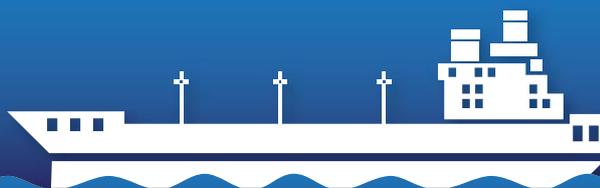
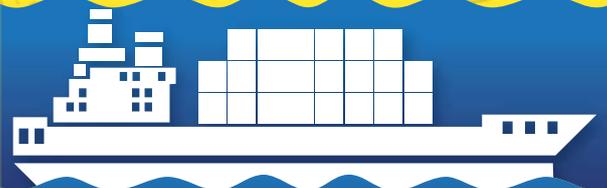
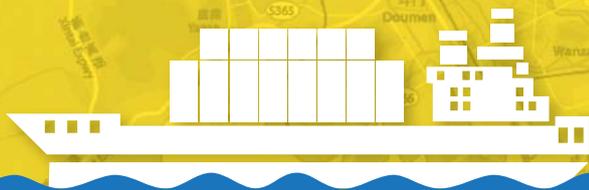


Working Towards a Quality Living Region – A Pearl River Delta Emission Control Area

November 2013

Simon Ng, Veronica Booth and Freda Fung



About Civic Exchange

Civic Exchange is a Hong Kong-based non-profit public policy think tank that was established in 2000. It is an independent organisation that has access to policy-makers, officials, businesses, media and NGOs - reaching across sectors and borders. Civic Exchange has solid research experience in areas such as air quality, energy, urban planning, climate change, conservation, water, governance, political development, equal opportunities, poverty and gender. For more information about Civic Exchange, visit www.civic-exchange.org.

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Preface & Acknowledgements

Hong Kong was the world's third largest container port in 2012. The port sector has contributed significantly to the city's economic development, but at the same time, it is inflicting adverse public health impacts to residents living close to the ports. The Pearl River Delta (PRD) port cluster, consisting of Hong Kong, Yantian, Shekou, Guangzhou and other smaller ports in the PRD region, handled over 10% of the world's throughput in 2011. Home to more than 63 million people, this level of ship movements, the resultant emissions and the public health impacts posed have drawn much attention.

This paper represents Civic Exchange's continuing efforts to conduct port-related emissions research and stakeholder engagement initiatives. In our September 2012 research report, *A Price Worth Paying: The Case for Controlling Marine Emissions in the Pearl River Delta*, we recommended one emissions control strategy – setting Emission Control Area (ECA) level fuel standards (0.1% sulphur content) for vessels within 100nm of Hong Kong. This research helped inform us that establishing an ECA will bring about the greatest emissions reduction and public health benefits to the whole PRD region. We hope that the current paper can build on the debate and stimulate discussion on establishing an ECA across the PRD, as well as the issues involved.

We would like to thank the industry and government experts who have participated in our discussions over the last five years. Special thanks to Arthur Bowring and the Hong Kong Shipowners' Association, the Hong Kong SAR Government's Environmental Protection Department and the Marine Department for contributing to this process since the first set of meetings in 2007, and for comments on this paper. Sincere thanks go to the Hong Kong Liner Shipping Association, and in particular Roberto Gianetta and Tim Smith for sharing their perspectives and comments on this paper, on top of regularly participating at our meetings and events. Thanks also to Exxon Mobil, and Pamela Mar (Fung Group) for reading the paper and providing suggestions and insights. Civic Exchange's work in this area would not have been possible without the participation and support of all of these organisations and people.

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Introduction

Hong Kong is a major seaport. The port sector contributes significantly to Hong Kong's economy

Hong Kong is one of the major seaports of the world. In 2012, over 23 million shipping containers (in the trade, called twenty-foot equivalent units or TEUs) were handled, making Hong Kong the world's third busiest container port after Shanghai and Singapore.¹ For decades, the port of Hong Kong has been a key driver for the city's economic growth and prosperity. It handles 90% of Hong Kong's cargo throughput.² The port and related sectors also account for 2.3% of Hong Kong's Gross Domestic Product, and 2.7% of total employment.³ In addition, the port of Hong Kong has contributed significantly to the economic development in the Pearl River Delta (PRD) since the late 1970s. About 70% of the container boxes handled in Hong Kong are connected with southern China.⁴

International shipping is a key driver of the economy and an energy-efficient transport mode. However, it also imposes a cost on the environment

International shipping is considered the most energy-efficient and cost-effective way for long-distance movements of goods, playing a major role in world trade and bringing enormous benefits to developing and developed economies. However, international shipping also imposes a cost on planet earth in the forms of air pollution, greenhouse gas emissions, water pollution, and other negative environmental impacts. The impact is particularly significant at the ship-port-city interface, as well as in coastal areas, where vessel movements and port activities make the most direct impact on residents living and working in port cities.

1.1 Ship exhaust emissions and human health

Ship emissions are getting more attention, reflected in growing research and regulatory control

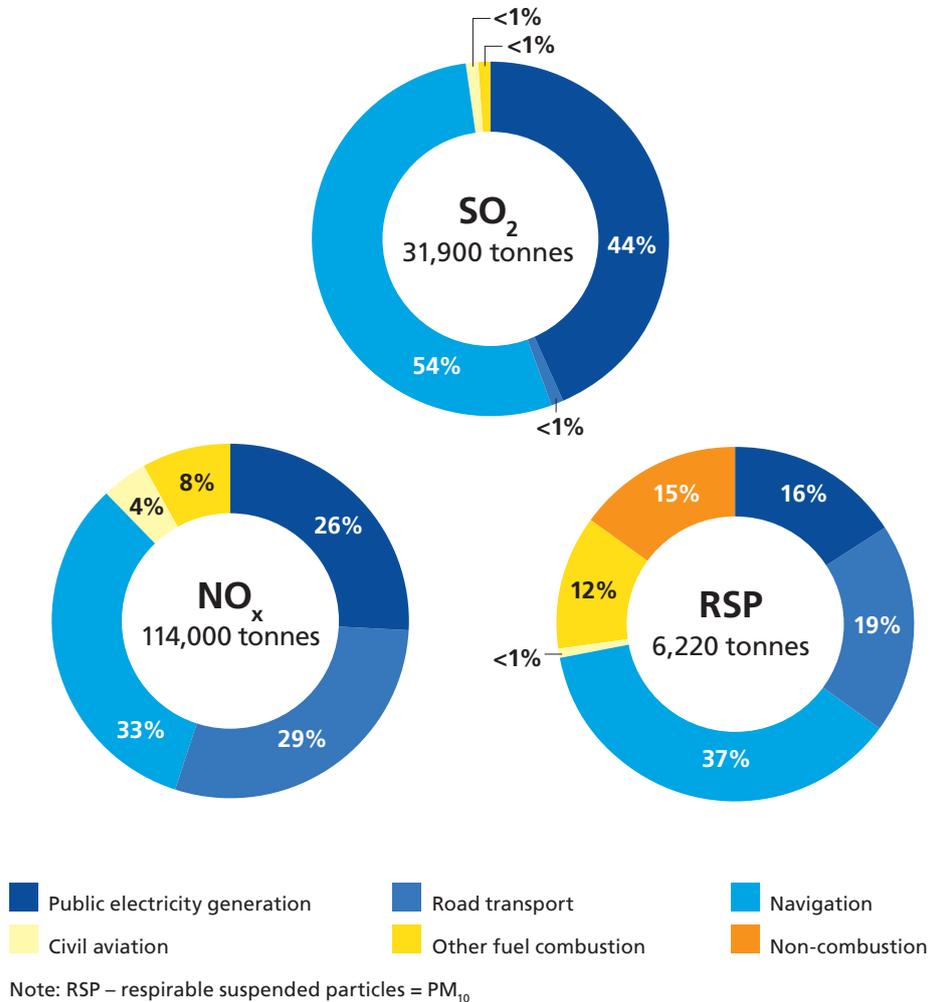
Amongst all the environmental impacts of ships, the emissions of air pollutants such as sulphur dioxide (SO₂), nitrogen oxides (NO_x) and particulate matter (PM) have received the most attention over the last 10 to 15 years. Scientific research on ship emissions has mushroomed in areas such as emissions estimation methods, impacts on public health, and emissions control strategies. With more data and a better understanding of the issue, agencies at the international, regional and local levels are seen to be exercising stronger regulatory control on ship emissions.

