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EUBIP Position Paper

European Automotive
Council (EAC)
of the European Chamber of Commerce
in Hong Kong

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Introduction

The European Chamber of Commerce Automotive Council (EAC) represents the European passenger car and commercial vehicle (CV) manufacturers in Hong Kong. It aims to bring forward proposals and be a partner to the Government of the Hong Kong Special Administrative Region, working together towards a safer, greener, more efficient and more competitive automotive sector. Members of the Council are European vehicle manufacturers, their subsidiaries and/or representative offices. This Position Paper expresses the common work and views of the members of the EAC and aims to lead to overall improvements in the target areas.

1 Regulations Inhibiting Future Technology

Digitalization has become a part of everyday life. Substantial Research & Development (R&D) is being invested in the features of connected vehicles, including digital service offers, Vehicle-to-X communication, navigation and driving safety assistance features. The purpose of these is to improve the safety, efficiency and comfort of driving today, and in the future.

However, to realize the benefits of connected vehicles, access to information and regulations allowing the use of the same, is needed. Since many features of connected driving and digitalization are new, this calls for substantial updates of previous regulatory frameworks. While progress is well underway on some continents, such as Europe and North America, Hong Kong is risking to lag behind. The existing regulations require updating as they do not allow for the existing, nor the future, technology to be fully realized in the market.

1.1. In-vehicle Digital Displays

Built-in vehicle displays are not a new concept, with the round dials displaying fuel level, vehicle conditions and speed being features as old as the modern car itself. However, with the new technology available on the market, the high resolution digital displays are able to provide far more information. The displays serve the purpose of keeping the driver updated on the vehicle as well as road conditions with features such as navigation and reversing camera. With the possibility of connecting devices directly to the vehicle system, drivers can enjoy the information they need behind the steering wheel without the risks of having to operate a phone, headset or other external device. This results in more control and less distraction.

1.1.1. In-vehicle Displays in Hong Kong

In-vehicle visual displays in Hong Kong come under regulation 37 of the Road Traffic Regulations. The regulation prohibits any person from installing a visual display unit on a motor vehicle at any point forward of the driver's seat or where the screen is visible to the driver whilst in the driving seat, unless those visual images give information about the current state of the vehicle or are solely for the purpose of navigation. This regulation has been in effect since 1984[1] and the only amendment made dates back to 2000.[2]

In 2011, the Transport Department (TD) published a set of guidelines for the installation of visual display units in a vehicle.[3] Apart from the legal restrictions, the guideline stressed the importance of the location of the displays. Displays showing information other than navigation, road conditions or vehicle conditions, should not to be visible to anyone in the driver's seat. The installation of the display should not disrupt the system of the vehicle or other passengers, which would cause safety hazards.

1.1.2. In-vehicle Displays in European Union

The European Union (EU) allows visual displays to be installed in vehicles under certain regulations. In 2006, the EU updated its principle regarding human-machine interface (HMI) for in-vehicle information and communication systems.[4] In 2007, the EU published the official statement of principles.[5] The new principles promote the introduction of well-designed systems into the market by balancing potential benefits and associated risks, aiming to encourage innovation within the industry.

With well-defined and detailed regulations, the road safety in the EU did not decline after allowing certain visual displays in vehicles. Therefore in the EU, it is already allowed to have full infotainment functions, including internet access, social media apps, and mirroring function of smartphone display. On the contrary, almost everything except navigation or map information is prohibited to be visually displayed in Hong Kong. Those features are nevertheless permitted in Macau.

1.2. Connectivity of Vehicles

1.2.1 The Existing Technology

Intelligent Transport Systems (ITS) describes technology which allows vehicles to become connected to each other, to the infrastructure, to other parts of the transport network, including telematics and all types of communications in vehicles, between vehicles (e.g. Vehicle-to-Vehicle), and between vehicles and fixed locations (e.g. Vehicle-to-Infrastructure,

Vehicle-to-X).[6] Information and Communications Technology (ICT) is a key enabler of connected vehicles. In order to allow for the vehicle systems to access relevant data for ITS use, there is a need for centralized traffic information being provided by the Government, and regulations allowing for back-end systems to access the data.

Connectivity features of vehicles have the possibility to improve road safety and traffic flow dramatically. Vehicle-to-Vehicle communication features enable vehicles to transmit and receive information from surrounding vehicles, which means that drivers can, for example, be made aware of traffic tailbacks, emergency vehicles approaching, wrong-way drivers, accidents and other occurrences that will affect their journey even before visual perception is possible. Furthermore, Vehicle-to-Infrastructure communication enables the sharing of information which can substantially improve the planning of driving. By receiving information about real-time traffic information and parking space information the vehicle system can provide drivers with updated navigation-routes to optimize the traffic flow and as a result decrease time spent on the road.

Another technology following this ambition is used in "Smart traffic lights", that allows traffic lights to adapt to vehicles' speeds and coordinate with the public transportation vehicles. The signals communicate with each other and adapt to changing traffic conditions to reduce the amount of time that vehicles spend idling while giving priority to public transport. By doing so, fuel consumption, air pollution, and carbon dioxide (CO_2) emissions from vehicles are all reduced.

1.2.2. Connectivity of Vehicles in Hong Kong

The Hong Kong Government is committed to promoting the development of a smart city, and has laid the foundation for ICT applications in traffic management with the Trade and Industry Department programme. On the other hand, there do not yet appear to be overall strategies or implementation plans for smart city development, nor has there been large-scale publicity. Strategies for providing consolidated real-time traffic information and route guidance to road users, are still at a preliminary stage. Public-private cooperation and business initiatives appear hindered with, for example, reports that restrictions have been encountered in launching applications for parking guidance.[7]

A 423 million USD ITS development project was initiated in 2001, with the objective to improve the traffic management and control systems on Hong Kong's territory-wide road network. The functions of the ITS project include traffic management, monitoring, data analysis and control activities. Various programs have been enacted to achieve these goals. A Traffic Management and Information Centre was set up, which includes a traffic information system that sends information wirelessly to electronic road signs, display boards, mobile phones, pagers and in-vehicle navigation systems.[8] Although the ITS has been in place in Hong Kong for the past two decades, the project was unable to deliver the desired

results as most of the applications were single purpose systems and confined to small scale operations only.[9] For instance the application HKeRouting, developed with the purpose of providing driving routes, real time traffic condition and parking information, doesn't have the expected reviews and should have more potential than seen today amongst drivers in Hong Kong.

Public Sector Information (PSI) is the information produced, collected and disseminated by the Government and public bodies. The Government introduced the Data.Gov.HK-portal (previously Data.One-portal) in March 2011 to create a central platform for disseminating PSI in machine-readable formats to facilitate value-added re-use. Many mobile applications have been developed using the portal as data source. The most popular dataset, with over 700,000 daily downloads recorded to date, is the traffic snapshot data. The snapshot data provides real-time road traffic information and thus lends itself well to helping Hong Kong drivers to plan and optimise their car journey routes. The Government has also opened up another 11 categories of PSI, and is aiming for more.[10]

ICT is not only a key enabler underpinning Hong Kong's thriving economy; it is also taking shape as an economic sector in its own right. The 78,000 strong workforce constitutes roughly only 2% of the total labour force, but contributes around 6.1% of Hong Kong's GDP.[11] In its World Competitiveness Yearbook, the International Institute for Management Development ranked Hong Kong first in technological infrastructure in both 2012 and 2013. The Internet connection speeds and broadband and mobile penetration rates at 85% and 231% are among the highest in the world.

