlights the urgent need for ongoing research that combines economic analysis with social psychological investigations. Such integrated research is crucial to bridging theoretical understandings and effectively guiding strategies to promote Hong Kong's transition to sustainable urban transport.

3. METHODS

In this study, a public survey is conducted to investigate the awareness, perceptions, and attitudes toward HFCVs and EVs within Hong Kong. Adopting a socio-psychological approach, the questionnaire is designed to quantitatively compare societal acceptance levels of HFCVs and EVs. The survey is administered through offline random sampling techniques during January-February 2025. A total of 200 valid samples from randomly selected locations across Hong Kong, including streets, parking lots, and university campuses was collected.

The questionnaire contains three separate sections which work together to evaluate public opinions about new energy vehicles. The first section gathers complete socio-demographic data through variables that include gender, age range, educational level and work sector, vehicle ownership status and driving license possession. The collected information provides essential context to understand the following survey results. The second section of the survey examines how well people know about HFCVs and EVs. The survey evaluates public opinions about price points and operational capabilities and safety features of these vehicles to understand current market reception. The third section evaluates public perception about HFCV and EV progress through questions about technology support and vehicle adoption intentions. The forward-looking section helps researchers understand future market directions and public acceptance of sustainable transportation solutions.

The objective of this survey is to deepen our understanding of the awareness, attitudes, and behavioral intentions of Hong Kong residents with respect to new energy vehicles. To enhance the robustness of the analysis, comparative perspectives are incorporated using referencing results from a 2015 survey conducted in Japan. By integrating both current perceptions and future expectations, this study aims to provide insights into the developmental path and strategic possibilities for HFCVs and EVs. The study achieved its high response rate through voluntary participant involvement in the research process. However, the challenges include the inability to rapidly obtain a large sample size within a short time frame, as well as it takes longer to enter paper-based questionnaires manually. Table 1 presents the survey implementation details and sample characteristics.

Table 1 The basic data of implementation of the surveys and the characteristic of the samples.

Survey Period	January-Febrary 2025
Survey Area	Across Hong Kong
Survey Method	Ramdom Walk
N=	200
Sex Groups	
Male	55.50%
Female	44.50%
Age Groups	
≤19	3%
20-29	30%
30-39	33%
40-49	24%
50-59	7%

60-69	3%
Education Levels	
High school or below	17.50%
Bachelor's degree	44.50%
Master's degree or above	38%
Job Types	
Government and Central SOEs	11%
Euduaction	13%
Student	14%
Financal	23%
Driver	12%
Others	27%
Have driving license or not?	
Yes	77.80%
No	22.2%
How many cars do you own?	
None	37%
1 car	34%
2-3 cars	29%

4. RESULTS AND DISCUSSION

4.1 AWARENESS

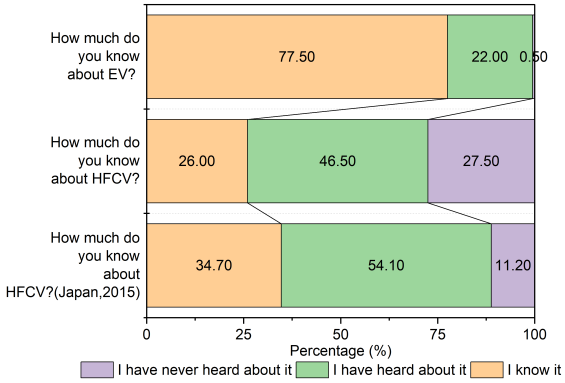

Fig.1 Awareness of HFCVs and EVs

Figure 1 indicates a considerable divergence in public awareness regarding HFCVs and EVs within Hong Kong. EVs awareness significantly surpasses that of HFCVs, exhibiting a difference of 51.5%. Specifically, 77.5% of participants recognized EVs but only 0.5% stated they had no knowledge about them. The public shows limited knowledge about HFCVs because 26.0% of respondents claim familiarity but 46.5% show basic understanding and 27.5% demonstrate complete unawareness. The results show that half of the respondents who never heard about HFCVs hold a Bachelor's degree which indicates poor information distribution about HFCV technology and shows a wide difference in public understanding between HFCVs and EVs in Hong Kong.

A comparative observation arises when examining these findings in relation to data from a large-scale (n=3133) Japanese study evaluating public perception of HFCVs [23]. Despite Japan's prior and more extensive investment in HFCV development, their reported HFCV familiarity rate was 34.7%. This represents a statistically significant increase in familiarity compared to the 26.0% observed in the current Hong Kong 2025 survey. The percentage of Japanese people who had never heard of HFCVs before stood at 11.2% which was lower than the Hong Kong results. The study shows that Hong Kong residents remain less aware about HFCVs than Japanese people were at the time of their baseline study ten years ago. The current public education and outreach programs for HFCVs in Hong Kong do not seem to be effective enough to reach a wide audience. The research indicates that the Hong Kong government along with relevant stakeholders need to launch extensive promotional activities and specific public education programs to increase HFCV awareness levels.