Hong Kong and PRD regulators should be concerned about ship emissions for various reasons: high container throughput, high emissions, high density of population, and potential health impacts

Ship emissions should be a key focus of the air quality management plan of Hong Kong and the PRD for a number of reasons. First, the port cluster in the PRD region, including Hong Kong, Yantian, Shekou, Guangzhou and other smaller ports, handles over 10% of the world's container throughput.⁵ In other words, there is an extremely high concentration of ship movements and maritime activities in the PRD waters. Second, high levels of activity lead to high levels of emissions. In Hong Kong, the air pollutant emission inventory of 2011 shows that ships are the biggest source of SO₂, NO_x and PM emissions in Hong Kong (Figure 1).⁶ As Yantian and Shekou ports are operating at a similar scale,⁷ it is reasonable to assume that ships in the other PRD ports contribute roughly equivalent air pollutant emissions as Hong Kong.⁸ Third, it is widely acknowledged that exhaust emissions from ships

are harmful to human health (see Box 1). As the PRD is a densely populated region with over 63 million people,⁹ the negative health impact imposed on those who live in this region will be extremely high. A recent study estimated that 519 premature deaths were attributable to SO₂ emissions of ocean-going vessels in the PRD,¹⁰ and the number could be much higher if the impacts of other pollutants such as NO_x and PM were also considered. Last but not least, the World Health Organization (WHO) announced in October 2013 that outdoor air pollution is carcinogenic to humans, and there is sufficient evidence to suggest that exposure to outdoor air pollution will cause lung cancer.¹¹ This announcement puts out a strong message to governments around the world that swift action must be taken to address air pollution to protect public health. Ships, which are predominantly powered by diesel engines, should be considered a major target for emissions control.

Figure 1: Ships' contribution ("Navigation") to air pollution in Hong Kong, 2011



Box 1: Ship emissions and health impact

Ocean-going vessels (OGVs) use mainly bunker fuel (also known as residual oil or heavy fuel oil) to provide propulsion and heat. This is a residual product from the refinery process characterised by a high sulphur content, high viscosity, and the presence of heavy metals such as cadmium and vanadium. For comparison, OGVs may burn bunker fuel with sulphur content of up to 3.5%, whereas harbour craft are burning marine light diesel of less than 0.5% sulphur, and road vehicles are using fuel with much lower sulphur content, such as Euro V diesel with 0.001% sulphur. The level of sulphur content in the fuel will determine the level of PM emissions, and so bunker-burning vessels will emit a much higher level of PM (especially sulphate-based PM) than local craft and road vehicles per unit of fuel burned.

Over the last decade, several research studies have demonstrated the impact of ship exhaust emissions on human health.¹² A study completed in 2007 found that PM_{2.5} emissions attributable OGVs are responsible for about 60,000 cardiopulmonary and lung cancer deaths annually around the world and about 15,000 deaths in East Asia.¹³ Recent studies show that earlier studies may have underestimated the health impact of international shipping.¹⁴

1.2 Ship emissions control

1.2.1 International regulations

At the global level, the International Maritime Organization (IMO) is the United Nations agency that is dedicated to the safety and security of shipping, and the prevention of marine pollution by ships. It lays out regulations in relation to the environment through the International Convention for the Prevention of Marine Pollution from Ships (MARPOL). Annex VI of the Convention (last revised in 2008) specifically deals with the prevention of air pollution from ships, and covers the control on sulphur oxides (SO_x) and NO_x emissions, and also indirectly the emissions of secondary PM through the SO_x limits. MARPOL Annex VI also allows a signatory country to apply to the IMO for the designation of an Emission Control Area (ECA) with more stringent control of ship emissions (see Section 2 for more information).

SO_x emissions are controlled mainly through the global sulphur cap of 3.5% for fuel oil used on ships, which will be progressively reduced to 0.5% by 2020, subject to a feasibility review to be conducted by 2018. For ECAs, the fuel sulphur limit at present is set at 1%, which will be further tightened to 0.1%, effective from 1 January 2015 (see Figure 2). NO_x emissions, on the other hand, are restricted through progressively more stringent emission standards for marine diesel engines (see Table 1). Vessels operating in ECAs will have to meet the Tier III standard. In a nutshell, SO_x emissions are tackled via the fuel and NO_x via the engine.

The IMO's MARPOL Annex VI is a global tool to control ship emissions

There are different ways to control SO_x and NO_x

Figure 2: Fuel sulphur limits and implementation dates under MARPOL Annex VI

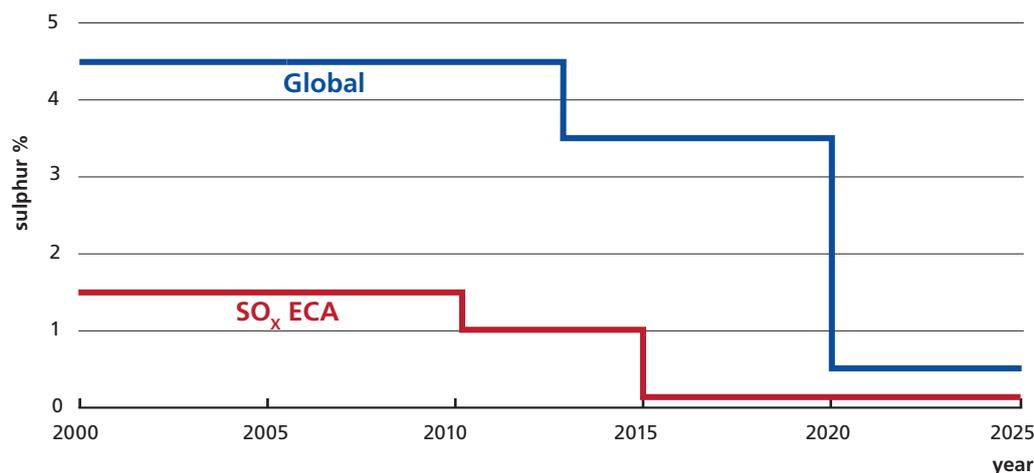


Table 1: NO_x limits for marine diesel engines under MARPOL Annex VI

Standard	Engines built-year	NO _x limit (g/kWh)			Relative NO _x reduction
		n < 130	130 ≤ n < 2,000	n ≥ 2,000	
Tier I *	2000-2010	17.0	45 x n ^{-0.2}	9.8	-
Tier II	2011-2015	14.4	44 x n ^{-0.23}	7.7	~ 15% lower than Tier I
Tier III	From 2016 **	3.4	9 x n ^{-0.2}	2.0	~75% lower than Tier II

Notes:

n = engine maximum operating speed in revolutions per minute.