1.2.3. Connectivity of Vehicles in European Union

The European Commission has decided to take a more prominent role in the deployment of cooperative systems. To that end, a Cooperative Intelligent Transport Systems (C-ITS) Deployment Platform was set up in 2014. One example of an activity covered by the Platform is to ensure the possibility of disseminating C-ITS related information to all transportation users through stimulating the coverage of cellular communications to support connected & automated driving.

The Platform was conceived as a cooperative framework divided in working groups, whereby each working group is working on specific topics such as safety, data protection and privacy. Those groups include national authorities, C-ITS stakeholders, the Commission, representatives of the Member States and experts from the concerned organisations (such as the European Automobile Manufacturers Association, with a view to developing a shared vision on the interoperable deployment of C-ITS in the EU.[12]

The European Telecommunications Standards Institute (ETSI) and European Committee for Standardization (CEN) cooperation on intelligent transport is leading the drive to achieve global standards for C-ITS. Applications include road safety, traffic control, fleet and freight management and location-based services, providing driver assistance and hazard warnings and supporting emergency services.[13] CEN and ETSI confirmed in the 6th ETSI workshop on ITS in Berlin that the basic set of standards for C-ITS have been adopted and issued in the EU. Developed by CEN and ETSI, the 'Release 1 specifications' was acceptable for test installations. Under 'Release 1', vehicles made by different manufacturers could communicate with each other and with the road infrastructure systems.[14] Presently, a working group of C-ITS experts is working on a "Release 2 set'. This Set has special focus on the needs of road administrations and cities, and will include new standards, as well as updates to the current standards.

The EU is moving forward and trying to find a way to push for global adoption of those standards. To do so, C-ITS International Harmonisation Task Group 6 met between January 2014 and July 2015 with the objective to develop a security policy framework for C-ITS that identifies the key areas for harmonisation across jurisdictional and international boundaries.

The European Council for Automotive R&D (EUCAR) is membered by major European passenger car and CV manufacturers. EUCAR facilitates and coordinates pre-competitive research and development projects while its members participate in a wide range of collaborative European R&D programmes.[15] The council's strategic vision for the Safe and Integrated Mobility domain consists of four vertical themes. The theme 'Travel/Transport System' is described as "an integrated system that provides comprehensive real-time actionable data, facilitates modal transitions and manages traffic for maximum mobility, efficiency and optimum use of infrastructure". For the theme 'Traffic Efficiency,' the goal is "Substantially increased efficiency of passenger and goods traffic measured by time available for other purposes, consumption of individual vehicles and whole-system efficiency." The theme 'Safety' is targeting "Reduction in the number of accidents, fatalities and injuries, contributing to the fulfilment of future EU guidelines, targets and regulations and to meeting increasing customer demands for safe road transport." And finally the theme 'Value Added Customers Service' intends to achieve a "Substantial and growing revenue from services (further metric to be identified)."[16]

1.2.4. The Global Connected Car Industry

Technological features have driven the automotive sector for decades, which resulted in high market growth for the connectivity in vehicles. This has the potential to significantly alter the competitive landscape. Consumers are increasingly looking for solutions that allow them to stay connected digitally, and governments are promoting and supporting these campaigns, as we can see in the following examples.

Germany[17]

Germany, as one of the driving economies of the EU, is also trying to move forward with the promotion and exploitation of the new technologies regarding the vehicle fleet.

In 2016, revenues in the German "Connected Car" market amounts to 3,021.7 million USD. Revenues are expected to show an annual growth rate (CAGR 2016-2020) of 26% resulting in a market volume of 7,641 million USD in 2020. The Connected Car penetration is at 6.7% in 2016 and is expected to hit 26% in 2020. The market's largest segment is the segment "Safety & Driving Assistance" with a market volume of 1,821 million USD in 2016.

Hong Kong

In 2016, revenues in Hong Kong's "Connected Car" market amounts to 43.5 million USD. Revenues are expected to show an annual growth rate (CAGR 2016-2020) of 34% resulting in a market volume of 144 million USD in 2020. The Connected Car penetration is at 6.5% in 2016 and is expected to hit 26% in 2020. The market's largest segment is the segment "Safety & Driving Assistance" with a market volume of 28 million USD in 2016.[18]

Already having one of the world's most developed technological infrastructures there is great potential for Hong Kong to take the lead as a lighthouse for the connected vehicles market. Infrastructure and databases to provide the relevant data are already in place. To realize the possibility of introducing connected vehicles in Hong Kong, the EAC recommends that the Hong Kong Government must develop a strategy for centralized information and allow for manufacturers to access the existing data.

1.3.1. Driving Assistance and Safety Features in Hong Kong

Despite the Hong Kong Government being publicly open for new innovations, the current unclear regulations restrict driving assistance features that essentially would help improve road safety. Under Hong Kong's Road Traffic Ordinance (CAP 374 Part 7[19]), a driver who gets into an accident with Autopilot engaged, could face prosecution and the possibility that his or her insurer would not cover costs from a collision.[20] Since the legal framework does not cover new technologies such as semi-autonomous or autonomous vehicles, it presents difficulties for the automotive industry's rapid development of new autonomous driving technologies, as well as challenges for insurance companies who base their policies on the law.[21] With regard to approval processes for new technologies against this regulatory backdrop, the TD's stance has been summarized in a press statement: "According to the Road Traffic Ordinance, Chapter 374 of the Laws of Hong Kong and its subsidiary legislation, all alterations affecting vehicle or road safety (including software updates) need to be approved by

TD, to confirm they meet the required safety standard, before they can be installed on the vehicle. Otherwise, the vehicles may be deemed to be not roadworthy."[22]

1.3.2. Autonomous Drive in European Union

As part of Horizon 2020, ERTRAC (European Road Transport Research Advisory Council) has adopted the International Society of Automotive Engineers definition of automated vehicles with typologies ranging from Level 0 (no automation) to Level 5 (full automation) depending on the functions offered.[23] In 2014, ERTRAC established a task force with stakeholders and experts from its member associations and individual members to define a joint roadmap for Automated Driving.

The biggest challenges faced today are adapting regulations for Pan-European testing in the short-term, and regulations in the medium- to long-term, especially with regard to Level 4/5 automated vehicles. Decisions have to be made with respect to how the safety of automated vehicles should be tested and by whom.[24] Responsibility and liability of stakeholders, including automotive manufacturers, automotive suppliers, road users, insurance companies, road and traffic authorities, the EU Member States among others[25], and appropriate safety requirements will need to be established. Furthermore, traffic rules and regulatory frameworks will need to be adapted. The further development of vehicle automation will demand a reform of driving education and licensing.

ECE Regulation no. 79 has been the primary regulatory hurdle for the type approval of automated vehicles in Europe.[26] An "Advanced Driver Assistance Steering System" is allowed to control steering only if the driver remains in primary control of the vehicle at all times, according to paragraph 2.3.4. In addition, the system must be designed such that "the driver may, at any time and by deliberate action, override the function" (paragraph 5.1.6.). Due to the likely fact that automated activation was not considered when the regulation was created, the need to adapt this regulation has been widely recognized. The EU Member States are already acting within their own jurisdictions, but fragmented regulatory approaches are likely to hinder implementation and jeopardize European competitiveness. The main objective now is to reach a harmonized regulatory approach for automated driving at EU-level, supporting innovations for safe, efficient and clean transport. Therefore, in order to follow up with the recent developments, Hong Kong could benefit from a close following of that harmonization.