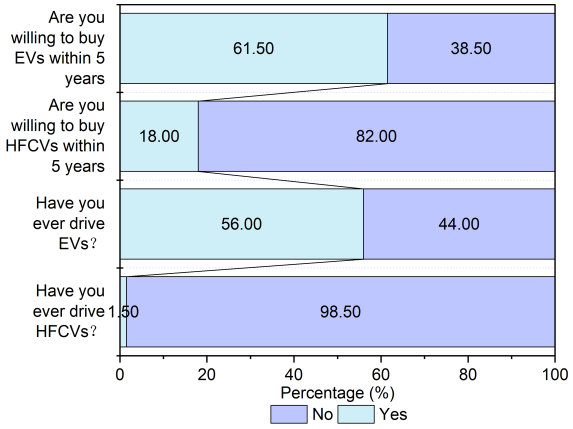

Fig.2 Driving Experience and Purchase Intention

Figure 2 highlights a marked discrepancy between experiential familiarity and stated purchase intentions regarding HFCVs and EVs. While EV driving experience is comparatively widespread, reported by 61.5% of respondents, HFCVs exposure remains exceptionally limited, with only 1.5% indicating prior usage. Notably, among these three individuals, one reported an HFCV test drive gained during an internship at Toyota, while the remaining two indicated their exposure stemmed from their roles as bus drivers. This pattern suggests that HFCVs exposure is currently largely restricted to industry-specific or commercial driving contexts. Despite this significant experiential deficit, a non-trivial

proportion of respondents (18.0%) expressed a willingness to purchase an HFCV within a five-year. This stated intention rate notably exceeds the minimal direct experiential exposure to the technology, potentially indicating the existence of latent market receptivity independent of widespread firsthand experience. Notably, the proportion of respondents expressing willingness to pay for EVs closely mirrors their reported driving experience, suggesting a strong correlation between firsthand exposure and perceived value.

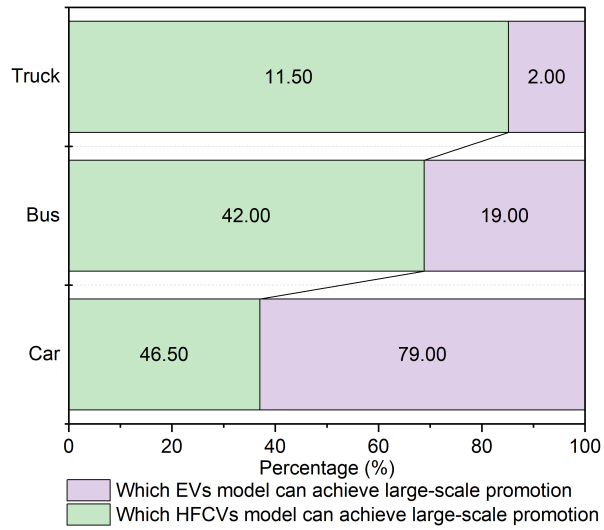

Fig.3 Respondents' views on the future large-scale patterns of HFCVs and EVs

Figure 3 reveals respondents' views on the HFCVs and EVs future development. This observation suggests that passenger cars hold the greatest potential for large-scale adoption of EVs, while trucks exhibit the least potential. This outcome is consistent with current market choice and technological limitations regarding battery capacity and weight. Analysis indicates that respondents perceive comparable potential for future adoption of HFCVs in passenger cars and buses, while trucks are again perceived as exhibiting the least potential. This perception may be attributable to a general lack of familiarity with HFCV technology, leading respondents to extrapolate their assessments based on their existing experiences with conventional vehicle types.

Analysis indicates a divergent trajectory for HFCVs across vehicle segments:

1) Passenger cars segment: HFCVs face considerable challenges in competing with EVs within the market. EVs have already achieved over 50% market penetration in China and benefit from established consumer acceptance, whereas HFCVs remain largely absent [24]. This difference is reflected in survey responses, with respondents selecting EVs over HFCVs for cars at a ratio of 2:1; specifically, 79% believe EVs are more suitable for large-scale promotion in the passenger car segment, compared to only 46.5% for HFCVs. Consequently, HFCV cars currently lack a clear development trajectory and require substantial future technological and infrastructural advancements to achieve viability. Notably, however, a perception gap exists: many respondents appeared unfamiliar with HFCVs technology, likely conflating it with EVs apart from the energy source ("refueling" vs. "charging"), potentially inflating HFCVs selections.

