Analysis of Climate Finance Policies and Innovative Finance Mechanisms in Guangdong

Policy Mapping and Case Studies

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Introduction

China, like many other countries in the world, is struggling with the challenge of how to finance the transition to a sustainable, low-carbon economy. Further complicating this challenge is the fact that the country is still going through the twin processes of rapid industrialization and urbanization. In addition, the shift toward a market-based economy has been gradual, and at present the government continues to function as the key player in the economy. As a result, there is a huge gap in financing climate reliance, and government funding remains central.

Chinese provinces have been assigned emissions reduction targets by the central government. They therefore urgently need to raise capital and deploy it effectively to achieve these policy targets. It is now more important than ever that they work with financial institutions to ensure that they have adequate capital flows to finance climate resilience. Besides the availability of capital, knowledge and capacity in both governments and financial institutions are critical for the implementation of climate policies and mechanisms.

Guangdong, in particular, has been assigned the highest emissions reduction target in China. As Guangdong is piloting its carbon market and becoming a leader of regional low carbon growth, the province has a pressing need for comprehensive local climate finance policies. It is imperative that a management system for innovative finance is introduced to achieve an effective and sustainable use of climate capital. However, to date there has been no systematic study on existing climate finance policies and mechanisms, hindering informed discussion and understanding of the issue.

This study, *Analysis of Climate Finance Policies and Innovative Finance Mechanisms in Guangdong: Policy Mapping and Case Studies*, aims to stimulate a broader discussion on climate finance systems and mechanisms. It provides in-depth case studies of real-life climate finance projects, and presents a set of policy recommendations for the region. A Guangdong Climate Finance Advisory Board, consisting of key stakeholders, was set up and has contributed to the research process, particularly in the areas of exploring key barriers to scaling up climate finance and identifying the capacity building needs of major actors.

The study was conducted by The Climate Group (TCG) on behalf of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in China. The results of this research are expected to support constructive discussion and collaboration on climate finance in the framework of the Sino-German Climate Partnership Project which GIZ is implementing on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. The findings of this report will also contribute to the ongoing, national-level China Climate Finance Research Project (launched in November 2013), implemented by China's National Center for Climate Change Strategy and International Cooperation, China CDM Fund and The Climate Group. Wider regional dissemination of the results will be ensured through the Alliance for Public Private Climate Finance Asia-Pacific, an initiative jointly established by GIZ and the Asia Investor Group on Climate Change to encourage and facilitate low carbon and climate resilient investment in the region.

This report consists of three parts:

1. Mapping of Guangdong's climate finance policies, starting with an overview of the national climate finance system and identification of knowledge gaps and barriers to the implementation of climate finance mechanisms in Guangdong;
2. Studies on three locally-implemented projects covering various industries and innovative finance mechanisms, giving a micro perspective on climate finance systems in Guangdong; and,
3. A set of policy and capacity building recommendations, providing policy makers with a means of improving the climate finance management system and mechanisms in Guangdong.

1 Methodology

This study took a four-tiered approach to assess the climate finance system and identify opportunities for knowledge exchange among key stakeholders. The research design consisted of convening the Guangdong Climate Finance Advisory Board as an intellectual platform on climate finance in Guangdong, mapping out climate finance policies and the management system, conducting face-to-face interviews and semi-structured discussions with key stakeholders, and conducting several case studies of on-going climate finance projects.

1.1 Advisory board

The Advisory Board brought together key policy implementers from the government, financial agencies and other key stakeholders from both the public and private sectors to facilitate the understanding of the climate finance policy system and the identification of barriers to scaling up climate finance. The Board served three main functions, which were to:

1. Contribute to the policy mapping exercise (as explained below);
2. Ensure local ownership of this study; and,
3. Advise the study process, outcome and outreach.

Ten members from both Beijing and Guangdong-based entities were selected to the Advisory Board. Their engagement consisted of two group consultations and several individual on-site meetings. Board members were drawn from government agencies, financial institutes and investors (Appendix 5).

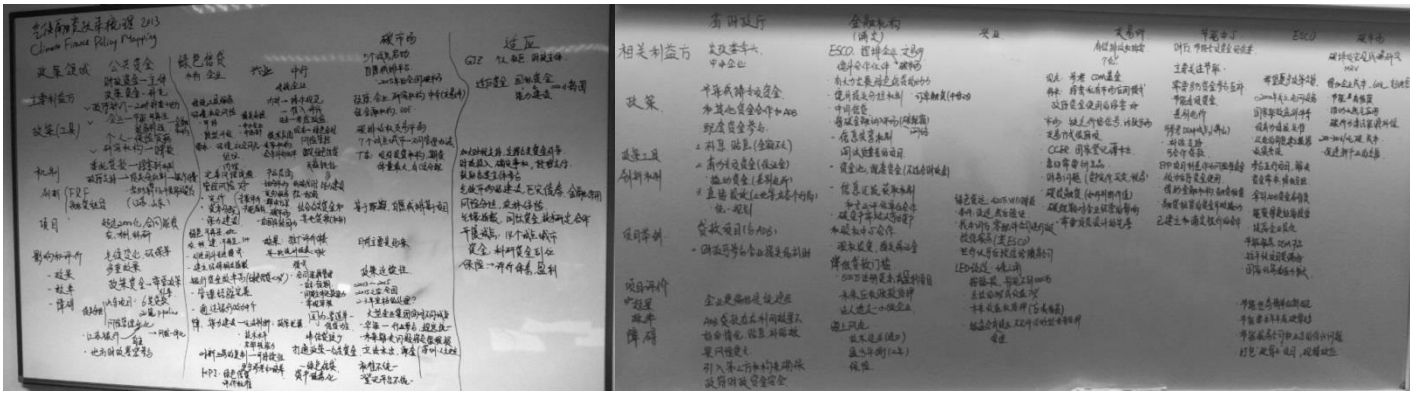
1.2 Policy mapping on the climate finance management system in Guangdong

The researchers worked with the Guangdong Climate Finance Advisory Board to map out the climate finance system in Guangdong, covering:

1. The current status of climate finance policies, the management system, innovative models and mechanisms in Guangdong; and,
2. The gaps and challenges for establishing a comprehensive climate finance management system in Guangdong.

Policy mapping used visualizations to enable a distinctive, holistic perspective and analysis of the climate finance system in Guangdong. A deeper understanding of the specific complex policy environment—the key actors, primary functions, and operational realities—is further reflected in the three case studies presented in this report.

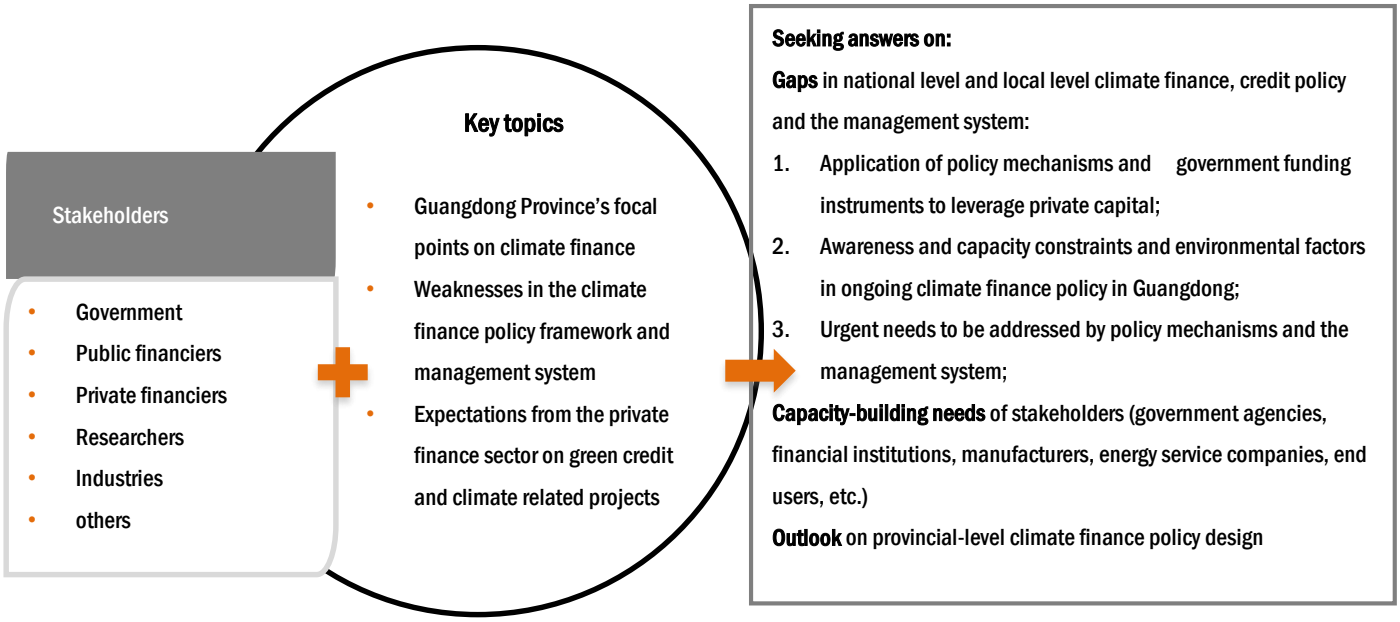
Fig. 1 Photos of conducting policy mapping exercise at Beijing and Guangzhou venues (in Chinese)



1.3 Interviews and semi-structured discussion

On-site interviews and semi-structured discussions were held after the policy mapping exercise to gather in-depth reflections on the research. The interviewees were key informants selected for their substantial expertise and knowledge of climate finance policies and projects in Guangdong (Appendix 5). The interviews and discussions followed the structure outlined in the figure below.

Fig. 2 Structure of interview and semi-structured discussion



1.4 Case studies of on-the-ground climate finance projects in Guangdong

Building on the policy mapping work, case studies of real-life projects were conducted to further analyze and assess the existing climate finance policies and management system in Guangdong. These case studies identified knowledge gaps and barriers in policy implementation, through literature review, site visits and communication with the Guangdong Climate Finance Advisory Board.

The study focuses on three cases, covering various industries and innovative finance mechanisms that are currently being deployed in Guangdong. Cases were selected on the following basis:

1. Ongoing projects managed under mature programs or frameworks that adequately reflect the long-term impact of Guangdong's climate policy and which demonstrate how the management system works;
2. Cases that help to identify gaps and barriers in different industries, namely LED deployment, energy efficiency and transportation and,
3. Cases that cover a broad range of stakeholders who can then relay their capacity building needs via interviews.