1.4. Recommendations

The EAC asks that the Hong Kong Government and where applicable the European Commission consider the following recommendations:

On-board Visual Displays

- The Hong Kong Government should update regulation 37 of the Road Traffic Regulations, as well as the Legislative Regulation and Guidelines over the Installation of Visual Display Unit (TV Screen) in a Vehicle to allow modern in-car displays.
- One way to achieve that is to adopt the European Commission recommendation on safe and efficient in-vehicle information and communication systems: update of the European Statement of Principles on HMI (2008/653/EC).

Connectivity

- In order to create a truly Smart City, to increase traffic efficiency and to enhance the road safety, Hong Kong should implement an overall strategy on intelligent traffic systems by utilizing different applications of ITS.
- One way to achieve this is to adopt Cooperative Intelligence Transport Systems (C-ITS), 'Release 1 specifications' developed by CEN and ETSI.

Autonomous Drive Features

The EU is encouraged to keep pace with technology developments, in particular regarding ECE Regulation no. 79, so as to allow the use of automated features in passenger cars.
The Hong Kong Government is encouraged to follow the progress in the ECE and EU regulations and revise the Hong Kong Road Traffic Ordinance (CAP 374 Part 7) in a timely fashion to reflect the latest developments

2 Greener Transportation including Electrical Mobility

In using the Intergovernmental Panel on Climate Change method of calculation, Hong Kong annual greenhouse gas (GHG) emissions ranged from 33.3 to 43.1 million tonnes of CO_2 over the period from 1990 to 2012.[27] The major local sources for emission are electricity generation followed by local transportation.

Electrical Vehicles (EVs) do not emit directly but indirectly, through power generation emissions. In Hong Kong the carbon intensity of the fuel mix of electricity generation and power station emissions are hindering the environmental friendliness of EVs. Currently, 53% of the fuel mix in Hong Kong is comprised by coal and 22% from natural gas, both fossil fuels,

with less than 2% of renewable energy sources.[28] Power generation Nitrogen Oxides (NOx) emissions can actually be greater for an EV than an equivalent petrol car while there is little significant reduction in CO_2 emissions. It is true that the NOx emissions are moved from the roadside to the power station but, during the research for the Government's Clean Air Plan, it was found that vehicles account for less than 3% of NOx emissions from vehicles.[29] It can therefore be discussed if this benefit is significant.

The research found the major contributors of NOx and Particulate Matter (PM) emissions to be older CVs. Recognising this the Government of Hong Kong has taken major steps through introducing the scrapping scheme for older CVs. However, the current emissions standard for new CVs in Hong Kong remains EuroV while the standard in Europe is EuroVI. The EuroVI standard gives significant advantages over EuroV with at least a 50% reduction in PM and 80% reduction in NOx. Although a limited incentive is granted to EuroVI purchasers through the Environmentally Friendly Vehicle Scheme (EFVS), the majority of replacement vehicles being purchased are still EuroV. At the same time as the scrapping scheme was introduced, an age limit was set for CVs of 15 years, further disincentivising operators to invest in the more expensive EuroVI vehicles.

The EFVS also incentivises car purchasers to buy EVs. So far the EAC calculates the effect of the current Scheme to be unbalanced towards EVs, while the real benefits would come from encouraging CV operators to buy EuroVI vehicles instead of EuroV. The following illustration shows the findings of the EAC investigation.

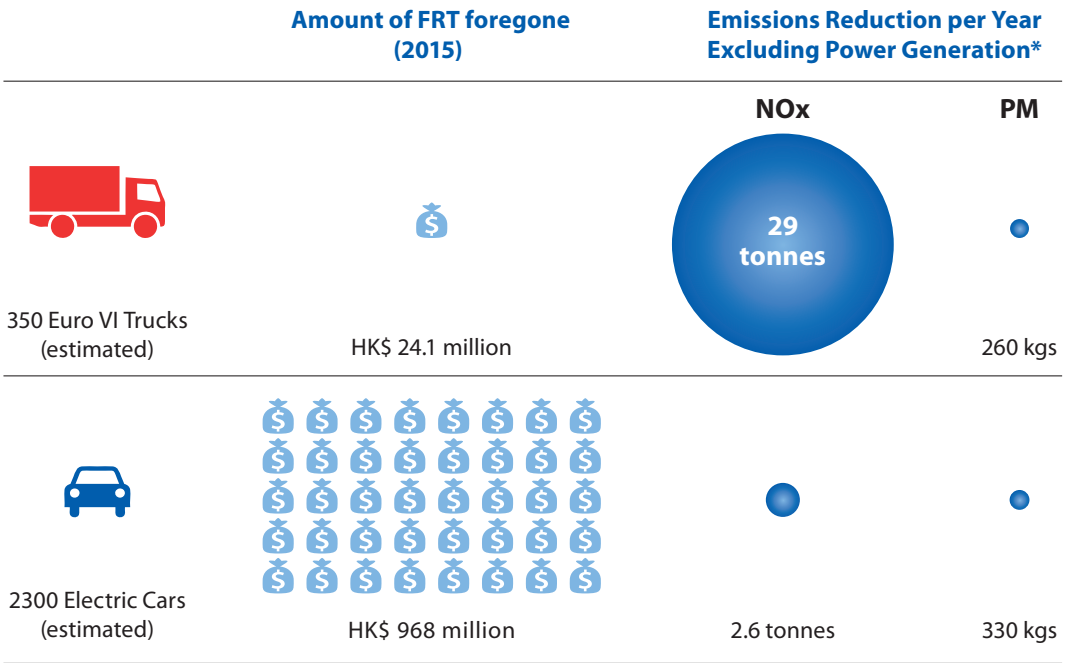

Chart 1: EFVS Results

**When power generation is included, the total NOx emissions were increased through the sale of cars while there was still a small reduction in PM emissions*

2.1. Passenger Cars in Hong Kong

Hong Kong has taken a strong position in the promotion of EVs. Since 2015, the Financial Secretary of Hong Kong has been chairing a Steering Committee on the Promotion of Electric Vehicles, guided by the objective to recommend a measure complemented strategy for the use of EVs in Hong Kong.[30]
Seemingly successful, the EV population has increased dramatically over the last years. As of October 2016 there were 6,860 EVs registered, as compared to less than a 100 at year end 2010.[31]

2.1.1. First Registration Tax (FRT) Waiver for EV

The current EFVS offers a 100% tax exemption of the First Registration Tax (FRT) for EVs. The FRT is imposed at an increasing rate relative to the vehicle value (chart 2).[32]

Vehicle Value	FRT tax rate (% of vehicle value)
0 < HK$ < 150,000	40 %
150,000 < HK$ < 300,000	75 %
300,000 < HK$ < 500,000	100%
HK$ > 500,000	115%

Chart 2: First Registration Tax Waiver for EV, Schedule of Tax Rate Waived

Furthermore, a company that procures EVs is allowed 100% profits tax deduction for the capital expenditure on EVs in the first year of procurement.

While a more significant environmental contribution can be achieved by focusing on encouraging EuroVI CVs to be purchased and operated instead of EuroV, there may be a strategic objective to encourage more EVs. In that case we believe the unique Hong Kong situation together with human nature should be taken into account if the growth in EVs is to continue.

Secretary for the Environment Mr. Wong Kam-sing, commented in 2015 that "since the waiver of FRT for EVs is time-limited, the Government will carefully examine relevant factors such as technological development of EVs, the latest EV market situation, and the drivers' attitude towards EVs when considering whether the waiver arrangement should be continued."[33] The EAC also suggests that the full environmental impact of vehicles (including roadside as well as power plant emissions), customer choice and long-term strategies for recycling and infrastructure are included in this consideration.