* The 2008 amendment of MARPOL Annex VI extends the Tier I requirement to existing engines installed on ships built between 1 January 1990 to 31 December 1999 with a displacement not less than 90 litres per cylinder and rated output not less than 5,000 kWh, subject to availability of approved engine upgrade kit.

** In NO_x Emission Control Areas

There are plenty of regional and local control measures in the US and Europe, but few in Asia

1.2.2 Regional and local control measures

At the regional and local levels, authorities around the world are implementing different measures to reduce ship emissions independent of IMO regulations. For example, the United States (US) has imposed national marine engine emissions and fuel requirements, and the European Union (EU) has adopted directives that enforce emission requirements on inland waterway vessels and has set sulphur requirements for local craft fuel.¹⁵ In addition, some regions or ports have mandated or offered incentives to encourage the voluntary adoption of operation-related practices, such as at-berth fuel switching, vessel speed reduction, and the provision of onshore power supply for vessels at berth.¹⁶ Table 2 summarises some common regulatory and voluntary measures considered by port authorities or government agencies to reduce ship emissions. Other control options not listed in Table 2 include after-treatment technology such as scrubbers, and the use of liquefied natural gas (LNG) as marine fuel. The US and Europe are clearly ahead of Asia in terms of ship emissions control.

Hong Kong started slowly, but is catching up fast and leading the way in Asia

1.2.3 Hong Kong's regulatory path to control ship emissions

Hong Kong has taken a slow start in ship emissions control. However, the global trend to clean-up the shipping sector has gathered momentum in the last decade. A study commissioned by the Environmental Protection Department also demonstrated the magnitude and spatial distribution of

Table 2: Examples of regional and local measures to reduce ship emissions¹⁷

Region/Port	Measures				
	Engine standards	Onshore power supply	Fuel sulphur content for local (or inland waterway) vessels	Fuel switching – mandatory (M) / voluntary (V)	Vessel speed reduction
EU	✓		✓	✓ (at berth, M)	
US	✓		✓		
California		✓		✓ (24nm, M)	✓
Hamburg		✓	✓	✓ (at berth, M)	
Antwerp		✓	✓	✓ (at berth, M)	
Rotterdam		✓	✓	✓ (at berth, M)	
Amsterdam		✓	✓	✓ (at berth, M)	
Singapore				✓ (at berth, V)	
Yantian / Shekou		✓			
Hong Kong			✓	✓ (at berth, V)	

ship emissions in Hong Kong waters.¹⁸ Scientific evidence, together with a world trend, has begun to drive change in the shipping sector and the government in Hong Kong.¹⁹

First, an industry-led, voluntary at-berth fuel switching initiative called the Fair Winds Charter took place initially for two years in 2011 and 2012, and was extended for one year in 2013. It set the tone of industry support in ship emissions reduction. Second, the government responded to the industry with an incentive scheme in September 2012. OGVs that switch to low sulphur fuel at berth will be offered 50% reduction in port facilities and light dues. Third, it was announced in the 2013 Policy Address that the government would require OGVs to switch fuel at berth through regulation. This is a major policy breakthrough in ship emissions control in Hong Kong. The new legislation is likely to come into effect on 1 January 2015. In doing so, Hong Kong will become the first port in Asia to regulate ship emissions.

Regulation is the way forward

Even though it has taken the government a few years to propose the first piece of regulation on ship emissions control, it was very clear to the industry right from the start that regulation is the best option forward, rather than voluntary programmes. Voluntary action is a good way to start in the short run to show industry support and to raise awareness. In the long run, environmentally conscious operators will be penalised by paying additional costs for green initiatives, thus losing out to their competitors on an uneven playing field. Hence, uniform regulation across the industry, and eventually across the whole PRD region, will prevent unfair competition and will bring maximum emissions reduction benefits to the people.

Setting up a PRD ECA will bring the greatest benefits to the region according to research...

The mandatory at-berth fuel switching in 2015 will be a tremendous achievement for Hong Kong, and represents the leading emissions control approach in Asia. However, it should only be considered as the first of many steps towards reducing ship emissions and protecting public health in Hong Kong, as well as in the wider PRD region. A report published in 2012, which integrated findings of groundbreaking research conducted by two local universities in Hong Kong,²⁰ compared and analysed four different ship emissions control scenarios, namely (a) mandatory at-berth fuel switching to fuel with 0.5% or less sulphur for OGVs; (b) mandatory fuel switching to fuel with 0.1% or less sulphur for OGVs in Hong Kong waters; (c) an ECA covering 100 nautical miles (nm) from Hong Kong, hence including waters of the PRD;

and (d) restricting vessel speeds to 12 knots in Hong Kong waters for OGVs.²¹ Table 3 shows that an ECA will bring the greatest emissions reduction and public health benefits to the PRD region, and is therefore recommended as the best long-term option for regulatory control of ship emissions.

Table 3: Emissions reduction and health benefits of four different control options in the PRD²²

	Emissions reduction potential		Health benefits
	SO ₂	PM	Excess death reduction
(a) Fuel switch at berth, 0.5% sulphur, OGVs	3.9%	2.9%	44%
(b) Fuel switch in HK waters, 0.1% sulphur, OGVs	9.6%	8.3%	62%
(c) ECA (100 nm from HK)	95%	85.3%	91%
(d) Vessel speed reduction at 12 knots, HK waters, OGVs	1.4%	1.3%	41%
Baseline emissions / excess death attributable to SO ₂ emissions from ships	141,920 tonnes	16,433 tonnes	519

...and the Hong Kong SAR Government has made it a long-term goal

This recommendation is echoed explicitly by the Government in its policy document called *A Clean Air Plan for Hong Kong*:

“Longer-term, our vision is for the whole of the waters of the PRD to be designated an Emission Control Area (ECA) under the IMO, as is the case for the waters of North America and also of Northern Europe... We believe an ECA designation will bring the highest public health benefits to the region.”²³

Likewise, ship emissions control and the specific idea of establishing an ECA in the Greater PRD waters has been included in the *Regional Cooperation Plan on Building a Quality Living Area* jointly published by the governments of Guangdong, Hong Kong and Macau²⁴, as well as in the *Shenzhen Air Quality Enhancement Plan*.²⁵

1.3 Purpose of the paper

Setting up an ECA is a technical and political process that involves many stakeholders. The proposal has to be prepared and submitted to the IMO by the Chinese Central Government. This paper aims to initiate discussion and facilitate the process

Establishing an ECA is an involved technical and political process. To be successful, it requires extensive discussions amongst stakeholders such as: government agencies in Hong Kong, Guangdong, Macau and Mainland China; shipping companies; operators; charterers; air pollution experts; civil society; and the business sector. It also requires a detailed technical analysis of ship emissions, ship activities, prevalent meteorology, and on-shore impacts. Ultimately, a PRD ECA proposal will need to be prepared and submitted by the Chinese Central Government to the IMO. To help initiate this process, this paper discusses the reasons for implementing an ECA, the experiences of other jurisdictions in implementing and managing their ECAs, and the issues that decision makers and industry should take into account when considering an ECA for the PRD.