2) Heavy-duty segment (buses/trucks): The survey indicates that HFCVs have a higher perceived development potential than EVs for buses and heavy-duty trucks. The results match the natural benefits of hydrogen for heavy-duty operations. The survey data indicates that HFCVs receive growing support from 42% of respondents for buses and 11.5% for trucks while EVs receive decreasing support at 19% for buses and 2% for trucks. The Chinese public transportation sector has adopted electric buses as its primary solution for urban bus decarbonization yet HFCBs provide better performance in high-intensity operations and long-distance travel and quick refueling capabilities [25]. HFCBs typically have a lifespan exceeding 5000 hours, with the fuel cell stack experiencing minimal degradation over the vehicle's operational life emphasizing their reliability in high-utilization environments. [26]. Due to their higher energy density, HFCBs can achieve an extended driving range—typically around 600 km [25]. This represents a significant advantage over conventional electric buses, which generally offer a range between 160 and 400 km per single charge [27], The superior energy density of HFCBs makes them particularly suitable for applications demanding long-distance travel, such as intercity routes and heavy-duty transport operations.

The main benefit of HFCBs and trucks stems from their fast-refueling process which allows a complete hydrogen tank refill in 5 minutes (0.08 hours) for 241 km range and 9 minutes (0.15 hours) for 483 km [28]. In contrast, the charging duration for electric vehicles to achieve equivalent ranges exceeds HFCVs since they need 29.2 hours with Level 1 charging (less than 2 kW at 120 V and 20 A) and 7.3 hours with Level 2 charging (240 V at 40 A single-phase circuits) and fast Level 3 charging (60–150 kW) requires 0.9 to 0.4 hours for 241 km range. The charging duration for 483 km reaches 77.6 hours with

Level 1 charging but fast Level 3 chargers can complete the process in 2.5 hours. [28–30]. HFCVs outperform EVs in operational downtime reduction because they need less time to refuel especially when operating at extended ranges and high usage rates. The placement of hydrogen refueling stations and electric vehicle charging stations becomes more efficient through strategic planning based on known operational routes. The adoption of sustainable transportation solutions depends on strategic infrastructure planning and supportive policies to improve accessibility. The market will follow different paths in the future because EVs will maintain their position in passenger car sales but HFCVs will find their main use in heavy-duty transportation. The absence of commercial hydrogen refueling stations in urban areas has resulted in electric buses becoming more popular than hydrogen buses and trucks in these areas. [31-32]. The solution of cost and infrastructure problems will enable HFCV buses and trucks to enter the market at increasing rates during the medium to long term. The Hong Kong Citybus procurement strategy supports this prediction because they plan to buy zero-emission buses with a 7:3 ratio of HFCV to EV models [33]. The heavy-duty vehicle segment shows strong market potential for HFCVs because the public demonstrates high acceptance rates of these vehicles. The implementation of separate support policies should focus on EVs for passenger cars but HFCVs for heavy-duty vehicles while building hydrogen infrastructure around public transportation.

4.2 PERCEPTION

4.2.1 Perception relevant to the society

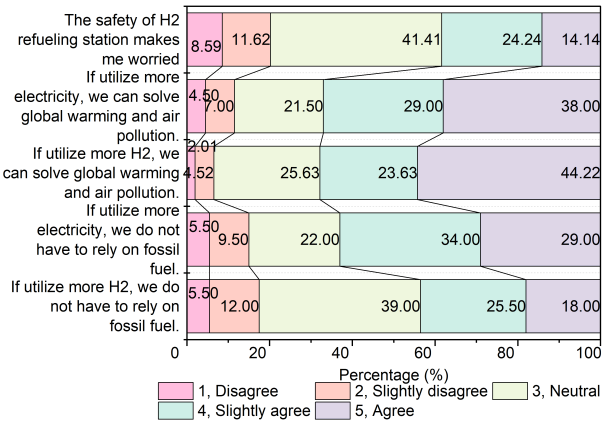

Fig.4 Respondents' views on HFCVs and EVs from a societal perspective

Figure 4 indicates a predominantly neutral perception among respondents regarding the safety of hydrogen refueling stations. The limited hands-on experience with these facilities stems from Hong Kong's insufficient number of hydrogen refueling stations. The public's unfamiliarity with hydrogen refueling technology systems might explain their neutral stance. Public education initiatives about hydrogen infrastructure safety could help people understand the subject better and develop more knowledgeable opinions about its safety. It also reveals notable differences in public assessments of HFCVs and EVs. Regarding the environmental dimension, HFCVs received 15.7% higher rates of strong agreement and the lowest incidence of negative evaluations, suggesting greater public trust in their end-use zero-emission characteristics. This finding may indicate that, even in the absence of extensive familiarity with this novel technology, respondents in Hong Kong retain a perception that HFCVs can contribute to a more environmentally sustainable future.