2.1.2. Charging Challenges

Even when charging with electricity from fossil fuel power sources, EVs can offer an environmental benefit if they are using off peak power, thereby smoothing the power generation. For this to happen the EVs need to be charged overnight, preferably with smart meters. However, there are so far very few charging opportunities at residences and this is not likely to change significantly in the near future.

Furthermore, car owners expect their vehicles to be ready for use at any time. As of March 2016, there were approximately 1,300 EV chargers, including more than 200 medium chargers in Hong Kong.[34] EVs are often charged at places of work or in public parking locations where spaces are limited and shared, using peak hour electricity. We believe the risk of not being able to find a vacant charging point to charge the car and therefore not having the car available for use when needed is a factor creating resistance to the purchase of EVs. The plug-in hybrid electric vehicle (PHEV) solution takes away that anxiety by offering "on-board" charging for emergency situations. As long as electricity is free or cheaper than petrol, the owners of such vehicles will drive on electric power whenever possible but with the comfort they have the back-up of on-board generation if needed. We therefore see PHEVs as a powerful stepping stone to the change to EVs.

If EVs and PHEVs are being promoted, this needs to go hand in hand with a move to home charging and smart meters to gain the benefits of off-peak charging, while moving in the longer term to clean burning renewable fuels for power generation. To gain the environmental benefits from EVs, PHEVs and indeed other technical solutions available today, we encourage a "roadmap" to be established with emission reduction objectives, working through future power generation fuel mix, alternative vehicle fuels, vehicle types and infrastructure for the new alternatives (be they electric or others).

2.1.3. Targeting Incentives

To gain most environmental benefit from any future incentive, it should not be weighted to vehicles with higher consumption of electricity. As the current scheme waives a progressive FRT tax, this results in the more expensive the car the greater the subsidy, which creates a distortion in favour of larger and more fuel consuming vehicles (Chart 3). This should be avoided in the future.

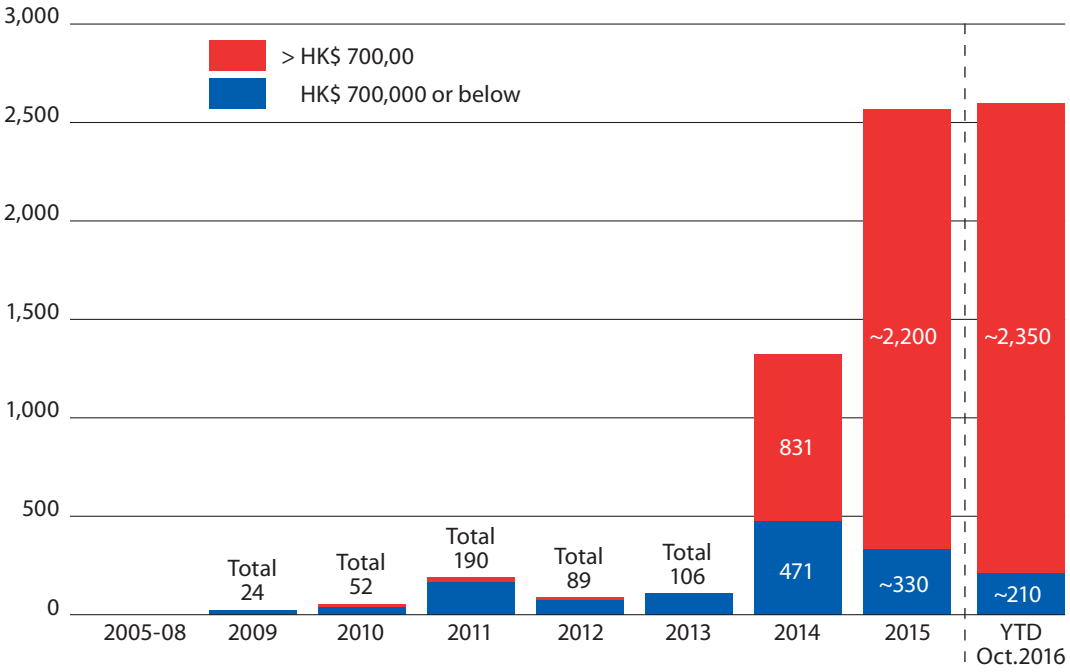

Chart 3: No. of EVs Exempted from FRT by Retail Price

2005-2014: LCQ Annex II, Legislative Council. 2015 and 2016 are estimated figures (~) based on calculations made by the council based on Environmental Protection Department (EPD) figures (http://www.epd.gov.hk/epd/english/environment)inhk/air/prob_solutions/promotion_ev.html (accessed December 2016))
Note: incl. PC and CV, excl. special purpose and government vehicles

2.1.4. Battery Recycling and Disposal

Battery disposal from EVs also needs to be considered and it falls under the Waste Disposal Ordinance and the Waste Disposal (Chemical Waste) (General) Regulation.[35] Waste car battery collectors and disposal facilities must be licensed and are required to manage waste car batteries in accordance with the license conditions. There are currently 23 licensed collectors and two licensed recycling or disposal facilities, but these are traditionally handling the small 12 volt lead-acid batteries fitted traditionally in passenger cars and CVs.[36] The advent of EVs will significantly increase the need for waste battery handling including the handling of different types of battery.

Currently most of the waste batteries are delivered to the landfill and the Chemical Waste Treatment Centre. A small amount of the waste batteries is delivered overseas.
3.2 Greener passenger cars in the European Union

2.2.1. Chargers for Electric Vehicles

In September 2011, the automotive industry recommended the use of the Type 2/ Type 2 Combo (IEC 62196) as the common plug in public infrastructure across Europe. On the vehicle side, all vehicles will have the same plug starting with new vehicle types as of 2017.[37] In 2013, the European Commission has proposed that common standards for electric charging points across Europe must be designed and implemented by December 2015. This was to ensure that EVs could circulate freely across the EU.[38]

2.2.2. National Incentive Schemes

With the introduction of the latest emission standards for petrol and diesel vehicles, the focus of attention in Europe for new vehicles has switched from roadside emissions to reducing GHG emissions. Several European countries have schemes in place to encourage low carbon transport ranging from the use of alternative fuels to promoting electro-mobility using electricity from renewable sources. An agreement has been reached at EU level concerning the renewable energy targets for each member state by 2020. For example, Germany's share of energy from renewable sources in gross final consumption of energy is determined at 18%, the United Kingdom's share is 15% and that of the Netherlands stands at 14%.[39] It is also common in Europe to be able to charge a car at home, helping to smooth power generation. Here we give some examples of schemes being used to encourage car purchasers to buy EVs.

Germany

A new incentive scheme worth about 1 billion EUR was approved in April 2016. All EV buyers enjoy a 4,000 EUR discount, while buyers of PHEV vehicles are eligible to a discount of 3,000 EUR. Vehicles with a net price tag of more than 60,000 EUR are not eligible. The first month of the discount program attracted 1,791 applications, including 1,194 for EVs and 597 for PHEVs, filing for discounts worth 6.6 million EUR.[40] The scheme has also allocated 300 million EUR of spending on charging stations.[41] The German government has set up the Nationale Plattform Elektromobilitat to develop Germany into a leading market for electric mobility, with about one million EVs on its street in the future.

Following that ambition, the German Parliament passed the Electric Mobility Act in March 2015 authorizing local governments to grant non-monetary incentives, which are not mandatory. The benefits include measures that are to privilege battery-powered vehicles, fuel cell vehicles and some PHEVs, by granting local governments the authority to allow these vehicles into bus lanes, and to offer free parking and reserved parking spaces in locations with charging points.

