CLEAN AIR PLAN

FOR HONG KONG

2013-2017 PROGRESS REPORT



Environment Bureau | June 2017

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Message from the Chief Executive



I congratulate the Environment Bureau and the Environmental Protection Department on their publication of the Clean Air Plan's "Progress Report".

Protecting the environment is a core commitment of the Hong Kong Government. This report updates the 2013 publication of "A Clean Air Plan for Hong Kong" and reveals discernible improvements in Hong Kong's air quality in recent years.

For that, my thanks to the Environment Bureau and the Environmental Protection Department. They are spearheading the government's efforts to fight air pollution in cooperation with the community at large.

I am also pleased with the deepening collaboration between Hong Kong and Guangdong Province in air quality management. Our cross-boundary cooperation has notably improved regional air quality.

I recognise that there is still much work to be done to improve air quality in Hong Kong and the region as a whole. But, thanks to the considerable strides we have made in recent years, our foundation is strong and our will unshakable.



CY Leung

Chief Executive
Hong Kong Special Administrative Region

Foreword

Clean Air Plan for Hong Kong, published in March 2013, was the first comprehensive policy document published by the Environment Bureau during this term of government (2012-2017). We were able to do this because of the good foundation of work by the Environmental Protection Department over the years. We added new areas of focus, particularly in reducing roadside air pollution and shipping emissions, and we strengthened cooperation with mainland authorities.

We wish to thank colleagues in the Transport and Housing Bureau and Development Bureau, including all relevant departments, since fighting air pollution needs to be a whole-government exercise. I also wish to thank the many stakeholders for their support and cooperation, especially those in the road and marine transportation, and power generation sectors.

We must also thank our mainland counterparts on the very positive collaboration over the last few years. At the national level, we wish to thank the Ministry of Environmental Protection, Ministry of Transportation, and Ministry of Industry and Information Technology. Special thanks must go to our counterparts in Guangdong Environmental Protection Department in improving regional air quality. We also wish to thank the Economic and Information Commission of Guangdong Province in promoting industrial clean-ups. Our deepening collaboration with the Guangdong and Shenzhen port authorities in controlling shipping emissions has resulted in solid progress.

Good air quality management also requires contribution from the air science sector. Non-government air quality experts and NGOs are also helping to raise public awareness about air and health. Indeed, there is also more effort that the Environmental Protection Department is making in public education.

I am pleased to be able to report we have accomplished what we have set out in *A Clean Air Plan for Hong Kong* and give an account of the details of the various measures we have put in place.

KS Wong
Secretary for the Environment

MAJOR GOALS AND ACTIONS
2013-2017

AQHI replaced old Air Pollution Index (API) in end 2013, one of two such health-based indices in the world

New AQOs became effective on 1 January 2014 with mandatory review every five years

2014 JAN 1

2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

Provides public with air quality updates and information through website, mobile apps, hotline and public education program

AIR QUALITY

Air quality monitoring stations:



Improvement in ambient air quality:

2016 (base year 2012)

SO_2	NO_2	PM_{10}
⬇18%	⬇8%	⬇19%

ROADSIDE

Pollution reduction:

	NO_2	PM_{10}
2016	⬇31%	⬇28%
2020 (projected)	⬇40%	⬇40%

base year 2012

DCV retirement deadlines:



MARINE

Emission reduction:

	SO_2	PM_{10}
2015	⬇30%	⬇17%
2020 (projected)	⬇69%	⬇49%

base year 2012

ENERGY

Electricity Fuel Sources:

	2012	2015	2020 (projected)
Coal	54%	48%	~25%
Natural Gas	23%	27%	~50%
Nuclear	23%	25%	~25%

1 | Making Headway

Air quality improvement is a front and centre issue for the Environment Bureau (ENB) and Environmental Protection Department (EPD). We believe air pollution does not have to be part and parcel of life in Hong Kong; and it should not be a passing concern only on high air pollution days.

In March 2013, we published *A Clean Air Plan for Hong Kong* (CAP 2013),[1] the basis of which is repeated in Figure 1 for ease of reference.

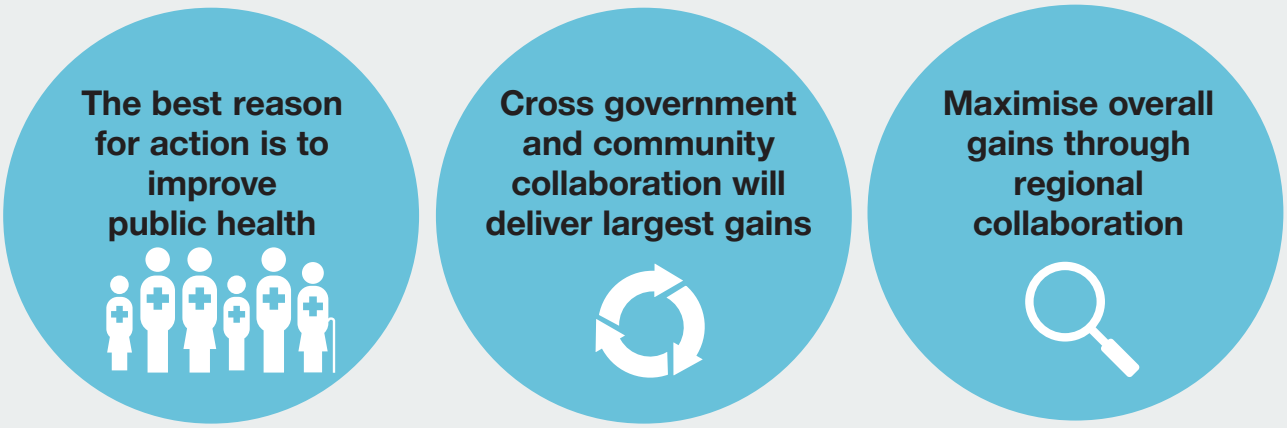
There has been discernible improvement over the past five years in air quality as a result of hard work to reduce pollutant emissions in Hong Kong, as well as in Guangdong. Air quality for the entire Pearl River Delta (PRD) Region has improved.

Our residents have become more knowledgeable about air quality issues, which is conducive to promoting further action. Pointed questions are being raised via the media and social media on Hong Kong's Air Quality Objectives (AQOs) and Air Quality Health Index (AQHI) and how they relate to the World Health Organisation Air Quality Guidelines (WHO AQGs). We deal with these questions in Chapter 2, which also updates the stated goal and actions we made in CAP 2013.

This report also gives an account of the results of CAP 2013. We have achieved what we have set out to do and we expect better air quality still by 2020.

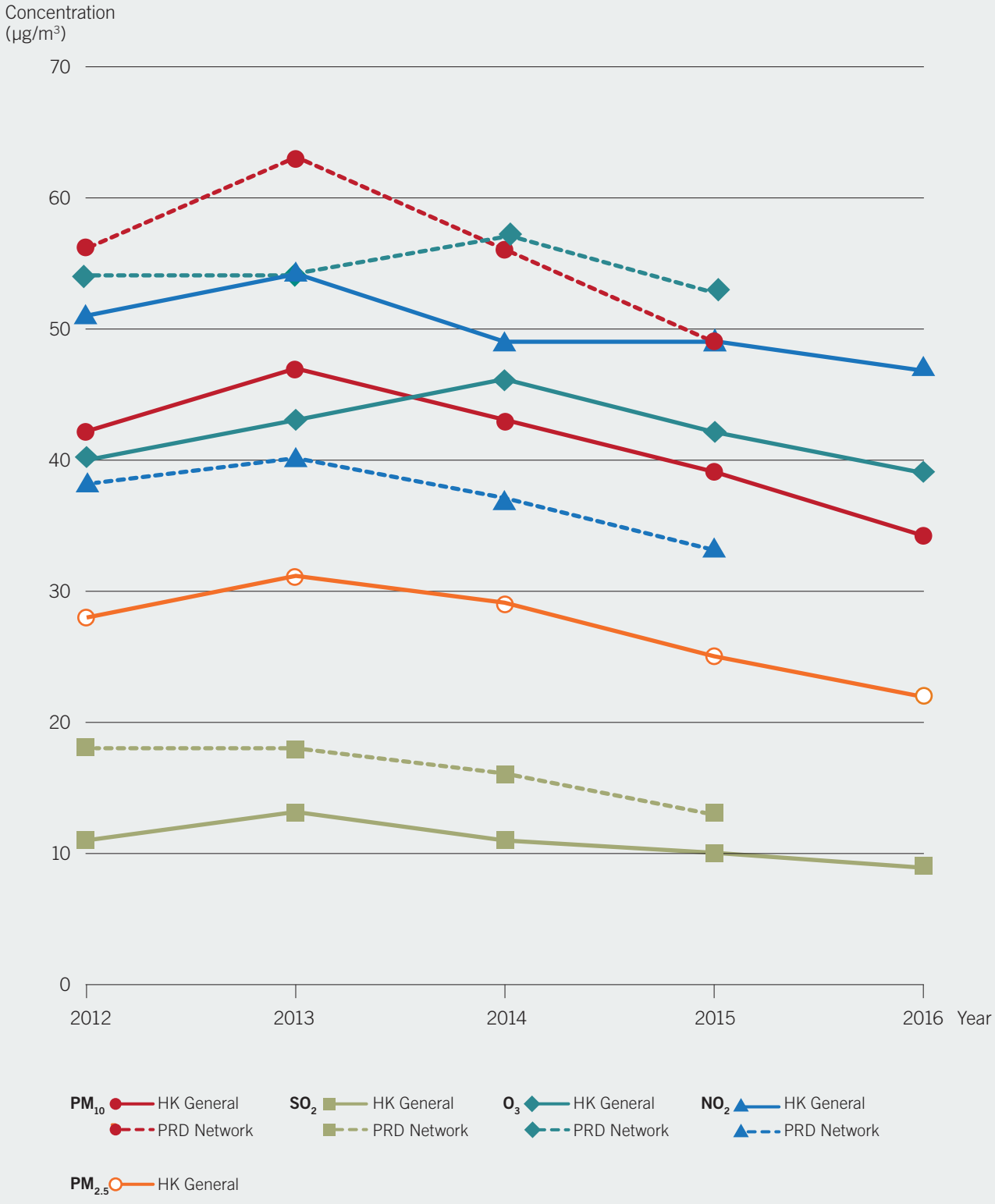
Moreover, we have embarked upon the mandatory five-yearly review of Hong Kong's AQOs, which is bringing forth many ideas and perspectives on what else can be done. We look forward to the continuing support from all stakeholders in the business and community sectors to work together to improve air quality.

FIGURE 1 **Premises of the Clean Air Plan**



1. *A Clean Air Plan For Hong Kong*, Environment Bureau, March 2013, see http://www.enb.gov.hk/en/files/New_Air_Plan_en.pdf.

FIGURE 2 Air Quality Trends of Hong Kong and the PRD Region (2012-2016)



2 | Improving Air Quality and its Management System

Our air quality policy aims to reduce air pollution and the associated health risk to the people of Hong Kong. EPD's air quality management (AQM) consists of regulatory activities undertaken to reduce air pollution. The AQM process includes understanding the sources of pollution and the health effects of the pollutants, and taking steps to reduce or control the sources of pollution to reach or not exceed specific targets. Figure 3 summarises our goal and actions to improve Hong Kong's AQM since 2013 and Figure 4 shows Hong Kong air quality monitoring network.

FIGURE 3 **Goal and actions implemented to improve AQM (2013-2016)**

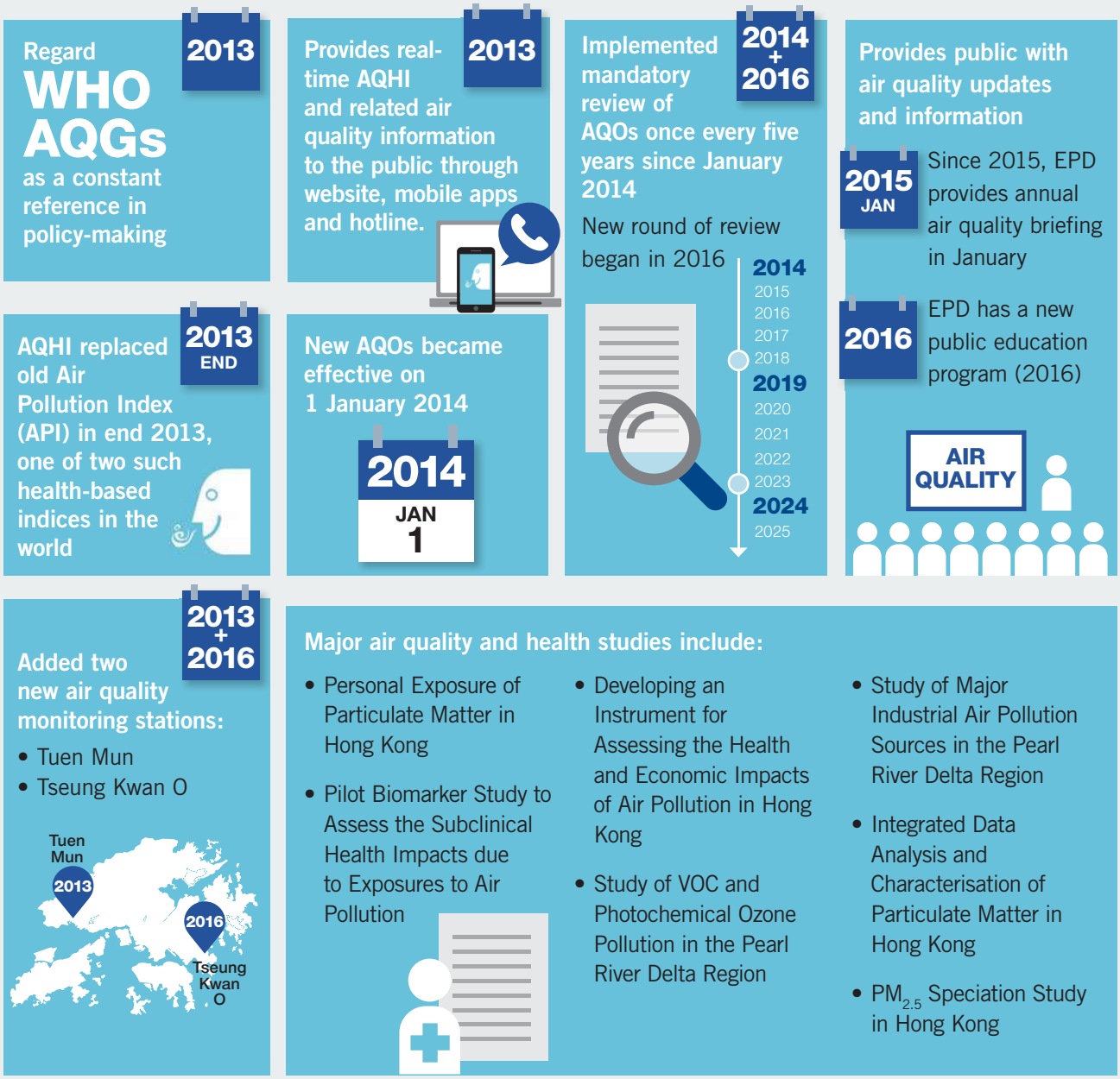
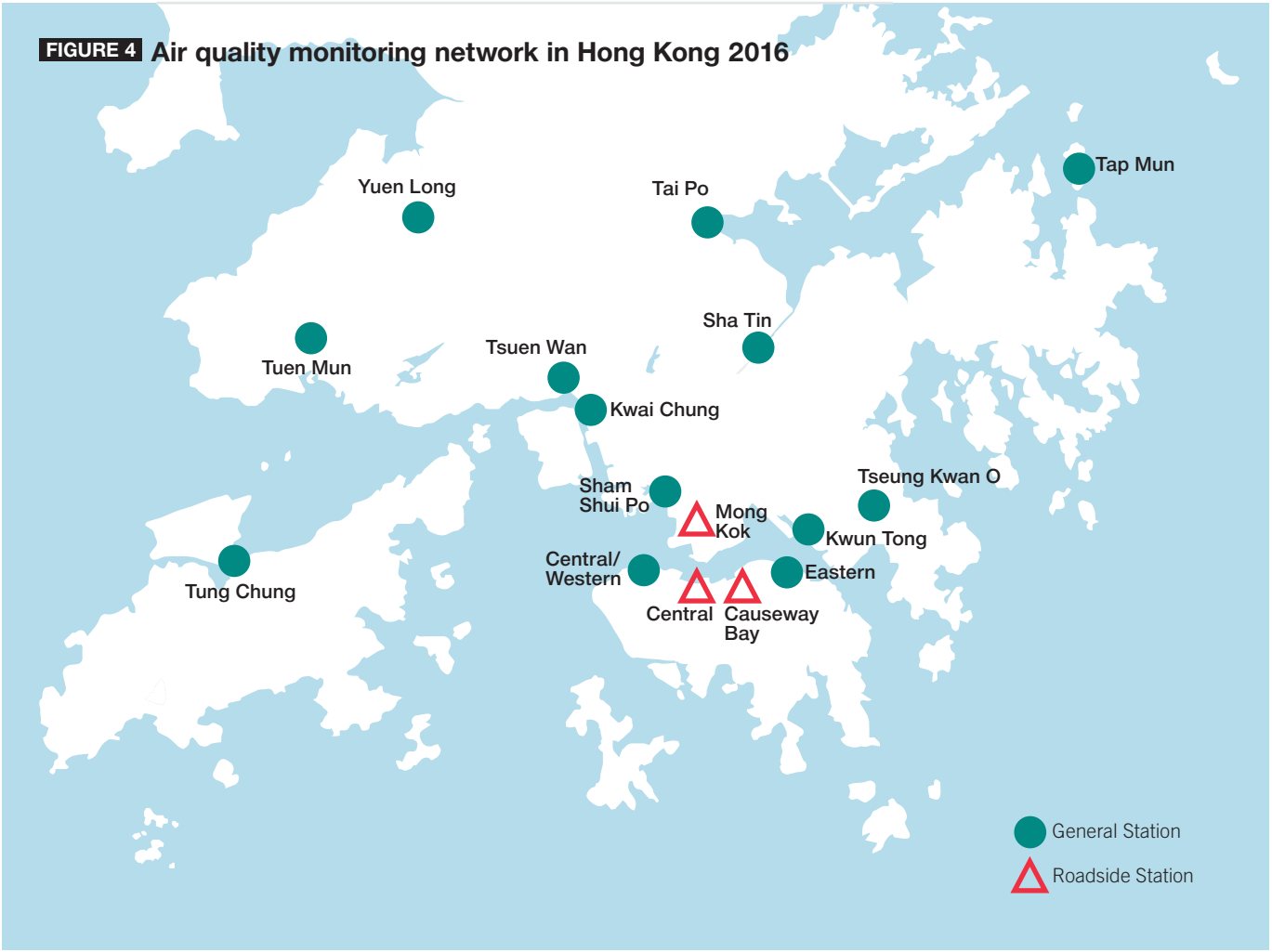


