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SHENZHEN, CHINA

Reducing Ozone Depletion through Green Public Procurement

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Through the successful application of Green Public Procurement (GPP), Shenzhen has greatly reduced the use of products that contain Ozone Depleting Substances (ODS). Going beyond the requirement set by national authorities, the Shenzhen Municipal Government introduced more stringent regulations on public purchases and promoted newer, more environmentally friendly technology, providing a model for other cities to emulate in combating ozone depletion and climate change.

Introduction

As a signatory of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer—which has been signed and ratified by all 193 countries of the United Nations—China has pledged its commitment to phasing out ODS in the country. However, considering that 90% of the world's ODS are currently produced in China, it would greatly help in the fight against ozone depletion if China adopts more ambitious measures to eliminate ODS. Although the Chinese central government has been taking steps to phase out ODS, local governments could go beyond national policies to accelerate the process—as demonstrated by the Shenzhen Municipal Government.

When emitted, ODS cause the thinning of the ozone layer, reducing the protection it offers against harmful ultraviolet (UV) radiation from the Sun. Excessive UV radiation increases the likelihood of developing several health problems in humans, including skin cancer and the formation of cataracts, and also disrupts land and marine ecosystems. In addition, most ODS are strong greenhouse gases (GHGs) with very high Global Warming Potentials (GWPs). Hence, phasing out ODS would achieve the dual goals of reducing ozone depletion and mitigating climate change.



Facts & Figures

Shenzhen

Country	People's Republic of China
Government	Shenzhen Municipal Government
Land Area	~1,997.47 km ²
Population	~12,528,300 (2017)
GDP	RMB¥2.24 trillion (2017) = US\$332 billion
GDP per capita	RMB¥183,100 (2017) = US\$27,100
Public Budget Expenditure	RMB¥417.8 trillion (2016) = US\$65.2 billion
Pillar Industries	Financial industry; logistics industry; cultural and related industry; and high-tech industry



Image 1: Shenzhen University Source: Shenzhen Municipal Government

What is GPP?

GPP (Green Public Procurement) involves public authorities procuring goods, services, and works with a reduced environmental impact throughout their lifecycle. Public authorities need to consume large amounts of goods and services to maintain their operations, and this consumption entails a strong environmental impact. By engaging in GPP, public authorities can greatly contribute towards sustainable development and environmental protection efforts.

An overview of GPP in China

Since 2004, the Ministry of Finance cooperated with the National Development and Reform Commission (NDRC) and the then Ministry of Environmental Protection (now the Ministry of Ecology and Environment) to enact administrative decrees and regulations on procurement. Under these, government procurement contracts are either mandatorily or preferably awarded to products certified as energy-efficient and environmentally friendly by two trusted domestic certification organs.

Despite the short history of GPP in China, it evidently has immense potential to achieve ambitious GHG reduction and sustainable development policies. In 2016, China spent over RMB¥2.57 trillion (USD\$370 billion) on procurement, increasing 22.1% from 2015. This makes up 11% of the country's fiscal expenditure, and the proportion is projected to soar to about 30% with greater inclusion of state-owned enterprises.

Thanks to ongoing negotiations on China's possible membership in the World Trade Organization's Government Procurement Agreement (GPA), the central government is benchmarking with international standards to establish a more holistic GPP scheme, to prevent an incoherent implementation of GPP in China.

Shenzhen in context

In 2017, Shenzhen became the city with the 3rd largest GDP in China at RMB¥2.24 trillion (US\$346 billion), behind only Shanghai and Beijing, and exceeding that of Hong Kong. Shenzhen's population grew nearly 500% between 1995 and 2016, with a corresponding need for more public infrastructure and facilities.

This rapid development came at the expense of the environment. At the turn of the millennium, Shenzhen has serious air pollution, a very high carbon footprint, and a heavy dependence on non-renewable energy sources. The government has since been taking actions to mitigate the environmental impact of Shenzhen's development, with GHG emissions control for heavy industries, stricter monitoring of compliance in air quality regulations, and the promotion of green technology (such as converting the entire public bus fleet to electric buses in 2017). One

of these measures is the use of GPP to phase out ODS products (e.g. chlorofluorocarbons (CFCs) in Shenzhen.

A significant part of Shenzhen's growth comes from public expenditure, which reached RMB¥417.8 billion (US\$64.4 billion) in 2016. This amount is similar to that of South Africa or Thailand, despite these countries having a population approximately 5-6 times larger than Shenzhen. Shenzhen's sizeable public expenditure makes GPP an effective method in promoting responsible consumption, as green technology can be adopted on a larger scale (e.g. Shenzhen's electric bus fleet has 16,359 buses), and the government can also place more pressure on goods and services providers to adhere to new regulations.