The German government is targeting that between 300,000 and 500,000 new EVs will take to the streets of Germany by 2018. In May 2016, 25,500 EVs (plus 130,000 PHEVs) were currently registered in the country.[42]

United Kingdom

In the UK, consumers receive a 35% discount on the price of an EV, up to 4,500 GBP.[43] Electric light CVs are eligible for a subsidy of 20% of the vehicle cost, up to 8,000 GBP. The government's target is that every new vehicle sold is to be zero tailpipe emission by 2040. The government provides funding available for 75% of the capital costs of procuring and installing the charge point and as associated dedicated parking bay, up to a maximum of 7,500 GBP per installation.[44] PHEVs, except vehicles with a recommended retail price over 60,000 GBP, are also eligible for a grant worth 35% of the vehicle cost, up to 2,500 GBP.[45] Same as the EVs, PHEVs are currently eligible for the Ultra Low Emission Discount in London. In the UK, registrations during the first six months of 2016 recorded the highest-volume half-year ever for EV registrations. After that, during the first three quarters of 2016 a total of 29,185 EVs were registered, of which, 28,035 vehicles were eligible for the Plug-in Car Grant.[46]

The Netherlands

In the Netherlands, Europe's largest national market for EVs, there are 92,600 EVs on the road as of April 2016.[47] E-laad Foundation was initiated in 2010. Its objective is to establish 10,000 charging points in total for public spaces comprising 2,000 charging stations requested by municipalities (one charging point per 10,000 inhabitants) and 8,000 charging spots requested by public demand (EV drivers) through a dealer organization.[48]

The Netherlands have a differentiated taxation scale relative to vehicle CO_2/km in place since 2016. Vehicles emitting zero CO_2 at the tailpipe, i.e. EVs, are fully exempt from the yearly motor vehicle tax, ranging from 304 to 724 EUR per year.[49] Other vehicles are grouped into five levels of CO_2 emissions with progressively increasing taxation per g CO_2/km. Many hybrid vehicles have qualified for a substantial bonus/registration tax reduction to encourage their sales. Conventional vehicles that are very energy-efficient, with emissions of less than 50 grams of CO_2 per kilometre, can earn a motor vehicle tax exemption as well.[50]

The scheme is fully coupled to CO_2 emission performances and the structure provides a beneficial scheme for all EFV options, with a steep taxation increase for combustion engine models with emissions ratings above 106 g CO_2/km. It has also had a positive impact on the hybrid vehicles market in the Netherlands. In 2013, 4.1% of all new sales were PHEVs.[51]
National subsidy strategy effect on greener vehicle deployment

The differences in purchase policies clearly create different adoption patterns of EV and PHEV respectively.

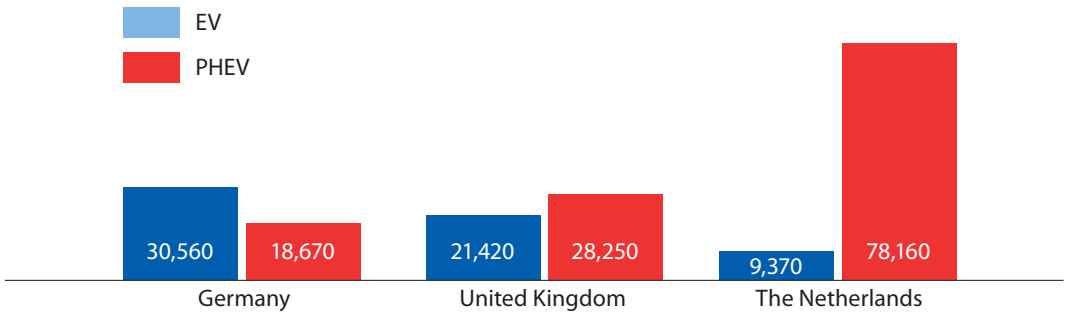

Chart 4: EV and PHEV Stock Per Country (2015)

International Energy Agency - Global EV Outlook 2016
https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf
(accessed December 2016)

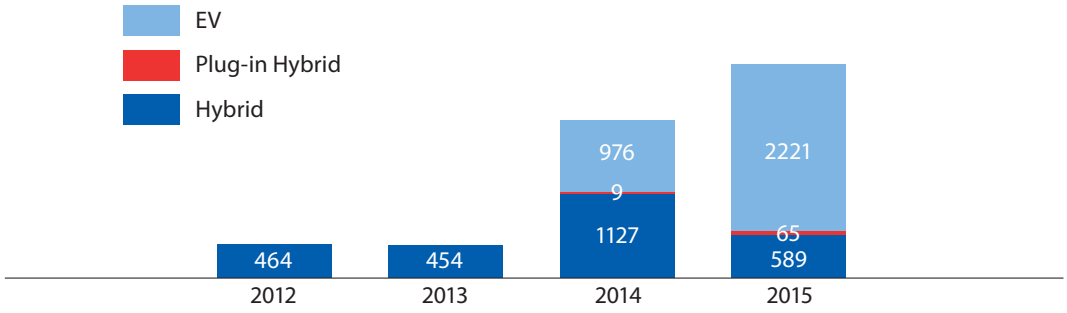

Chart 5: Hong Kong Greener Vehicle Registrations (2012-2015)

The Motor Traders Association of Hong Kong (MTA) database.
This contains brands from the luxury market only
(Audi, BMW, Mini, Mercedes Benz, Lexus, Porsche, Volvo, Jaguar, Infiniti and Land Rover).

2.2.3. Alternative renewable fuel and emission reduction strategy

Renewable fuels for vehicles are available today in the form of Bio-diesel, Bio-methane and Bio-ethanol. All these fuels give significant CO_2 emission reductions. They should be considered for all vehicles in the roadmap towards sustainable transportation but, in this paper, we focus on the opportunities for their use in CVs.

In November 2016 the High Level Group of Scientific Advisors published on the website of the European Commission a new report regarding vehicle emissions reduction. By 2017, the Commission's objective is to present a proposal concerning post-2020 CO_2 emission performance standards for light-duty vehicles. These standards will be based on the Worldwide harmonized Light vehicles Test Procedures (WLTP).

The WLTP define a global harmonized standard for determining the levels of pollutants and CO_2 emissions, fuel or energy consumption, and electric range from light-duty vehicles (passenger cars and light commercial vans). It is being developed by experts from the EU, Japan, and India under guidelines of UNECE World Forum for Harmonization of Vehicle Regulations. The Commission is targeting an emission reduction trajectory up to 2030, and at the same time is taking into account the competitiveness of car manufacturers and suppliers to the automotive industries.

On the European level, the introduction of the WLTP will affect two Regulations - Regulation (EC) 443/2009 for passenger cars, amended by Regulation 333/2014, and Regulation (EU) 510/2011 for light CVs, amended by Regulation 253/2014. These two regulations describe the average pan-European CO_2 fleet emission targets for all vehicles sold, which have to be reached by 2015 and 2020 (light CVs) and 2021 (passenger cars). Regarding the emissions, these fleet average targets are respectively 130 g CO_2/km and 95g CO_2/km for passenger cars, and 175g CO_2/km and 147g CO_2/km for light CVs.[52]

2.3. Recommendations relating to Passenger Cars

EAC would like to propose the following recommendations for the consideration of the Hong Kong Government and the European Commission:

- The European move to EVs should be done in parallel with a move to home charging infrastructure and smart metering to promote off-peak power generation smoothing together with a move to renewable power generation fuels.
- Hong Kong needs a long-term roadmap and e-mobility strategy for reducing the environmental impact of vehicles. This should take a holistic view reflecting their own power generation plans, starting with emission objectives then working through if and how EVs and alternative fuels fit into the bigger picture. Infrastructure for EVs and for renewable vehicle fuels should be part of the roadmap.
- If EVs are to be promoted then PHEVs should be included to reflect the Hong Kong situation so as to increase the appeal and introduction of a broader range of EVs.
- Any installation of infrastructure should meet internationally agreed standards
- Any incentives should encourage the minimum environmental impact when considered in a holistic way – re-introducing a cap to the FRT waiver would avoid greater subsidies to larger, more fuel consuming vehicles.
- Hong Kong government should stipulate a roadmap for vehicle batteries disposal and recycling.