2 Overview of the flow and scale of climate finance in China today

2.1 A brief overview of the national climate management system and climate finance policy in China

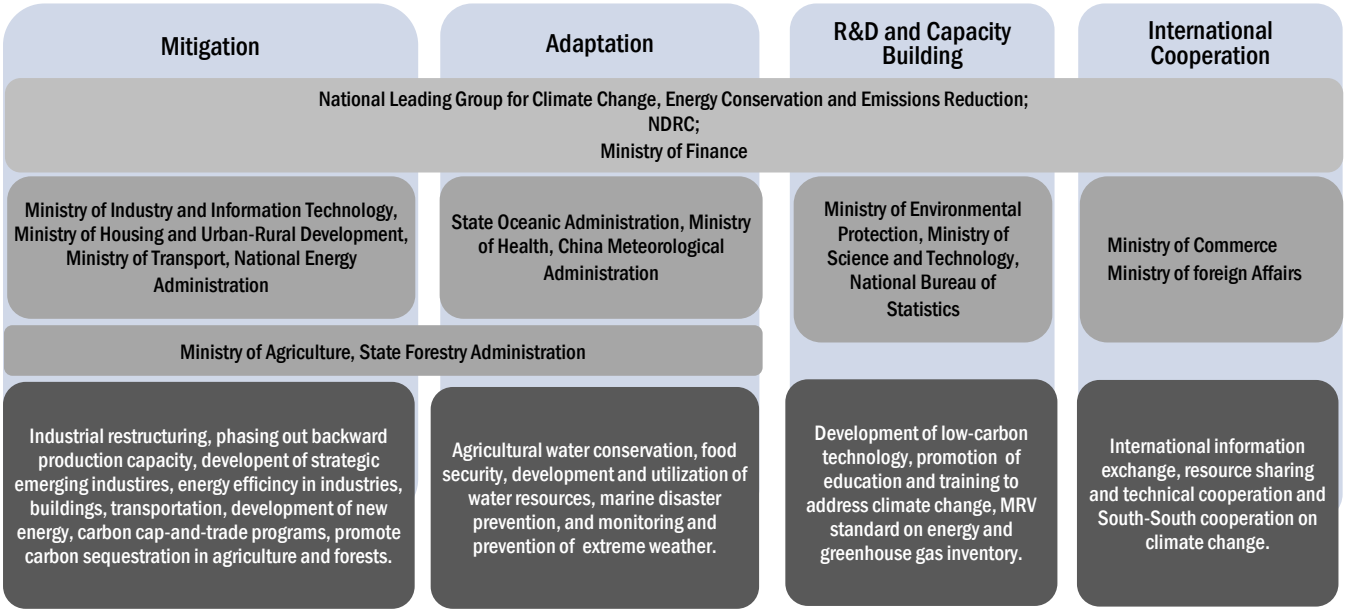
According to *China's National Climate Change Program* and the goals and objectives to tackle climate change in *China's 12th Five-Year Plan (FYP)*, climate finance is defined as the funding applied to mitigation and adaption aimed at actual emission reduction and adaptation outcomes. It includes the following four main areas (Fig. 3):

- Investment in mitigation activities covering economic and industrial restructuring, energy efficiency and emission reduction, development of new energy[1] and phase-out of backward and outdated production capacity;
- Investment in adaptation activities that monitor and prevent the impacts of extreme weather events, covering agriculture, forests, water, human health and infrastructure construction;
- Investment in technology research and development, awareness-raising and capacity building to address climate change; and,
- Investment in international cooperation on climate change with developed and developing countries.

The *National Leading Group for Climate Change, Energy Conservation and Emissions Reduction* is separated into two working groups; 1) energy efficiency and emission reduction; and, 2) addressing climate change in two departments under China's National Development and Reform Commission (NDRC)[2]. While the Ministry of Finance plays a vital role in providing and coordinating financial support, there are 11 other ministries and bureaus involved in implementing climate-related policies and projects (Fig. 3).

Overall, climate finance remains at a relatively immature stage within both governmental agencies and financial institutions. The *National Leading Group for Climate Change, Energy Conservation and Emissions Reduction* takes the lead and sets targets for addressing climate change. Other government agencies carry out their own mandates in assigned policy areas (Fig. 3) corresponding to fixed government budget items, many of which have positive side-impacts on tackling climate change.

Fig. 3 Map of Areas, Institutional Arrangements and the Mandates of Government Agencies in China's Climate Finance System[3]



[1] New energy is defined in China as unconventional energy that includes small hydropower, geothermal energy, ocean thermal energy conversion, nuclear power and renewable energy, including solar energy, wind energy, bioenergy and hydropower.

[2] Within the institutional arrangements for addressing climate change in China, energy efficiency and emission reduction are excluded from the broad definition of addressing climate change.

[3] Source: Author's design based on literature review and insights from interviews.

2.2 Climate finance management system

Sources of climate finance

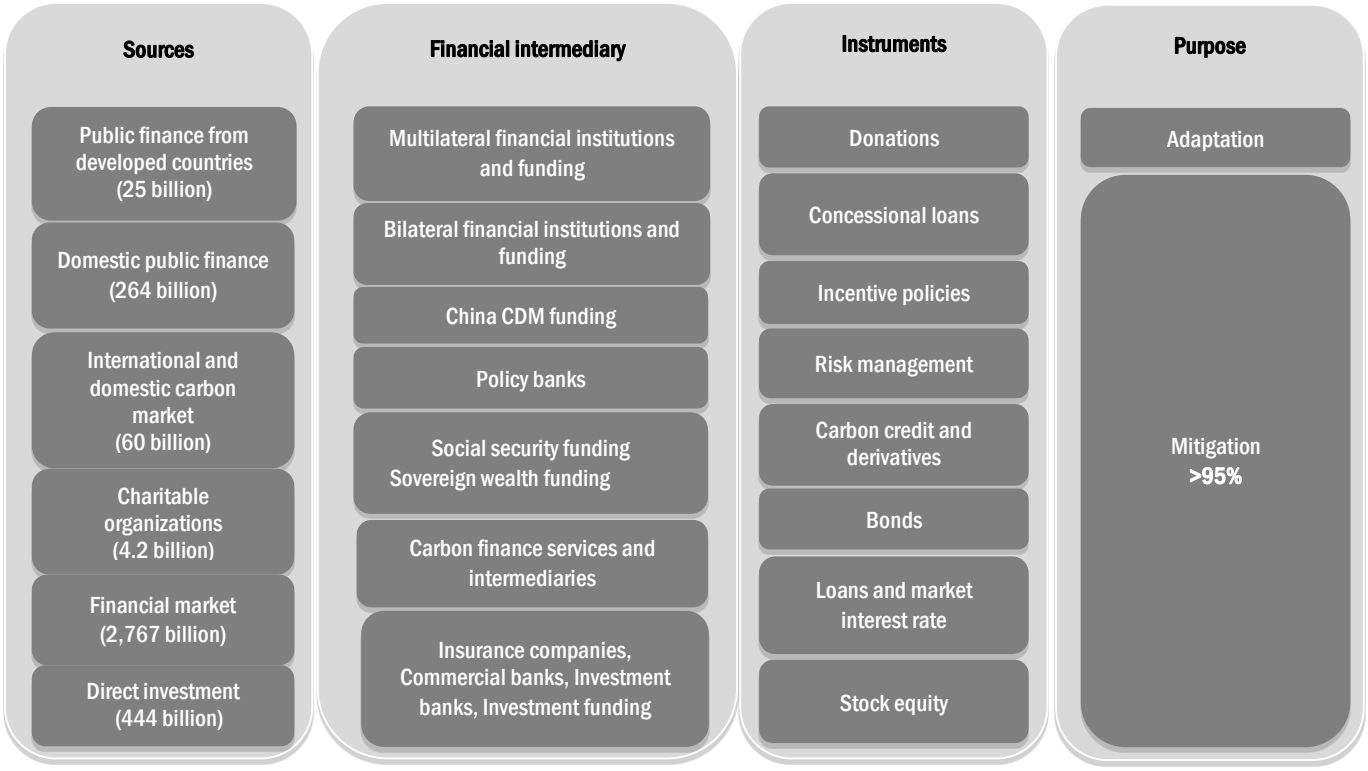
Climate finance in China comes from both domestic and international sources, which can be classified in six basic categories (Fig. 4). Domestic and international public finance is currently the main driver of China's climate change actions. Private finance is quite active in the market, with carbon market finance in the regional piloting platforms, financial markets and direct investment as the three main sources. Charitable finance is rather small but important in supporting climate-related research, piloting projects and capacity building.

Purpose of financing

To date, most climate finance in China has been directed towards mitigation activities, in particular renewable energy deployment, and energy efficiency in the power, industrial, transportation and building sectors. Private capital from direct investment and financial markets has followed public finance into mitigation sectors, especially in renewable energy where returns are significant.

Financial flows for adaptation have been much lower than for mitigation. It is clear that public investment plays a major role, with funding going to agriculture, water resources, marine management, health and meteorological activities. A recent development in China's climate finance regime has been the emergence of China as a donor to other climate vulnerable countries in the framework of the South-South Cooperation Fund.

Fig. 4 Flow of Climate Finance under its Management System in China[4] (2012, in CNY, based on available statistics[5])



2.3 Policy arrangements to finance mitigation

A large amount of the government budget is spent on supporting mitigation policies and projects (Fig. 4). As the key sectors contributing to achieve China's emission reduction target, energy efficiency and renewable energy are supported by the government budget and incentives that can leverage local matching funds and private capital (Fig.5).

[4] The Climate Group (2013), Shaping China's Climate Finance policy, Annex I.
[5] Data was retrieved from major official data sources (China Statistics Bureau) and private research institutions.

The national government budget is distributed through fixed budget items and special government funds, which are the two main basic policy vehicles for ensuring that intended policy impacts are achieved.

Adjusting the industrial and energy structure

Outdated production capacity is being phased out. Special government funds and subsidies collected via a surcharge on renewable energy prices are directly used to subsidize feed-in tariffs for all renewable energy projects. Tax incentives are offered to all sorts of renewable energy deployment projects and product end-users.

	Wind	Photovoltaic power station	Distributed solar PV	Biomass
Feed-in tariffs (CNY/kWh)	0.51-0.61	0.9-1	0.42	0.75
Tax incentives	50% VAT refunds	50% VAT refunds	Exempt government fund	100% VAT refunds

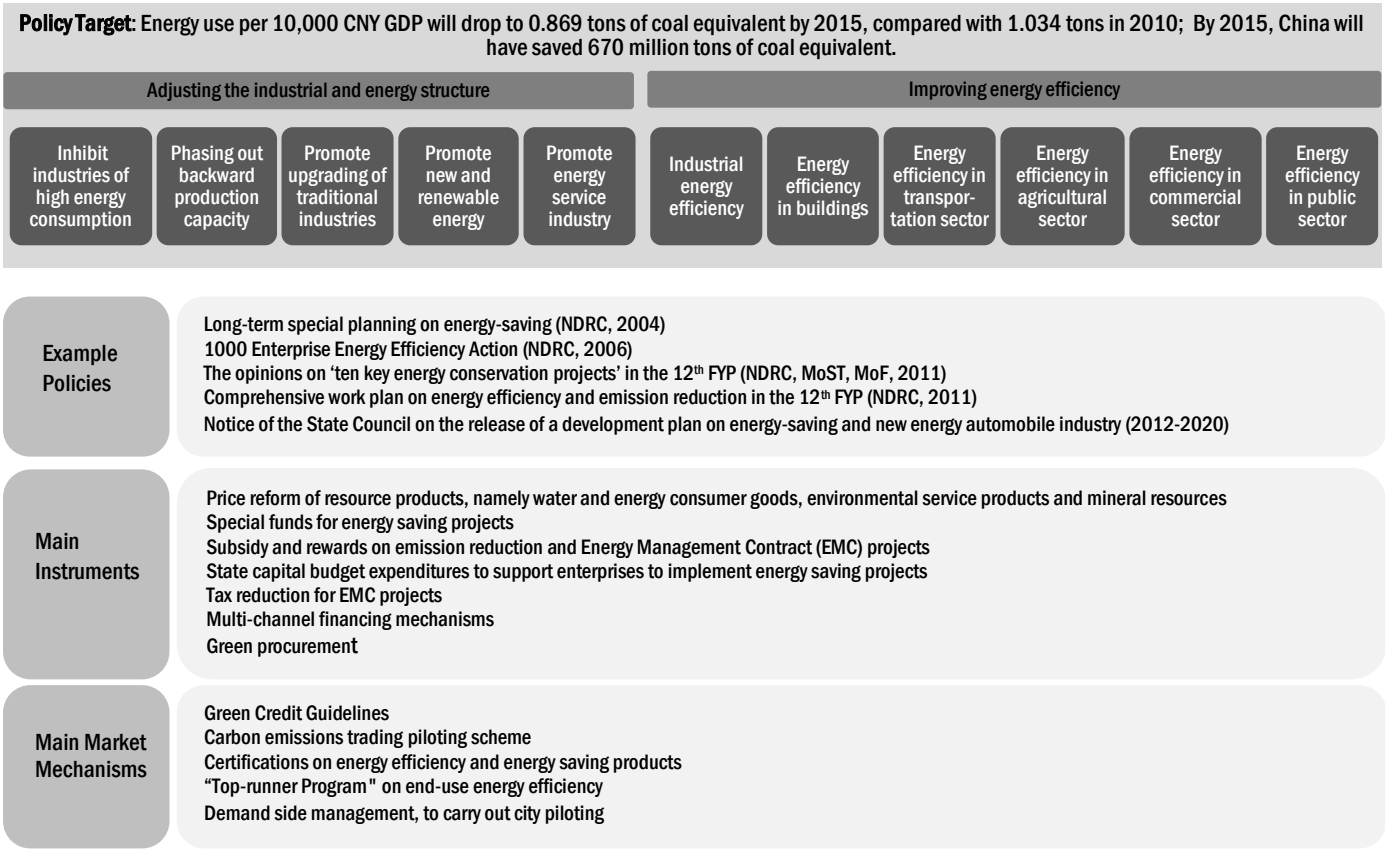
Energy efficiency

A continuous resource and product pricing reform covering water, electricity and natural gas has promoted energy saving and emissions reduction. The reform is being implemented in combination with policy tools such as tax incentives, special funds and subsidies provided to the following major sectors:

- Energy conservation technologies;
- Energy conservation products;
- Transportation, including energy-efficient vehicles and systematic energy saving; and,
- Utilization of renewable energy resources and building-integrated photovoltaic (BIPV) by the construction industry

  in the building sector.