GPP to phase out ODS in Shenzhen

In 2005, under the leadership of the vice-mayor in charge of environmental protection, the Shenzhen Municipal Government decided to use GPP to hasten the phasing out of ODS. The Environmental Protection Bureau (EPB) was tasked with crafting the new GPP policies, and they developed 2 methods: Stricter regulations regarding ODS for both new and existing government purchases, and the promotion of ODS alternatives.

A Joint Departmental Meeting System chaired by the vice-mayor was established, where 17 government departments, including those of Environmental Protection, Finance, Development & Reform, Security, and Transport, would hold regular meetings to ensure that GPP measures are comprehensively implemented throughout all government departments.

The Shenzhen EPB, Finance Bureau, and Government Procurement Center are the key departments in the implementation of new GPP policies. When the EPB creates new regulations or promotes an ODS alternative, it is crucial that they communicate clearly with the Finance Bureau and the Government Procurement Center since these two departments are ultimately responsible for the procurement process. Hence, besides meeting in the Joint Departmental Meeting System, these 3 departments also held one-to-one discussions to further coordinate their actions.

New criteria for public procurements

In 2006, the Shenzhen Municipal Government began introducing new criteria for public procurements to phase out ODS in the city. If providers of goods and services fail to meet these new criteria, they would

Table 1: Shenzhen Municipal Government's new criteria for public procurements

Product	Criteria	Results (2006-2017)
Office Electronics	<ul style="list-style-type: none"> Cleaning agents used for LCD displays and computer motherboards cannot contain CFCs. 	<ul style="list-style-type: none"> 28.6 tons of CFC-113 cleaning agents eliminated
Vehicles	<ul style="list-style-type: none"> Vehicle maintenance companies must have the capacity to recover and appropriately handle refrigerants from vehicle air conditioners. Recovered refrigerants must be properly disposed of (if ODS) or recycled (if non ODS) according to the guidelines from the Ministry of Ecology and Environment. This reduces neglectful emission of refrigerants, and reduces the amount of refrigerant consumed. 	<ul style="list-style-type: none"> The number of vehicle maintenance companies with refrigerant recycling capabilities increased from ~100 to ~400. 5 tonnes of CFC-12 eliminated 48 tons of HFC-134a refrigerant recycled
Air Conditioners and Refrigerators	<ul style="list-style-type: none"> The refrigerants used in air conditioners and refrigerators must not be CFC-11 and CFC-12. Alternatives like the non-ozone depleting hydrofluorocarbon (HFC) refrigerant R134a must be used instead of an ODS like the CFC-11 or CFC-12 refrigerants. 	<ul style="list-style-type: none"> Many sellers of appliances that use CFC refrigerants replaced them with ODS-free appliances. 120 tons of CFC refrigerants eliminated

be unable to bid for government contracts. Some of these criteria became national policy afterwards, showing the foresight of the Shenzhen Government. There were 3 products targeted:

Tightening of regulations for air conditioner maintenance companies

Existing regulations in China stipulates that if air conditioner maintenance companies were to bid for government contracts, they have to possess a quality evaluation certificate issued by a municipal Market Regulation Bureau.

In 2013, the Shenzhen EPB prompted the Shenzhen Market Regulation Bureau to amend the criteria in the quality evaluation certificate, resulting in ODS related criteria making up 10% of the total score in the quality evaluation. The new criteria evaluated maintenance companies on their capacity to recover and recycle refrigerants used in existing air conditioners. This reduces the consumption of both ODS and non ODS refrigerants, and ensures that certified maintenance companies are up to par in preventing the neglectful release of ODS during air conditioner maintenance.

Since 2013, over 620 maintenance companies have reapplied for quality evaluation certificates. 47 of these companies failed to meet the new ODS criteria and were hence either denied certification or denied a promotion in quality grade. In the process, 3 tons of CFC-11 and CFC-12 refrigerants were eliminated, and 80 tons of HFC-134a were recycled.

Promotion of the low GWP, climate-friendly R290 refrigerant

Many air conditioners today use HFCs as ODS alternatives due to their zero Ozone Depletion Potential (ODP). For instance, many vehicles use R134a, while many air conditioners in Japan use R32. However, although HFCs have zero ODP, they still have a high GWP, hence they remain significant contributors to climate change.

Table 2: Properties of different refrigerants

Refrigerant	Type	ODP	GWP*
R12	CFC	1	10900
R22	HCFC	0.055	1810
R134a	HFC	0	1430
R32	HFC	0	675
R290 (Propane)	Hydrocarbon	0	3

*GWP measures how much heat a greenhouse gas traps relative to CO₂: a GWP of 3 means that the gas traps 3 times as much heat as CO₂.

To address this problem, the national Ministry of Ecology and Environment decided to promote the zero ODP, low GWP R290 refrigerant. Building on this momentum, the Shenzhen EPB in cooperation with municipal procurement departments prompted Shenzhen University to pioneer the procurement and installment of 243 air conditioners with R290 refrigerants in 2015.