2.4. Commercial Vehicles

It is easy to believe that electro-mobility can be the answer to all vehicle emission issues but it is the opinion of the EAC that a holistic and pragmatic approach is needed rather than simply saying EVs are the answer. In years to come, electric CVs will offer benefits where the power is generated from sustainable sources. However, for the time being, such vehicles are at the early stages of development, they are not generally available nor do they offer operators viable operating costs with acceptable levels of reliability. Furthermore, where power is generated from fossil fuel, other solutions are available today offering greater environmental benefits. This is especially true for CVs where improving transport efficiency while using the latest EuroVI engines with renewable fuels and other new technologies used to reduce fuel consumption, such as hybrid drives, will make a real difference when trying to reduce the environmental impact.

In addition to the EFVS, a 300 million HKD Pilot Green Transport Fund has been put in place by the Hong Kong Government since March 2011 for application by transport operators encouraging them to try out innovative green and low carbon transport technologies (including EVs). However, challenges with establishing infrastructure for refuelling with alternative fuels and for establishing charging points for commercial EVs have slowed the take up of the Fund.

Pro-active support for the installation of refuelling points and charging infrastructure is necessary if the Hong Kong Government wish to see an improved take up of the Fund to try alternative solutions for low carbon commercial transport.

2.4.1. CV Dimension Requirements in Hong Kong

According to the Hong Kong legislation (Cap 374A) for CVs, the maximum length, height and weight are 16m, 4.6m and 38 tonnes respectively.[53] Hong Kong has more restrictive regulations in terms of maximum length and weight in comparison to the EU regulation (Chart 6).[54] This prevents Hong Kong operators taking full advantage of the vehicles they are purchasing while there is a high risk of accidents where loaded construction materials hang dangerously over the end of the truck bodies.

	Max. Length (HK/EU)	Max. Width (HK/EU)	Max. Height (HK/EU)
Light Bus	7.0m / 12.0m	2.3m / 2.55m	3.0m / 4.0m
Single Deck Bus	12.0m / 15.0m	2.5m / 2.55m	3.5m / 4.0m
Medium Goods	11.0m / 12.0m	2.5m / 2.55m	4.6m / 4.0m
Heavy Goods (Rigid)	11.0m / 12.0m	2.5m / 2.55m	4.6m / 4m
Heavy Goods (Articulated)	16.0m / 16.5m	2.5m / 2.55m	4.6m / 4m
Trailer	n/a / 12.0m	n/a /2.55m	n/a / 4.0m
Road Train	n/a / 18.75m	n/a /2.55m	n/a / 4.0m

Chart 6: CV Weight and Length Requirements in Hong Kong and EU

Note: In the EU, the maximum width can be 2.6m if it is a superstructure of conditioned vehicles or conditioned containers or swap bodies transported by vehicles.

Weight limits

The permissible weight limits are also lower in Hong Kong than European requirements. This leads to capacity wastage as trucks are not loaded to their full capacity, and more trucks are needed to transport the same amount of goods in Hong Kong than would be needed if the weight requirements were aligned to current EU standards. For example, rigid trucks such as construction tippers are allowed to carry an additional two tonnes in Europe, offering up to 18% additional load carrying capacity resulting in 18% fewer trucks needed for a given transport task. There is also an opportunity to allow longer and heavier double trailer articulated trucks to pull two containers instead of only one on certain routes. This would reduce the number of trucks significantly on those routes. Reduced emissions and reduced congestion would be immediate benefits.

We encourage the Hong Kong Government to recognise the environmental and commercial benefits of larger and heavier vehicles. The benefits of increasing permissible weights and lengths would result in pollution reductions, such as less total fuel consumption, less emissions per tonne.km, lower cost per tonne.km, less total room on road consumed by CVs, less congestion, less road damage, less particulate matter caused by road damage and fewer accidents caused by material extruding from CV back-ends.

2.4.2. CV Dimension Requirements in European Union

The White Paper 2011 on transport policy, "Roadmap to Single European Transport Area", set the goal of reducing the emission of GHG from transportation by 60% by 2050. In this context, the European Commission proposed to revise the regulation (Directive 96/53/EC of July 1996) regarding weight and dimensions of road vehicles to improve energy efficiency and road

safety.[55] The commission classifies vehicles with distinct emission standards and vehicle regulations.[56] Large CVs are classified as category N and trailers being classified as category O.

The weights and dimensions directives (1996) had set the maximum weights and dimensions for national and international road transport within member states.[57] The maximum length is 18.75 meters (maximum 12 meters for trailer), 4 meters in height and 40 tons in weight. However, member states are allowed to moderate the regulations on vehicles used in national transport.

2.4.2.1. European Modular System (EMS)

European Modular System is a concept that uses a new approach in combining the existing loading units into longer and sometimes heavier vehicles.[58] The new approach rearranges the current CV "components" - trucks, semitrailers and trailers - allowing a maximum length of 25.25 meters and a weight of 60 tons. The concept was developed when Sweden and Finland joined the EU. Having allowed longer and heavier vehicles for environmental and competitive reasons prior to entering the EU, it was deemed unacceptable for both countries to apply the existing EU directives on vehicle dimension and weight.[59] The new approach allows both countries to comply with the EU regulations on vehicles while improving the road transport efficiency and reducing its environmental impact.

Facing the growing transportation demand in EU member states with the expectation of 82% growth between 2005 and 2050, EMS can absorb part of the demand by providing more efficient road transportation. In addition, EMS is able to substitute three regular articulated trucks with two road train trucks, which significantly reduces energy usage by 10-15% per tonne-km, CO_2 exhaust emission by the same amount and NOx emissions by 14%.[60]

The environmental impact of trucks is mainly caused by exhaust emission from fuel consumption. As a rule of thumb heavier trucks consume more fuel. However, related to load capacity, the heavier the truck, the fuel consumption is reduced per tonne-km by reducing the number of needed kilometres driven for a certain transportation task, which in turn lowers the overall fuel consumption. Currently discussions are held regarding the possibilities to open the Directive introduced in 1996 for changes. A potential amendment is for example to increase the load area length to ameliorate the utilization level of allowed weight.

2.4.3. Public Light Buses in Hong Kong

Due to the restrictions stipulated by the TD, European manufacturers are not able to supply their Euro VI vehicles to Public Light Bus (PLB) operators in the Hong Kong market. The main restricting factors for bringing the safer and more environmentally friendly Euro VI buses to the market are:

- TD requirement of 7m maximum length for a vehicle to be registered as a PLB.
- TD requirement for rear door emergency exit.

The European vehicles meeting the Euro VI standard are larger in size due to the need to accommodate more components within the driveline, and therefore cannot comply with the size restrictions set for PLB in Hong Kong. As a result, the fleet of PLB under the current size restrictions can only comply with Euro V. Also, the European models are designed with road and passenger safety in mind. For the current fleet of PLB, the engine is placed within the passenger compartment whereas the European concept is to place the engine in a forward location, outside the passenger area. As well as creating more space inside the vehicle, the front compartment also serves as an important collision cushion in case of frontal collision, particularly to reduce the harm on the vehicle's driver.