Fig. 5 Map of Main Policy Areas and Policies on Climate Finance for Mitigation



Green Credit Guidelines

The China Banking Regulatory Commission (CBRC) looks over Chinese commercial banks' environmental performance by using Green Credit Guidelines, which aim to encourage the voluntary development of climate resilience-related products and services. After the release of the Green Credit Guidelines in 2012, CBRC has prioritized green finance as one of its main tasks. To upgrade the guidelines to a policy that is to be enforced within commercial banks, CBRC will issue Green Credit Statistics in late 2014, based on which banks will have to report to CBRC on a quarterly basis. The statistic methodology is supposed to include eleven major climate-related industries and cover medium to large-scale enterprises. It also includes key indicators of the four main pollutants mentioned in the 12th FYP: COD, ammoniacal nitrogen, SO_2 and NO_x. CBRC will further develop a Key Performance Indicator Evaluation Process and Framework, and associated banking software to help banks deploy the statistics system smoothly.

CBRC also applies green credit requirements focused on traditional financial tools and services to support corporate environmental management, social risk control, risk management and control of (capital) pricing, capital allocation and capacity building. CBRC considers that green finance, to a large extent, is better channeled through commercial banks. However, currently only 10% of total credits are considered 'green'[6], due to a capacity shortage in processing green projects and a lack of depth of knowledge and understanding of green policies.

Carbon markets

According to a number of specialists in the field, a Chinese nation-wide carbon market is expected to be developed by the end of the 13th FYP (2016-2020). Seven regional pilot emissions trading systems have been launched so far. All seven pilots have established trading schemes based on their specific market needs. Uniquely, Guangdong Province has designed an analogous futures contract[7] for mandatory carbon allowances auctions in order to attract investor attention. Shenzhen and Tianjin are the first pilots accepting individual investors. Besides the regional pilots, a voluntary GHG emission trading system is under construction and China Certified Emission Reductions (CCERs) are accepted in all the above-mentioned piloting systems for up to 10% of the total allowance requirement. However, due to the slow progress of the CCER management system, CCERs are still only traded in voluntary project-based markets and will likely not play a significant role in the regional carbon market pilots.[8]

Once in place, the national carbon market is expected to be one of the biggest sources of climate finance in China. In the longer term, carbon market revenues could provide the government with additional funding to incentivize the development of climate-resilient projects and industries.

Uncertainty with regard to national carbon market policy remains a major concern among industries, market players and researchers. Other concerns include: the discrepancies among current piloting management systems, such as the legal status of carbon credits; system administration; allowance distribution and Monitoring, Reporting and Verification (MRV) methods.

2.4 Policy arrangements for adaptation finance

Adaptation finance involves a wide range of stakeholders including government agencies, enterprises and the public. A financial mechanism for climate change adaptation has not been fully established in China. Government funding is definitely not sufficient[9] under the current ambiguous policy definition of adaptation finance. Funding is distributed to

[6] According to the Policy Mapping exercise with an expert from CBRC.

[7] According to stock exchange regulation in China, futures are not allowed at carbon exchanges. However, Guangdong Province auctions carbon allowances at a floor price (of 60 CNY/ton), which implies opportunities for investors based on possible market fluctuations.

[8] According to the Policy Mapping exercise with an expert from China's National Center for Climate Change Strategy and International Cooperation.

[9] 54 billion CNY in 2013 were spent on adaption-related projects, equivalent to 0.7% of total government budget expense.

a large number of adaptation-related national actions, but none of them are managed, measured or verified in terms of climate change adaptation.

On the positive side, the government released its first *National Climate Change Adaptation Strategy* at the UN Climate Change Conference 2013 in Warsaw. Xie Zhenhua, Vice Chairman of NDRC, stressed that the strategy clarifies China's guiding ideology and principles with regard to adapting to climate change. It also instructs relevant departments to coordinate and make overall adaptation plans by setting goals and tasks, and putting forward supporting measures and regional demonstration projects. Government budgets will be allocated to support the accomplishment of these targets, as well as leveraging private capital to invest in adaptation. Climate financial products and services are considered the most effective tools in adaptation finance, where Catastrophe Bond and Weather Index-based Insurance, in particular, are named as two of the innovative and practical financial products that can play significant roles in financing adaptation.

3 Overview of the flow and scale of climate finance in Guangdong Province

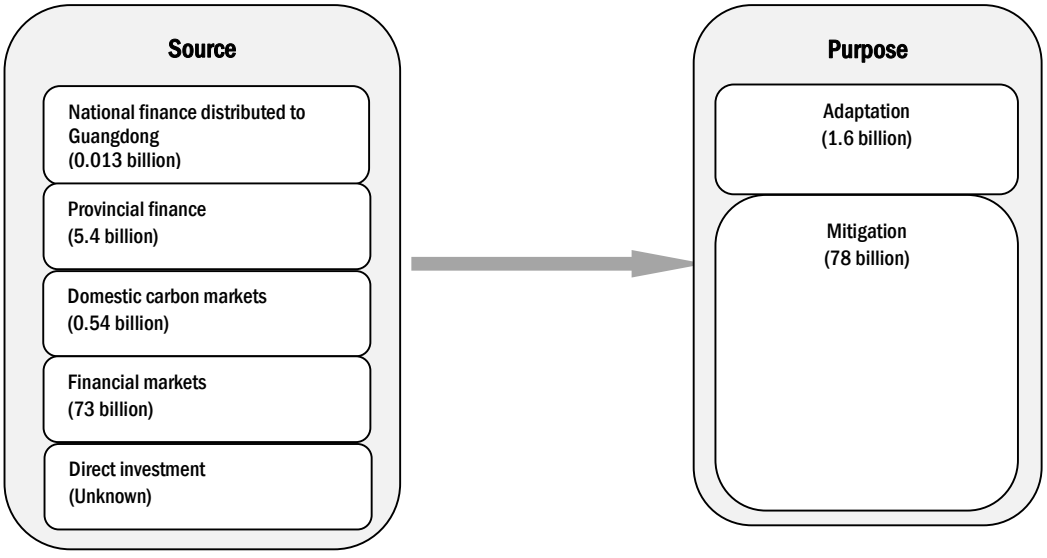
To better understand the climate finance mechanisms deployed in Guangdong Province, it is important to identify funding sources, key stakeholders, such as government agencies and financial institutions, and industrial policies in the context of national and provincial requirements for energy saving and emission reductions. In this chapter, the flow and scale of climate finance are mapped out. In addition, the gaps and challenges of the current approach are identified.

3.1 Climate finance sources

Climate finance in Guangdong Province comes from both domestic and international sources, which can be grouped into four basic categories (Fig. 6):

- Public finance from the national and local government is the conventional source of funding for climate-related projects; however, in 2013 it amounted to only 5.4 billion CNY;
- Public finance from international sources, for example sovereign loans from the Asian Development Bank (ADB), is currently an important incentive for the province's climate-related activities;
- Private finance, mainly mainstream commercial bank loans and direct investment, is the biggest source of funding, with 73 billion CNY provided in 2013 to support small and medium scale enterprises in the region; and,
- The new carbon market turnover reaches 600 million CNY in the first year and it offers potential financial opportunities for investors and for the enterprises covered by the scheme, as long as the market grows as expected under stable policies and an appropriately designed mechanism.

Fig. 6 Flow of Climate Finance under its Management System in Guangdong (2013, in CNY, based on available statistics[10])



Purpose of financing

Guangdong has been assigned an emissions reduction target of 18% under the 12th FYP, the highest in China. This explains, in part at least, why most climate finance in Guangdong has flown into the mitigation sector, with an emphasis on energy efficiency and emissions reduction. Alongside national funds and subsidies allocated to industry,

[10]Data was retrieved from the Fiscal Budget Sheet, Guangdong, 2013 and an interview with China Emission Exchange.

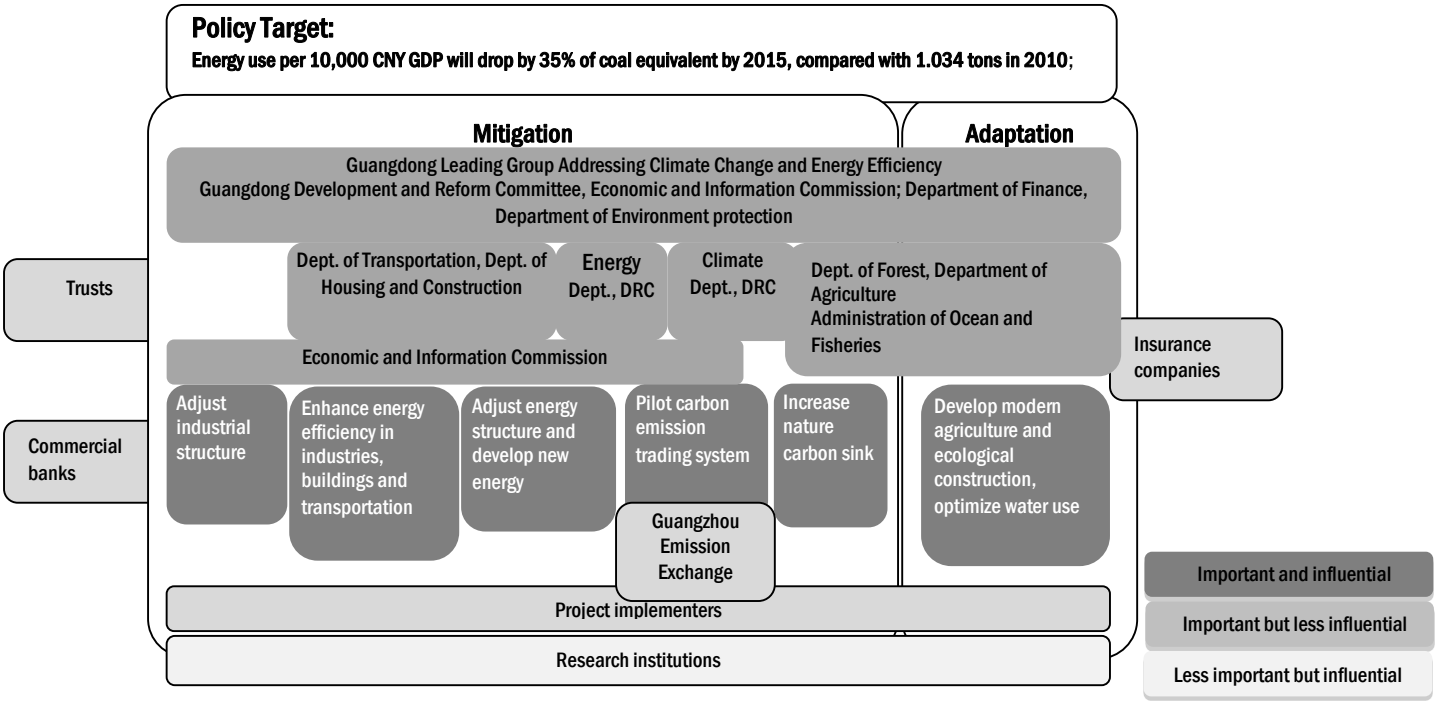
transportation and renewable energy projects, the Guangdong Provincial Government (GPG) spends around 500 million CNY per year on energy conservation projects and on promoting energy efficiency pilots and technologies. The private sector, however, also has a wide interest in both mature renewable energy projects and low-carbon technologies (such as PV solar and LED lighting), which have solid industrial bases in Guangdong Province.