Emission Control Area (ECA)

An ECA is a designated area with stricter requirements for SO_x and NO_x emissions from ships

2.1 What is an Emission Control Area?

Under MARPOL Annex VI, one or more parties can apply to the IMO to designate an ECA. It is a non-discretionary action by the IMO, meaning that complete applications must be approved. An ECA designation can cover SO_x emissions only, NO_x emissions only, or both. In ECAs, emissions standards for SO_x and NO_x are more stringent than the global standards (see Section 1.2.1). Vessels must meet the standards, but Regulation 4 of MARPOL Annex VI allows for vessels to use any effective 'equivalent' mitigation method, rather than restricting to a single fuel or technology to comply with the requirements (see Section 3.2.2).

2.2 Why set up an Emission Control Area?

Air pollution from ships is predicted to grow

In some countries and regions, regulations for land-based sources of air pollution have achieved a degree of success in reducing emissions from the power generation, industrial and road transport sectors. As maritime activities continue to grow, it is predicted that the absolute and relative contribution of ships to air pollution would become more and more significant. The United States Environmental Protection Agency (USEPA) estimates that by 2030, NO_x emissions from ships would more than double to 2.1 million tons per year, whereas PM_{2.5} emissions would almost triple to 170,000 tons, both from 2009 levels.²⁶ Likewise, it is estimated that without regulation, SO_x and NO_x emissions from ships would increase by about 45% to 3.5 million tons and by 67% to about 6 million tons between 2000 and 2020 in the EU.²⁷

A co-ordinated strategy with consistent regulations from port to port will be most effective

It is a challenge to address ship emissions that are produced outside jurisdictional boundaries, in areas where ship activities could still impose an impact on the local region. It is also important to have consistent regulations from port to port to simplify operation procedures and to maximize compliance among industry members. In this respect, IMO provides a regulatory framework consistent around the world. An ECA offers MARPOL Annex VI parties an option to regulate ship emissions in a broader area with stringent requirements, thus producing the greatest benefits for public health. It also provides a solution to port rivalry and competitiveness issues caused by inconsistent standards on ship emissions control.

ECA is also a cost-effective means to address air pollution

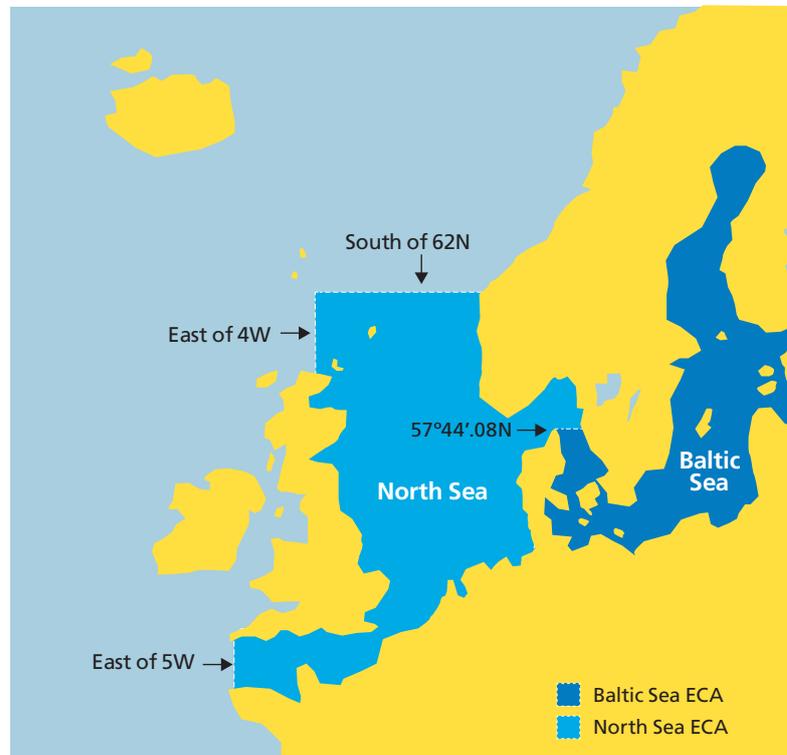
In addition, setting up an ECA is a cost-effective way to reduce air pollution. The cost to reduce a tonne of SO_x, NO_x and PM_{2.5} in the US portion of the North American ECA is estimated at US\$1,200, US\$2,600 and US\$11,000, respectively. These numbers compared favourably to the cost-effectiveness of the land-based control programmes, which typically ranged from US\$200 to US\$6,000 for SO_x reduction per tonne, US\$200 to US\$12,000 for NO_x reduction per tonne, and US\$2,000 to US\$50,000 for PM reduction per tonne.²⁸

2.3 The Baltic Sea and North Sea ECAs

The world's first two ECAs were set up in Northern Europe

The world's first two ECAs were established in the Baltic Sea in 2006 and in the North Sea in 2007. They were set up originally as Sulphur Emission Control Areas (SECAs), and only restricted SO_x emissions from ships. Figure 3 shows the boundaries of the two ECAs.

Figure 3: Baltic Sea and North Sea ECAs



Benefits of the two ECAs in Northern Europe far outweigh their costs

The potential annual public health and environmental savings made through the two ECAs in Northern Europe are estimated at €8 to €16 billion in 2015 and €10 to €23 billion in 2020, compared to the cost of €0.6 to €3.7 billion and €0.9 to €4.6 billion in 2015 and 2020 respectively.²⁹

Discussion of a NO_x ECA underway, and Norway provides support for early adoption of NO_x reduction technologies

There are discussions underway to designate an Emission Control Area for Nitrogen Oxides (NECA) in the Baltic and North Seas.³⁰ To ensure that NO_x emissions are addressed earlier, some Nordic countries are encouraging the early adoption of NO_x abatement technologies. For example, Norway has developed a NO_x Fund. Companies contributing to the NO_x Fund are exempted from paying the NO_x Tax, which is more expensive (for example, a ship owner has to pay ~€2 per kg NO_x for the Tax, while it may contribute €0.5 per kg NO_x for the Fund). Contributors to the NO_x Fund are also eligible to apply for support from the Fund for implementing NO_x mitigation measures, such as selective catalytic reduction (SCR) retrofit, LNG engine retrofit, and LNG infrastructure.³¹ Over €300 million has been invested in the NO_x Fund, leading to disbursements of about €80 million a year to support NO_x emissions reduction.³²

2.4 The North American ECA

The North American ECA is the first full ECA that restricts SO_x and NO_x emissions from ships

The North American ECA is the first full ECA that restricts fuel sulphur levels, SO_x and NO_x emissions. In 2010, the IMO approved the application from Canada and the US to implement an ECA that extends 200 nm from most of their coastlines, including the waters surrounding Hawaii and much of Alaska³³ (see Figure 4). In 2011, the IMO approved the US request to expand the North American ECA by creating a new US Caribbean Sea ECA, which includes Puerto Rico, the US Virgin Islands, and their surrounding waters (extending roughly 50 nm from these islands in most places).³⁴ Efforts have been made to include Mexico in an expanded agreement that would eventually cover the entire North American continent.