FIGURE 4 Air quality monitoring network in Hong Kong 2016



Frequently asked questions (FAQ)

A: How does air pollution affect Hong Kong?

We need to consider both general air quality and localised air quality, such as at roadside. Hong Kong air quality is greatly affected by regional and meteorological factors. The regional influence is more fully explained in Chapter 7. Air pollution also needs to be seen from the perspective of exposure to people. A place which has high general air pollution means the people there are constantly exposed to higher air pollution concentration than people who live in better air quality environments. We are particularly concerned about roadside air quality in Hong Kong because of the high number of people exposed to roadside emissions from vehicles.

FIGURE 5 **Five health risk categories under the AQHI system**



B: Instead of the AQOs, why not use the WHO AQGs as Hong Kong air quality standards?

Every jurisdiction has its own air quality standards that reflect the realities of its own circumstances. The WHO AQGs are prepared by the WHO using the latest health science without reference to the circumstances of particular jurisdictions. The WHO makes clear that even if a jurisdiction can meet the WHO AQGs, it does not mean there are no health risks.

The WHO recognises that most jurisdictions are unable to meet all aspects of the WHO AQGs. Currently, no jurisdiction has adopted the entire WHO AQGs as their domestic air quality standards. To help those jurisdictions with existing high air pollution levels, the WHO provides three sets of Interim Targets (IT-1, IT-2 and IT-3) for several of the pollutants so that jurisdictions may use them as a guide to stage their control measures to reduce specific air pollutants. There are no Interim Targets for nitrogen dioxide (NO_2), carbon monoxide (CO) and lead (Pb). Similar to the case in Hong Kong, many jurisdictions are also unable to meet these WHO AQGs, in particular for NO_2. Whether there are Interim Targets or not, it is the implementation of effective control measures for pollutants that would bring about air quality improvements.

Figure 6 shows Hong Kong's former and current AQOs (adopted since 1 January 2014) and the WHO AQGs. Hong Kong is able to meet three of the WHO AQGs – namely for the 10 minutes sulphur dioxide (SO_2) target, and the CO and Pb targets. While Hong Kong has adopted the WHO AQG for NO_2, we are unable to meet it. As for those pollutants with Interim Targets, as well as NO_2, we are working hard on control measures to reduce their levels.

In summary, we use the WHO AQGs as our constant reference in policy-making and we focus on effective control measures to reduce pollutant emissions. We have put in place a mandatory AQO review process which must be conducted at least once every five years.

The amendment bill to tighten the AQOs and to mandate their review was put to the Legislative Council in February 2013; the bill was passed in July 2013 and became effective from 1 January 2014.

C: What is the AQHI and how useful is it as a health risk indicator?

The AQHI, compiled by EPD, informs the public of the short-term health risk of air pollution in Hong Kong. They are reported hourly at each general and roadside station, and forecasts are also made. The AQHI enables the public to take precautionary measures to protect their health.

The AQHI reports on a scale of 1 to 10 and 10+ and are grouped into five AQHI health risk categories with health advice

FIGURE 6 Former and current AQOs and WHO AQGs

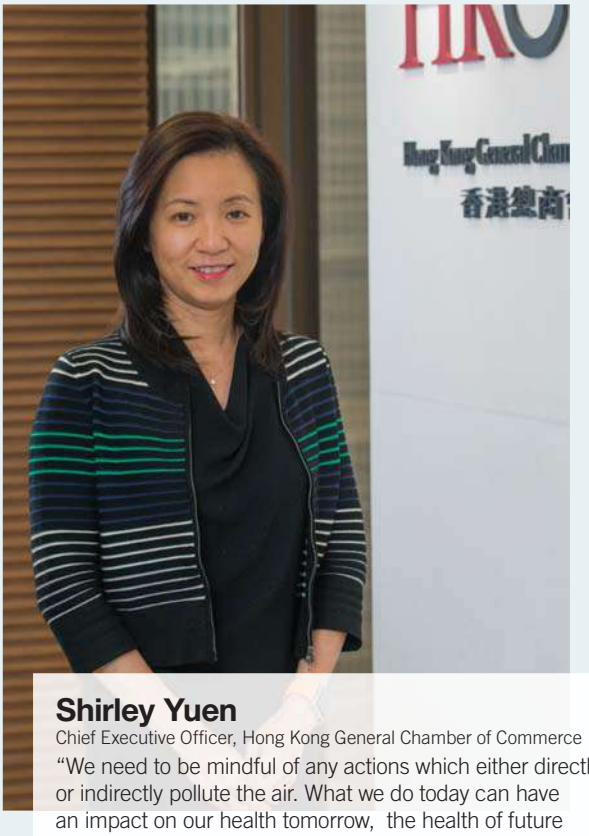
Pollutants	Averaging Time	Former AQOs		Current AQOs		WHO AQGs and ITs (microgrammes per cubic metre; ug/m³)			
		(μg/m³)	No. of Exceed-ances Allowed	(μg/m³)	No. of Exceed-ances Allowed	IT-1	IT-2	IT -3	AQGs
Sulphur Dioxide (SO_2)	10-min	--	--	**500**	**3**	--	--	--	500
	1-hour	800	3	**--**	**--**	--	--	--	--
	24-hour	350	1	**125**	**3**	125	50	--	20
	Annual	80	--	**--**	**--**	--	--	--	--
Total Suspended Particulates (TSP)	24-hour	260	1	**--**	**--**	-	--	--	--
	Annual	80	--	**--**	**--**	-	--	--	--
Respirable Suspended Particulates (RSP / PM_{10})	24-hour	180	1	**100**	**9**	150	100	75	50
	Annual	55	--	**50**	**--**	70	50	30	20
Fine Suspended Particulates (FSP/$PM_{2.5}$)	24-hour	--	--	**75**	**9**	75	50	37.5	25
	Annual	--	--	**35**	**--**	35	25	15	10
Nitrogen Dioxide (NO_2)	1-hour	300	3	**200**	**18**	--	--	--	200
	24-hour	150	1	**--**	**--**	--	--	--	--
	Annual	80	--	**40**	**--**	--	--	--	40
Ozone (O_3)	1-hour	240	3	**--**	**--**	--	--	--	--
	8-hour	--	--	**160**	**9**	160	--	--	100
Carbon Monoxide (CO)	1-hour	30,000	3	**30,000**	**--**	--	--	--	30,000
	8-hour	10,000	1	**10,000**	**--**	--	--	--	10,000
Lead (Pb)	3-month	1.5	--	**--**	**--**	-	--	--	--
	Annual	--	--	**0.5**	**--**	--	--	--	0.5



Professor Hao Jiming

Academician, Dean of Environmental Sciences and Engineering, Tsinghua University, Beijing

"I am pleased to see that in recent years, Hong Kong has made significant improvement in ambient air quality. I look forward to Hong Kong continuing to move forward with more stringent air quality objectives for better health protection."



Shirley Yuen

Chief Executive Officer, Hong Kong General Chamber of Commerce

"We need to be mindful of any actions which either directly or indirectly pollute the air. What we do today can have an impact on our health tomorrow, the health of future generations as well as the health of Hong Kong's economy. The business community has long advocated that clean air is a crucial component of our competitiveness, which is why 11 years ago we engaged the entire business community to drive forward Project Clean Air, with the Clean Air Charter at its heart. We are glad that many of our recommendations were incorporated into the Clean Air Plan. As the Voice of Business, we would like to see the Government offer more incentives and financial tools to help companies upgrade their operations and become more sustainable in an era driven increasingly by green enterprises."



Professor Emily Ying Yang Chan

Director, Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response

"Our studies found that air pollutants are associated with adverse health outcomes during heatwaves and cold spells in Hong Kong. We call for relevant government departments and service units to step up preparedness mechanisms to cope with extreme temperature health needs, especially under hot and cold weather warnings and among high-risk groups. Strengthened cooperation among the government, academia and civil society is direly needed to provide vital extreme temperature information and support to these people. "

Professor T W Wong

Research Professor, The Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong

"Air pollution affects everyone health. Everyone must make an effort to combat air pollution."



There are other indices people may refer to. For example, the Hedley Environmental Index (HEI) uses EPD's real-time air quality data and calculates the economic costs in terms of public health impact and the associated monetary value. Weather Underground of Hong Kong refers to the Air Quality Index issued by the US Environmental Protection Agency (USEPA). Its calculations are anchored to the relevant USEPA standards. These indices may differ from the AQHI due to different methodologies used. They should be seen as complementary; and the AQHI was not designed to lessen the reporting of health risks.

provided. When the AQHI is 'High', children, the elderly and people with heart or respiratory illnesses should reduce outdoor physical exertion. When it reaches 'Very High' or 'Serious', the general public should also reduce or avoid outdoor physical exertion.

Questions have been raised in social media about the usefulness of the AQHI on the basis that the AQOs are less stringent than the WHO AQGs. The AQHI provides information on short-term health risks and what people can do to reduce the risk to them. The risk factors associated with each of the four criteria pollutants used for the AQHI – NO_2, SO_2, particulate matter (PM_{10} and $PM_{2.5}$) and ozone (O_3) – are derived from local health statistics and actual air pollution data. The AQHI also makes reference to the short-term WHO AQGs to define the level where health risk is high due to short-term exposure air pollution. As an information tool on short-term health risks arising from air pollution, the AQHI is not based on the AQOs.

D: What are Hong Kong's specific air quality challenges today?

Our current air quality challenges are:

- Roadside air quality presents the major daily public health threats in Hong Kong (NO_2, diesel PM). Since 2013, our various measures to control vehicular emissions are effective but more needs to be done (see Chapter 3).

- Shipping emissions arising from burning highly polluting bunker fuel (SO_2, PM and NO_X). Since 2014, our two major marine emissions control measures are effective, and we expect further improvement by 2020 (see Chapter 4).

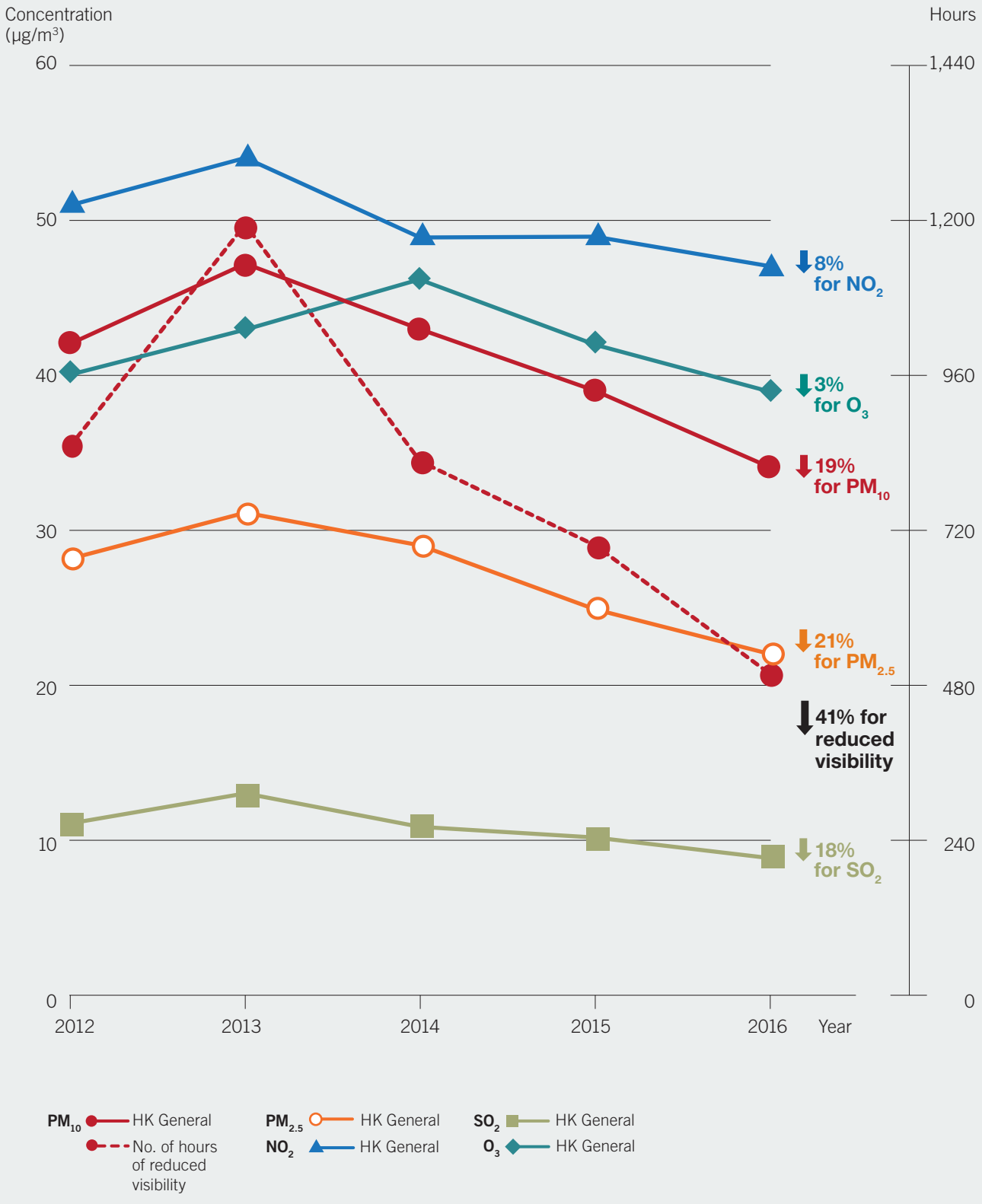
- Over the years, our measures to reduce emissions from local power generation have been effective, and there will be further improvement as Hong Kong continues to replace coal-fired generating units with gas-fired ones and generating facilities using non-fossil fuels (see Chapter 5).