Notably, a significant number of respondents explicitly concerns regarding the full lifecycle environmental impacts of EVs. Representative concerns included: “high energy consumption and heavy metal pollution during battery production,” “environmental risks associated with end-of-life battery disposal,” and “the absence of local recycling infrastructure in Hong Kong”. This suggests that respondents possess a degree of background knowledge regarding the environmental challenges associated with EVs. Conversely, a lack of similar concerns regarding HFCVs may indicate a limited understanding of HFCV technology, hindering the ability to accurately assess its potential environmental impacts on human society. In contrast, a greater proportion of respondents expressed a belief that hydrogen energy can potentially mitigate global warming, while more individuals also agreed that increased electricity usage can reduce dependence on fossil fuels. This disparity may stem from a lack of sufficient knowledge among respondents regarding the complexities of electricity and hydrogen generation processes.

4.2.2 Perception relevant to Vehicles

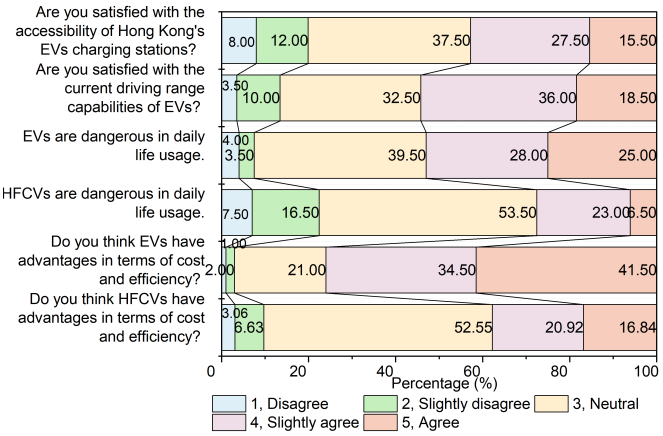

Fig.5 Respondents' views on HFCVs and EVs

Figure 5 shows that survey respondents in Hong Kong reported higher satisfaction with the current driving range of EVs compared to their satisfaction with the accessibility of charging stations. This difference indicates that EVs generally meet users' range needs for daily commuting, with the average EV in Hong Kong offering around 375 km per charge—sufficient for typical urban travel in Hong Kong [34,35].

However, expanding the charging infrastructure in Hong Kong remains critical to enhancing customer satisfaction. Results indicate that a higher proportion of respondents perceive EVs as more dangerous in daily life compared to HFCVs. This perception likely stems from media coverage disproportionately highlighting battery fires. Beyond media reports, official statistics gathered by sector-specific agencies highlight the prevalence of lithium-ion battery (LIB) fires. In China, the largest EVs market globally, an average of 31 LIB fires occur annually, with the primary cause being sudden ignition at 36.9%, followed by charging-related incidents at 26.2% [36] . In the United States, there were 17 fire incidents involving Tesla vehicles out of a total of 350,000 reported cases, as well as 3 fire incidents involving BMW i3 vehicles from 175,000 cases [36,37]. Additionally, over half of the respondents expressed neutral views on the safety of HFCVs, reflecting limited public familiarity with this emerging technology. Most markets including Hong Kong have not seen HFCVs become widespread because they remain scarce in the market. The limited exposure to HFCVs makes it difficult for people to evaluate risks because they lack experience with hydrogen flammability.

The survey data shows that EVs remain the preferred choice for consumers because 75% of participants found them cost-effective and efficient while 60% of participants showed willingness to pay. EVs achieve tank-to-wheel efficiency between 60% to 80% which outperforms conventional vehicles at 20% to 35% while their charging expenses remain lower because electricity prices are typically cheaper than gasoline or diesel [38]. But interestingly, half of the respondents expressed uncertainty regarding the cost and efficiency advantages of HFCVs. The lack of commercial HFCVs in Hong Kong market and insufficient public knowledge about HFCVs leads to this situation. The difference in perception between EVs and HFCVs shows that people choose EVs because of their practical advantages and government support yet they view HFCVs as desirable without fully understanding their benefits which requires specific educational initiatives and market expansion to enable smart purchasing decisions.