The impact of ship emissions travel far inland, so an ECA will benefit both coastal and interior areas

Through air pollution control programmes implemented between 1990 and 2007, Canada and the US have successfully reduced SO_x, NO_x and PM emissions from sources other than vessels by 43%, 30% and 26% respectively. The two governments then decided to turn their attention to addressing emissions from the 93,000 vessels that call at North American ports each year. As emissions from ships travel far inland, the benefit of an ECA is not just limited to the improvement of air quality and environmental conditions in coastal cities, but also in the interior of the US and Canada.³⁵

Figure 4: The North American ECA³⁶



Ship emissions reduced and health costs avoided with ECA implementation

In 2020, emissions from ship operating in the ECA are expected to be reduced annually by 320,000 tons for NO_x, 90,000 tons for PM_{2.5}, and 920,000 tons for SO_x, which is 23%, 74% and 86% below predicted levels in 2020 without the ECA.³⁷ Based on these numbers, the USEPA has conducted extensive modelling and estimation of the future public health benefits of the North American ECA in the US. It is estimated that between 5,500 and 14,000 premature deaths, 3,800 emergency room visits, and 4.9 million cases of

acute respiratory symptoms will be avoided in 2020.³⁸ The monetised health benefits are projected to range from US\$47 to 110 billion.³⁹ By 2030, the ECA is estimated to avoid up to 31,000 premature deaths and 1.4 million lost work days annually, resulting in net health and other benefits valued at up to US\$270 billion per year.

Benefits far outweigh the costs

On the other hand, the overall cost of the North American ECA is estimated at US\$3.2 billion in 2020. This reflects the total costs of improving the emissions of ships operating in the ECA from current performance to ECA standards, including the use of low sulphur distillate for fuel switching and the SCR technology to comply with the ECA SO_x and NO_x requirements, respectively.

An outreach programme to engage stakeholders was organised in preparation of the ECA proposal

It is noteworthy that in forming the proposal, officials also engaged in an extensive outreach programme to stakeholders including shipping industry, ports, green groups, state and provincial governments, and master mariners. The proposal “strives to minimise the impact on the shipping community, while achieving needed environmental protection.”⁴⁰

High fuel compliance levels

The US Coast Guard and the USEPA are both able to enforce the law, with the USEPA responsible for ship and engine certification for the NO_x requirements, the US Coast Guard bearing most responsibility for surveys and enforcement on board, and both agencies having joint authority and responsibility for fuel oil availability and quality.⁴¹ 1% sulphur fuel is widely available in many US ports. In a two-month review of the fuel data at US ports held during September and October 2012, vessel operators reported that they were only unable to procure compliant fuel in 2% of all port calls.⁴²

Some members of industry remain resistant to the ECA

Some members of the US shipping industry have objected to the North American ECA and sought exemptions. The cruise lines, many of which often operate within the 200 nm boundary for all or most of their trips, are amongst the most vocal. Some cruise industry members have promoted an emission averaging system, where vessels would be allowed to use bunker fuel near sparsely populated areas in exchange for using lower sulphur fuels when hoteling in ports or operating in densely-populated areas. However, many environmental organisations and community groups question the fairness of any population-weighted emissions averaging scheme from an environmental justice perspective and dismiss the idea.

A PRD ECA: Issues to be Considered

This section highlights the key issues to be considered prior to setting up a PRD ECA, partly based on views expressed by members of the maritime trade in past engagement activities organised in Hong Kong.⁴³ Experience will also be drawn from existing ECAs, where appropriate, to show the main questions raised (see Box 2), and the possible ways to address the challenge. Discussions below are meant to engage and facilitate dialogue amongst stakeholders and government agencies on what needs to be done to realise the establishment of a PRD ECA in the future.

Box 2: Frequently raised issues in existing ECAs

The issues that have been most frequently raised by stakeholders in the existing ECAs include:

1. Fuel availability and operational concerns related to fuel switching:
 - Would sufficient low sulphur fuel that complies with the ECA sulphur limits be available by the enforcement date?
 - What are the operational issues and solutions for switching to low sulphur marine fuel?
2. Technological readiness:
 - Would the technologies for meeting the Annex VI emission standards be commercially available when the regulation is in force?
3. Impacts of ECA on ship operators and the shipping industry:
 - How much would compliance cost? And who would pay for the additional costs?
 - Would the higher costs lead to modal shift or port shift?
4. Any incentive programmes to encourage early adoption?

3.1 Technical and operational issues

3.1.1 Fuel availability

The main feature that makes an ECA unique under IMO's regulatory framework is the tighter fuel standards that vessels must comply with while operating in an ECA. The current fuel sulphur limit is 1%, and it will become 0.1% starting from 2015 (see Section 1.2.1 and Figure 2). The overall consensus among experts is that the supply of 0.1% sulphur distillate should be sufficient for the existing ECAs, given the projected increase in demand for such fuel will be limited as ships are only required to switch fuel while they are operating within ECAs.⁴⁴ Other forthcoming regional or local measures, such as Phase 2 of the California Air Resources Board (CARB) Fuel

0.1% sulphur distillate supply should be sufficient for existing ECAs

Regulation may put pressure on 0.1% sulphur fuel supply,⁴⁵ but it is too soon to tell the impact.

ECA-compliant fuel demand could change in the PRD after 2015, and would certainly rise if a PRD ECA was set up

In the PRD, with or without an ECA, the fuel market situation could change come 2015, when the 0.1% fuel sulphur limit becomes effective. There could be a higher demand for ECA-compliant fuel, as ECA-bound vessels (to North America or Europe) leaving the PRD might look for 0.1% sulphur distillate in this region. If a PRD ECA were set up eventually, the demand for ECA-compliant fuel would certainly rise, as the intra-Asia carriers which are currently not using 0.1% sulphur distillate at all would have to enter the market with additional demand. At the moment, such fuel is low in supply in the PRD market, and there are concerns about fuel availability in the future.⁴⁶ To ensure better planning and successful implementation of a PRD ECA, it is essential to understand the future ECA-compliant fuel demand in the PRD region, as well as the potential for Chinese refineries to supply 0.1% sulphur distillate in the market through operational upgrade with sufficient lead time.

Safety concerns were raised initially and have been largely overcome. Implementation of fuel switching programmes has been smooth

3.1.2 Fuel switching

OGV engines, boilers and fuel systems are typically designed for use with residual oil. Since various regions adopted marine fuel sulphur requirements (such as the EU at-berth fuel switching requirement, the California fuel switching requirement and the ECA fuel sulphur limit), some concerns have been expressed that the changeover of residual oil to lower sulphur fuel may result in operational and safety problems with the main and auxiliary engines, boilers and associated fuel supply systems. Some of the anticipated operational issues are caused by the lower fuel sulphur content, but the main effects are related to other fuel characteristics that are found inherent in lower sulphur fuels, such as viscosity, flashpoint, and acidity⁴⁷ (see Box 3). Nevertheless, European, US and Californian programmes that require fuel changeover have been implemented smoothly.

A changeover procedural manual should be developed for the crew

For ships that trade between areas with different fuel sulphur requirements, it is advisable to develop a detailed changeover procedure and ensure that the crew is familiar with it. Areas that require special attention are changes in viscosity and temperature gradients in the fuel oil and incompatibility of HFO and the low sulphur distillate. Vessel manufacturers have also developed guidelines on using low sulphur fuels that could be good references for vessel owners and operators.⁵⁰

Fuel switching will be a new challenge for the intra-Asia carriers in a PRD ECA

If the PRD waters are designated as an ECA for SO_x, fuel switching will present a new challenge to the intra-Asia carriers, as they have little previous experience with low sulphur fuel. On the other hand, owners and operators of OGVs trading regularly with ECA ports should be very familiar with existing and forthcoming ECA fuel sulphur requirements, and the preparation necessary to ensure compliance. Their experience will be valuable to the smooth implementation and safe practice of fuel switching.