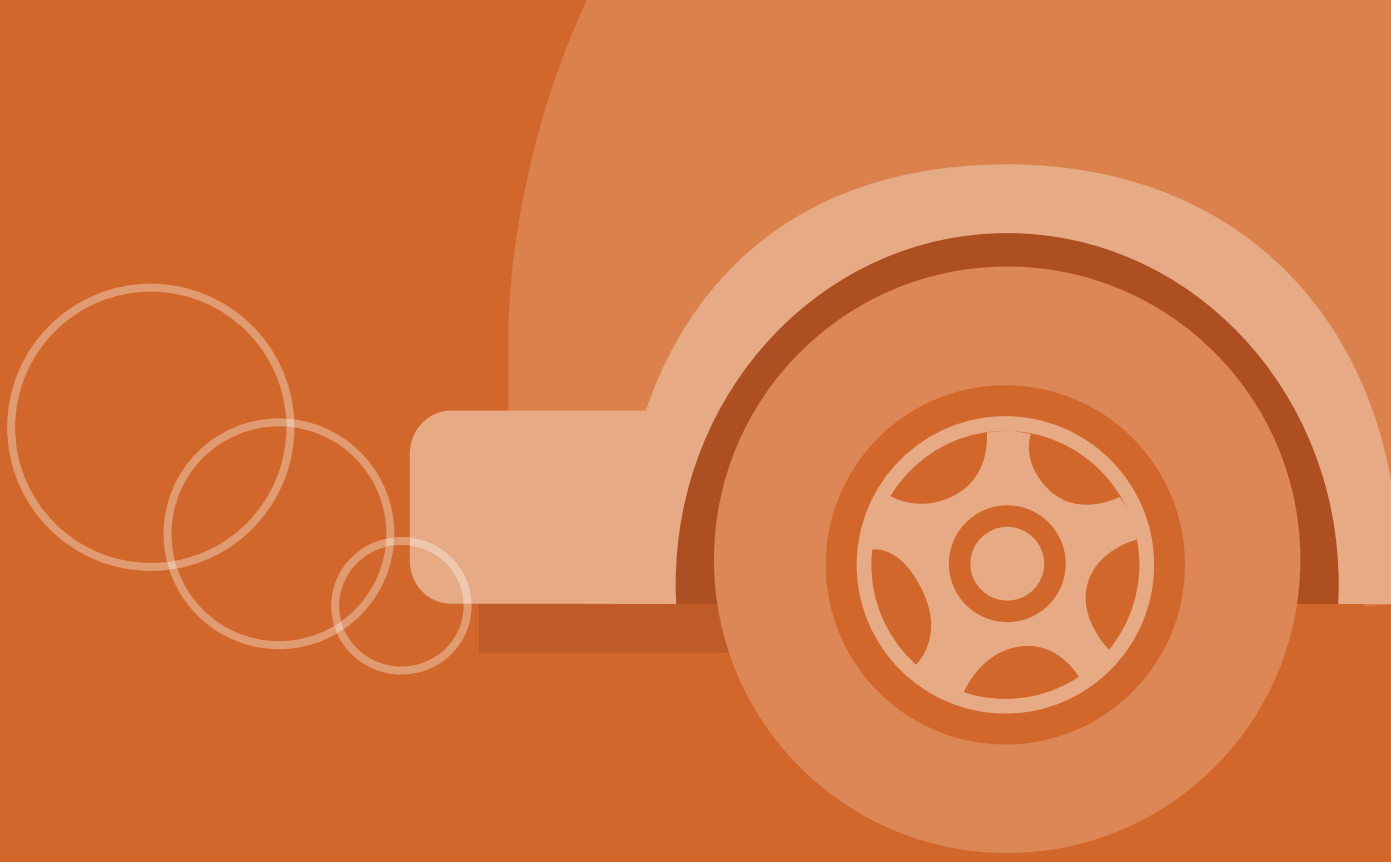
- Regional O_3 has risen even though other air pollutants have dropped. While there are some initial signs of trend reversal for O_3, longer observation is needed. O_3 is a secondary pollutant, which makes it very challenging to control. Significant improvement requires regional effort.

- Hong Kong is affected by pollutant emissions arising from the PRD. We acknowledge the efforts made by Guangdong Province and Shenzhen to improve air quality as part of the national push to fight air pollution. There is continuing efforts to collaborate to improve regional air quality; and there is now specific effort focused on reducing ozone (see Chapter 7).



FIGURE 7 Discernible improvements in ambient air quality and visibility 2012-2016





REDUCING **ROADSIDE AIR POLLUTION**

3 | Reducing Roadside Air Pollution

Reducing vehicular emissions

Our end-of-pipe measures to reduce vehicular emissions have proven to be effective. At roadside, we are most concerned about PM and NO_2/NO_x. Figures 8 and 9 show our projected and actual improvement since 2012. There have been higher than estimated progress for PM but reducing NO_2 has been more challenging (see below).

Roadside air quality improvement was achieved through the aggressive targeting of three types of high polluting vehicles: pre-Euro IV diesel commercial vehicles (DCV), inadequately maintained liquefied petroleum gas (LPG) and petrol vehicles, and Euro II and Euro III franchised buses.

Figures 10, 11 and 12 update the equivalent figures in CAP 2013, and Figure 13 shows the emissions comparison of DCV.

FIGURE 8 **Projected and actual PM_{10} concentration at roadside 2012-2020**

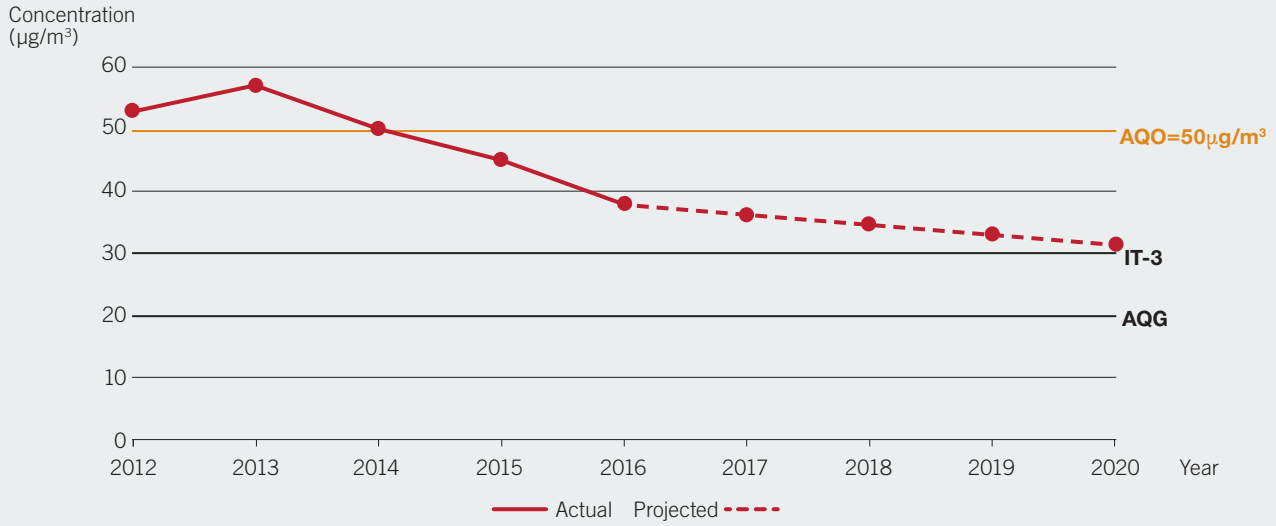


FIGURE 9 **Projected and actual NO_2 concentration at roadside 2012-2020**

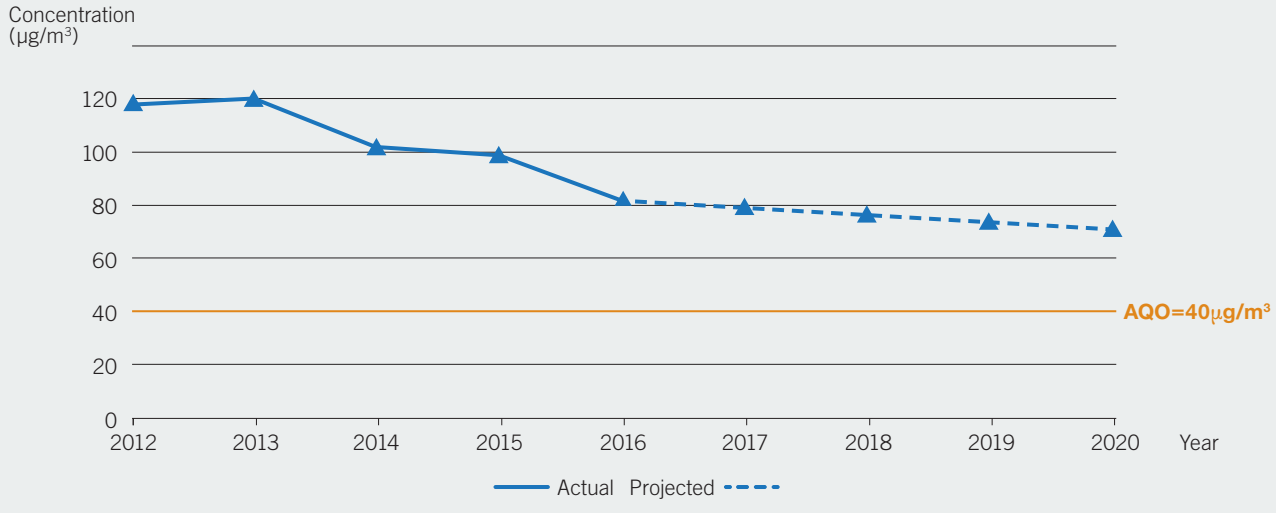


FIGURE 10 Types and numbers of registered vehicles in Hong Kong (as at December 2016)

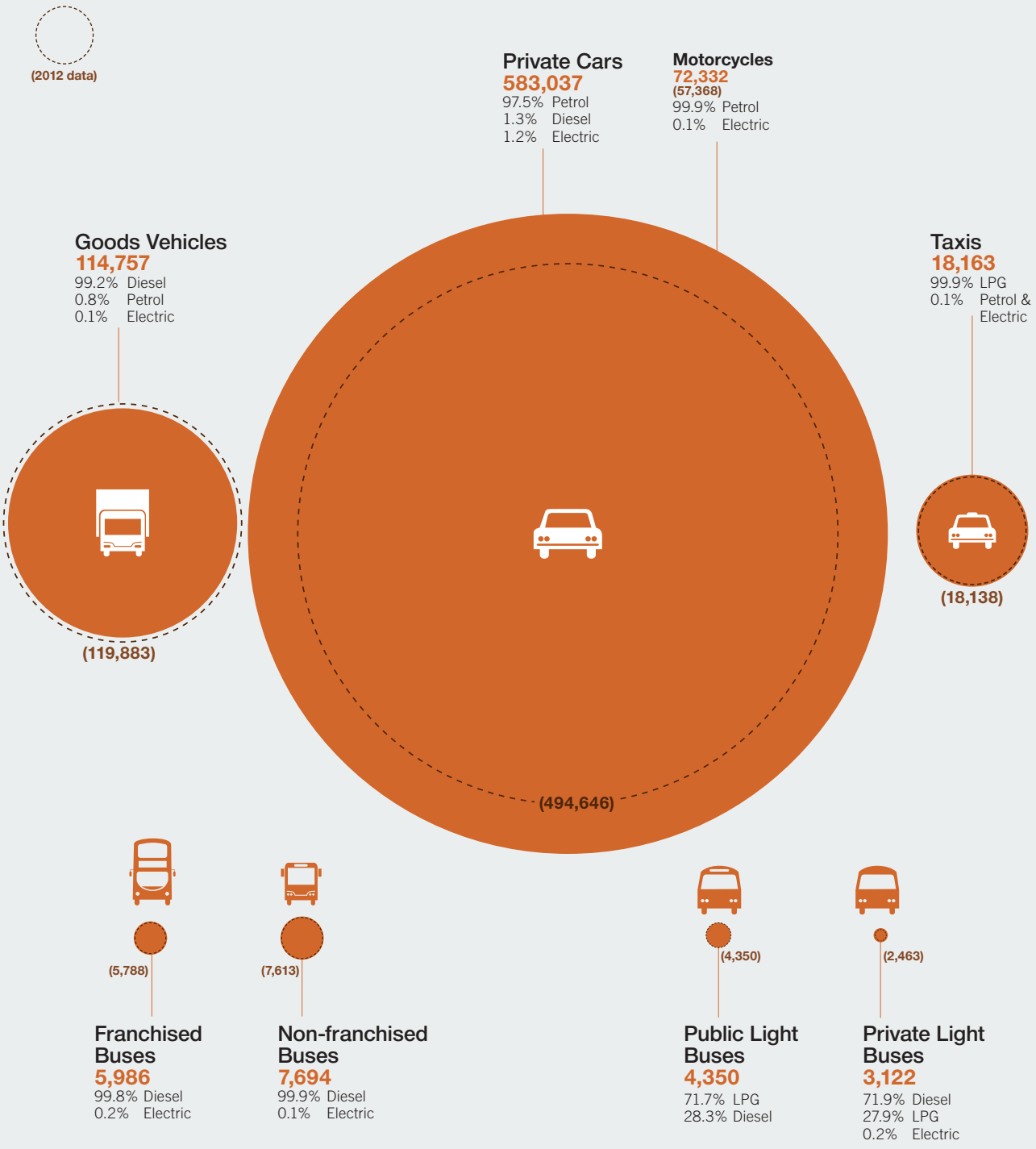


FIGURE 11 Emissions profiles of Hong Kong's vehicular fleet (2011 vs 2015)