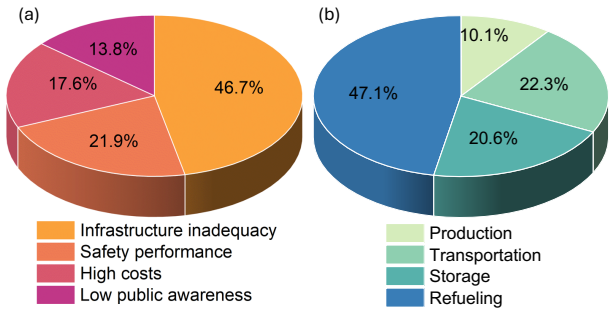

Fig.6 (a) Respondents' views on the development barriers of HFCVs. (b) Respondents' views on the potential hazards in the HFCVs

The commercialization of HFCVs faces significant challenges, as reflected in respondents' views (Figure 6(a)). The market adoption of HFCVs faces major challenges because of technical restrictions that stem from needing imported core components such as membranes and noble catalysts and because of material durability concerns and underdeveloped hydrogen supply systems. The market adoption of HFCVs faces significant challenges because hydrogen production systems and transport networks and storage facilities and refueling stations are not adequately developed. The high vehicle prices together with restricted hydrogen supply networks create major challenges for market penetration. To address these issues and promote HFCV adoption, developed countries such as the USA, Britain, Germany, Norway, and Canada have undertaken long-distance demonstration projects [39]. Additionally, while improvements in infrastructure are underway, if the price of hydrogen remains substantially higher than that of gasoline and diesel for equivalent energy, the market positioning of HFCVs will continue to focus on promoting environmental benefits primarily to consumers with

higher purchasing power. The survey reveals a distinct public prioritization of barriers shown in Figure 6 (a). Notably, 89% of respondents expressed confidence that government subsidies targeting cost reduction would accelerate HFCVs adoption. However, nearly 50% of respondents confirm inadequate infrastructure as the foremost barrier for HFCVs. This finding underscores the necessity for coordinated government-industry investment to establish a robust hydrogen network prior to commercial rollout, ensuring baseline convenience for potential buyers. In addition, more people are caring about the safety issue instead of the cost. Safety concerns surpass cost considerations as the dominant consumer apprehension.

Analysis of survey data reveals a notable divergence in public risk perception, reflecting prevalent safety concerns surrounding HFCVs applications. Specifically, hydrogen refueling stands as the main safety concern (47%) which exceeds all other risks including transportation (22%), storage (21%) and production (10%). The public focuses on hydrogen refueling risks disproportionately because they lack sufficient knowledge about the hydrogen industry instead of understanding actual risk distribution. The hydrogen energy industry operates through all stages of the value chain which includes production in the upstream sector followed by storage and transportation in the midstream sector and hydrogen application in various sectors including mobility through fuel cell vehicles in the downstream sector [40].

Regarding the hydrogen refueling process, the Hong Kong government has established a comprehensive set of safety standards, which are based on various references including ISO 19880 [41], GB 50156-2021 [42], and NFPA 2 Hydrogen Technologies Code (The National Fire Protection Association) [43]. In addition, the Hong Kong government created specific rules for hydrogen filling station placement and operational requirements which match the local needs of Hong Kong. The Code of Practice states that hydrogen filling stations need to find their locations on main roads that allow safe hydrogen tube trailer transport or positions which provide direct access from main roads without entering densely populated zones. The minimum distance requirements for hydrogen filling stations from surrounding land uses include 25 meters for low-density residential areas and incidental and commercial and industrial and recreational zones and 50 meters for high-rise residential buildings and educational institutions and hospitals [44]. The safety and risk assessment requirements for Hong Kong's dense population and unique terrain are incorporated into these standards to protect the local environment. The technical nature of these standards makes them difficult for non-experts to understand because they focus on refuelling station operations. Most survey participants did not believe that existing safety standards made hydrogen refueling operations appear safer because they failed to understand the technical details. The public continues to recognize the dangers of refueling because it remains the only step in the process which consumers can observe directly. The public shows limited understanding about the complete hydrogen lifecycle because they lack knowledge about production methods and transport systems and storage facilities and their corresponding safety risks. The knowledge gap between public understanding and technical expertise leads to an uneven distribution of risk perception which makes people focus on the most visible interface. The public needs better education about complete hydrogen system operations to modify their safety concerns and support evidence-based safety discussions.