As one of the most developed southern coastal areas in China, Guangdong has been making efforts to establish climate resilient ecosystems and insurance schemes for the agricultural sector. The government has allocated 1.6 billion CNY for agricultural insurance and eco-environmental construction. The impact, however, cannot be assessed until these programs have been fully implemented for a reasonable period of time.

3.2 Policies, institutional arrangement and stakeholders involved in Guangdong's climate finance system

The *Program on Addressing Climate Change in Guangdong Province* in 2011 and the *12th FYP on Addressing Climate Change* in Guangdong Province in 2014 have provided the main climate change finance policy structures, as shown in Fig. 7.

Fig. 7 Map of Policies, Institutional Arrangement and Key Stakeholders in Guangdong's Climate Finance System[11]



Institutional arrangements for climate finance in Guangdong Province are similar to the existing structures at the national level. The Guangdong Development and Reform Commission (Guangdong DRC) plays the role of general coordinator for climate-related issues: emissions reduction, energy conservation, carbon market piloting, environmental protection etc. They all contribute to addressing climate challenges but are managed by various government departments, which are supported by fixed government budget lines, normally under 'Energy Efficiency and Environment Protection'.

The relevant government agencies and their mandates are listed below:

- Guangdong DRC is responsible for overall policy design and execution;

[11] People's Government of Guangdong Province (2011), Program on Addressing Climate Change in Guangdong Province, available online from: http://zwgk.gd.gov.cn/006939748/201101/t20110124_12498.html (accessed 04/10/2014)
Guangdong DRC (2014), 12th FYP on Addressing Climate Change in Guangdong Province, available online from: http://www.gddpc.gov.cn/xxgk/tztg/201401/t20140127_237793.htm (accessed 04/10/2014)

- Guangdong Provincial Economic and Information Technology Commission (EITC) is in charge of industrial energy conservation and emission reduction;
- The Department of Finance of Guangdong Province handles the distribution of government funding; and,
- Other related executive departments (Fig. 7) work on fund coordination, supervision and regulation.

There are also important but less influential stakeholders from the private sector who are taking a major role in achieving policy impact, but have a minor role in decision-making processes. In contrast to public agencies, stakeholders from the private sector are more active in mobilizing funding and investing in climate-related projects. Thanks to a healthy and prosperous financial market, private capital has supported numerous small- and medium-sized enterprises (SMEs) to quickly enhance the biggest energy service market in the country, and, to a large extent, help the province meet its emissions reduction target. The private sector uses different pathways to contribute to climate finance in Guangdong:

1. Commercial banks provide loans to and invest in green projects, such as renewable energy, environmental and energy services. Banks connect with Guangdong's carbon market by providing basic clearing services as wellas involving innovative secondary financial instruments.
2. Trust companies jointly invest with commercial banks and provide investment management services.
3. Insurance companies provide farmers and urban residents with climate-related insurance products, such as agricultural policy insurance.
4. Guangzhou Emissions Exchange (GZEEX) is responsible for the design of the carbon trading platform, including transaction rules, the trading mechanism, and the clearance system and risk management.
5. Project implementers, energy service companies (ESCOs), project owners and other technology or service providers, are the basic forces for implementation and development of energy-related projects. They support overall climate finance policy implementation on and are supported by funding from the public and private sectors.

Research institutes are less important in achieving policy objectives in this case, but quite influential in the policy making process. They provide research and policy recommendations to Guangdong DRC, on which the latter relies heavily. The Energy Strategy Research Center of the Chinese Academy of Sciences (CAS), for instance, provides research and policy recommendations to the government of Guangdong Province and Guangdong DRC in such policy areas as the pilot cap-and-trade scheme, including on the design of registry and allowances allocation systems and key MRV issues.

Similar to the national level, two working groups have been formed under the *Guangdong Leading Group Addressing Climate Change and Energy Efficiency*, in charge of energy efficiency and emission reduction, and addressing climate change, respectively. However, the two working groups are hosted by Guangdong EITC and the Bureau of Resource Conservation and Environment and Climate of Guangdong DRC respectively, which is different from the national arrangement where both operate within the NDRC.

Given that the two working groups operate under different government agencies, more coordination is required. It has been suggested from inside Guangdong DRC that it takes responsibility for both working groups, but this will not become a reality until after discussions on long-term ambition take place and decisions on institutional reform are made.

The *Working Group on Addressing Climate Change* needs greater attention from the higher level of administration, as well as greater funding and human resource allocation. While Guangdong DRC is taking the lead in every important area of economic development, the *Working Group on Addressing Climate Change* is responsible for overall climate change strategy and the implementation of a carbon emission trading system (ETS). The group's budget is quite small,

and at present the group operates on the 30 million CNY allocated by the Special Fund for Low-carbon Development of Guangdong Province. This is primarily used for research and capacity building purposes.

Adjusting the industrial structure

The 'dual-transfer' strategy is the main industrial policy being implemented and includes the 'industrial transfer' and 'labor transfer' of high energy-consuming and high-emitting industries from the Pearl River Delta to the east and west wings of the mountains in north of Guangdong. These industries have been restructured to ensure that the emission reduction of those industries meets the targets of Guangdong Province before they are relocated in northern Guangdong. The strategy has helped the development of east and west wings of the mountainous region, as well as emission reduction in the Pearl River Delta, where industries that feature high added-value and low emissions, such as modern logistics, corporate headquarters and energy conservation services, become the main industries.

Table 1 Main policy areas and policies on climate finance to adjust the industrial structure

Policy target: The proportion of the tertiary industry reaches 48% of total GDP by the end of 2015[12]			
Key decision makers: Guangdong DRC; Guangdong EITC Other stakeholders: enterprises			
Policy	**Timeframe**	**Issued by**	**Status quo and Impacts**
Decision on the promotion of industrial transfer and labor transfer	May 2008-	GPG	36 industrial parks for those industries that have been relocated and transferred have been established in the east and west of Guangdong Province, which have achieved total industrial added-value of 76.69 billion CNY.[13] The proportion of the tertiary industry in Guangzhou's GDP has increased by 2.23% in from 2011 levels.
Notice on further strengthening the implementation of phasing out backward and outdated production capacity[14]	March 2006-	Guangdong DRC	12.75 million tons[15] of backward and outdated steel production capacity and 57.82 million tons of cement production capacity have been phased out; 12.21 million kilowatts of small-scale thermal power generation[16] was shut down; and 90% of the targeted backward and outdated production capacity has been eliminated.
Instruments: Subsidy in the form of provincial grants for phasing out backward and outdated steel production capacity; grants for phasing out backward and outdated cement production capacity;[17] and cancelation of subsidies[18] for small-scale thermal power generation			
Market mechanisms: Direct investment of 3.3 billion CNY			

Guangdong Province planned to start phasing out backward production capacity as early as the beginning of the *11th Five-Year Plan* (FYP) (2006-2010), in industries such as small-scale steel and thermal power generation. Since 2006, policy implementation has contributed greatly to shifting the proportion of the three industries (primary, secondary and tertiary) in the local economy and to improving overall economic performance. The proportions of the three industries of Guangdong were 6.3:49.6:44.1 in 2005[19] and 4.9:47.3:47.8 in 2013[20], when, for the first time in ten years, the relative share tertiary industry exceeded that of secondary industry. Shenzhen and Guangzhou, two major cities in

[12], Guangdong Province, Full report of 12th FYP

[13] People's Government of Guangdong Province (2013), Notice: Evaluation results of Industry transfer and labor transfer, available online from: http://zwgk.gd.gov.cn/006939748/201309/t20130916_405841.html (accessed 04/10/2014)

[14] People's Government of Guangdong Province (2011), Notice: Further eliminate outdated capacity production facilities in Guangdong Province, available online from: http://zwgk.gd.gov.cn/006939748/201010/t20101013_12300.html (accessed 04/10/2014)

[15] Tons in this report refers to metric tons or tonnes.

[16] People's Government of Guangdong Province (2011), Government work report, available online from: http://www.gd.gov.cn/govpub/gzbg/szf/201101/t20110128_137102.htm (accessed 04/10/2014)

[17] Guangdong EITC (2011), Notice: Apply subsidy of eliminating outdated cement capacity in Guangdong Province, available from: http://www.gdei.gov.cn/flxx/yclgy/ttlhcn/tzgg/201105/t20110511_104654.htm, (accessed 04/10/2014)

[18] People's Government of Guangdong Province (2011), Notice: Implementation of closing small-sized fossil fuel power plants, available online from: http://zwgk.gd.gov.cn/006939748/200909/t20090915_9419.html (accessed 04/10/2014)

[19] Statistical Bureau of Guangdong Province (2005), Guangdong economy and society developed statistical bulletin, available online from: http://www.gdstats.gov.cn/tjgb/t20060223_35213.htm (accessed 04/10/2014)

[20] Statistical Bureau of Guangdong Province (2014), Guangdong economy and society developed report, available online from: http://www.gdstats.gov.cn/tjzl/tjkx/201401/t20140123_138785.html (accessed 04/10/2014)

the Pearl River Delta region and also the main contributors to Guangdong's total GDP, now generate over 60% of their GDP from the tertiary industry.

The strategy of *Early Planning* provides a summary of Guangdong's experiences. From the 11th FYP to the 12th FYP, phasing out backward production capacity and emission reductions were top priorities for the Guangdong authorities. As a result, Guangdong had completed the process of phasing out backward production capacity by 2010, five years ahead of schedule, at a time when most other provinces and regions in China had just started their efforts.

Energy efficiency and emission reduction

Although most of the funding for energy efficiency and emission reduction activities is sourced from the private sector, public funds still play an important role in supporting key energy efficiency and emissions reduction projects and campaigns. Special funds and incentives are created and interact with market mechanisms that help promote energy efficient end products, leading to a decrease in annual energy consumption per unit of GDP by 3.78% in 2011 and 5.38% in 2012 respectively, exceeding the mid-term target of 7.63%[21].

Table 2 Main overall policies on climate finance for energy efficiency and emission reduction

Policy target: By 2015, the province's energy consumption per unit GDP will decrease to 0.477 tons of standard coal / 10,000 CNY (2010 prices), decreasing 18% and 31.46% over those of 2010 and 2005 levels, respectively.			
Key decision makers: Guangdong DRC, EITC Other stakeholders: Enterprises, end users			
Policy	**Timeframe**	**Issued by**	**Status quo and Impacts**
12th FYP on comprehensive work plan for energy efficiency and emission reduction in Guangdong	Feb. 2012-	GPG	The province's annual energy consumption per unit of GDP fell by 3.78% in 2011 and 5.38% in 2012 respectively, exceeding the set mid-term target of 7.63%. Over 238 enterprises[22] are subject to the low-carbon energy actions for the "10,000 enterprises" program.
12th FYP on low-carbon and energy efficiency campaign for "10,000 enterprises" in Guangdong, a leading program designed to drive industrial energy efficiency and emission reduction	Feb. 2012-	EITC	
Comprehensive work plan for energy efficiency and emissions reduction in Guangdong	July 2007-	GPG	
Instruments: Special Funds; pricing policies; tax incentives; subsidy incentives			
Market mechanisms: 'Top Runner standard for energy efficiency review Supply-side and demand-side management Emission rights trading Low-carbon product certification pilot			

Special funds and subsidies

Besides the national special funds designated for Guangdong enterprises, provincial government funding is spent on energy efficiency and emission reduction projects, energy service projects, industrial technology research and qualified demonstration projects with grants, subsidies and loan interest deduction. For example:

- The Guangdong Special Fund for Energy Efficiency is supervised by the EITC and the Department of Finance with an approximate budget of 500 million CNY per year to finance Energy Management Contract (EMC) projects.