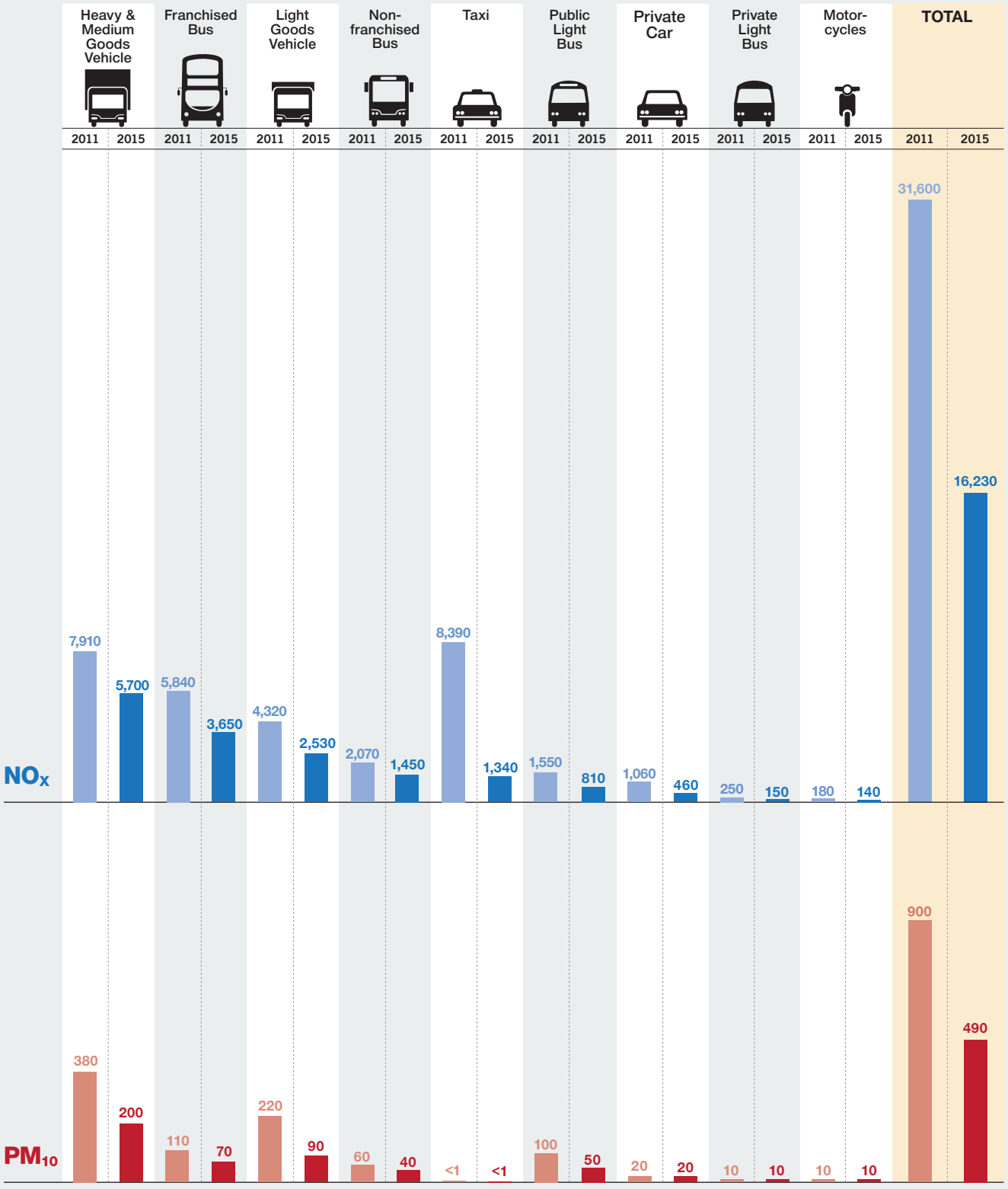
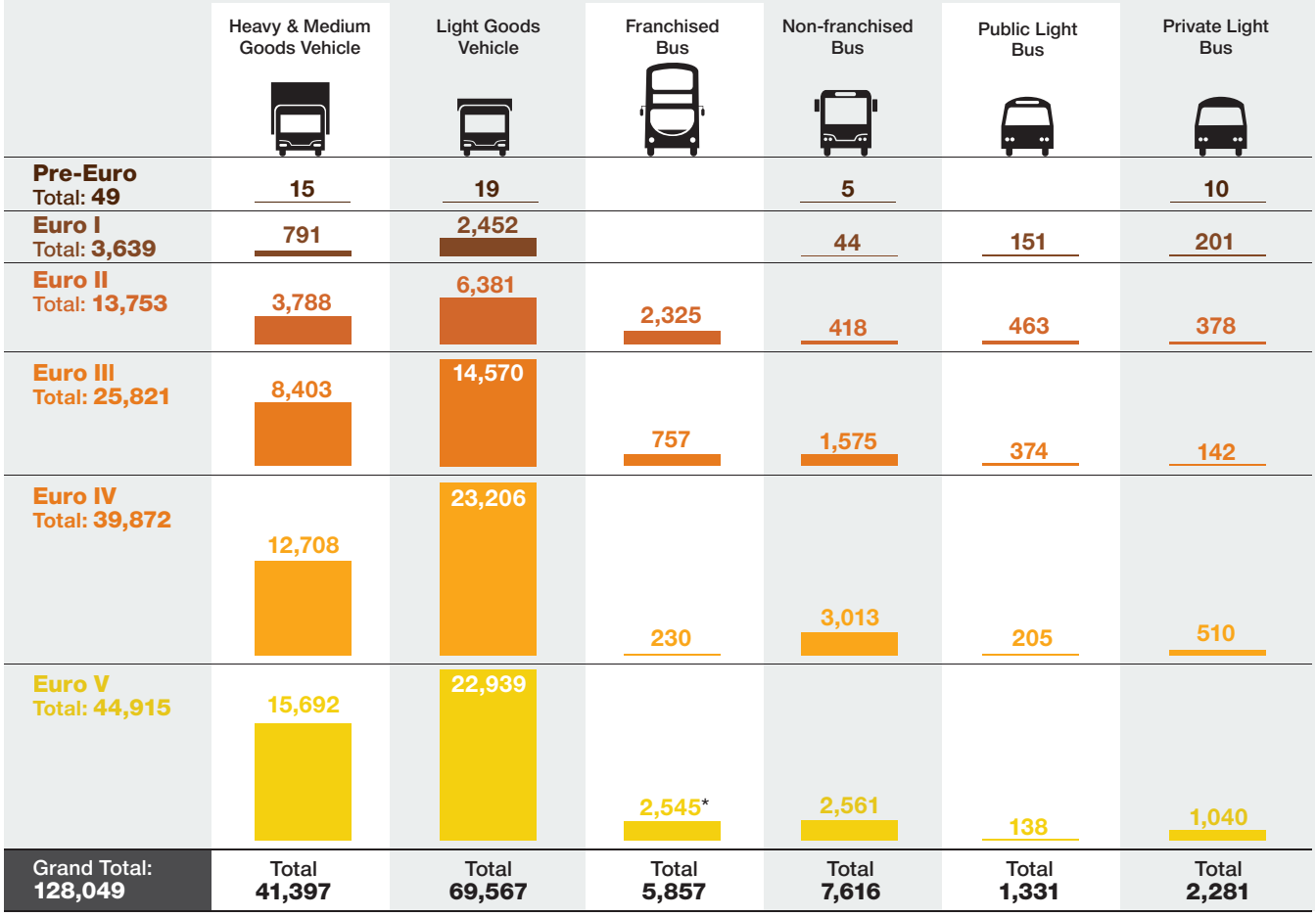


FIGURE 12 **Distribution of licensed diesel commercial vehicles and franchised buses by emission standards** (as at December 2015)



* including 6 Euro VI buses

Retire pre-Euro IV DCV

At the end of 2012, Hong Kong had some 129,000 of DCV (including goods vehicles, light buses and non-franchised buses) with about two-third of them being pre-Euro IV. The pre-Euro IV DCV accounted for the dominant sources of NO_X and PM_{10}, or 10% and 10% of the respective overall NO_X and PM_{10}. Figure 13 shows how much more polluting pre-Euro IV DCV are and why we focused on them.

We put in place two measures to address the problem of aging DCV and to retire pre-Euro IV DCV. The Air Pollution Control (Air Pollutant Emission) (Controlled Vehicles) Regulation, passed on 18 December 2013, stipulates the retirement deadlines for pre-Euro IV DCV (Figure 14) and limits the service life of DCV first registered on or after 1 February 2014 to 15 years. Figure 15 compares the numbers of the different classes

Age limit for new DCV:
Hong Kong did not have a legal limit on the retirement of vehicles and thus had an old fleet of DCV. With the new law, the DCV fleet will be renewed as all such vehicles newly registered on or after 1 February 2014 must retire after 15 years.

FIGURE 13 **Emissions comparison of diesel commercial vehicles** (Pre-Euro to Euro VI)

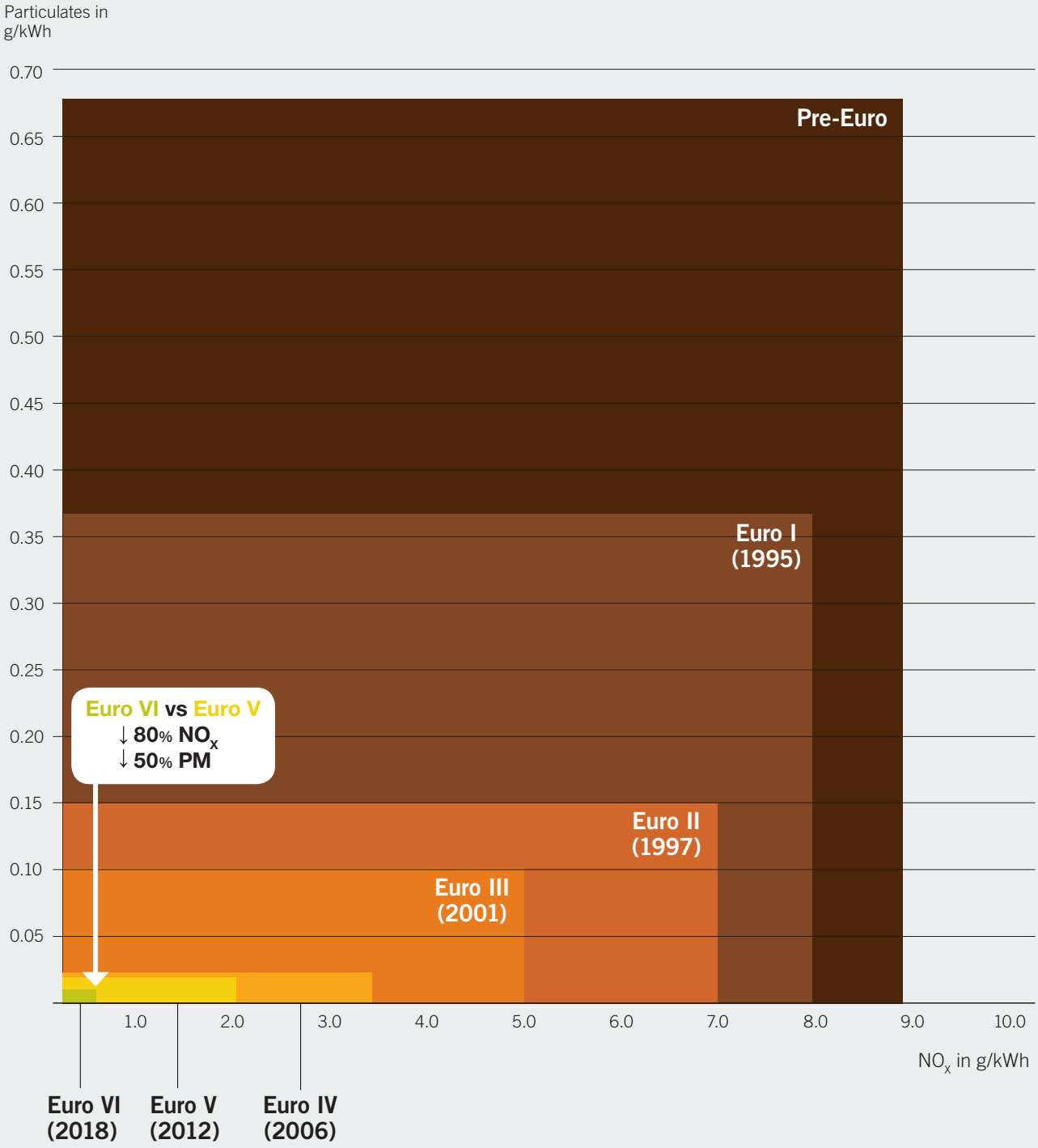


FIGURE 14 DCV retirement deadlines



FIGURE 15 The number of the different classes of registered DCV from end 2012 to end 2016

	Heavy Goods Vehicle		Medium Goods Vehicle		Light Goods Vehicle		Non-franchised Bus		Light Bus		TOTAL	
	2012	2016	2012	2016	2012	2016	2012	2016	2012	2016	2012	2016
Pre Euro	678	3	7,629	14	10,625	34	192	4	344	5	19,468	60
Euro I	316	0	2,509	5	9,643	51	140	5	686	38	13,294	99
Euro II	882	348	6,645	2,096	12,681	3,878	1,013	225	915	712	22,136	7,259
Euro III	516	388	9,670	7,084	17,608	13,460	2,687	1,060	545	506	31,026	22,498
Euro IV	1,504	1,501	11,601	11,564	23,837	23,665	3,111	2,937	724	706	40,777	40,373
Euro V	450	3,651	1,216	16,245	498	29,827	469	3,452	128	1,509	2,761	54,684
TOTAL	4,346	5891	39,270	37,008	74,892	70,915	7,612	7,683	3,342	3,476	129,462	124,973

Note: Only 6 pre-Euro DCVs and 66 Euro I DCVs still had valid vehicle licences as at end 2016. Their licences will not be renewed upon expiry and therefore they will retire afterwards

of Euro DCV from end 2012 to end 2016. Nearly all Pre-Euro and Euro I DCV have been phased out. The remaining very few of these DCV will have to retire upon the expiry of the vehicle licenses. We are well on the way to phasing out Euro II and III DCV as well.

As the most polluting DCV have retired by the end of 2016, we have seen solid emissions reduction at roadside. There will be further improvement by end-2019 although the magnitude will be smaller. This incentive-cum-regulatory scheme targeting all pre-Euro IV DCV cost HK$11.4 billion in ex-gratia payment to the affected owners. We wish to thank all the relevant stakeholders in the smooth passage of the new law and implementation of the scheme.

Strengthened control of emissions for LPG-powered vehicles and petrol vehicles

From 1 September 2014, EPD put in place strengthened emissions control of LPG vehicles that used remote sensing equipment to identify vehicles with excessive emissions. The same equipment could also detect excessive emissions from petrol vehicles (which are mainly private cars). If a vehicle is detected to emit excessive pollutants, a notice would be sent to the owners to have the vehicle tested at a designated vehicle emissions testing centre within 12 working days. Failure to comply will lead to cancellation of the vehicle licence.



Replaced catalytic converters in LPG taxis and PLBs

Virtually all taxis and about 72% of the PLB fleet are powered by LPG, and these are heavily used vehicles because they are on the road all the time. For example, taxis contribute 20% of the total road mileage in Hong Kong. The emissions-reduction catalytic converters installed in such vehicles get worn out and must be replaced after about 12-18 months of use, otherwise NO_x, CO and volatile organic compounds (VOC) levels would increase substantially (up to 10 times more pollutants). Studies showed that their vehicle owners did not practise regular replacement of the catalytic converters.

We launched a one-off subsidy scheme in August 2013 to assist and educate these vehicle owners about the importance of replacing the catalytic converters. The scheme was completed in April 2014 and about 80% of eligible vehicles participated. Those did not participate were mainly new vehicles. A sum of HK$150 million was set aside for the scheme and HK$80 million was spent. Coupled with the subsidy was a strengthened enforcement programme to catch offending vehicles. The subsidy-cum-enforcement programme was effective and roadside emissions have been reduced. We wish to thank all relevant stakeholders for the success of this programme.

Retrofit selective catalytic reduction devices (SCR) to Euro II and Euro III franchised buses

Franchised buses form a special category of vehicles. Under their operating franchise, buses can operate for up to 18 years. At the end of 2012, while there were no pre-Euro buses in the fleet, there were still many Euro II and III buses in service. Based on their normal retirement timetable, all the Euro I buses were retired by 2016 and that the majority of Euro II and some Euro III buses would also retire by 2020. EPD designed a programme to retrofit the remaining Euro II and Euro III buses that had at least two years of operating life left with SCR so that NO_x could be reduced by some 60% thereby enabling these buses to have comparable performance to Euro IV standard or even better. A sum of HK$400 million was set aside in July 2013 and installation of SCR started in May 2014. We envisage that by the end of 2017, all the eligible buses (about 1,030) will be retrofitted. This programme also helped to improve roadside air quality.