4.3 Acceptance

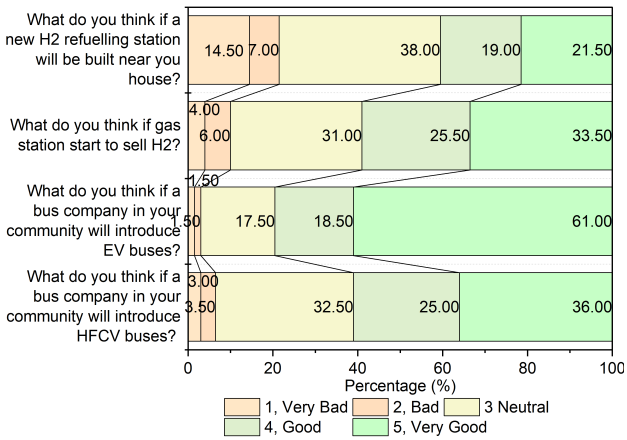

Fig.7 Respondents' acceptance of hydrogen station and HFCVs

Figure 7 indicates reveals a significant Not In My Backyard (NIMBY) effect regarding hydrogen infrastructure in Hong Kong. The survey shows that people oppose hydrogen refueling stations at a rate of 10% but this number increases to 21.5% when these facilities are built near residential areas. The survey data shows that people have conflicting views about hydrogen refueling stations because 40% of participants worry about safety but 40% support the installation of such facilities near their homes. The survey results

indicate that safety worries exist among the public, but they do not automatically lead to opposition because some people evaluate advantages against potential risks.

This locational sensitivity contrasts sharply with EV infrastructure acceptance, where 61% support introducing electric buses in their communities, a figure closely aligned with the proportion WTP EVs (60%). The acceptance gap becomes more pronounced for HFCV buses adoption, with community support dropping to just 36%. Notably, a persistent 30-40% of respondents maintain a neutral position about hydrogen technologies throughout all survey questions which demonstrates a critical knowledge barrier. The market potential of HFCVs in Hong Kong remains strong but the public's lack of understanding about these vehicles creates significant barriers to their adoption that go beyond conventional infrastructure challenges.

5. CONCLUSIONS

Hong Kong is committed to achieving a zero-carbon society by mid-century. Emerging transportation technologies such as HFCVs will play a key role in decarbonizing the transportation sector by replacing vehicles based on fossil fuels. As a key driver of this transition, public understanding of HFCV technology is crucial to promoting its widespread adoption and integration into Hong Kong's transportation landscape. This study aims to assess the public's knowledge, awareness, and acceptance of HFCVs in Hong Kong, using EVs as a comparative benchmark. By analyzing survey data, the research aimed to identify key barriers and opportunities for HFCV promotion, including the influence of technological familiarity, risk perceptions, and infrastructure readiness.

The analysis reveals critical asymmetries in public understanding and market readiness. Awareness of EVs (77.5%) is much higher than HFCV familiarity (26.0%), with 27.5% completely unaware of HFCV technology. Despite minimal HFCV driving experience (1.5%, primarily industry-limited), 18% expressed purchase intent. In addition, the public understanding on the large-scale adoption of EVs and HFCVs diverges: EVs dominate passenger vehicle projections, while HFCVs show stronger heavy-duty potential (e.g., buses/truck) due to range/refueling advantages. Risk perceptions exhibited spatial contradictions: 40% expressed general hydrogen safety concerns, yet 40% accepted local refueling stations. Crucially, infrastructure gaps (cited by 50%) and safety uncertainties (47% prioritizing refueling risks) outweighed cost barriers of HFCVs, despite 89% believing subsidies would accelerate adoption of HFCVs.

These findings highlight the pressing socio-technical challenges facing Hong Kong's hydrogen transition, particularly the lack of public understanding of HFCVs, which may lead to misjudgment of their potential for transport decarbonization. The gap between public perception and technical feasibility highlights a critical knowledge gap that requires targeted intervention. To address this issue, policymakers should (1) expand HFCV infrastructure to ensure scalability and accessibility; and (2) implement a public engagement program, including safety demonstrations and experiential learning opportunities, to alleviate public concerns and enhance public hands-on experience with HFCVs. By bridging this gap, such measures can foster informed public acceptance and accelerate the integration of HFCVs into Hong Kong's mobility systems. This research provides a roadmap for transforming Hong Kong's latent HFCVs receptivity into tangible decarbonization outcomes.

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REFERENCE

[1] Environment and Ecology Bureau. The Hong Kong's Climate Action Plan 2050. 2021.

[2] Environment Bureau. Hong Kong Roadmap On Popularisation Of Electric Vehicles. 2021.

[3] Hong Kong Quality Assurance Agency. Green Bond Report 2024. HKSAR of the People's Republic of China; 2024.

[4] The Government of the HKSAR. The Chief Executive's 2024 Policy Address. 2024.