21 [2013-08-05], Guangdong Province fulfills its energy saving target, available online from: http://news.xinhuanet.com/fortune/2014-06/24/c_126662753.htm (accessed 04/10/2014)

22 Guangdong EITC (2014), Notice: Adjusting list of 10,000 enterprises with energy efficiency and low carbon action during 12th FYP, available online from: http://www.gdei.gov.cn/flxx/jnjh/jyny/201401/t20140107_112062.htm (accessed 04/10/2014)

- The Guangdong Province Conservation and Circular Economy Fund is also supervised by the Guangdong Provincial EITC and the Department of Finance, with a total budget of 200 million CNY per year to target projects that apply energy efficiency technology and resource conservation solutions.
- The Special Fund as Rewards for EMCs[23] is provided in combination with the National Special Fund as Rewards for Energy Service Contracts. When executed, EMC projects will receive a reward of 320 CNY for every ton of standard coal saved. 240 of the 320 CNY originate from the national budget while the remaining 80 CNY come from the Guangdong Province Conservation and Circular Economy Fund.
- The Municipal-level Special Fund for Energy Efficiency: besides those funds available at the provincial level, some of the municipal governments, such as Shenzhen and Dongguan, spend additional budget on energy efficiency technology and cleaner production-related projects. Though the volume of each fund is only several million CNY, they offer a further means to address the shortage in budget when technology upgrading costs are high.

Taxation incentives

Applying policy tools similar to those at national level, Guangdong has implemented tax incentives for enterprises with projects on resource utilization, energy-saving equipment, EMCs, energy-saving and renovation of existing buildings for energy-saving purposes.

	Resource utilization	Energy-saving equipment purchase	Energy Management Contract projects	Energy-saving and renovation for existing building projects
Tax incentives	Reduction in taxable income by the sales revenue on resource-utilization products	Special depreciation and exempt from corporate income tax of 10%-30%	Exempt from sales tax and exempt from corporate income tax of 10%-30%	A reduction of corporate income tax of 10%-30%

The Guangdong ADB Loan Efficiency Power Plant (EPP) Program

With financial and human resource support from the Department of Finance of Guangdong Province, ADB's sovereign loans are able to benefit small-scale enterprises in Guangdong with a major focus on energy saving projects[24]. These asset-light enterprises, though equipped with solid techniques and products, have problems getting credit from commercial banks that issue loans requiring longer payback schedules. The ADB Loan EPP program established a flexible mechanism through which the loan can be processed with various guarantee methods, and can be issued for longer-term use (as long as 3 to 5 years). The program also offers its clients an interest rate that is 10% lower than what commercial banks usually charge, and rewards can be obtained to further reduce the financial cost, if project emissions reductions are verified according to the loan contract. To scale up the program and increase the number of beneficiary enterprises, the program has lined up commercial banks and guarantee corporations, which in partnership provide long-term commercial loans and guarantee services. Further details on the program can be found in Chapter 5.

Research and development

Some of the government funding is spent on technology innovation and commercialization, which will indirectly lead to emission reductions. For instance,

1. Key technology for energy conservation: Guangdong is implementing the '*Low-carbon Technology Innovation and Demonstration*' program, a scientific and technological project supporting the R&D base and

[23] Guangdong Finance Bureau (2011), Notice: Management of financial incentive for Energy Performance Contracting, available online from: http://zwgk.gd.gov.cn/006939991/201103/t20110329_23404.html (accessed 04/10/2014)

[24] More details can be found in Chapter 3.

technology teams to accelerate the commercialization of their outputs, with a total budget of 100 million CNY per year.[25]

2. Energy saving technology commercialization demonstrations: 100 energy saving IT application demonstrations and 100 cleaner production demonstration projects with IT application are supported.
3. The Provincial Key Energy Technology Promotion Directory: The Directory focuses on energy cascade utilization, waste heat power generation, advanced coal gasification, high frequency control, Coke Dry Quenching, regenerative furnace, high-efficiency heat exchanger, as well as dry and semi-dry flue gas desulfurization, membrane bio reactors and selective catalytic reduction of nitrogen oxides.

[25] Department of Science and Technology (DoST) (2009), Notice: Interim measures of special funds management for key technical projects, available online from: http://www.gdstc.gov.cn/HTML/zwgk/zcfg/zxzcfg/1244449048801-20001702749362952 56.html (accessed 04/10/2014)

Market-oriented and market-based mechanisms

Several market-oriented mechanisms are applied by the provincial government, covering various industries and end users. These mechanisms are combined with government executive orders and help promote climate-friendly products and services. Examples of these mechanisms include:

1. The low-carbon and energy efficiency campaign for "10,000 enterprises", a national campaign under which large emitters, whose annual energy consumption exceeds 50,000 tons of standard coal equivalent, are reviewed and assessed annually against a specific emission cap. Guangdong Province is part of this campaign and has provided incentives to promote energy efficiency technologies.
2. A 'Top-runner' standard system for energy efficiency is regularly applied to review new projects and energy-saving products and enhance technology improvements.
3. Supply-side and demand-side management is promoted through prioritizing clean, efficient electricity generation units and promoting efficient power plants to improve the efficiency of total energy use.
4. Emission rights (permits) for various pollutants[26], such as sulfur dioxide, are being piloted in Guangdong. A carbon emission trading system is piloted as a way to support ongoing carbon emission reductions.
5. Low-carbon product certification pilots: Guangdong, Chongqing and Hubei have provincial-level piloting schemes for low-carbon product certification under the national policy of *Low-carbon Product Certification Interim Measures*[27]. The pilots include common household appliances, such as refrigerators, air conditioners, small appliances and glass. Guangdong Province is piloting aluminum material standards and the promotion of low-carbon product certification.

Adjusting the energy structure and developing clean energy

Table 3 Main policies on climate finance for adjusting the energy structure and developing clean energy

Policy target: Non-fossil fuels at 20% of Guangdong's energy use in 2015, compared with 15% in 2010[28]			
Key decision makers: Government of Guangdong Province, Guangdong DRC, Energy Bureau Other stakeholders: enterprises			
Policy	Timeframe	Issued by	Status quo and Impacts
12th Five-Year Plan of Energy Development of Guangdong Province	September 2013-	Energy Bureau, Guangdong DRC,	Non-fossil fuels at 16.7% of Guangdong's energy use by November 2013[29], which is lower than expected in the plan
Guangdong Province offshore wind farm project planning	July 2012-	Guangdong DRC,	Two offshore wind farm projects are under approval by State Council.
Industrial development plan on new energy vehicles	2013-2020	Guangdong DRC	New energy vehicles at about 8,000, of which more than 3,600 are electric vehicles and over 4000 are LNG vehicles[30]
Instruments: Tax incentives Government green procurement			
Market mechanisms Green finance; direct investment			

Guangdong Province is adding large amounts of nuclear and wind power, with some facilities already completed and others under construction. According to the *Program on Addressing Climate Change* in Guangdong Province, Guangdong has been the accelerating economic transformation and vigorously promoting energy conservation to actively optimize the energy mix. For instance, under the 12th FYP, Guangdong has planned to start three new nuclear power projects - Lufeng Nuclear Power Plant, Shaoguan Nuclear Power Plant and Taishan Nuclear Power Plant Phase

[26] [2013-12-19], Emission trading system launched in Guangdong, available online from: http://www.gov.cn/gzdt/2013-12/19/content_2550849.htm (accessed 04/10/2014)

[27] The policy will pilot a unified certification system for low-carbon products, carbon products catalogue, standards, certification specifications and certification rules as well as certificate and certification mark. The piloting will also provide qualifications while institutions and personnel engaged in low-carbon product certification, testing activities, clear implementation procedures, supervision and management requirements and the related liability.

[28] 12th FYP, Guangdong Province

[29] Review on 12th FYP, Guangdong Province, available online from: http://gd.people.com.cn/n/2013/1120/c123932-19952924.html (accessed 04/10/2014)

[30] People's Government of Guangdong Province (2013), Industrial development plan on new energy car, available online from: http://zwgk.gd.gov.cn/006939748/201208/t20120823_340589.html (accessed 04/10/2014)

II[31]. Through those efforts, the proportion of new energy in Guangdong's energy use will be much higher than in other provinces.

The recent focus on the development of the coastal onshore wind power and emphasis on the development and construction of offshore wind power has been driven by private finance. Shanghai Pudong Development Bank will support the first offshore wind farm project in Guangdong, applying its experiences from China's leading off-shore wind farm projects in Shanghai. With core technologies being localized, the economic performance of this project is considered to be highly improved.

An industrial development plan for low carbon vehicles is being newly developed, especially for electric cars and LNG cars, which are also highly recommended for procurement by all public service sectors. In addition, a sales tax exemption policy will be applied for new energy vehicle companies and key automobile parts enterprises. Together, these are expected to increase the production capacity of new energy vehicles to 200,000, and cumulative sales to 50,000 by 2015.

Carbon markets

According to the Guangdong Provincial DRC, the Guangdong carbon trading pilot is the largest of China's seven regional schemes, with carbon allowances in the system totalling 388 million tons (Mt) in 2013. It is also the second largest carbon trading market in the world following the EU ETS. This could potentially generate major revenues from carbon finance that could be further spent on climate-related projects in the future. The Guangdong scheme caps carbon emissions for 242 enterprises in the power, iron and steel, petrochemical and cement industries, and will cover more industries from 2015 onward. Enterprises which emit more than 20,000 tons of carbon dioxide (or 10,000 tons of standard coal equivalent) per year are covered under the cap.

The scheme officially commenced in March 2014. The scheme helps to engage related stakeholders, develop trading mechanisms, and enhance technological capacity for a standardized future national carbon market. Guangdong is regarded as the most transparent trading pilot in China, as it not only discloses the number of allocated allowances, but also the method and consultation process used to calculate the numbers. This policy massively encourages enterprises to learn and play an active role in the trading scheme, thus helping build up stable market foundations for future trading.

Before free allowances are allocated to enterprises, the trading scheme stipulates that mandatory allowance auctions take place. Guangdong is the only pilot scheme that requires enterprises to purchase a portion of their allowances through auction, accounting for 3% of the total allowances in 2013, 5% in 2014 and 10% in 2015[32]. All allowances from the first auction were sold out in December 2013. However, leftover allowances still exist from the second auction, indicating that enterprises, especially those with limited cash flows, become more conservative and careful when taking decisions on purchasing carbon allowances. Foreign enterprises and companies that have been operating CDM projects, in contrast, have become the first group of traders in the market.

The ongoing auction mechanism is estimated to generate at least CNY 630 million per year from 2014, at an estimated price of 60 CNY/ton. This is to be used to finance development of carbon markets and emission reduction projects, as planned by government agencies. Both market players and enterprises have high expectations of this funding in terms of its uses. Currently, it is housed in the provincial government budget. It is expected that the money could leverage more resources by providing incentives to attract private finance to invest in low carbon development in the province.

31 [2011-02-03], Guangdong Province will launch 3 nuclear power stations during 12th FYP, available online from: http://finance.qq.com/a/20110203/000072.htm (accessed 04/10/2014)

32 Source: interview with Guangdong DRC officer

Table 4 Provincial-level policy for development of carbon emission trading system

Policy target: By 2015, to establish a sound carbon emission trading mechanism and management system, so Guangdong carbon market can become an important carbon trading market in China; By 2020, to establish a sophisticated provincial-level carbon emission trading system; and to establish inter-provincial carbon emission trading system.			
Key decision makers: GPG, Guangdong DRC and its Energy Bureau Other stakeholders: GZEEX, enterprises subject to ETS			
Policy	**Timeframe**	**Issued by**	**Status quo and impacts**
Notice on the issuance of implementation of carbon emissions trading scheme	Dec. 2012-	GPG	GZEEX has been set up as the official exchange for Guangdong ETS. Enterprises subject to ETS have been identified and notified for emissions reporting. Voluntary and inter-provincial carbon emission trading systems are not ready yet.
Guangdong Province carbon emissions management and trading schemes	Jul, 2013-	Guangdong DRC	Officially announced
The first allocation and work plan on carbon emissions allowances	Nov. 2013-	Guangdong DRC	Initial carbon allowance auction was conducted in December, 2013, and three million tons of allowances were auctioned. Second carbon allowance auction was conducted in January, 2014, and 2.89 million tons of allowances were sold.
Guangdong Province carbon emissions management and trading schemes (officially announced)	Jan. 2014-	GPG	New enterprises subject to ETS. Standards on MRV have not been established yet.
Reporting guidelines on mandatory carbon emissions	Mar. 2014-	Guangdong DRC	Government instructions on implementation of MRV will soon be released.
Specifications on verification of carbon emissions reporting	Mar. 2014-	Guangdong DRC	
Recommended list of verification agency	Mar. 2014-	People's Congress of Guangdong Province	
Legislation of carbon emissions trading schemes	Jun. 2014-	GPG	Carbon emissions allowances will be assigned a legal status, which is not in place yet. Penalty on refusal of implementation will be decided.
Instruments: Special fund for low-carbon development			
Market mechanisms: Cap-and-trade scheme			

Special Fund for low-carbon development

Since 2011, GPG has been allocating 30 million CNY per year for research and capacity building for low carbon development, with a particular focus on piloting low carbon projects and the carbon cap-and-trade scheme. The money is spent through a standard procurement system on a project-by-project basis. In 2013, the fund supported research projects on the development of provincial greenhouse gas inventories and the definition of carbon emission peaking in Guangdong, the outputs of which have been submitted to provincial government as references for establishing the carbon trading scheme. According to those Guangdong DRC officials interviewed, the funding is limited to supporting the specific fields of research and capacity building projects currently mandated by the fund's policy. An application for additional funding has been proposed but approval from the provincial government remains uncertain.