NO_x reduction technologies are ready for the 2016 Tier III NO_x standards

3.1.3 Availability of NO_x emission reduction technologies

A review study⁵¹ completed in February 2013 found that a variety of technology options, including SCR, exhaust gas recirculation (EGR), LNG and other technologies (such as direct injection, fuel-water emulsions, humid air motor (HAM), and variable valve technologies), either alone or used in some combination with each other, have the potential to achieve the 2016 Tier III NO_x limits.⁵² The study hence concluded that there is no problem with keeping the enforcement date for the Tier III NO_x standards on 1 January

Box 3: Some operational issues associated with fuel switching⁴⁸

There are several issues related to the use of low sulphur fuel:

1. Lower viscosity – using fuel with a viscosity lower than the designed grade could cause (a) an increase in internal leakage in fuel pumps, and (b) an increase in flow rates through nozzles, restrictors and injectors;
2. Lower lubricity – reduced fuel lubricity could cause damage to components that rely on the pumped medium for their lubrication (e.g. fuel pumps). This can affect both engines and boilers;
3. Decreased acidity – cylinder oil is chosen with alkalinity that neutralises the corrosive effects of the acidic sulphur products formed during combustion of residual fuel. If the alkalinity of cylinder oil is not reduced when used with low sulphur fuel, deposits will build up that will damage the lubricating film;
4. Lower flashpoint – flashpoint reflects a fuel's ease of ignition, and using fuel with lower flashpoint increases the explosion risks. Furthermore, using lower flashpoint fuel in boilers may lead to poor combustion, an irregular flame, or flame extinction. In certain conditions, this could once again increase the risk of explosion, although this is a low probability risk;
5. Fuel incompatibility – distillate and residual fuel are mixed during fuel switching; distillate has a low aromatic hydrocarbon content and have less solubility of asphaltenes; the mixing of the two may result in asphaltenes of the residual fuel precipitating out of the mixture as heavy sludge, causing clogging of fuel filters and separators, and sticking fuel injection pumps; and
6. Increase catalytic fines (cat-fines)⁴⁹ – if not removed, cat-fines may cause wear and damage to engine moving parts and components that come into contact with fuel, such as the cylinder, piston ring, cylinder liners and groove, and lead to seizure of barrel-pumps and fuel valves.

2016. However, Russia and a number of Baltic countries recently called for a 5-year extension of the enforcement date, which will have an impact on the development of the NO_x emission reduction technologies.⁵³

SCR is proven and ready in use. Other technologies are making progress in development

Amongst the NO_x emission reduction technology options, SCR is a viable and proven technology, and can achieve Tier III NO_x standards as a sole strategy for most (if not all) marine applications. SCR technologies have been used in the marine sector for over 10 years in EU and the US,⁵⁴ and some manufacturers are already marketing Tier III compliant SCR engines. No expert raised any concern in the IMO review study regarding the availability of the reductant (urea) and other catalyst materials needed for SCR operation.⁵⁵ However, SCR operators need a high inlet temperature. If the vessel is operating at a low speed (e.g. during slow steaming), or if other technologies are employed that reduce exhaust gas temperature, the effectiveness of SCR will be undermined. Technology providers are working on this issue to try to find a solution.

Switching to LNG will meet both the ECA NO_x and SO_x requirements, but the use of LNG would likely be more economically viable for new ships than for retrofit. Also, due to limited LNG refueling infrastructure (particularly outside Europe), adoption of LNG for long haul shipping is constrained in the near term. However, the adoption is expected to grow over time as LNG refueling infrastructure expands.

EGR can be used on its own, or in combination with other strategies, to meet Tier III NO_x standards, but its application could be limited mainly due to susceptibility to corrosion caused by sulphur, metals and other elements in the engine exhaust. Other water-based technologies, though still under development, should be able to meet the Tier III NO_x.

3.2 Cost issues

3.2.1 How much are the compliance costs? Who pays?

Analysis in the North American ECA proposal shows a small rise in operation costs for vessels...

In the North American ECA proposal, a detailed analysis on the engineering and operational costs found that only a modest cost will be added on goods transported by ships to and from the US and Canada: the price of a new vessel is estimated to increase by 0.5 to 2%, depending on the vessel type; the operating cost increase in the transportation service sector would vary and depend on the route and the amount of time a vessel spent in waterways covered by the ECA. For example, it is estimated that the cost of operating a ship in liner service between Singapore, Seattle, and Los Angeles/ Long Beach, which includes about 1,700 nm of operation in waterways covered by the ECA, would increase by about 3%. For a container ship, this would represent an US\$18 increase in the shipping cost per container. For a seven-day Alaska cruise on a vessel operating entirely within the ECA, per-passenger price is expected to increase by about US\$7 per day. The expected cost impact on ships that spend less time in waters covered by the ECA will be smaller.⁵⁶

...with the assumption that additional costs would be fully passed onto OGV customers

On the question about who should pay for the increased cost, the North American ECA proposal assumed that the demand for marine transportation service is nearly perfectly inelastic.⁵⁷ Therefore, the users of such service (e.g. shippers and cruise ship customers) would bear the entire compliance costs, as any additional costs would be expected to be fully passed onto the customers in the form of modestly higher prices.

An analysis of the impact of a PRD ECA on shipping costs is needed to understand the full picture and to inform further discussions

To better understand the compliance costs for vessel operators under a PRD ECA, a study should be conducted that takes into account different sizes and types of vessels, and typical passages for OGVs operating in the PRD region. The North American ECA proposal offers a useful example for such kind of cost analysis. The study could also summarise experiences in the existing ECAs on cost sharing among shippers, ship operators, and other parties. Findings of the study could help inform: (a) the government's decision on whether to offer any subsidy and at what levels during the interim period until full ECA is implemented; and (b) the discussion between vessel operators and their customers about compliance cost sharing. Besides, local vessels and river vessels operating in Hong Kong and the PRD will also be required to meet the same IMO NO_x emission standards as OGVs.⁵⁸ Therefore, the proposal for a PRD ECA should also include an estimate of the compliance costs for local and river vessels.

3.2.2 Measures to help ship owners manage operation costs

Annex VI offers flexibility for alternative compliance measures at lower costs

Regulations 3 and 4 of Annex VI offer flexibility mechanism for ship owners to comply with the ECA requirements with lower cost options.⁵⁹ Per Regulation 4, ship owners can comply with ECA requirements by means of alternative measures if those measures can achieve 'equivalent' levels of emission reduction as the ECA requirements. Exhaust gas cleaning system (SO_x

scrubbers) or LNG are considered two possible alternative options instead of switching to distillate fuels. These two technologies have demonstrated to be able to reach equivalent (or even higher) level of SO_x / PM reductions as using 0.1% sulphur fuel, and in some circumstances, could be cheaper than using distillate fuel, so could lower the compliance costs.