In Hong Kong the safety of PLBs has been of special concern. Hong Kong road safety statistics point to a trend of decreasing accidents in general, but a stable and partially increasing amount of PLB involvement in road accidents during the recent decades.[61] The European automotive manufacturers provide many suitable models, with features that could extensively improve the safety of public transport drivers and passengers (incl. multiple emergency exits, deformation zone, air bags, Anti-Slip Regulation, Electronic Brakeforce Distribution, Brake Assist, Cross Wind Assist, Lane Keeping Assist, Blind Spot Assist, Collision Prevention Assist, Electronic Stabilizer Program, Traction Control System, Cruise Control etc.). However, the introduction of such models require a relaxation of the current length requirement.

Hong Kong Government also has ambitions to reduce the level of general and roadside emissions substantially. To introduce Euro VI compliant vehicles is an important step towards reaching these goals. However, since no PLB models on the market are compliant with the Euro VI standard under the rule of current regulation, the Environmental Protection Department (EPD) has not provided a timeline for the implementation of Euro VI for light buses (whereas LGV, MGV, double decked bus and Single decked bus (DW>7t) are proposed to be implemented completely at the latest in mid-2018). As such, current TD regulations are inhibiting the implementation of governmental goals and road maps.

2.4.4. Mandating EuroVI Standards for Commercial Vehicles

From the Hong Kong Government's Clean Air Plan (2013) it can be seen that vehicles account for less than 3% of emissions of NOx and 10 micron Particulate Matter (PM10) whereas heavy goods vehicles account for 31% and 56% respectively. In other words, heavy goods vehicles by far account for the greatest amount of roadside air pollution generation. Hence, making sure that the heavy goods vehicles on the roads of Hong Kong adhere to the latest emission standards is of utmost importance in reducing the level of roadside emissions. This should be even clearer, when considering the fact that EuroVI vehicles emit some 80% roadside emissions less than an equivalent EuroV vehicle.

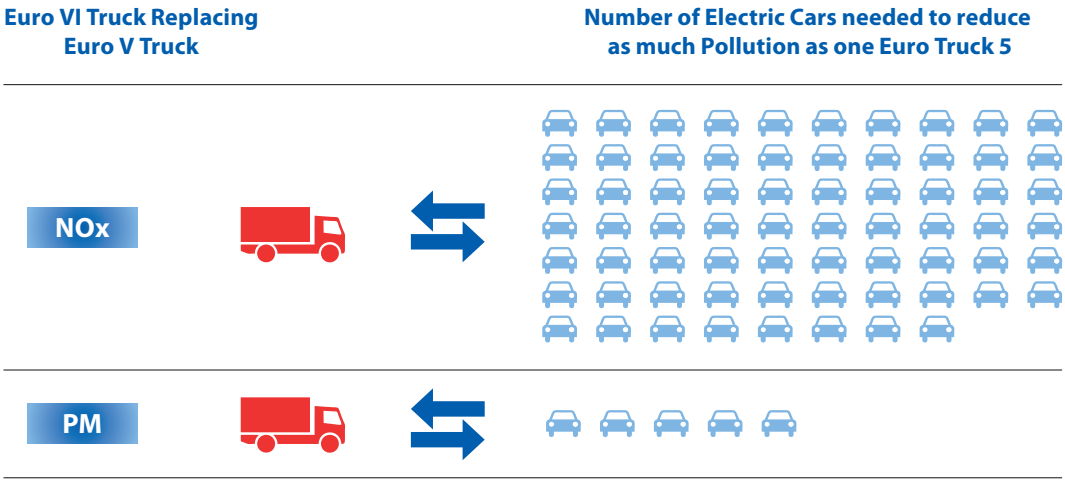

Chart 7: Pollution Reduction by Euro V to Euro VI Trucks Replacement

**NOx and SO_2 from Hong Kong's power generation to charge an electric car are greater than the emissions from an equivalent pretrolcar so an EV does not reduce total emission .*

The EPD has successfully introduced a scrapping scheme for older CVs, (i.e. CVs older than EuroIV), an effort which the EAC fully supports as a way to reduce roadside emissions. However, the current incentive within the EFVS has not been enough to encourage the majority of operators to make the necessary investment in EuroVI vehicles. By EAC's own estimations, only around 350 (9%) out of a total of 4,000 heavy trucks registered in 2015 were EuroVI certified. The level of incentive is not sufficient to cover the higher level of investment required if choosing a EuroVI vehicle instead of EuroV. At the same time an age limit was set for CVs of 15 years, also acting as a disincentive to make larger investment than necessary in a vehicle. In that sense, the Government of Hong Kong is to be congratulated on taking major steps to reduce NOx and PM emissions through introducing the scrapping scheme for older CVs but it is disappointing that it has not taken the step to make sure replacement vehicles are EuroVI. This misses the significant advantages EuroVI has over EuroV of at least a 50% reduction in PM and 80% reduction in NOx emissions.

In Europe EuroVI is mandated and there is no age limit set for CVs. With the high investment needed in a heavy CV and as a way to further incentivize the purchase of EuroVI vehicles, we encourage the government to increase the financial incentive until EuroVI is mandated and also to waive the age limit for EuroVI vehicles. Instead of an age limit we recommend introducing strict emissions tests for heavy CVs. Age is no guarantee of a vehicle's emissions with a well maintained older vehicle likely having much lower emissions than a poorly maintained newer vehicle. As emissions testing technology is continually being developed and improved, we encourage the Hong Kong Government to look for testing instead of age as the way forward to ensuring vehicles of this type will operate on Hong Kong roads with low emissions.

Replacing the heavy goods vehicle fleet with vehicles meeting the EuroVI standard would have a substantial impact on the roadside air pollution levels.

2.4.5. Alternative Renewable Fuels

Renewable fuels for vehicles are available today in the form of Bio-diesel, Bio-methane and Bio-ethanol. All these fuels give significant CO_2 emission reductions.

Bio-diesel can be blended with standard diesel up to 7% (B7) in nearly all diesel engines and can be used in higher blends up to 100% (B100) in adapted engines, generally available on the market today meeting the EuroVI standard. Bio-diesel is produced in Hong Kong from waste cooking oil, but the production is exported due to a lack of local demand.

Bio-methane has a similar chemical composition as fossil methane (natural gas) so the two can be intermixed. Natural gas stored as either compressed (CNG) of liquefied (LNG) can be a stepping stone to Bio-methane and engines running on methane can meet or exceed the demands of EuroVI while running quieter than diesel engines. In Europe, since January 2016, LNG mono fuel systems with European type approval (ECE Regulation 110) are being introduced to the market. LNG increases the operability of CVs, and that allows more energy to be stored on-board the vehicle, but the engine technology remains the same with CNG and LNG. So far, around 1.2 million vehicles are running on CNG, which represents 0.7% of the EU 28 vehicle fleet including Switzerland. 75% of that market concerns Italy. In 2016, Around 3,000 refuelling points are available, mostly in Italy and in Germany. 18 million CNG vehicles are running in the world, which represents 1.2% of the world vehicle fleet.[62]

Bio-ethanol is the world's most widely produced bio-fuel and can be used in specially adapted diesel engines or as a blend in petrol engines, which is common in many countries.
3.5 Recommendations relating to Commercial Vehicles
The EAC recommends the Hong Kong Government:

- To review and update the current legislation (Cap 374A) for CVs dimensions, to harmonize with European standards wherever feasible with concerns to particular Hong Kong conditions.
- Where the conditions in Hong Kong prevent across the board harmonisation of vehicle size and weight regulations, identify opportunities to realise environmental and commercial benefits from longer and heavier vehicles on specific routes and in specific applications. (One example would be double container trucks operating on specified routes).
- To offer weight allowances on CVs having new technologies contributing to reduced emissions, for example hybrid technology.
- To review the PLB homologation requirements to introduce European models complying with the Euro VI standard to the Hong Kong market.
- To make a greater impact on the air quality in Hong Kong we encourage mandating EuroVI as soon as possible and, in the meantime, offering an additional financial incentive while taking away the 15 year life limit, to really encourage the purchase of EuroVI CVs.