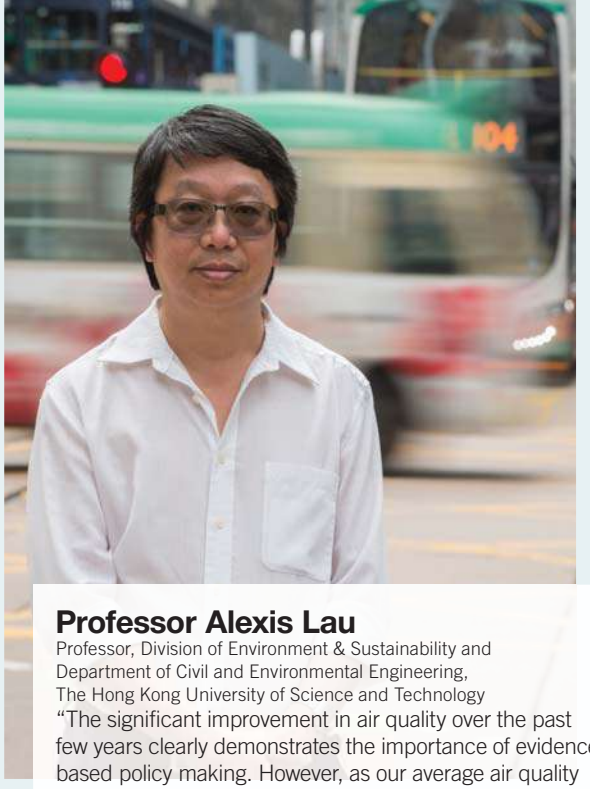
Low Emission Routes and Zones for franchised buses:
Franchised buses are one of the major sources of roadside air pollution at busy urban corridors. In Central, Causeway Bay and Mong Kok, they could account for up to 40% of the traffic flow. The SCR retrofit programme enabled a new arrangement to be implemented with the franchised bus companies. They would only deploy Euro IV or better buses to run on routes that enter these three areas. As of April 2016, all the franchised bus operators could comply with this arrangement, bringing improvement to the busiest urban areas as well as along the whole route.

New technology franchised buses

We are keen to test new technology franchised buses in order to reduce pollution at roadside. Over 90% of Hong Kong's franchised buses are double-decked, we are particularly keen on new technology for them. As of the end of 1Q2017, there are 6 custom-made, double-decked Euro VI hybrid buses on the road, 5 single-decked battery e-buses and 2 single-decked super-capacitor buses on trial. More single-decked battery e-buses (23) and super-capacitor buses (6) would be put into service progressively in 2017. While the technologies are workable, there are challenges that they still need to meet due to the very tough road and operational conditions in Hong Kong (slopes, summer heat, high humidity, summer heavy rains, long-hours in operation, etc). As such, the bus companies are not ready to propose a replacement programme for a part of their fleets using these technologies.







Professor Alexis Lau

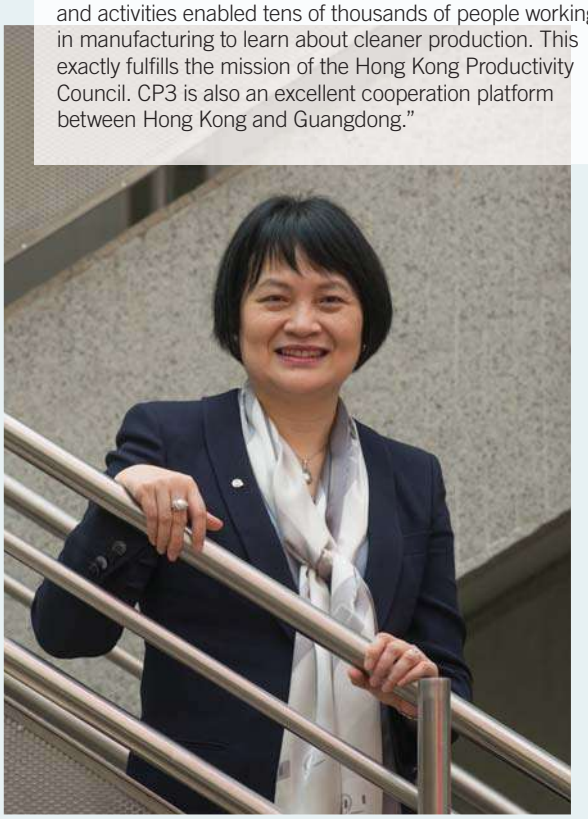
Professor, Division of Environment & Sustainability and
Department of Civil and Environmental Engineering,
The Hong Kong University of Science and Technology

"The significant improvement in air quality over the past few years clearly demonstrates the importance of evidence-based policy making. However, as our average air quality improves, there are still many air pollution hot spots in our densely populated urban areas (e.g. the street canyons) where significant population-exposure to air pollution are still occurring. The next phrase of the government's air quality management system must start to address the population health risks at these hot spots. Besides improving the quality of life for the public in Hong Kong, such targeted exposure reduction policies can make Hong Kong, once again, a global leader in urban air quality management."

Agnes Mak

Executive Director, Hong Kong Productivity Council

"The Cleaner Production Partnership Programme (CP3) has helped Hong Kong-owned enterprises in Guangdong to upgrade their environmental performance. The results speak for themselves. The programme has inspired many others to likewise upgrade their production. The outreach workshops and activities enabled tens of thousands of people working in manufacturing to learn about cleaner production. This exactly fulfills the mission of the Hong Kong Productivity Council. CP3 is also an excellent cooperation platform between Hong Kong and Guangdong."





Professor Wing-tat Hung

Veteran researcher in vehicle emissions,
retired Hong Kong Polytechnic University associate professor

"Vehicle generated air pollution, particularly at the roadside of congested urban areas, have huge impacts on our health. Reducing roadside air pollution in these areas saves our health, money and life. The reduction of major pollutants - fine particulates and nitrogen oxides - by over 15% and 30% since the Clean Air Plan 2013 is a marvelous achievement which was undoubtedly attributed to the unrelenting efforts of the Environment Bureau and Environmental Protection Department and the collaborations of many in the community. We are now having more days of blue sky with white cloud. It is going to be an uphill battle to further clean up the air. I am glad to see the continuous commitment shown in this progress report to strive for further reduction of air pollutants up to 2020 and beyond."

Professor Tao Wang

Chair Professor, The Hong Kong Polytechnic University

"Air quality has improved in Hong Kong in the past 4 years due to various control measures. In particular, Hong Kong is the first Asian city to control shipping emissions. However, high levels of pollution can still haunt the city, like the smog episodes in May 2017. The ongoing AQO review should lead to tightened air quality standards and more aggressive actions, especially for ozone. Hong Kong should also play a more proactive role in tackling regional pollution in the Pearl River Delta."



Transport Management and Urban Planning Solutions

A range of road transport management measures have been implemented that have helped improve roadside conditions. As the rail network has continued to expand, bus and PLB routes will continue to be rationalised. For example, the recent network extensions to Southern District on Hong Kong Island and to Hung Hom in Kowloon have reduced the need for both franchised bus and PLB services. The Transport and Housing Bureau (THB) is also looking into a range of measures proposed by the Transport Advisory Committee to relief congestion that include rationalising cross-harbour tunnels usage, electronic road-pricing etc.[2] New initiatives can be expected in the next few years.

Meanwhile, THB and Development Bureau (DEVB) have been promoting walking and cycling, which are very helpful to improve roadside conditions. THB's WALK in HK promotes walkability, accessibility and connectivity in many urban areas;[3] and DEVB is planning for walking and cycling in new towns, and to provide harbour-front promenades.[4] As these initiatives have been featured more fully in other government publications, we will not go into depth in this document.

Financial Tools for Solutions

The Government has used FOUR financial tools to help promote better roadside air quality. These are:

- Subsidies to retire pre-Euro IV DCV; fit catalytic converters in LPG taxis and PLBs; and retrofit SCR to Euro II and Euro III franchised buses (see above);
- Subsidies to franchised bus operators to purchase and trial new technology buses (see above);
- Subsidise the public transport sector and non-profit organisations to try green innovative vehicular technologies through the Pilot Green Transport Fund; and
- Reduction in First Registration Tax (FRT) to incentivise buyers to opt for clean vehicles.

As the emissions reduction success of the first two subsidies categories have already been noted in this chapter, we will focus on the Pilot Green Transport Fund and FRT below.

Pilot Green Transport Fund

To encourage the transport sector to try out green innovative transport technologies, the Government set up the HK$300 million fund in March 2011 to subsidise the public transport sector, goods vehicle operators and non-profit organisations to use them. The fund has provided for commercial hybrid and electric vehicles (taxis, light buses, coaches and goods vehicles) and various innovative systems (solar, inverter air-conditioning) to operators in courier and logistics services, construction sector, passenger services, beverage delivery sector, supermarket trade, universities and schools, taxi business, etc. As for the end of 1Q2017, the fund has some HK$210 million remaining.

First Registration Tax

A reduction in FRT was first implemented in April 2007 for petrol private cars with lower emissions and higher fuel efficiency, and in April 2008 a similar concession was made to encourage buyers of commercial vehicles to opt for environmentally friendly models. The reduction in FRT for petrol private cars was terminated on 1 April 2015 as the emission control technology of

2. *Report on Study of Road Traffic Congestion in Hong Kong,* Transport Advisory Committee, December 2014, see http://www.thb.gov.hk/eng/boards/transport/land/Full_Eng_C_cover.pdf.
3. *WALK in HK*, see http://www.thb.gov.hk/eng/psp/publications/transport/publications/THB%20Pamphlet-EN.pdf. Walking is also featured in *Hong Kong's Climate Action Plan 2030+*, see http://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf.
4. A summary can be seen in *Hong Kong's Climate Action Plan 2030+*, see http://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf.

petrol private cars has advanced to such a mature stage that further emission reduction is limited.

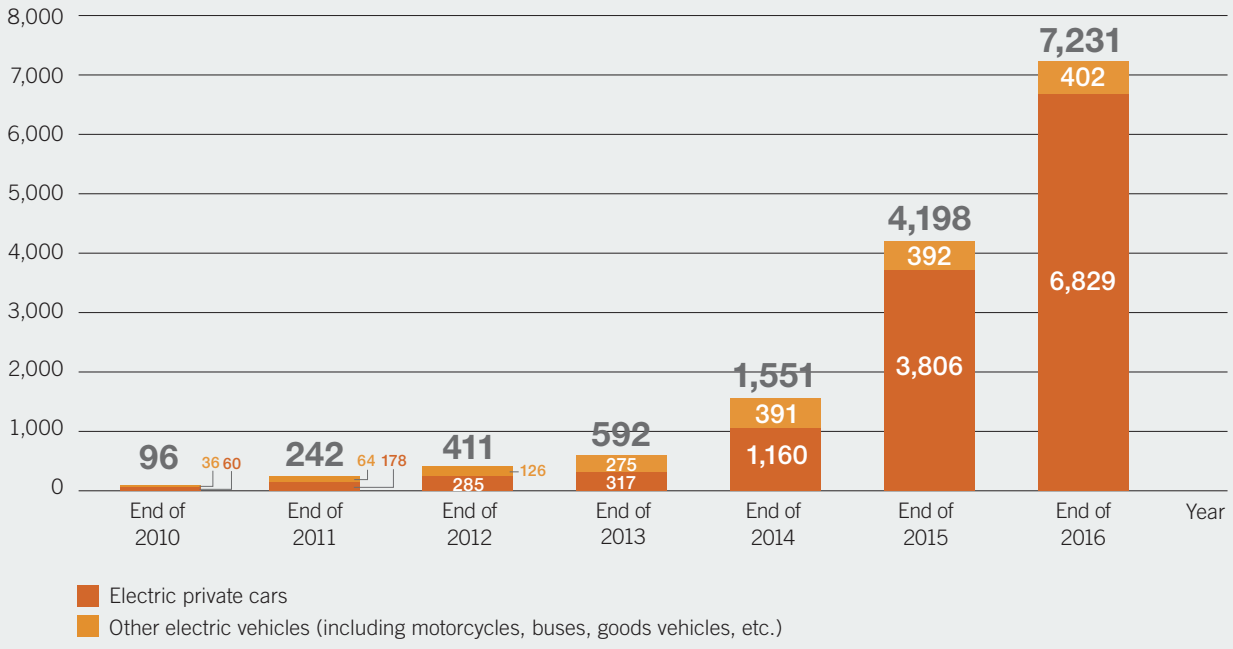
From April 1994, we have fully waived the FRT for electric vehicles. In consideration of the advancement in electric private car technology in recent years that renders the driving performance of electric private cars competitive with that of conventional private cars and electric private cars more acceptable by drivers, we consider it opportune to cap the FRT concession for electric private cars. Also relevant are the public transport-oriented policy with railway as the backbone and the substantial growth of the private car fleet in the last few years. Taking account of all relevant factors, including owners of electric private cars also enjoy other advantages, such as a lower annual vehicle licence fee and savings from higher fuel efficiency of electric vehicles, we capped the FRT waiver for electric private cars at $97,500 from 1 April 2017 to 31 March 2018 inclusive. As for other electric vehicles (electric commercial vehicles, electric motor cycles and electric motor tricycles), they still have a considerable price premium over their conventional counterparts and lag behind in driving performance. Their FRT will thus be waived in full during the same period.

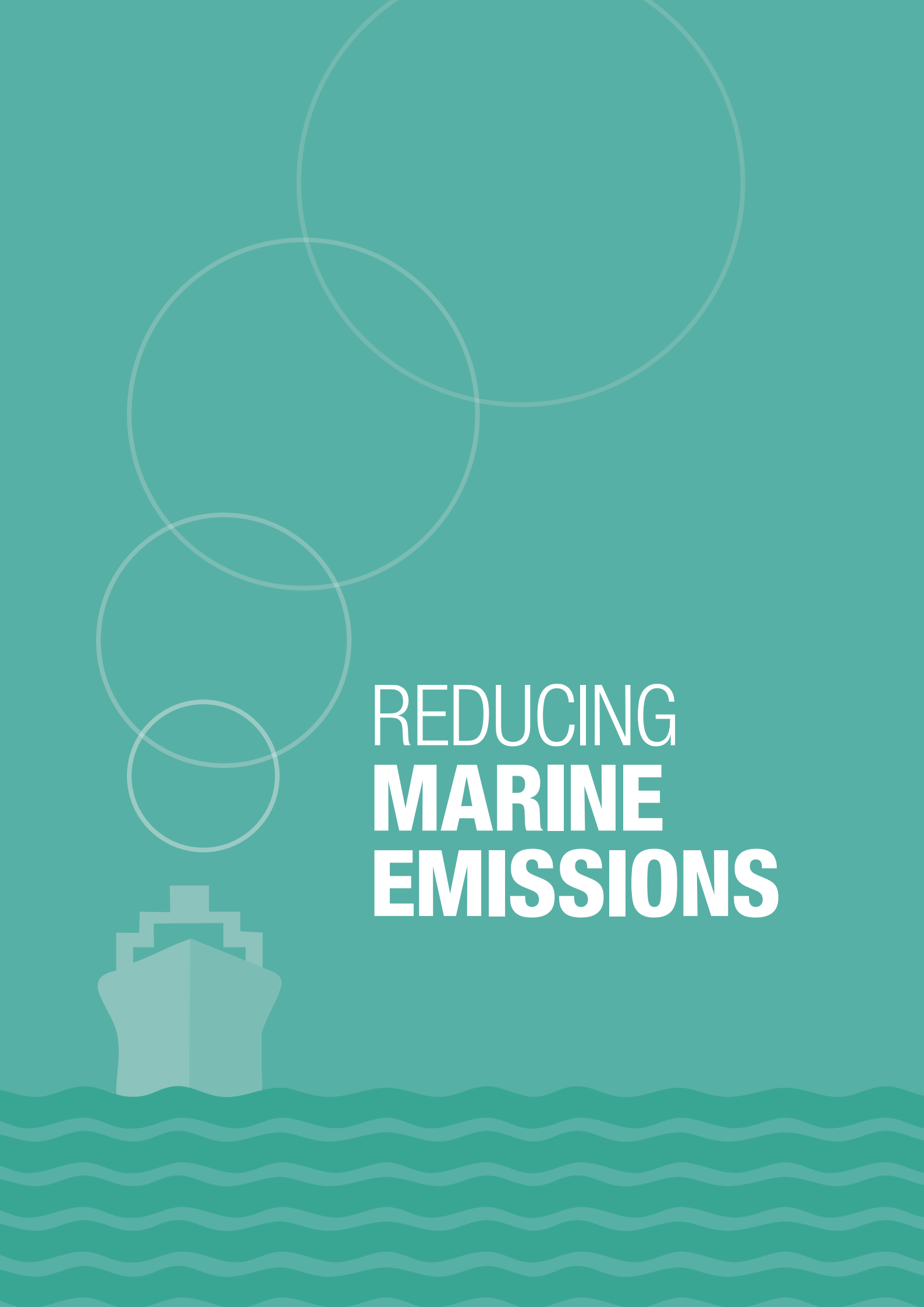
Low/zero emission vehicles

As more electric vehicle models became available in Hong Kong over the past few years and as we have continued to expand charging facilities for electric vehicles, their numbers have increased rapidly. Figure 16 shows the rapid rise of electric vehicles in Hong Kong since 2010.