Scrubbers can be used instead of distillate with equal or even better emission reduction benefits, but certain technical issues have to be overcome

Scrubbers have been successfully used in industrial applications for many years, but the technology has only been adopted on a limited number of ships. As a result, its technical feasibility and availability for use on ships is limited. Nevertheless, results from trials reported that scrubbers can be highly effective in reducing SO_x emissions (over 90%), and moderately effective in cutting PM emissions from ships (about 30 to 75%, depending on the type of scrubber technology).⁶⁰ Furthermore, a study conducted by the technical arm of the European Commission, the European Maritime Safety Agency, found that scrubbers are highly cost-effective and can payback within one year compared to using distillate, so scrubbers could be the cheapest option to meet the ECA sulphur limits.⁶¹ Yet, the acidity limit for discharge washwater could be a key obstacle hindering further adoption of open-loop wet scrubbers (a cheaper scrubber technology). The typical pH of the washwater discharged from open-loop scrubbers is around 3.5. The current IMO discharge standard requires the pH value of scrubber discharge washwater be no less than 6.5.⁶²

LNG is also a viable alternative to distillate for certain types of ships, but supply infrastructure is lacking

LNG is another alternative to distillate fuel that offers three potential benefits:⁶³ (a) significantly lower SO_x and NO_x emissions (over 90%) compared to fuel oil, meaning that promoting the use of LNG could be an emission control strategy for meeting both the 2015 ECA SO_x requirements and the 2016 Tier III NO_x standards; (b) expected lower cost than the use of distillate under certain circumstances;⁶⁴ and (c) potentially lower lifecycle greenhouse gas emissions compared to conventional distillate, especially if best practices are deployed to reduce methane leakage. Northern Europe has been leading the way in the use of LNG as a marine fuel, and there is growing interest in North America and Asia to follow suit.⁶⁵ However, LNG supply infrastructure outside Europe is likely to remain limited in the near future. The slow development of LNG bunkering facilities globally and the delay in the adoption of the IMO safety protocol for LNG-fuelled ships could present significant hurdles for LNG to overcome before becoming a serious alternative to distillate fuels, especially for deep sea shipping, in the near term.⁶⁶

3.2.3 Incentive programs to encourage early adoption of ECA requirements

There are programmes in Europe to promote early adoption of emission reduction technologies, not exactly ECA compliance

The US and Canada have not adopted any incentive programmes to encourage early adoption of ECA requirements. In the EU, there are a number of incentive-based programmes that have encouraged early adoption of emission mitigation technologies on ships even though those programmes are not initially designed for promoting ECA compliance. One example is the differentiated 'fairway dues' programme adopted in Sweden, which vary the dues by the vessel's NO_x emission level and the sulphur content of fuel being used. The dues are charged on berthing ships for ice-breaking services and coastal and navigation lights. The Swedish fairway dues encouraged operators to switch to low sulphur fuel even before the establishment of the ECA for SO_x, and are believed to have enhanced compliance levels in the Baltic Sea ECA.⁶⁷ The programme has also encouraged the use of NO_x reduction technologies on ships, such as SCR and HAM, even though the North Sea has not implemented an ECA for NO_x.⁶⁸ In the deliberation of a PRD ECA, the governments of Hong Kong, Guangdong

and Macau should determine together if any incentive programmes are necessary to encourage early adoption of emissions reduction strategies and compliance with the ECA standards. Decisions should be made based on the findings of a cost-benefit assessment of a PRD ECA.

3.3 Economic issues

3.3.1 Would the higher costs in ECA ports lead to modal shift or port shift?

Tighter regulations at sea may mean more land transport, unless efforts are made to lessen the cost impact of ECA on the shipping industry

In the EU, concerns have been raised regarding the impacts of the ECA on short sea shipping, and in particular the potential of modal shift from marine to road transport, which would result in higher emissions, or switching longer sea routes with shorter sea routes and driving more.⁶⁹ The European Commission pledged to continuously monitor the impacts of ECA on the shipping industry. It also offered to use part of the existing funding instruments, including the Trans-European Transport Network (TEN-T) and Marco Polo Programmes, to support and facilitate the adoption of emissions mitigation measures (such as establishing handling facility for sludge from scrubbers, and LNG refueling facilities), with the goal to lessen the economic impacts of the ECA on the shipping industry.⁷⁰ The TEN-T, for instance, has recently contributed half of the funding of a €2.5 million study to identify and address the potential barriers to the construction and operation of LNG-powered vessels.⁷¹

Uniform regulation across the PRD should minimise port shift, but there are worries that cargoes coming from further inland may switch to less expensive ports

The port of Hong Kong has been competing for a long time with the ports in Shenzhen, and to a lesser extent with Guangzhou, as the import/export gateway for southern China. In light of the looming, tighter emission standards for ships, one view is that a uniform standard in the form of a PRD ECA would actually create a level playing field for all the competing ports in southern China. Inter-port competition and cargo shift from one port to another to evade tighter regulation would be minimised. However, some members of the industry caution that cargoes exported via the PRD ports may come from locations further inland. If the PRD ports become more expensive, then there is a chance that the inland cargoes could find cheaper export options through other ports in China outside the PRD. The same may happen to trans-shipment cargoes going through Hong Kong. For the cruise sector, the competition among the cruise ports in Southeast Asia and the response of the cruise market to a PRD ECA is less clear at the moment. Possible modal shift and port shift triggered by a PRD ECA is an important topic to be investigated.

The Next Steps

HKSAR Government is committed to work with Mainland regulators to support a PRD ECA proposal to the IMO

It is the Chinese Central Government's decision and responsibility to submit a PRD ECA proposal to the IMO for consideration. To facilitate discussion about a PRD ECA at multiple government levels, as well as other preparatory work, the Hong Kong SAR Government has set a long-term goal to work with relevant authorities in Beijing, Guangdong, Shenzhen and Macau. Initial contact has been made, and the dialogue is on-going.

Important work can also be done amongst non-government stakeholders to facilitate the process, including research and engagement

Preparing a proposal for a PRD ECA is a complex, multi-year process that requires a lot of input in terms of research and assessment (see Box 4). Some of this work can actually be done in full or in part by non-government stakeholders such as think tanks, universities, and the business sector, in collaboration with the governments. Apart from research, stakeholder engagement is also an important part of the process to raise awareness about ship emissions and the ECA, to seek support from the industry and the general public, and to solicit views from the industry on technical, operational, cost and other related issues.

4.1 New research

New research needs to show a clear picture of the extent and impact of ship emissions in the PRD

It is clear that additional research has to be undertaken to demonstrate the cost effectiveness of regulating ship emissions. The core of the new research should include a detailed study of the future public health and environmental benefits of controlling emissions from ships and land-based sources, and a vigorous analysis of the cost of compliance and impacts on the shipping industry. Based on the discussions in Section 3, the following topics are recommended as a starting point:

- (a) To compile a ship emission inventory for the PRD and to assess the health impact of ship emissions in the region;
- (b) To study and determine the boundary of a PRD ECA;
- (c) To identify and assess NO_x emission reduction technologies and their application in the PRD;
- (d) To study the feasibility of using LNG as an alternative to distillate fuel in the PRD;
- (e) To study future demand of ECA-compliant fuel and fuel availability in the PRD;
- (f) To examine the cost of ECA compliance in terms of fuel costs and technology costs;
- (g) To examine the costs and benefits of land-based emission control; and
- (h) To assess the economic impact of a PRD ECA, and to investigate the potential of modal and port shift.