[5] First Registration Tax Concessions for Electric Vehicles. Transport Department 2018. https://www.td.gov.hk/en/public_services/licences_and_permits/vehicle_first_registration/new_frt_concessions_for_electric_vehicles_2018/index.html.

[6] EMSD. Proposed Amendments to the Gas Safety Ordinance (Cap. 51). 2024.

[7] Environment and Ecology Bureau, Transport and Housing Bureau, Food and Health Bureau, Development Bureau. Clean Air Plan for Hong Kong 2035. 2021.

[8] Transport Department. The Annual Traffic Census 2023. n.d.

[9] Air Science and Modelling Group, Environmental Protection Department, The Government of the Hong Kong Special Administrative Region. 2022 Hong Kong Emission Inventory Report. n.d.
[10] Temple Water. Bravo Transport launches #MissionZero campaign and unveils Hong Kong's first electric double-decker bus 2022. https://www.templewater.com/news/bravo-transport-launches-missionzero-campaign-and-unveils-hong-kongs-first-electric-double-decker-bus.
[11] Wang Zhan. Green transition: Hong Kong rolls out first hydrogen bus. China Daily 2023. https://www.chinadailyhk.com/hk/article/364169#Green-transition%3A-Hong-Kong-rolls-out-first-hydrogen-bus-2023-11-30.
[12] Duta R. Hong Kong Electric Vehicle Market Insights 2025. Mishcon de Reva Group 2025. https://mdr-i.com/hong-kong-electric-vehicle-market-insights-2025/.
[13] GlobeNewswire. Hong Kong Electric Vehicle Charging Stations Market Forecasts Report 2024-2029: Growth Opportunities, Challenges, Supply Chain Outlook, Regulatory Framework, Customer Behaviour, and Trend Analysis November2024. https://www.globenewswire.com/news-release/2024/11/11/2978416/28124/en/Hong-Kong-Electric-Vehicle-Charging-Stations-Market-Forecasts-Report-2024-2029-Growth-Opportunities-Challenges-Supply-Chain-Outlook-Regulatory-Framework-Customer-Behaviour-and-Tren.html.
[14] The International Energy Agency. Global EV Outlook 2023 April2023. https://www.iea.org/reports/global-ev-outlook-2023.
[15] Colin McKerracher(2025). Electric Vehicle Outlook 2025. BloombergNEF 2025. https://about.bnef.com/insights/clean-transport/electric-vehicle-outlook/.
[16] Harichandan S, Kar SK. An empirical study on consumer attitude and perception towards adoption of hydrogen fuel cell vehicles in India: Policy implications for stakeholders. Energy Policy 2023;178:113587. https://doi.org/10.1016/j.enpol.2023.113587.
[17] Chi Y, Xu W, Xiao M, Wang Z, Zhang X, Chen Y. Fuel-cycle based environmental and economic assessment of hydrogen fuel cell vehicles in China. Energy 2023;282:128773. https://doi.org/10.1016/j.energy.2023.128773.
[18] Li H, Welsh R, Morris A. Emergency responders' perceptions of Hydrogen Fuel Cell Vehicle: A qualitative study on the U.K. fire and rescue services. International Journal of Hydrogen Energy 2021;46:32750–61. https://doi.org/10.1016/j.ijhydene.2021.07.146.
[19] Singh M, Singla MK, Safaraliev M, Singh K, Odinaev I, Abdel Menaem A. Advancements and challenges of fuel cell integration in electric vehicles: A comprehensive analysis. International Journal of Hydrogen Energy 2024;88:1386–97. https://doi.org/10.1016/j.ijhydene.2024.09.212.
[20] Offer GJ, Howey D, Contestabile M, Clague R, Brandon NP. Comparative analysis of battery electric, hydrogen fuel cell and hybrid vehicles in a future sustainable road transport system. Energy Policy 2010;38:24–9. https://doi.org/10.1016/j.enpol.2009.08.040.
[21] Yan J, Zhao J. Willingness to pay for heavy-duty hydrogen fuel cell trucks and factors affecting the purchase choices in China. International Journal of Hydrogen Energy 2022;47:24619–34. https://doi.org/10.1016/j.ijhydene.2022.03.252.
[22] Sovacool BK, Axsen J, Sorrell S. Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design. Energy Research & Social Science 2018;45:12–42. https://doi.org/10.1016/j.erss.2018.07.007.
[23] Itaoka K, Saito A, Sasaki K. Public perception on hydrogen infrastructure in Japan: Influence of rollout of commercial fuel cell vehicles. International Journal of Hydrogen Energy 2017;42:7290–6. https://doi.org/10.1016/j.ijhydene.2016.10.123.
[24] Khaleel M, Nassar Y, El-Khozondar HJ, Elmnifi M, Rajab Z, Yaghoubi E, et al. Electric Vehicles in China, Europe, and the United States: Current Trend and Market Comparison. Int J Electr Eng and Sustain 2024:1–20.
[25] Yan H, Liu Z, Zhou C, Liu L, Li X, Xue B, et al. Can hydrogen fuel cell bus facilitate carbon neutrality in the transportation sector? Transportation Research Part D: Transport and Environment 2025;144:104754. https://doi.org/10.1016/j.trd.2025.104754.
[26] Li Y, Kimura S. Economic competitiveness and environmental implications of hydrogen energy and fuel cell electric vehicles in ASEAN countries: The current and future scenarios. Energy Policy 2021;148:111980. https://doi.org/10.1016/j.enpol.2020.111980.
[27] Karson. What is an Electric Bus? February2023. https://www.karsan.com/en/blog/e-mobility/what-is-an-electric-bus#.
[28] Thomas CE. Fuel cell and battery electric vehicles compared. International Journal of Hydrogen Energy