A contrast with Shenzhen ETS

Shenzhen launched its trial carbon emissions trading in June 2013, the first of the seven pilots. Though Shenzhen is located in the south of Guangdong Province, it is piloting the ETS as an independent region. Shenzhen has issued local regulation to support its ETS. Unlike Guangdong's trial, Shenzhen has required key companies in the service sector to join the scheme, given that the city has low industrial emissions. Shenzhen allows individual investors and entities that are not covered by the ETS, such as financial institutions, to participate in trading, resulting in higher trading frequency and potentially larger price fluctuations.

Functions of carbon finance

The purposes of the carbon market are to achieve the reduction of carbon emissions and mobilize additional funding sources to do so. However, to date there have been limited transactions of carbon allowances in Guangdong's carbon market. Based on interviews, financial institutions are willing to participate in the carbon market if market fluctuations and the possibility of speculation exist. The positive externalities of the carbon market must be ensured to attract investors since internal transaction costs negatively affect the value of the carbon market. Moreover, standard carbon accounting, which is critical for enterprises' carbon asset management, has not yet been fully developed.

Carbon sink enhancement from natural resources: forests and oceans

Table 5 Main policies on climate finance for carbon sink enhancement from ecosystems

Policy target: By 2020, Guangdong's forest area will increase by more than 900 million acres compared to 2009 levels; timber volume will increase by 132 million cubic meters; and the forest coverage rate will reach 58%.			
Key decision makers: Department of Forestry, Administration of Ocean and Fisheries Other stakeholders: Farmers, forestry growers and fishers			
Policy	**Timeframe**	**Issued by**	**Status quo and Impacts**
Action Plan on Forestry for addressing climate change in Guangdong Province	January 2011-	Department of Forestry	In 2012, 6 cities accomplished afforestation of 3.62 million acres, increasing by 120% annually
Key ecological projects on forestry carbon sink in Guangdong[33] Province	May 2012-	Department of Forestry	
Piloting 'blue ocean carbon sinks[34]	February 2012	Administration of Oceans and Fisheries	Discussion in progress
Instruments: Subsidy from Guangdong Province and national budgets			
Market mechanisms: Payment for Environmental Services Charity donation			
Gaps and Barriers: Funding gaps that government budget can only support part of funding requirements for afforestation and reforestation			

Approved by the provincial government, 2.4 billion CNY have been allocated as a special fund for key ecological projects on forestry carbon sinks during 2012-2015, from which 600 million CNY are being allocated annually. In the meantime, 2 billion CNY from central government and 2.25 billion CNY from various private sectors have also been raised for the projects. The funding is allocated in a competitive manner so that all cities can take part in the bidding process but only six are selected each year.

From the philanthropic side, the Guangdong Green Carbon Foundation[35] has received a 10 million CNY donation from Changlong Group, which helps Guangdong to increase its forest growth. However, the plan and scale of afforestation have not yet been finalized.

According to the *Ocean Economic Development Plan for Comprehensive Experimental Zone of Guangdong*, issued by the State Council, piloting blue ocean carbon sinks is under discussion and actions are required to address climate change using ocean carbon sinks. These actions include proliferation of shellfish, seaweed farming and seaweed cultivation.[36]

Adaptation finance

[33] [2014-01-27], 4 key forestry eco projects promoting fast, available online from: http://zwgk.gd.gov.cn/006939916/201402/t20140207_465787.html (accessed 04/10/2014)

[34] [2012-02-03], Guangdong Province will start piloting "Blue Ocean Carbon Sink, available online from: http://www.gdofa.gov.cn/index.php/Catagories/view?id=170232 (accessed 04/10/2014)

[35] China Green Fund Foundation, Special fund list, available online from: http://www.thjj.org/act-6.html (accessed 04/10/2014)

[36] [2012-02-03], Guangdong Province will start piloting "Blue Ocean Carbon Sink, available online from: http://www.gdofa.gov.cn/index.php/Catagories/view?id=170232 (accessed 04/10/2014)

Table 6 Main policies on adaptation finance

Policy targets: Establish sound agricultural policy insurance system covering the basic types of the province's major agricultural crops			
Policy	**Timeframe**	**Issued by**	**Status quo**
Opinions on promoting agricultural policy insurance [37]	2012	GPG	52% of rice cultivation area be covered
Instruments: Climate insurance, risk-sharing pool			
Mechanisms: Government-set risk reserves for huge agricultural catastrophes Shenzhen Catastrophe Insurance Program			
Gaps and barriers: A lot of funding is required to further scale up the insurance mechanism; and the gap needs to be bridged by other sources of finance.			

Since Guangdong Province is considered one of the coastal regions most vulnerable to natural catastrophes such as typhoons, the province is active in building up its agriculture insurance system, mostly using a mechanism of risk reserves set aside by insurance companies and the government for major agricultural catastrophes. Risk reserves are used to pay for the huge losses caused by catastrophes in excess of the insurer's ability. At the same time, the large agricultural catastrophe insurance business has developed steadily since 2011, expecting an average profit of 25% per year[38].

Since 2009, Guangdong Province has promoted agricultural insurance products, jointly financed by the central government and provincial government[39]. The scheme now covers 52% of rice cultivation in the province and has been extended to cash crops, livestock production and forestry[40]. With 80% of premiums covered by the government budget, the commercial scheme is experiencing rapid expansion in the region, which turns government compensation into insurance benefits for those suffering losses from climate disasters.

Most recently, the Shenzhen municipal government set up the *Shenzhen Catastrophe Insurance Program*. This program is considered innovative as it integrates government bailout catastrophe insurance, a catastrophe fund and individual catastrophe insurance. In the first place, government funding is used to provide all personnel with basic emergency aid when the catastrophe occurs, but through commercial insurance tools. The catastrophe fund, which was established by the municipal government and is open to social donations, will pay for those losses in excess of the insurer's ability. Individual catastrophe insurance, on a voluntary basis, is provided by commercial insurance companies to meet high-level and personalized needs in this area.

Green finance from the private sector

Though provincial policies for green finance are available, commercial banks adopting green finance standards in Guangdong have developed their own policies and practices that help climate-related projects to be funded[41].

Commercial banks are considered one step ahead of state-owned banks in developing green finance management systems, especially at the local level where ongoing green projects have been developed under systematic and

[37] People's Government of Guangdong Province (2012), Advice on promoting policy-related agricultural insurance, available online from: http://zwgk.gd.gov.cn/006939748/201206/t20120604_317393.html (accessed 04/10/2014)
[38] [2012-08-13], Breakthrough development of agricultural insurance in Guangdong Province, available online from: http://finance.ce.cn/rolling/201208/13/t20120813_16925010.shtml (accessed 04/10/2014)
[39] [2013-09-17], Coverage of rice insurance reached 52%, available online from: http://www.ntv.cn/a/20130917/4412.shtml (accessed 04/10/2014)
[40] [2012-02-15], Insured rice area breakthrough 355 acre in Guangdong Province, available online from: http://www.agri.gov.cn/V20/ZX/qgxxlb_1/qg/201202/t20120215_2482207.htm (accessed 04/10/2014)
[41] [2013-07-12], Banks in Guangdong Province launching best practices on green credits, available online from: http://www.cbrc.gov.cn/guangdong/docPcjgView/DC1D222646294D948946BF1232460510/601710.html (accessed 04/10/2014)

standardized procedures. While state-owned bank staff often lack the knowledge and understanding of business models and technology applications in typical green finance projects, a few leading commercial banks have been building up capacity and practical experience through interpreting green policies and processing green projects on a daily basis.

A top-down policy is a priority for mainstreaming green finance in a bank's business map[42]. The board of directors of Shanghai Pudong Development Bank, for instance, has made the commitment to support green finance projects with human and financial resources, covering the areas of energy efficiency, clean energy, environmental protection and carbon finance.

Some of the other ongoing strategies and models in Guangdong's private climate finance market are discussed below.

Sourcing projects

State-owned strategic projects, supported by the national government or sovereign loans, are always pursued by banks. In Guangdong Province, partnerships around syndicated loans with other financial institutions not only help banks to share project risks, but also to develop new channels to get more projects financed. The banks also work with industrial associations while information on good-value projects and fundable technologies from them. EMCA (China Energy Management and Conservation Association) provides such platforms for industries and banks to exchange information and promote projects at a regional level, which help connect financers and project owners from different areas.

Information asymmetry causes loan losses and wastes banks' resources when project risks are not revealed to all stakeholders. While banks report on progress on green finance projects to CBRC and regulatory agencies on a quarterly basis, information disclosure from official channels is fairly rare.

Various guarantee models for green finance projects

To better respond to the clients' lack of sufficient collateral and the relatively high risk they represent, leading commercial banks have developed different models for typical green finance projects with optional means of project or portfolio guarantee. These include (but are not limited to): future revenue pledges, (order) contract mortgages; personal credit guarantees, and (carbon/ pollutant) emission right mortgages. For micro and small scale enterprises, banks can provide legal and overdraft services as long as the settlement accounts of enterprises are opened at the same bank, with stable cash flow every month.

Risk management

Seen as a new growth opportunity, green finance projects are pursued by commercial banks, and higher economic performance from them is expected. Though little external incentives are given, banks are willing to participate as long as risks are controllable.

For commercialized micro and small projects which combine high technology risk with investment returns over 20%, the bank will issue credit but charge a higher interest rate, which compensates for the cost of risk sharing with other agencies. For national strategic projects with low but stable investment returns, the bank will also support the technology until it is commercialized.

[42] Views from experts in policy mapping consultations in Guangdong

3.3 Gaps and challenges for establishing a comprehensive climate finance management system in Guangdong

Driven by rapid economic and industrial restructuring, as well as energy saving and emission reduction policies, Guangdong has spent lots of resources on emission reduction activities and adaptation. But climate finance still faces challenges which must be addressed if Guangdong is to fully develop its low-carbon economy and meet its emissions reduction target. Based on the policy mapping results, there are five main gaps to be addressed.

Gap in institutional arrangements for addressing climate change at Guangdong provincial level

Guangdong's current regulatory and policy system poses a huge challenge to the effective deployment of climate finance. The *Guangdong Leading Group Addressing Climate Change and Energy Efficiency* is separated into two working groups. They deal with energy efficiency and emissions reduction, and other aspects of addressing climate change respectively, and are based in two distinct departments: Guangdong EITC and DRC. This arrangement has resulted in barriers to communication and coordination between the two groups. In addition, while the *Working Group on Energy Efficiency and Emissions Reduction* enjoys a relatively large budget, the *Working Group on Addressing Climate Change* has received much less, which compromises the capability to develop an effective work plan.

Gap in scale of public finance available for climate-related actions

There is much less finance available in Guangdong compared to what is actually needed. As discussed earlier, several policy areas, including adjusting the industrial and energy structure, and carbon sink enhancement and adaptation, are all in need of large funding. Even when private finance is available, enterprises and financial institutions check if policy incentives are put in place that offer the assurance and certainty of political support from the government.