R290 was not very popular in the past because of its flammable nature. However, with proper safety procedures, there is little risk to using this refrigerant. In Shenzhen University, the personnel from the maintenance company chosen by the provider of R290 air conditioners had received proper training in the safe installation and maintenance of R290 air conditioners, and there have been no incidents since the R290 air conditioners were installed.

Due to the efforts in promoting R290, the air conditioning market has become more accepting of this type of refrigerant. As of current, several other government departments and schools have also begun using R290 air conditioners, reducing the use of the ozone depleting hydrofluorocarbon (HCFC) refrigerant R22 by 0.5 tons.

In 2016, the Kigali amendment to the Montreal Protocol was made, obliging signatories to begin phasing out HFCs in order to combat climate change. Shenzhen's adoption of R290 is a year earlier thus ahead of its time.

Table 3: Substances equivalent in CO₂ reduced by the Shenzhen Municipal Government 2016-2018.

Substance	Amount reduced	Equivalent in CO ₂ in terms of GWP
CFC-11, CFC-12	128 tons	1,001,600 tons
CFC-113	28.6 tons	175,318 tons
HCFC-22	0.5 tons	905 tons
Total ODS	150.9 tons	1,177,823 tons
HFC-134a	128 tons	183,040 tons
Total GWP	-	1,360,863 tons

Results

- **Reduction of ODS and GHG emissions.** Since Shenzhen began implementing GPP in 2006, the city has eliminated 150.9 tons of ODS, as well as greenhouse gases equivalent to 1,360,863 tons of CO₂.
- **Transformation of industries.** As the Shenzhen Municipal Government is a major consumer of goods and services, tighter regulations on public purchases pressures goods and services providers to adapt to the new regulations; providers have an incentive to pass the certification process as government contracts are lucrative sources of revenue.
- Besides regulations, the promotion of ODS alternatives (such as R290) also directly reduces ODS through direct competition—the more ODS alternatives are in demand, the less ODS products will be present in the market.
- **Market growth for green technologies and products.** Increased spending on ODS alternatives prompts more goods and services providers to stock such products, growing the market for ODS alternatives. The increased availability of ODS alternatives also makes it easier for private consumers to buy these products instead of ODS products. As the market grows, the cost of ODS alternatives will fall due to increased economies of scale.
- **Increased public awareness of green alternatives.** Pioneering the procurement of ODS alternatives encourages other consumers to adopt such ODS alternatives, as it demonstrates that they are viable options. This can be seen in how other government buildings and schools began adopting R290 air conditioners after Shenzhen University procured them.

Lessons learned for replication

- **GPP has the potential to change entire industries.** When the Shenzhen Government introduced new regulations for public purchases, many goods and services providers adapted to comply with them. This is shown by the numerous vehicle and air conditioning maintenance companies respectively acquiring refrigerant recovery capabilities and reapplying



Shenzhen University Science and Technology Building . Source: Honghuang at Skypixel

Key Contacts

Shenzhen Municipality

Human Settlements and
Environment Commission
Mr. Jiansheng Li, Engineer
Shenzhen, China
Tel: +86-13631680655
Email: lijiansheng30@foxmail.com

ICLEI East Asia Secretariat

Haiping Yu
Tel: +82-2-3789-0496
Email: iclei-eastasia@iclei.org

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Author

Lam Chi Tun
ICLEI East Asia Secretariat

Contributors

Jiansheng Li
Shenzhen Municipality,
Human Settlements and
Environment Commission

Haiping Yu; Julie Yang;
Bong-hee Son
ICLEI East Asia Secretariat

for the quality evaluation certificates. Also, Shenzhen's promotion of the R290 refrigerant increased the use and acceptance of R290 air conditioners.

As a key consumer, governments are in a strong position to exact change in entire industries, placing pressure on goods and services providers to adapt to new GPP regulations in order to be eligible for lucrative government contracts.

To replicate Shenzhen's success, other cities should take note of the relative size of the public to private sector. The Shenzhen's Municipal Government has a high public expenditure, making it more able to exert pressure on goods and services providers. If a city's public expenditure is not significant enough relative to private consumption, goods and services providers might feel less inclined to adapt to new GPP regulations.

- **Good leadership and communication key to making GPP a success.** As demonstrated by Shenzhen, communication between government departments is key to coordinate actions across different sectors, in order to ensure a comprehensive implementation of GPP throughout the city or region. A central authority has to lead the overall efforts to phase out ODS, to make sure that each department is doing their part. In Shenzhen, this role was held by the vice-mayor in charge of environmental protection.

To replicate Shenzhen's success, municipal governments must likewise establish clear lines of communication across different government departments, either by forming a special ODS committee (like Shenzhen) or otherwise. They must also have a strong leader dedicated to the phasing out of ODS, who has the responsibility to ensure that GPP measures are being properly carried out across all related government departments.

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