2009;34:6005–20. https://doi.org/10.1016/j.ijhydene.2009.06.003.
[29] Kromer MA. Electric powertrains : opportunities and challenges in the US light-duty vehicle fleet. Thesis. Massachusetts Institute of Technology, 2007.
[30] Morrow K, Karner D, Francfort J. Plug-in Hybrid Electric Vehicle Charging Infrastructure Review. Idaho National Laboratory; 2008.
[31] Riedl SM. Development of a Hydrogen Refueling Station Design Tool. International Journal of Hydrogen Energy 2020;45:1–9. https://doi.org/10.1016/j.ijhydene.2019.09.234.
[32] Zhu J, Sun K, Jia S, Li Q, Hou X, Lin W, et al. Urban Traffic Density Estimation Based on Ultrahigh-Resolution UAV Video and Deep Neural Network. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 2018;11:4968–81. https://doi.org/10.1109/JSTARS.2018.2879368.
[33] Wu J. Hong Kong to replace its 70% Citybus fleet with FCEVs. China Hydrogen Bulletin 2024. https://chinahydrogen.substack.com/p/hong-kong-to-replace-its-70-citybus (accessed August 27, 2025).
[34] Range of full electric vehicles. Electric Vehicle Database n.d. https://ev-database.org/cheatsheet/range-electric-car.
[35] Pearre NS, Kempton W, Guensler RL, Elango VV. Electric vehicles: How much range is required for a day's driving? Transportation Research Part C: Emerging Technologies 2011;19:1171–84. https://doi.org/10.1016/j.trc.2010.12.010.
[36] Bravo Diaz L, He X, Hu Z, Restuccia F, Marinescu M, Barreras JV, et al. Review—Meta-Review of Fire Safety of Lithium-Ion Batteries: Industry Challenges and Research Contributions. J Electrochem Soc 2020;167:090559. https://doi.org/10.1149/1945-7111/aba8b9.
[37] Victor Chombo P, Laoonual Y, Wongwises S. Lessons from the Electric Vehicle Crashworthiness Leading to Battery Fire. Energies 2021;14:4802. https://doi.org/10.3390/en14164802.
[38] Cerdas F, Titscher P, Bognar N, Schmuch R, Winter M, Kwade A, et al. Exploring the Effect of Increased Energy Density on the Environmental Impacts of Traction Batteries: A Comparison of Energy Optimized Lithium-Ion and Lithium-Sulfur Batteries for Mobility Applications. Energies 2018;11:150. https://doi.org/10.3390/en11010150.
[39] He C, Sun H, Xu Y, Lv S. Hydrogen refueling station siting of expressway based on the optimization of hydrogen life cycle cost. International Journal of Hydrogen Energy 2017;42:16313–24. https://doi.org/10.1016/j.ijhydene.2017.05.073.
[40] Pingkuo L, Junqing G. Comparative analysis on the development potential of green hydrogen industry in China, the United States and the European Union. International Journal of Hydrogen Energy 2024;84:700–17. https://doi.org/10.1016/j.ijhydene.2024.08.298.
[41] The International Organization for Standardization. ISO 19880-1:2020 Gaseous hydrogen-Fuelling stations. March2020.
[42] Ministry of Housing and Urban-Rural Development of the People's Republic of China. GB 50156-2021 Technical standard of fuelling station. 2021.
[43] The National Fire Protection Association (2023). NFPA 2, Hydrogen Technologies Code 2023. 2023.
[44] Electrical and Mechanical Service Department. Code of Practice for Hydrogen Filling Stations. 2024.