Lack of efficient mechanisms through which government budget can be spent

Government budget in terms of direct rewards, subsidies and in forms of grants are spent with no requirement for profit but high requirement on fund security. Limitations in spending public funding represent challenges in regards to the efficiency of government spending.

Direct subsidy is inefficient considering its operating procedure and the small amount granted to each enterprise. The Special Funds are distributed by the provincial government and cover hundreds of qualified enterprises each year in Guangdong. The subsidy for each project is transacted once the application is approved. That approach generates often uncontrollable risks in post-project supervision and verification of emission performance, where cheating on emission data is possible. The annually allowable subsidy for each enterprise ranges from 100,000 to 1,000,000 CNY, which is a relatively small amount for most of them that will not produce sustainable impacts over a reasonable period of time.

The strict regulations on budget allocation create barriers to potential collaborations with private funding sources which may have certain profit expectation or risk preference. Loans for instance, if allowed, could provide financial support on a much larger scale, and over a much longer term. Certain risks can be identified and eliminated before the loan defaults[43]. Although the government may spend less on operating subsidies than loans, restrictions in government spending negatively impact the effectiveness and efficiency of using the funding.

Gaps in communication and transparency

Most of the time, the government uses a one-way method to communicate with other stakeholders, even with direct executive agencies, resulting in a deviation of policy implementation and limited cooperation among all the stakeholders. No official channels for feedback or questions are provided.

[43] Perceptions from experts, Policy Mapping consultation, Guangdong.

Transparency of government information is poor in terms of information sharing and verification. Though the regulation for *Disclosure of Environmental Information* is already in place, there is still no platform or channels where information can be shared. All stakeholders lack access to government-owned statistics and information, and information exchange platforms on energy saving and emissions reduction activities do currently not exist. This makes it difficult for financial institutions to include and evaluate environmental performance as assessment criteria during the loan issuance process, and to have adequate knowledge of the projects with the biggest potential for emissions reduction.

Gaps in institutional design and participants' awareness of building an active carbon market

Carbon market participants currently face significant market uncertainty making it difficult for them to make decisions about the future. This is reflected in the lack of confidence among the investors in the carbon market highlighted in the policy mapping and interview process.

Compared to the EU ETS, the development of the institutional structure is at a very early stage in Guangdong. The legislative framework has not been fully developed so that the market has a clear definition of what constitutes a ton of carbon. The required infrastructure for the trading and transaction process has also not yet been well established. All these pose challenges at this early stage for a dynamic carbon market to play its role at the full capacity.

4 Introduction of case studies

Drawing on the conclusions of the previous chapters, the case studies in the following chapters provide greater insights into how climate finance policies in Guangdong Province influence concrete projects at the micro-level (Table 7). The three cases are:

1. The *Guangdong Energy Efficiency and Environment Improvement Investment Program*

The Asian Development Bank (ADB) has allocated 100 million USD to invest in the Efficiency Power Plant (EPP) Program[44] in Guangdong with an emphasis on energy conservation in SMEs. The program has significantly improved the energy efficiency of energy users with a package of Demand Side Management solutions and is successful in terms of economics. By the end of 2013, there were 19 projects funded under the program with low interest rates and special rewards.

2. *Green Truck Technology Demonstrations* in the framework of the *Guangdong Green Freight Program*

Supported by the Global Environment Facility (GEF), Guangdong has launched the Green Freight Program, aimed at reducing emissions in the transportation sector. To expand this program, the Industrial Bank has collaborated with the GPG by providing loans. Industrial ESCOs are nominated and supported by the Industrial Bank and project owners receive technical assistance and financial support.

3. LED deployment project in Guangzhou

Guangdong has opened a large-scale government procurement market to LED producers and realized significant investment in LED production and deployment since 2009. As one of the most energy efficient lighting technologies, LED deployment has achieved cumulative carbon dioxide emissions reductions of 917,000 tons in public and commercial facilities in the province.

Table 7 Brief overview of the three case studies

	Rooftop Photovoltaic Power Station Demonstration Project in the framework of Guangdong EPP	Green Truck Technology Demonstrations in the framework of Guangdong Green Freight Program	Industrial LED lighting Project
Industry	Energy efficiency	Freight transportation	ESCO and LED
Operation Duration	36 months	18 months	6 months
Related climate policy sectors	Energy conservation and environment protection; New energy	Transportation industry ESCO industry	Emerging industries Public LED lighting ESCO industry Green credit Guidelines
Programs/ frameworks	Asian Development Bank EEP program	World Bank and GEF's Guangdong Green Freight Program	——
Board range of stakeholders	ESCOs, government funders, private financers, project owners	Logistic industry, technology providers, ESCOs, financers	LED technology providers and consumers, financers
Remarks	The program has significantly improved energy efficiency of energy users with a package of Demand Side Management solutions and is successful in terms of economics.	The Industrial Bank has collaborated with GPG by issuing 20 billion CNY in loans, coverage of which expand from transportation sector to all other green industries.	Large-scale investment in LED industrial and deployment sector has been pledged since 2012 with active supports from commercial banks.

[44] The EPP bundles efficiency programs so that the resulting savings are as predictable and substantial as the output of a middle-scale power plant on a yearly basis, 'Meeting China's Energy Efficiency and Environmental Goals with Efficiency Power Plants (EPPs)', 2007

5 Case Study 1: *Rooftop Photovoltaic Power Station Demonstration Project* in the framework of Guangdong EPP

5.1 Overview

In June 2008, the ADB approved a 100 million USD multi-tranche financing facility (MFF) to finance an Efficiency Power Plant (EPP) investment in China's Guangdong Province. The *Guangdong Energy Efficiency and Environment Improvement Investment Program* (Guangdong EPP Program) aims to improve demand side energy efficiency, thereby releasing more energy for other users and creating a virtual expansion of power generation capacity. It is the first program in China involving the establishment of a pilot energy efficiency project financing model which could be scaled up or replicated in provinces with high energy consumption and relatively low energy efficiencies.

The ADB has initiated and supervised three batches of loans supporting specific EPP projects in Guangdong Province since 2008. After the loans are recovered, ADB has allowed for the 100 million USD to be used to build a revolving fund, which can be utilized and supervised by local authorities to promote the program at the local level.

Rationale for the project

The anticipated impact of the Guangdong EPP program is improved energy security and environmental conditions in Guangdong through enhancing energy efficiency in the province's industrial and commercial sectors. The *Rooftop Photovoltaic Power Station Demonstration Project*, located at SingYes New Energy Industry Park, is one of the projects supported by the revolving fund and aims to achieve energy saving and emission reductions under the EPP program, hereinafter referred to as the *case project*. The project comprises the construction and operation of a 10 MW rooftop photovoltaic power station and is the first of its kind approved by the Guangdong DRC. The project obtained a 15 million CNY loan from the ADB MFF investment program. This chapter will explore the financing mechanism and corresponding policy framework that support the implementation of the case project under the EPP program.

Project Overview

Topic	Description / Assessment
Project name	Rooftop Photovoltaic Power Station Demonstration Project
Location / area	Zhuhai City, Guangdong Province
Sector	Renewable energy
Size of finance	120.6 million CNY
Scalability	High
Leverage ratio	1:8.04

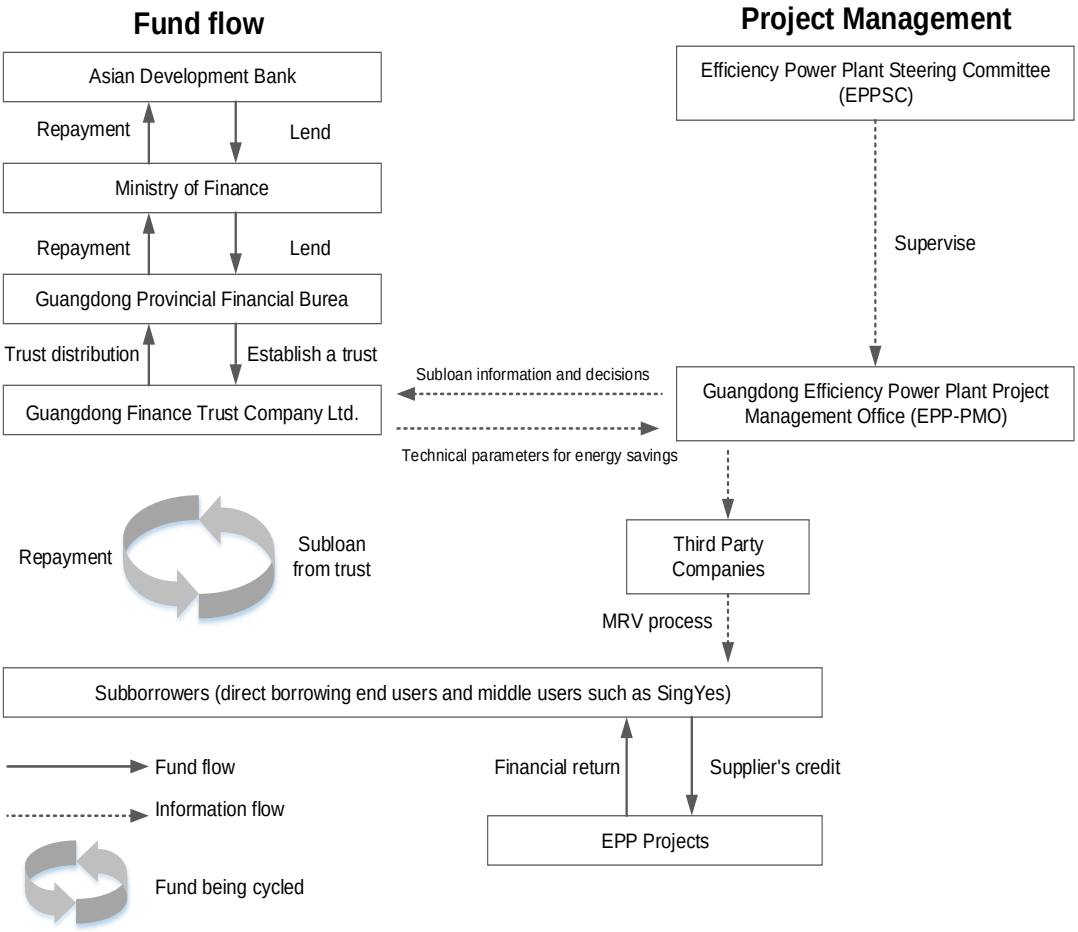
5.2 Management system and financial incentives

Organizational structure of the Guangdong EPP program

The GPG serves as the executing agency for the program. The GPG established the EPP project management office (EPP-PMO) in January 2008 to supervise the implementation of the EPP projects, and designated the Guangdong Finance Trust Company (GFTC) as the financial intermediary to administer the on-lending of the ADB fund to the approved entities (Fig. 8). The 100 million USD funding, which is the sovereign loan from the ADB to the Chinese government, has a 15-year term with a grace period of 12 years, with a LIBOR based interest rate, significantly lower than that of commercial loans. Endorsed by the Chinese Government, the principal and interest on the US$100 million

can be secured via contracts between ADB and the Ministry of Finance. The exceptionally low interest rate derives from the low risk of the loan issued by ADB.

Fig. 8 Guangdong EPP On-lending Model[45]



To supervise the use of this funding, an EPP Steering Committee (EPPSC) was established to lead the management of the fund. The EPPSC comprises senior officials from the provincial Economic and Trade Commission, DRC, Finance Bureau, and State Asset Supervision and Administration Commission, and is responsible for formulating policy direction and making decisions concerning issues such as funding management and project management.

The EPP-PMO, the executing agency of EPPSC, was established to oversee the implementation of the energy efficiency EPP projects and thus plays a key role within the EPP on-lending model. The EPP-PMO is responsible for accepting and screening applications from enterprises seeking financial support from the program, employing third parties to assess and monitor the energy savings of qualified projects, analyzing the anticipated energy saving and making corresponding decisions.