FIGURE 16 Rise of number of electric vehicles 2010-2016




REDUCING
MARINE
EMISSIONS

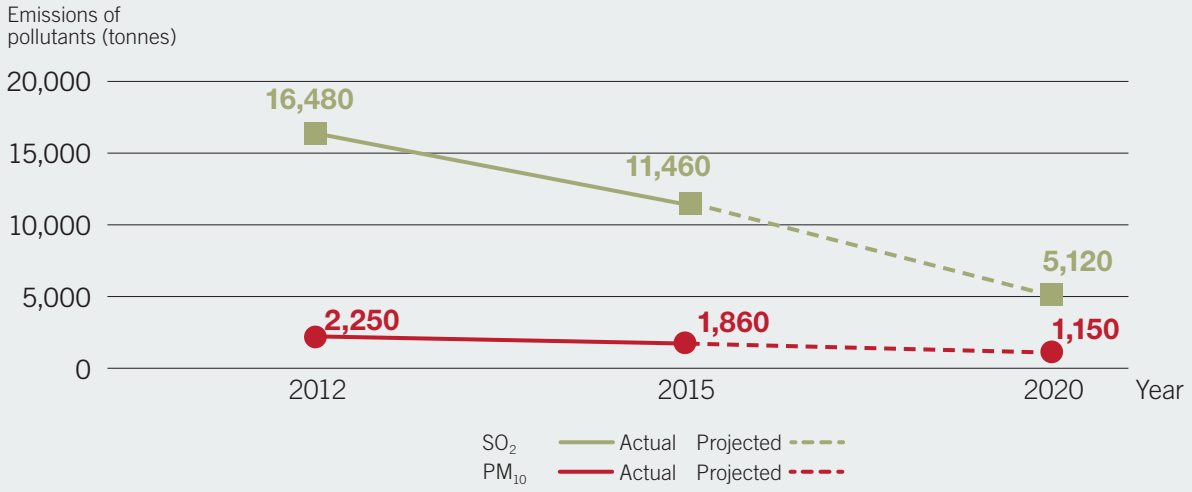
4 | Reducing Marine Emissions

Our efforts since 2012 to reduce marine emissions have been significant, and we can expect further reduction before 2020.

Figure 17 shows the marine emissions from 2012 to 2015 and its projected emission up to 2020. Compared with 2012, the emissions of SO_2 and PM_{10} from marine sector in 2015 has been reduced by approximately 5,020 tonnes and 390 tonnes respectively. Between 2015 and 2020, the emissions of SO_2 and PM_{10} are expected to be further reduced by 6,340 tonnes and 710 tonnes respectively, with the implementation of a domestic emission control area in the PRD waters in January 2019.

Hong Kong remains a busy port with heavy usage by ocean-going vessels (OGV), such as container vessels, cruise liners, oil tankers and dry bulk carriers; vessels plying regional waters, such as river barges and hydrofoils; as well as smaller local vessels, such as ferries. Figure 18 updates the statistics of these various vessels using Hong Kong waters since 2012. While the number of OGV arrivals has slightly dropped, some of the container vessels have increased in size. In any event, marine vessels remain the major local air pollution source for SO_2, PM and NO_X. Figure 19 shows the contribution of shipping emissions in 2015.

FIGURE 17 **Marine emissions from 2012 to 2015 and its projected emission up to 2020**



Note: All figures are rounded to the nearest ten.

FIGURE 18 **Statistics of ships arriving in Hong Kong (2012-2016)**

Year	2012	2013	2014	2015	2016
OGV arrival	30,703	29,915	30,176	29,011	27,642
River vessel arrival	160,156	157,625	159,275	158,508	157,369
HK Licensed vessels*	16,286	17,224	17,752	18,281	18,540

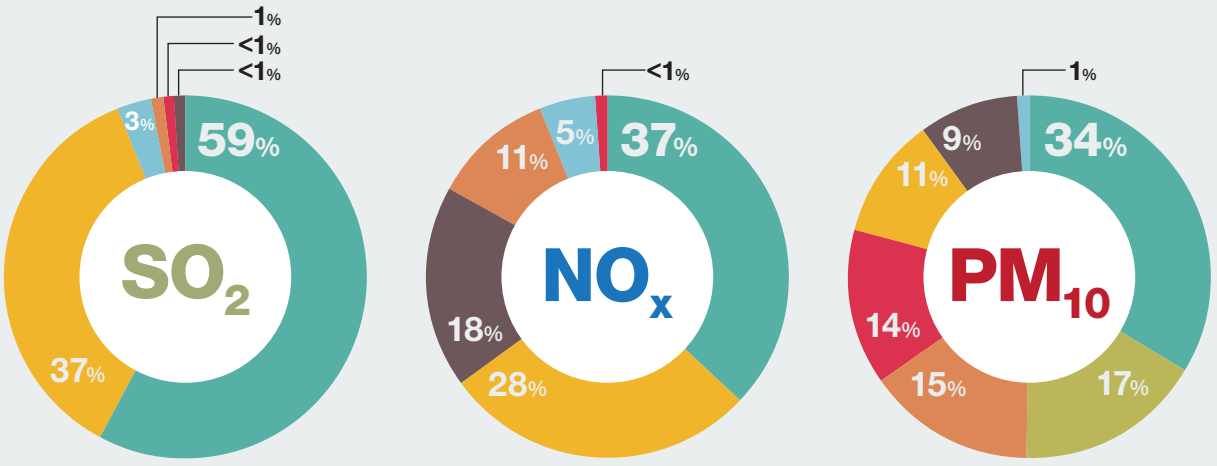
* excluding approximately 800 government vessels

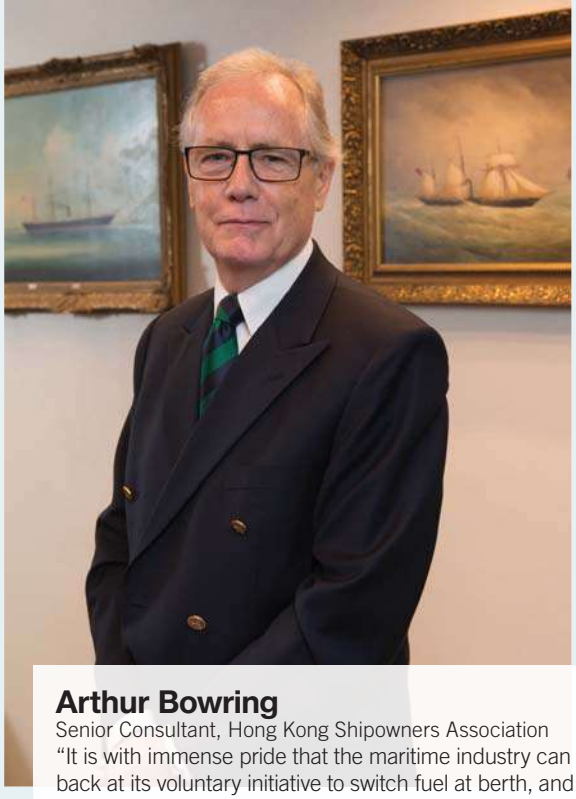
FIGURE 19 Shipping emissions in Hong Kong in 2015

	Ocean going vessels	River vessels	Local vessels	TOTAL
SO_2 Total: 11,460 (59%)	11,100 (57%)	210 (1%)	150 (1%)	**11,460 (59%)**
NO_x Total: 33,900 (37%)	14,650 (16%)	9,170 (10%)	10,090 (11%)	**33,900 (37%)**
PM_{10} Total: 1,860 (34%)	1,390 (26%)	140 (3%)	330 (6%)	**1,860 (34%)**

Notes:
1. All figures in tonnes are rounded to the nearest ten.
2. The data in bracket represent the contribution to total emissions in Hong Kong.
3. There may be slight discrepancies between the sum of individual items and the total emissions due to rounding

FIGURE 20 Emissions in 2015 by sector





Arthur Bowring

Senior Consultant, Hong Kong Shipowners Association

"It is with immense pride that the maritime industry can look back at its voluntary initiative to switch fuel at berth, and the changes in legislation that followed both in Hong Kong and on the Mainland. Hong Kong residents, especially those who live near the port, have benefitted from cleaner air, and the application of the Mainland Domestic Emission Control Area regulations for the PRD and Hong Kong's adoption of coordinating legislation will ensure the further reduction of air pollution from ocean-going ships."



Roberto Giannetta

Secretary General, Hong Kong Liner Shipping Association

"The container liner community in Hong Kong is committed to continue its proactive approach to working with the Hong Kong and regional governments to ensure clean and healthy marine emissions. Having built on the successful voluntary introduction of fuel switch in Hong Kong starting in 2010, ocean going container liner vessels serving Hong Kong and neighbouring ports are pleased to see a broader regional collaboration towards the introduction of an emission control area for the PRD area - thus ensuring a uniform and level policy for all operators, and best results for local population. As air emission policies expand even further, the Hong Kong Liner Shipping Association is keen to work alongside regional governments to promote workable, effective, and efficient solutions to clean air."



Simon K W Ng

Independent consultant on environmental and transport issues

"I commend the Clean Air Plan 2013 for charting a new course for effective air quality management in Hong Kong and for solid regional collaboration. I am encouraged by recent progress in the right direction, but not disillusioned by the size of the task, which requires long-term strategies and ongoing commitment from the government and other stakeholders to be successful. Collective efforts in the coming years would determine how far we can go to clean up air pollution in our city for the benefits of public health and general quality of life."



Jackie Yiqi Zhang

PhD student of HKUST Environmental Science, Policy and Management Program

"My current research focuses on ship emissions and their environmental impacts. It is encouraging to see that the air quality in Hong Kong has improved after controlling emissions from ships. I hope that Hong Kong's leadership and experience in regulating ship emissions will help improve coastal and along-river air quality on the Mainland, as well as inspire other port cities in Asia to take more proactive action."

Substantial reduction in OGV emissions

OGVs contribute the bulk of the shipping emissions in Hong Kong, as could be seen from Figure 19. The International Maritime Organisation (IMO) currently allows the sulphur content of bunker fuel to be 3.5% maximum although this will be tightened to 0.5% by 2020. We sought to move ahead earlier in Hong Kong. In September 2012, we launched a 3-year incentive scheme to reduce port facilities and light dues by half to encourage shipping companies to switch to low sulphur fuel (with sulphur content not exceeding 0.5%) while at berth in Hong Kong. In addition, we proposed in the Policy Address 2013 to mandate OGVs to switch to low sulphur fuel while at berth. After extensive consultation with stakeholders in 2013 and 2014; and with their support, the regulation requiring OGVs to switch to low sulphur fuel while at berth was enacted on 1 July 2015. Hong Kong is the first port in Asia to mandate the fuel switch requirement. We also extended the incentive scheme till 31 March 2018 to ensure our port competitiveness would not be compromised.

This measure helped reduce SO_2 emissions from OGVs at berth very significantly. After the regulation came into effect, the average concentration of SO_2 recorded at the Kwai Chung Air Quality Monitoring Station from July 2015 to June 2016 was 50% lower than that recorded in the preceding 12 months when it was downwind of the Kwai Chung container terminals. This indicated an improvement of air quality at areas, including coastal areas, affected by emissions of OGVs at berth subsequent to the implementation of the regulation.

Cleaner marine light diesel: We introduced a new regulation from 1 April 2014 to cap the sulphur limit of locally supplied marine light diesel at 0.05%– a 90% improvement from the previous limit of 0.5%. Thus, only cleaner marine fuel is available to local vessels in Hong Kong.

Regional collaboration

We undertook in the Policy Address 2013 to step-up efforts with the Guangdong authorities to explore the feasibility of requiring OGVs to switch to cleaner fuel while berthing in PRD ports, as this would bring an even bigger benefit to Hong Kong and residents of the PRD region. We brought Hong Kong new policy to the attention of the relevant authorities in Beijing and Guangdong; and had extensive exchanges with relevant parties through 2013 to 2015. We are pleased that in December 2015, the mainland's Ministry of Transport released an action plan to establish Domestic Emission Control Areas (DECAs) in the waters of PRD (Figure 21), as well as Yangtze River Delta and Bohai Rim (Beijing, Tianjin and Hebei) according to a timetable in Figure 22. Under the plan, from 1 January 2019 onwards, vessels plying within the PRD DECA are required to run on low-sulphur fuel with the sulphur content not exceeding 0.5%.

FIGURE 21 **The PRD DECA designated by the Ministry of Transport**

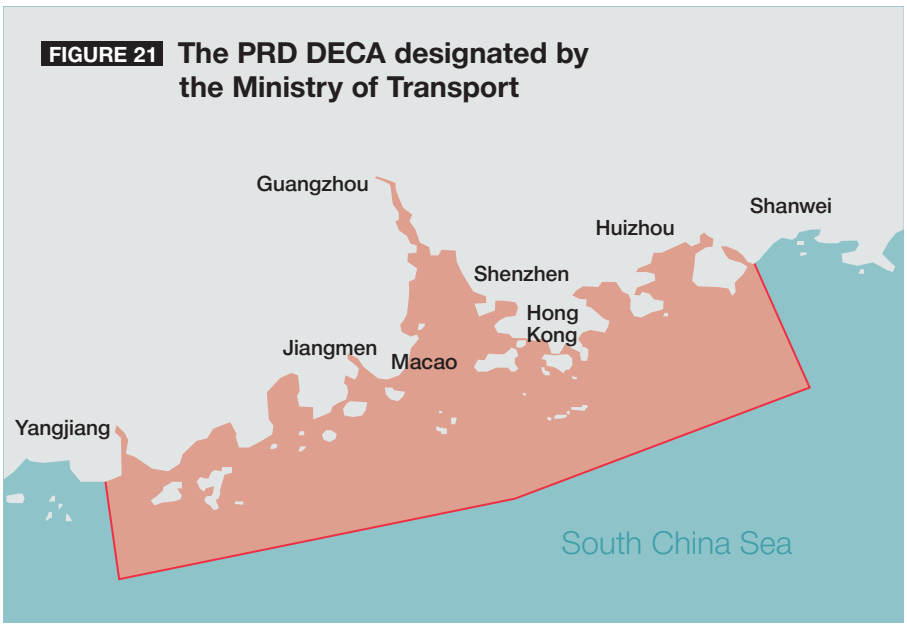
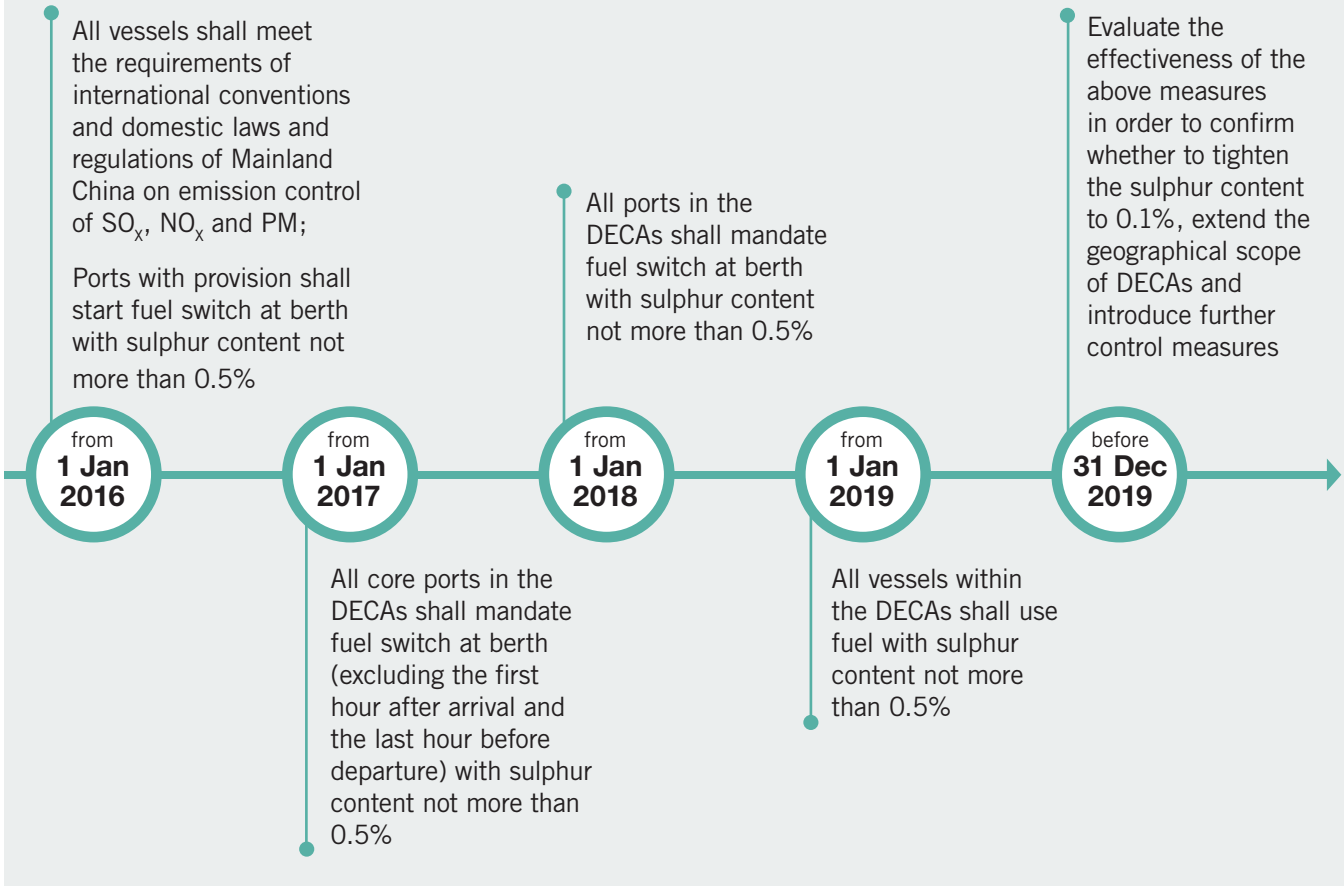