Box 4: What to include in an ECA proposal?

According to Appendix III to MARPOL Annex VI, a proposal to designate an ECA must demonstrate a need to prevent, reduce, and control emissions of SO_x, NO_x, and/or PM, or all three pollutants from ships operating in that area. The proposal should address the following eight criteria:

1. A clear delineation of the proposed area of application, along with a reference chart on which the area is marked;
2. The type or types of emission(s) that is or are being proposed for control (i.e. NO_x or SO_x and particulate matter or all three types of emissions);
3. A description of the human and environmental areas at risk (on land and at sea) from the impacts of ship emissions;
4. An assessment of the contribution of ships operating in the proposed area of application to ambient concentrations of air pollution or to adverse environmental impacts;
5. Relevant information pertaining to the meteorological conditions in the proposed area of application to the human populations and environmental areas at risk;
6. Description of ship traffic in the proposed ECA, including patterns and density of such traffic;
7. Description of the control measures taken by the proposing party or parties addressing land-based sources of NO_x, SO_x and particulate matter emissions affecting the human population and environmental areas at risk that are in place and operating concurrent with the consideration of measures to be adopted in relation to provision of regulations 13 and 14 of Annex VI (i.e. control of NO_x and SO_x from ships); and
8. The relative costs of reducing emissions from ships when compared with land-based controls and an assessment of the economic impacts on shipping engaged in international trade.

These eight criteria essentially mean that the proposal needs to present a compelling case that shipping emissions should be regulated given their environmental and health impacts, that land-based emission sources are already controlled by stringent regulation, and that controlling shipping emissions is as cost effective as, or even more cost effective than, regulating emissions from land-based sources.

4.2 Stakeholder engagement

Inter-governmental discussion to co-ordinate regulations

In parallel with the research efforts, the Hong Kong SAR Government should continue to engage the Chinese Central Government, including the Ministry of Transport and the Ministry of Environmental Protection, and the corresponding bureaus under the Guangdong and Shenzhen governments, to discuss the reasons for shipping emissions control to become a priority, and the benefits and challenges of implementing an ECA versus other regulatory and voluntary measures. The inter-government dialogue could also explore the need and benefits of implementing PRD-wide interim measures before a PRD ECA is established, such as mandatory at-berth fuel switching, shore power, slow steaming, and a low emission zone for ships (see Box 5).

Box 5: Low Emission Zone

Since the establishment and implementation of an ECA is a multi-year process that requires IMO adoption, a possible interim solution could be to introduce a Low Emission Zone (LEZ) within Chinese territorial waters, covering the PRD area and out to 12 nm from shore.⁷² Within the LEZ, ships are required to meet the ECA standards. This could take place quickly, as any nation can dictate emission standards to protect the environment within its territorial waters for vessels calling at its ports.⁷³ While the public health benefits would not be as extensive as an ECA, the impact would still be beneficial, and faster to achieve. The public health costs incurred during the preparatory process for an ECA will be substantial, especially if no other interim control measures are put in place to reduce ship emissions.

Consulting the industry and civil society will lead to better regulation

To keep everyone abreast of the latest development in ship emissions regulatory control, international best practices, financial models, emission reduction technologies, and the challenge faced by the industry, regular dialogue amongst government agencies, members of the maritime industry, think tanks, academics and researchers, environmental groups, and other stakeholders must be maintained. As ship owners and operators of long-haul routes are very familiar with the ECA requirements, future discussion with the industry should be extended to stakeholders from other sectors (such as shippers, terminal operators and logistic companies) and shipping companies serving different trade routes and services (such as short- and medium-haul operators such as intra-Asia carriers, bulk carriers, river trade operators, cruise ship operators, and others).

Fuel suppliers must know of regulatory developments in order to plan for cleaner fuel

The oil industry is undertaking major upgrades of existing refineries and building new facilities in China and other Asian countries to meet the growing demand for fuel and to comply with increasingly stringent fuel quality regulations. It would be best to keep the oil industry informed of the development of any ECA proposal, so that the demand for ECA-compliant fuel could be taken into account during the planning for refinery upgrades, and there will be a higher chance that sufficient compliant fuel can be made available to the shipping sector when new standards come into effect.

4.3 A note on the timeline

An ECA could take years from preparation to fruition

This is no clearly defined schedule or timetable for the process of having an ECA designated and adopted by the IMO. As an illustration, the proposal for the North American ECA was submitted to IMO by the US and Canada in March 2009, which was then adopted by the IMO in March 2010. The ECA entered into force in August 2012. In addition to this, one has to take into account the amount of time required in years, rather than in months, for research, impact assessment, and other preparatory work to be undertaken before the submission.

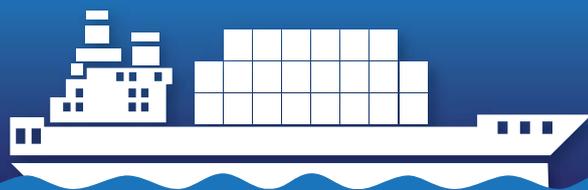
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53. At the May 2013 IMO Marine Environment Protection Committee (MEPC) meeting, Russia, with support from a few other Baltic countries, called for a 5-year delay in implementing the 2016 Tier III NO_x standards. They argued that compliance with the standards will be prohibitively expensive and the technologies still have some problems. The Russian proposal will be subject to a final vote at IMO in March 2014. Any delay will likely slow down the development and adoption of the NO_x reduction technologies, and seriously undermine the emission benefits of the North American ECA and any future ECAs.
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57. The cruise industry argues that the demand for cruise services is not nearly perfectly inelastic. While USEPA acknowledges that this could be true, it argues that the overall compliance cost for cruise ships (US\$7 per passenger for an Alaska cruise) is small relative to the price of a week-long cruise.

- Therefore, USEPA believes that the small cost increase due to the ECA would unlikely discourage potential customers from joining a cruise. In addition, the cruise industry could potentially offset part of the cost increase by marketing the cruise services within ECA as more environmentally friendly, and attract more customers that favour environmentally friendly cruise experiences.
58. This is different from North America and Europe where local vessels are subject to stricter NO_x emission requirements than those for OGVs.
 59. See IMO (2013) *MARPOL Annex VI and NTC 2008*, 2013 Edition, London, pp.12-13.
 60. European Maritime Safety Agency (EMSA) (2010) *The 0.1% Sulphur in Fuel Requirement as from 1 January 2015 in SECAs – An Assessment of Available Impact Studies and Alternative Means of Compliance*, Technical Report, 13 Dec 2010. Some other studies suggested higher PM reduction efficiency (60 to 85 %), such as Panasiuk and Lebedevas (2013) 'The comparison of technologies to reduce the toxicity of ship exhaust gas', *Proceeding of 8th International Scientific Conference TRANSBALTICA 2013*, Vilnius, 9-10 May.
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 62. To meet this requirement in the open sea requires substantial dilution on-board, which would increase energy consumption and therefore would limit the adoption of open loop scrubbers.
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 64. Key variables include the time spent in the ECA, the price differential between LNG and distillate, and the cost of distributing LNG compared to the cost of distributing residual or distillate fuel.
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 72. California's Fuel Rule applies to vessels out to 24 nm from shore, so there is some precedent for larger distances covered under regional regulation. See http://www.arb.ca.gov/ports/marinevess/documents/marinenote2012_1.pdf (accessed 13 August 2013).
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