- To set up a study into the introduction of alternative renewable fuels, especially for CVs where the major reductions in CO_2 emissions can be made.
- To be proactive in helping with the practical challenges that are met when trying to set up trials of alternative fuels and EVs using the Pilot Green Transport Fund.

3 Manpower

3.1. Manpower in Hong Kong

In Hong Kong, there are 730,000 vehicles maintained by approximately 12,958 mechanics.[63] While the number of vehicles in Hong Kong is steadily increasing, the manpower has remained at a fixed level for the last 30 years.[64] There is a clear shortage of qualified blue collar workers in Hong Kong that needs to be addressed. A possibility is to open the market to foreign labour force. For instance, the number of migrant workers in Mainland China is significant, about 270 million in 2013, and represents a third of the total labour force and half of urban employment.[65]

3.1.1. Registration Schemes

In order to enhance the standard of local vehicle maintenance trade, the Electrical and Mechanical Services Department introduced a Voluntary Registration Scheme for Vehicle Mechanics and Vehicle Maintenance Workshops in 2005. The scheme allows vehicle mechanics in possession of necessary qualifications and/or experience in vehicle maintenance to be registered by the Vehicle Maintenance Registration Unit.

There are four categories within the registration classifications: mechanical, electrical, car body, and specific. In order to become and continue to be a registered mechanic, it is required to have at least 20 hours of continuing professional development within the immediate past three years. For non-registered technicians, there is no equivalent requirement. Registered vehicle mechanics dropped from 7,394 in 2012 to 6,375 in 2015.[66] A qualification framework was implemented in 2008 to enhance capability and competitiveness of the local workforce.

To ensure that the detailed arrangements of the registration scheme can meet the needs of the trade, the Vehicle Maintenance Technical Advisory Committee (VMTAC) was established in May 2006. The members represent trade associations, professional institutions, training institutes, transport operators, vehicle suppliers' associations, vehicle owners' association, relevant government departments, and an independent person nominated by the Home

Affairs Bureau. Members of the VMTAC are appointed by the Secretary for Transport and Housing and the committee is chaired by the Director of Electrical and Mechanical Services Department (EMSD), which is the Government Department responsible for inspection and enforcement of operation and safety of mainly electricity and gas installations

The Vehicle Maintenance Registration Unit (VMRU) has been set up under the EMSD. The VMRU provides administrative support to the VMTAC and is responsible for the promotional activities, the day-to-day management and operational functions for the voluntary registration schemes for vehicle mechanics and vehicle maintenance workshops.

3.1.2. Vocational Education Training (VET) Programs

A common effort for attracting labour to underserved professions is to promote these through vocational training. However, vocational programs in place seem to have had limited traction in Hong Kong. About 34% of secondary school students would not consider pursuing Vocational Education Training (VET) programs, and 28% of their parents would not advise their children to pursue the same.[67] Only 51% of the upper secondary school students were even aware of VET-related articulation and career options.[68] Meanwhile, the industry is moving towards a knowledge-based direction, since vehicle technicians need to be familiar with the computer system of a vehicle.

Besides traditional learning, the Hong Kong Examinations and Assessment Authority provides Applied Learning (ApL) which is an integral part of the senior secondary curriculum. Subjects in this category consist of practical elements linked to broad professional and vocational fields. The duration of each ApL course is 180 contact hours, extending over two school years, normally in Secondary 5 and Secondary 6. Automotive technology is offered as one of those electives. In 2015, 46 candidates from 24 participating schools were enrolled.[69]

Vocational Training Council (VTC)'s "Earn & Learn" Pilot Schemes integrates structured vocational education and on-the-job training with clear progression pathways to attract talents for industries with a keen demand of labour. Under this scheme, VTC provides apprenticeship for Vehicle Mechanic, Vehicle Body Repairer/Builder, Vehicle Electrician, Vehicle Painter and, Vehicle Panel Beater/Body Builder. Within the first 12 months of training, apprentices will receive 15,400 HKD as incentive allowance and a specified salary. Between the second and fourth year, in addition to the salary, the apprentices receive 2,000 HKD average monthly government subsidy. After graduation, the trainees should receive a salary of 10,500 HKD. However, the dropout rate remains high, even though most of the apprentices receive job offers right after graduating from the program.

3.2. Manpower in European Union

In Germany a successful vocational "dual system" is in place: learn in the classroom and learn by doing.[70] Trainees receive about one-third of the salary of a qualified worker (average monthly stipend is about 680 EUR). In 2014, 57.3% of German students chose vocational education programs. Students apply directly to the employer for apprenticeship, who then enrols the student in a local training school.

Around 330 professions are officially recognized as training occupations. Syllabus of vocational schools may vary, however, training regulations implemented by companies are under a centralized regulation of the federation government. Employer organizations and trade unions are key drivers when it comes to updating and creating new training regulations and occupational profiles or modernizing further training regulations.

3.3. Recommendations

EAC would like to propose the following recommendations for the consideration of the Hong Kong Government and the European Commission:

- Both European and Hong Kong Governments are encouraged to raise the awareness of the importance of skilled workers to their economies and to make efforts to raise the status of such workers.
- Hong Kong should adopt best practices from the German vocational education system – such as the dual-track VET- to attract the local youths to the vehicle maintenance industry.
- To increase the labour market competitiveness further, Hong Kong should look to other national examples (e.g. People's Republic of China) of opening up the market to foreign workforce.
- Hong Kong Government should include vehicle maintenance professionals in the service sectors enjoying preferential treatment under the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA).

Abbreviations

ApL	Applied Learning
CEN	European Committee for Standardization
CEPA	Mainland and Hong Kong Closer Economic Partnership Arrangement
C-ITS	Cooperative Intelligent Transport Systems
C-ITS	Cooperative Intelligent Transport Systems
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CV	Commercial Vehicle
EAC	European Automotive Council
EMSD	Electrical and Mechanical Services Department
EPD	Environmental Protection Department
ETSI	European Telecommunications Standards Institute
EU	European Union
EUCAR	European Council for Automotive R&D
EUR	Euro
EV	Electric Vehicle
GHG	Greenhouse Gas
HK	Hong Kong
HKD	Hong Kong Dollar
HMI	Human-Machine Interface
Hong Kong	Hong Kong Special Administrative Region
ICT	Information and Communications Technology
ITS	Intelligent Transport Systems
LNG	Liquefied Natural Gas
NO_x	Nitrogen Oxides
PHEV	Plug-in Hybrid Electric Vehicle
PLB	Public Light Bus
PM	Particulate Matter
PSI	Public Sector Information
R&D	Research and Development
TD	Transport Department
USD	United States Dollar
V-2-I	Vehicle-to-Infrastructure
V-2-V	Vehicle-to-Vehicle
V-2-X	Vehicle-to-X
VMRU	Vehicle Maintenance Registration Unit
VMTAC	Vehicle Maintenance Technical Advisory Committee
VTC	Vocation Training Council
WLTP	Worldwide harmonized Light vehicles Test Procedures

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