FIGURE 22 **The Mainland's Ministry of Transport's action plan timetable**



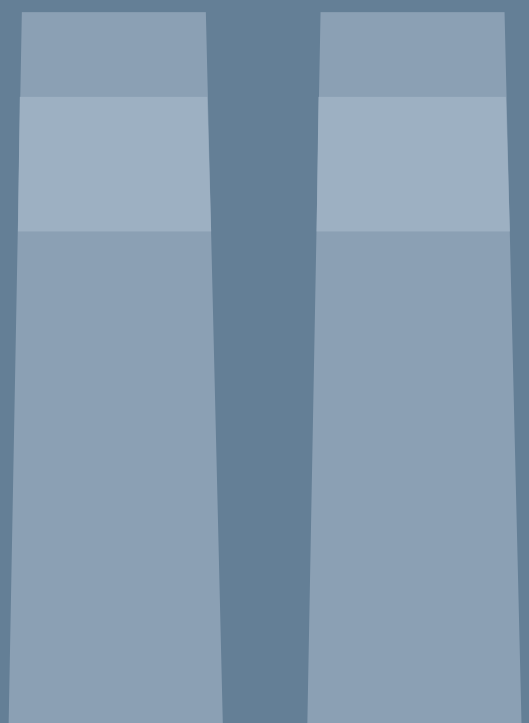
This will bring additional air quality and health benefits to the people in the entire PRD region.

The boundary of the PRD DECA (excluding the waters of Hong Kong and Macao) is about 12 nautical miles and it includes the ports of Shenzhen, Guangzhou and Zhuhai. To complement the efforts under the Ministry of Transport's action plan, Hong Kong will introduce our own regulation to require vessels plying Hong Kong waters to use cleaner fuel from January 2019. We are working closely with the relevant Mainland authorities to ensure this will be done on time to dovetail their timetable. A working group with representatives from the Environmental Protection Department, the Marine Department and the Guangdong maritime authorities has been formed to collaborate on the implementation of the PRD DECA.

On-shore power for cruise terminal

The Kai Tak Cruise Terminal started operation in June 2013. Since 1 July 2015, all cruise ships had to fuel switch at berth. The terminal has reserved space for the installation of on-shore power equipment so such equipment could be installed in the future. In the early years, the number of cruise ships using the terminal was relatively modest. However, the number is increasing. We will consider what may be an appropriate time to review the timetable for on-shore power installation (see Chapter 8).

EMISSION CONTROL OF **POWER PLANTS**



5 | Emission Control of Power Plants

The electricity sector is one of the major local emission sources. Since 2005, the Government has progressively imposed increasingly stringent emission caps to reduce emissions from Hong Kong's electricity generation plants. To meet the caps, the two power companies had retrofitted their major coal units with emission control devices (including Flue Gas Desulphurisation and de-NO_x systems), as well as increased the use of low emission coal and natural gas in their fuel mix.

The Air Pollution Control Ordinance was amended in 2008 to set out the emission caps for 2010 and beyond in a Technical Memorandum (TM). So far, we have promulgated six TMs between 2008 and 2016 that stipulated emission caps covering the period from 2010 to 2021 and beyond. Figure 23 shows the emission caps of the six TMs and the drop in emissions over the years.

FIGURE 23 **Emissions caps and trend of Hong Kong's electricity sector**

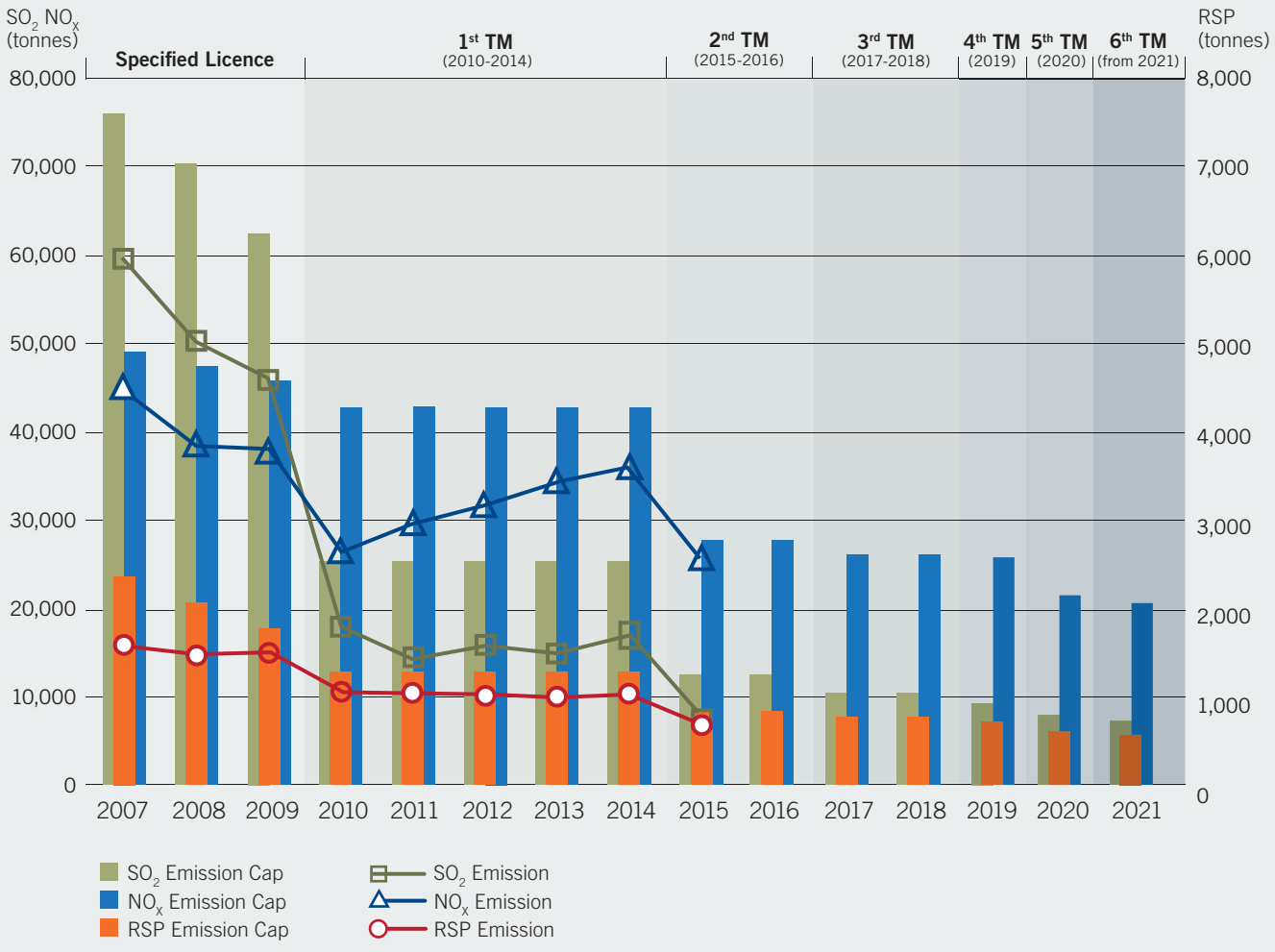
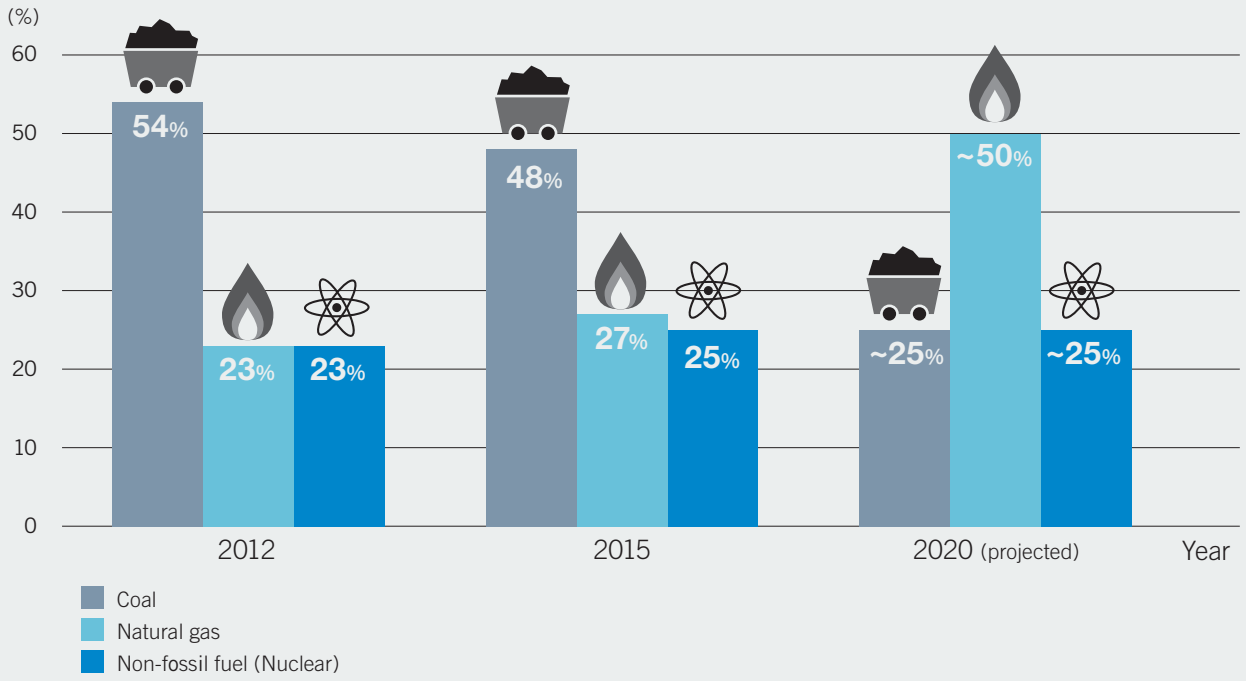


FIGURE 24 **Hong Kong's electricity fuel mix from 2012 to 2020**



Coal is the most carbon intensive fossil fuel and phasing down coal is a key aspect of Hong Kong's Climate Action Plan 2030+. Figure 24 shows Hong Kong's fuel mix change from 2012 to 2015 and projected to 2020.[5] This change will also bring about substantial air quality improvement.

Demand-side management

Energy efficiency and conservation practices have become increasingly important in Hong Kong. Since the publication of the CAP 2013, we have addressed energy efficiency extensively in our Energy Saving Plan for Hong Kong's Built Environment 2015~2025+ and Hong Kong's Climate Action Plan 2030+.[6]



Emission monitoring at power plants





5. *Hong Kong's Climate Action Plan 2030+*, Environment Bureau, January 2017, see pp. 20-21, http://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf.
6. *Energy Saving Plan for Hong Kong's Built Environment 2015-2025+*, see http://www.enb.gov.hk/sites/default/files/pdf/EnergySavingPlanEn.pdf, and *Hong Kong's Climate Action Plan 2030+* as per footnote 5.

6 Emission Control of Non-Road Mobile Machinery (NRMM)

NRMM include a wide range of mobile or transportable machines that are mainly used in the airport, container terminals and construction sites. They contribute 8% NO_X and 10% PM_{10} to Hong Kong's total air pollution in 2015. The Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation took effect on 1 June 2015 and from 1 September 2015, all regulated machines sold or leased for use in Hong Kong must be approved or exempted with a label issued by EPD. The new standard reduces emissions by about 60%. Owners of NRMM could apply for exemption during the six-month grace period between 1 June and 30 November 2015. Starting from 1 December 2015 only approved or exempted NRMM with a proper label are allowed to be used in specified activities and locations including construction sites, container terminals and back up facilities, restricted areas of the airport, designated waste disposal facilities and specified processes. We are also promoting the use of cleaner fuel for the operation of NRMM with biofuel blends, which the construction sector is taking up. The Government has introduced the mandatory use of B5 for NRMM in new public works contracts invited after 1 March 2016.



NRMM contribution to Hong Kong's total air pollution in 2015

PM_{10} 10%

NO_X 8%



MAINLAND AND REGIONAL **COLLABORATION**

7 | Mainland and Regional Collaboration

Cleaning up air pollution is both a national imperative and a local policy priority. There have been important air pollution control efforts in the 11th Five Year Plan and 12th Five Year Plan. Furthermore, on 10 September 2013 the State Council issued the Action Plan on Prevention and Control of Air Pollution and introduced nationwide Ten Measures to Improve Air Quality.[7] Provinces, counties and cities have developed commensurate plans and measures to improve air quality, including Guangdong Province and Shenzhen Municipality.[8] Guangdong Province is a leader in air quality management on the Mainland and it has made substantial efforts over the past decade to improve air quality. While Hong Kong does not come directly under the jurisdiction of the Mainland's Action Plan on Prevention and Control of Air Pollution, our local efforts and those of Guangdong Province have brought significant improvement to regional air quality over the past few years (noted in Chapter 1). The 13th Five Year Plan (2016-20) adopts green development as Mainland's approach to restructuring its economy so as to achieve green growth, which we believe will play an important role in bringing about a cleaner environment overall, including in the PRD region.

Hong Kong's collaboration with Mainland authorities, in particular the Guangdong authorities, has deepened and expanded over the years. In this chapter we explain the impact of regional air quality, as well as our collaboration with Guangdong and other Mainland authorities on various fronts.

Regional air quality

Industrialisation and urbanisation in the PRD has had a great impact on the region's air quality. Since the 1980s, the PRD-Hong Kong-Macao region has seen some of the most rapid industrial and urban expansion in human history. According to the World Bank, the PRD has overtaken Tokyo to become the world's largest metropolis in both size and population.[9] Thus, the whole region is a relatively high emissions region in light of the many industrial, logistics and commercial activities.

The general air quality of Hong Kong is also affected by meteorological factors, such as wind direction, wind speed, rainfall, total bright sunshine hours etc. There is also the region's land-sea breeze, which is created by air circulation between the sea and landmass in the PRD estuary that can lead to the trapping of air pollutants within the region when wind flow is weak (such as during the approach of a typhoon), thus causing very high pollution episodes (Figure 25).

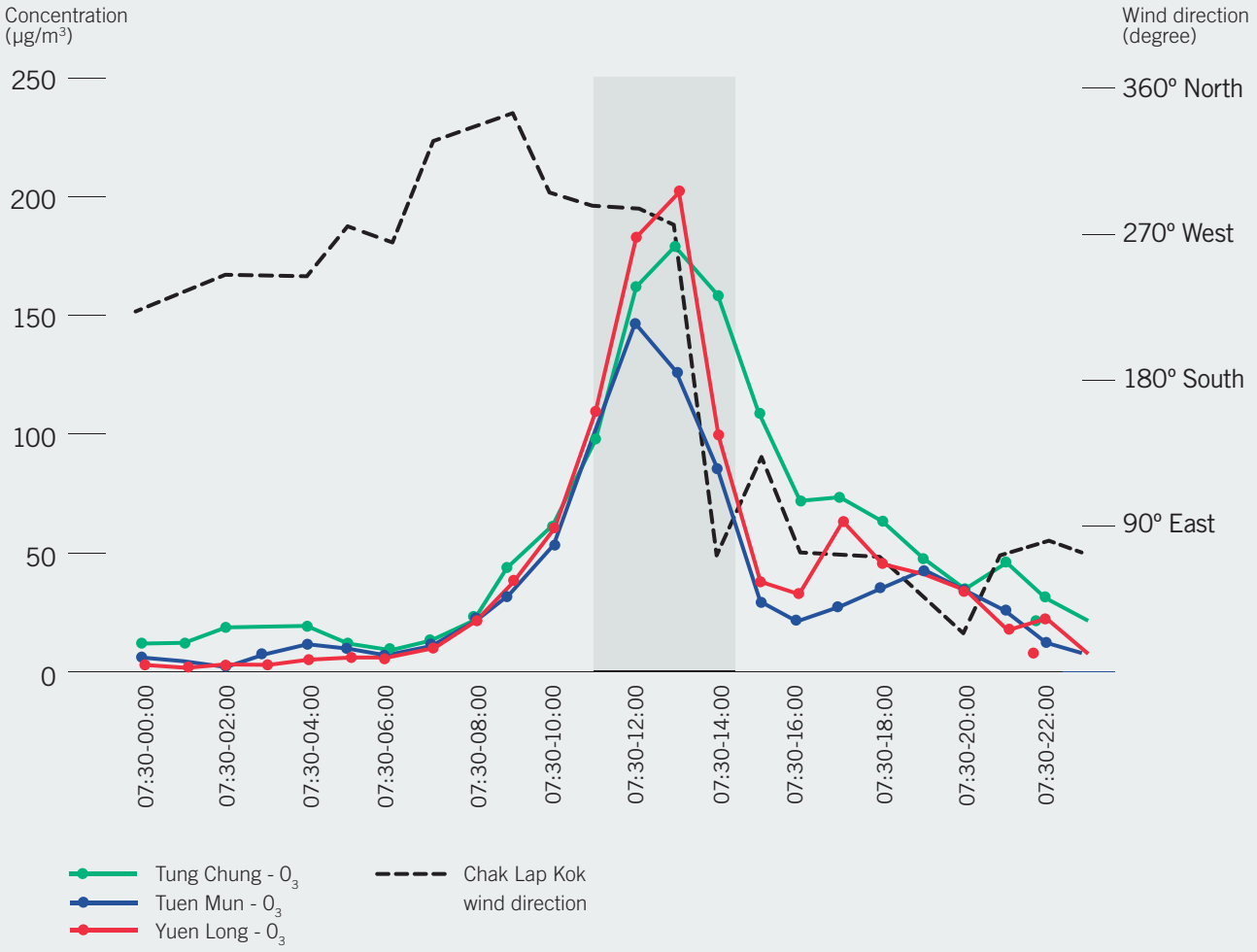
Cooperation framework with Guangdong

Hong Kong must work hard to deal with our own pollution and collaborate with regional partners to deal with regional pollution. Our key platform for collaboration with Guangdong Province is through the Hong Kong-Guangdong Joint Working Group on Sustainable Development and Environmental Protection (JWGSDEP) set-up in 2000 to cover a wide range of environmental issues. The JWGSDEP is co-chaired by Hong Kong's Secretary for the

7. See http://www.gov.cn/zwgk/2013-09/12/content_2486773.htm.
8. See http://zwgk.gd.gov.cn/006939748/201402/t20140214_467051.html and http://zwgk.gd.gov.cn/007543382/201309/t20130930_407564.html.
9. *East Asia's Changing Urban Landscape: Measuring a Decade of Spatial Growth*, World Bank, January 2015, https://openknowledge.worldbank.org/handle/10986/21159.

FIGURE 25 **Influence of Meteorological Factors on Local Air Quality**

On 30 July 2016, northwesterly wind brought the regional ozone accumulated at the PRD estuary to HK west causing a surge in ozone level. Subsequently, when the wind direction changed to southeasterly, the ozone level dropped instantly.



Environment and the Director General of the Guangdong Environmental Protection Department. The two sides meet annually. Air quality has been a key focus from the start. Important achievements include:

- Reaching agreement in April 2002 to reduce SO_2, NO_x, PM_{10} and VOC emissions with targets by 2010, using 1997 as the base year;
- Setting-up the Regional Air Quality Monitoring Network covering four pollutants – SO_2, NO_2, PM_{10} and O_3 – and comprising 16 monitoring stations in the PRD by 2005, the number of which has been extended in 2014 to 23 stations (Figure 26) with the addition of two new monitoring parameters, i.e. CO and $PM_{2.5}$;

- Implementing a basket of emissions reduction measures under the Regional Air Quality Management Plan which aimed at meeting the 2010 targets;
- Entering into a new agreement in November 2012 to reduce pollutant emissions with targets to be reached by 2015 and target ranges for 2020 (Figure 28);
- Including Macao in conducting a joint regional study on $PM_{2.5}$ in 2014 and for it to be completed in 2017; and
- Preparing joint air pollution forecasting so as to provide information to residents of the region through data sharing and forecasting exchanges, meetings on anticipated heavy pollution days, staff training and technology exchanges etc.

Macao:
In September 2014, Guangdong, Hong Kong and Macao signed a new cooperation agreement, which includes joint release of air quality information, conduct studies, and foster exchange and promote environmental technologies.

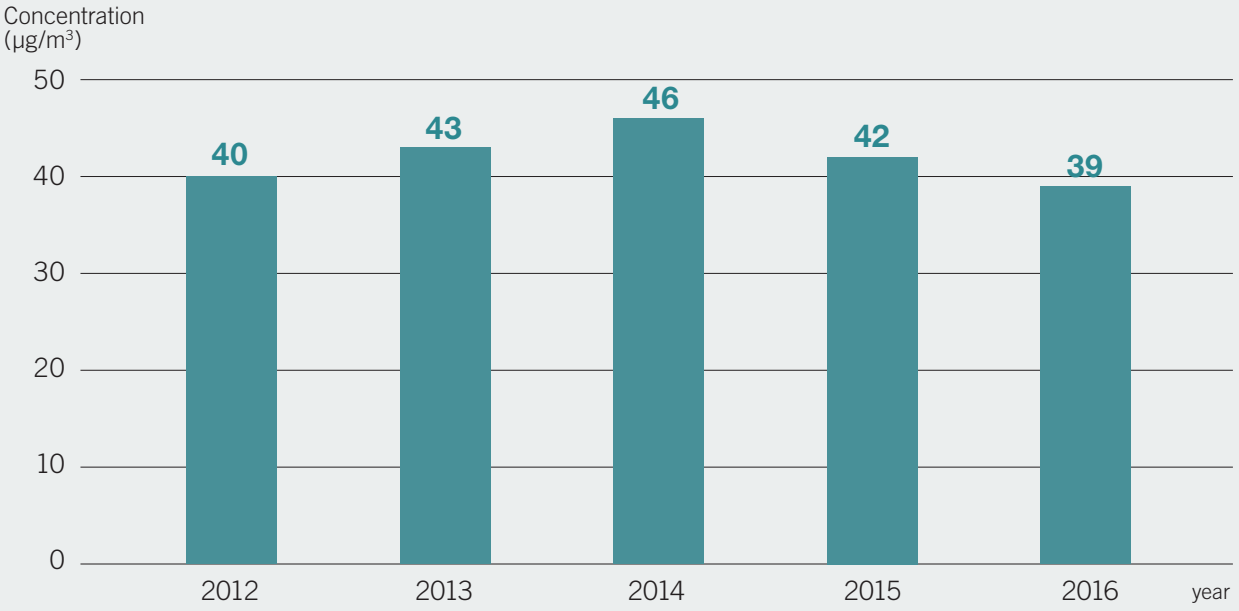
FIGURE 26 **Map of Regional Air Quality Monitoring Network**



The regional ozone challenge

Under sunlight, NO_X reacts with VOC to form O_3, which in turn helps the formation of fine particulates (commonly called photochemical smog). O_3 pollution is a regional problem. A recent research study concluded after analysing the local O_3 data from 2002 to 2013 that, on average, regional O_3 accounted for 70% of the O_3 in Hong Kong while the rest was locally produced. An observation of the study is that locally produced O_3 had been reduced but the reduction had been more than offset by the increase in regional O_3, thereby leading to a rise in O_3 levels in Hong Kong. There are some initial signs of a reversal of the past increasing trend in O_3 in general during 2012 to 2016 (Figure 27), which could be due to our collaboration with the Guangdong Provincial Government in reducing the emissions of NO_X and VOC, the precursors leading to the formation of ozone via photochemical reactions. Further observations are needed to affirm the reduction trend while we continue our collaboration with Guangdong in reducing the emissions of NO_X and VOC, among other key air pollutants, in the whole PRD region.

FIGURE 27 **Ozone concentration in Hong Kong from 2012 to 2016**



Improving regional air quality by 2020

As noted above, Guangdong and Hong Kong endorsed emissions reduction targets for 2015 and reduction ranges for 2020 in November 2012. Both sides are now conducting a joint mid-term review to assess the achievement of the 2015 emission reduction targets and to finalise the emission reduction targets for 2020. It is expected that the mid-term review will be completed around mid 2017. As VOC continues to be a challenge for the region, it was agreed on 6 January 2017 that it should be included in the Regional Air Quality Monitoring Network.

FIGURE 28 **Emissions reduction targets for 2015 and target ranges for 2020**

Pollutant	Area	2015 Emission Reduction Targets* (%)	2020 Emission Reduction Ranges* (%)
SO_2	Hong Kong	-25%	-35% – -75%
	PRD Economic Zone	-16%	-20% – -35%
NO_x	Hong Kong	-10%	-20% – -30%
	PRD Economic Zone	-18%	-20% – -40%
RSP	Hong Kong	-10%	-15% – -40%
	PRD Economic Zone	-10%	-15% – -25%
VOC	Hong Kong	-5%	-15%
	PRD Economic Zone	-10%	-15% – -25%

*as compared with 2010 emission levels

Cooperation in Marine Emissions Control

As noted in Chapter 4, the control of marine emissions is a relatively new area of collaboration between Hong Kong and the Mainland. As the Mainland authorities have devised a plan that covers the PRD, Yangtze Region and Bohai Region, we have participated alongside officials and experts from the Mainland to share experience. We are also working closely with the Ministry of Transportation and Maritime Safety Administration at the national and PRD levels to dovetail our work with the implementation of the PRD Domestic Emissions Control Area in 2019.

Cooperation with the Economic and Information Commission of Guangdong Province

Our Cleaner Production Partnership Programme (CP3),[10] first started in 2008, is on-going till 2020. The purpose is to encourage and facilitate Hong Kong-owned factories in Hong Kong and Guangdong to adopt cleaner production technologies and practices through funding support and technology promotion activities to reduce air pollution emissions (and also save energy and water). Our partner is the Economic and Information Commission of Guangdong Province. As ozone is a major regional challenge, we have placed emphasis to encourage factories to adopt cleaner production technologies for reduction of VOC and NO_x in target industry sectors, including furniture, metal and metal products, chemical products and printing industries, etc. Up until end of April 2017, over 2,800 funding applications have been approved under the CP3 and some 470 technology promotion activities have also been organised with over 37,000 participants.

Shanghai:
We also have a cooperation agreement on air quality exchange with the Shanghai Environment Bureau

10. The Cleaner Production Partnership Programme, see https://www.cleanerproduction.hk.

8 | Going Forward

AQOs Review Process

Cleaning-up Hong Kong air quality will continue to be a top priority. Since 1 January 2014, the revised Air Pollution Control Ordinance requires the Secretary for the Environment (SEN) to review the AQOs at least once every five years and submit a report to the Advisory Council on the Environment (ACE). This means effectively every administration has to consider what else could be done to improve air quality and whether the AQOs could be revised.

To meet the statutory requirement, we have already started the AQOs Review process in 2016 so that we aim at completing the review and report it to ACE in mid-2018, after which we expect to consult the public in late 2018. The review covers:

- Appraisal of the latest relevant development in air science, the health effects of air pollution and air pollution control technologies;
- Examination of the current state of air quality and the effectiveness of improvement measures to date;
- Identification of new practicable air quality improvement measures and evaluation of cost and benefit of the measures;
- Assessment of the scope of tightening the AQOs; and
- A Work Plan to attain the updated AQOs.

The review process starts by seeking suggestions on air pollution improvement measures from a wide number of stakeholders from the academics, health experts, and business and community sectors. Their suggestions are deliberated upon and the magnitude of air pollution reduction potentials and health improvement considered. The review report combining all their views and findings will be sent to the SEN for consideration. The SEN will present the review findings to ACE for consideration, after which the Government will launch a public consultation.

Air quality, energy and climate change

We know the burning of fossil fuels is the main cause of air pollution and climate change. Rising temperatures may also increase the frequency of days with higher level of photochemical smog. Thus, there is a need for us to approach air quality control, energy usage and climate change mitigation in a multidisciplinary manner.

We know the burning of fossil fuels is the main cause of air pollution and climate change. We have extensive plans on energy saving since the less energy we use, the better it will be for air quality and climate change.

We have already embarked on reducing coal usage in our local electricity generation, which has brought substantial reduction in air pollutants, and it also has reduced Hong Kong's carbon emissions. As noted in Chapter 5, we have a target and timeline for further reduction in carbon intensity to be brought about by phasing down coal through till 2030, which would also result in continued reduction in emission of air pollutants. At the same time, we have extensive plans on energy saving since the less energy we use, the better it will be for air quality and climate change. It is everyone's duty to save energy and reduce emission!

Abbreviations

CAP	A Clean Air Plan for Hong Kong 2013
ACE	Advisory Council on the Environment
AQHI	Air Quality Health Index
AQM	Air Quality Management
AQO	Air Quality Objectives
CO	Carbon monoxide
CP3	Cleaner Production Partnership Programme
DCV	Diesel commercial vehicles
DECA	Domestic Emission Control Area
DEVB	Development Bureau
ENB	Environment Bureau
EPD	Environmental Protection Department
FAQ	Frequently Asked Questions
FRT	First Registration Tax
FSP	Fine Suspended Particulates
IMO	International Maritime Organisation
IT	Interim Target of WHO AQGs
LPG	Liquefied petroleum gas
NGO	Non-government organisations
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NRMM	Non-road mobile machinery
O_3	Ozone
OGV	Ocean-going vessels
Pb	Lead
PM	Particulate matter
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometers in diameter
PM_{10}	Particulate matter less than or equal to 10 micrometers in diameter
PRD	Pearl River Delta
RSP	Respirable Suspended Particulates
SCR	Selective catalytic reduction
SEN	Secretary for the Environment
SO_2	Sulphur dioxide
THB	Transport and Housing Bureau
TM	Technical Memorandum
VOC	Volatile Organic Compound
WHO AQGs	World Health Organisation Air Quality Guidelines

For *"A Clean Air Plan For Hong Kong*" published in March 2013, please see CAP 2013.