The GFTC, under the terms of a trust agreement with the Guangdong Finance Bureau on behalf of GPG, established a separate unit to administer the trust. Its on-lending responsibilities include assessing the financial viability of the EPP projects, disbursing funds and managing the sub-loan portfolio, including sub-loan collateral and guarantees, and preparing financial statements. For internal control purposes, GFTC maintains segregation of duties for the various functions of administration, financial accounting, and legal matters. It is currently managing the sub-loan portfolio and all revolving loan proceeds. However, in the event that GFTC does not meet performance standards to the satisfaction of the ADB and GFB, or its financial health deteriorates significantly, GPG may, in consultation with ADB, propose a new financial intermediary.

[45] Summarized from Interim Management Measures of EPP Projects, available online from: http://www.gdepp.cn/ewebeditor/uploadfile/20131210164352629.pdf (accessed 04/10/2014)

Project selection process

The project selection process follows the flow illustrated in Fig. 9. After applications are submitted, they are reviewed by both EPP-PMO and GFTC. Projects with applicable scope and technologies are selected in this phase and the feasibility studies of each project are examined carefully. The EPP-PMO then analyzes their technical applicability, making sure that the energy savings of the project are measureable, reportable, and verifiable. Meanwhile, GFTC will assess fulfillment of the financial criteria. The scopes of applicable projects and financial indicators can be found in Appendix 4, Technical notes for case studies.

Once a project passes the preliminary review, EPP-PMO and GTFC conduct a joint on-site visit to the enterprise which is directly responsible for project implementation. During the visit, the authenticity, scale and technology of the project are confirmed by EPP-PMO. The GFTC carries out due diligence by investigating credit history in local financial institutions, looking through financial statements and talking with key project stakeholders.

After the field survey, EPP-PMO and GFTC jointly draft a formal report covering the technology and financial analyses respectively. Project reports are delivered to the EPPSC and a review meeting is held by government officials and the expert panel to make the final decision on the approval of projects and lending amount for each project. Official approval is issued later and the project owners/implementers then sign a contract with the EPP-PMO, which stipulates energy savings obligation, and a contract of loan assignment with the GTFC.

The project owner of the *Rooftop Photovoltaic Power Station Demonstration Project* is SingYes Solar Technologies Holdings Limited, a company (00750.HK) listed on the Hong Kong Stock Exchange. According to its 2012 annual report, the company meets all the stipulated financial criteria. The company supports the project by providing assets as collateral, and a personal property guarantee by the president of the company. With recognition of the enterprise and the project, it was approved by the EPPSC and was assigned 15 million CNY credit from the revolving fund.

Financial incentives

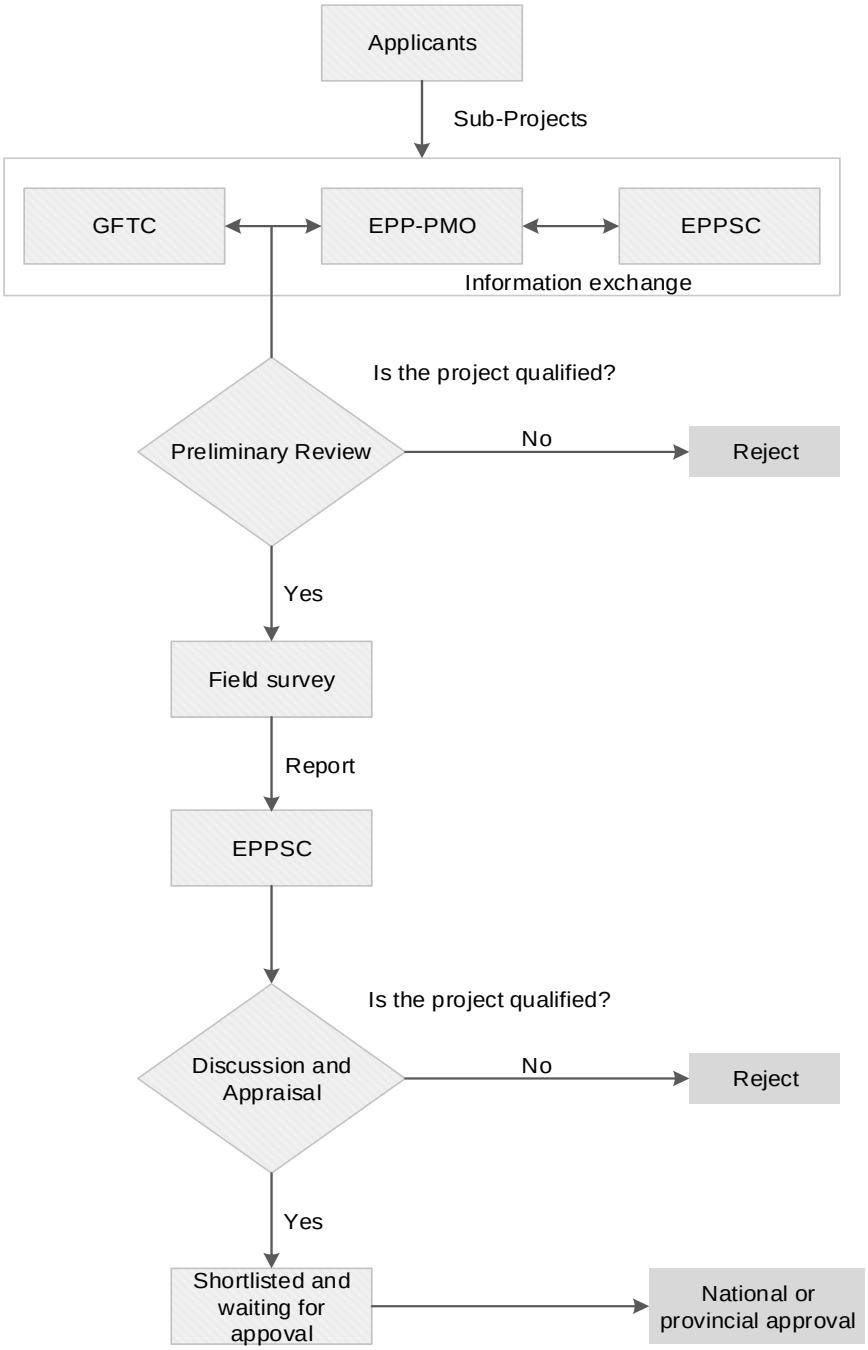
To maximize the benefits from the revolving fund, the term of each sub-loan typically lasts for 3 to 5 years, including a grace period of 1 to 2 years. The recovered sub-loan will then be revolved and lent to more sub-borrowers within 15 years. The interest rate of the sub-loan is 10% below the 6-months interest rate set by the People's Bank of China for lending by commercial banks, which is about 20% and 24% less than the benchmark interest rate of 3-year and 5-year commercial loans, respectively.

A further financial incentive is available once an EPP project fulfills its energy saving target. Though the interest rate on credit is 10% below the 6-month interest rate set by the People's Bank of China, the loan cost can be lowered further. The funding for the financial incentive comes from the interest gained from the ADB loan (10% below the 6-month interest rate is still much higher than London interbank offered rate). Part of the interest gain from the 100 million USD covers the administration fee and the remainder serves as financial incentive for projects which have attained their energy saving targets. The incentive will reimburse up to 70% of the interest the enterprise paid for the loan, therefore lowering the actual interest rate to around 2% annually.

MRV of energy savings

In order to measure, report and verify the energy savings of approved projects, energy performance is measured and recorded to establish the baseline scenario. Once an EPP project application is accepted, the EPP-PMO assigns a third party company with the necessary expertise and qualifications to conduct the baseline validation. After its completion, the same third party company conducts the ex-post verification and evaluates the energy saving performance accordingly. To maintain the independence of the third party companies, the EPP-PMO selects them through public bidding and they are paid by the EPP-PMO.

Fig. 9 EPP project selection flow[46]



5.3 Performance and efficiency

The management and operation of the funding is well-structured and effective; not only is the fund distributed efficiently and recovered safely, but the emission reduction target is also successfully accomplished. It is notable that no bad debt has occurred since the program was launched. In addition, projects financed by the program are mostly well developed and continue to make profits and generate employment. The case project represents an outstanding demonstration of the revolving fund.

In contrast to the commercial banks, the EPP program provides favorable conditions for the case project to acquire low-cost funding, as illustrated in the table below.

[46] Summarized from Interim Management Manual for Circulation Funds of EPP Projects, available online from: http://www.gdepp.cn/ewebeditor/uploadfile/20131211102232636.pdf (accessed 04/10/2014)

Table 8 Credit conditions comparison between commercial bank and the case project[47]

	Commercial bank	Case project
Annual interest rate	6.15%	5.53%
Loan period	1 year	3 years
Incentives or subsidies	None	Financial incentives according to the energy saving outcome
Amount	Up to 5 million CNY	15 million CNY

The corresponding financial analysis is illustrated in the following table:

Table 9 Financial indicators of the *Rooftop Photovoltaic Power Station Demonstration Project*[48]

Total Investment	120.6 million CNY
Capacity	10 MW
Annual electricity generation	10.86 GWh
Electricity tariff	0.521 CNY/kWh
FIRR	10.37%
Payback period	7.4 years

5.4 Impacts of the case project

Economic impact

Based on annual electricity produced, which is estimated to be as high as 10.86 GWh, the project has led to energy cost reductions of 1.17 million USD each year. SingYes solar benefits economically from the project through reduced energy costs and therefore has enhanced its market competitiveness and promoted overall economic development in Guangdong and beyond.

The longer than usual grace period was considered essential to maximize the benefits of the MFF by making the full amount of the loan available for rotation and relending to a greater number of entities, thereby generating maximum energy savings and emission reductions.

Social impact

The case project established a rooftop-based photovoltaic power station, supplying electricity to energy users in the industrial park. By providing renewable energy, the project indirectly reduced GHG emissions which would otherwise have been produced by fossil fuel power plants. The project has reduced the threat to public health, freed up resources, and lowered safety risks associated with coal mining and transportation. In addition to being consistent with the national and provincial policy to support development of the solar PV industry, the project has also set an example of how to make better use of vacant space in existing buildings, showcasing a new concept of a multi-functional building.

Environmental impact

Since the project is located at the top of a building in an industry park, it will not have any adverse environment impact to local residents. The project has not produced any waste water, solid waste or noise during its operation. In short, the project is environment-friendly.

[47] Perceptions from project manager of SingYes Solar Technologies Holdings Limited
[48] From Feasibility Research Report (FSR) of the project

Scalability

On the project basis, by adopting the established management process of the ADB funding, financing the case project becomes a low-risk and an inviting option. The EPP-PMO has continuously invested in similar projects from their project pool, demonstrating the replicability for similar projects under the framework of the EPP program. EPP-PMO and GTFC could make good use of the revolving fund to satisfy expectation on energy savings and the recycling of the money. It can be anticipated that more projects will be attracted and recruited to EPP program for the financial incentives, post-project monitoring services of energy saving and .standardized management procedure.

At a program level, though the EPP program provides favorable credit and rewards which support the case project - and the management of the revolving fund has demonstrated the efficiency and reliability of the program - the low financial return to the lender is the most important barrier to expansion at scale. According to its staff, GTFC makes no profit from managing the fund while EPP-PMO, the administrator of the program, is funded by the local government. The non-profit principle of the fund makes it very difficult to attract other major funding sources, especially those seeking financial returns. Therefore, it is not feasible for other private funders to replicate the same management structure.

5.5 Gap analysis and needs assessment

Gaps in awareness and perception of policies

Expectation of EPP program	Raise awareness of project stakeholders and promote the program for enterprises which have potential to save energy and reduce GHG emissions.
Current status	Active participation of qualified enterprises and projects, but to scale up, the program would require greater support.

The EPP-PMO is the agency in charge of promoting the EPP program. Though EPP-PMO has set up a website for the program as a platform showcasing all its aspects, its marketing strategy relies heavily on related government agencies. At the very beginning of the program, there were only a few ways to promote the program:

- Sending officials to local enterprises
- Sharing information with formal partners (GFTC)
- Information sessions held by government agencies.

Gap	Lack of public exposure
Barriers	• Besides the website, publicity channels are limited • No budget for marketing is allocated

Despite several authorized ways of accessing the program, greater public exposure is needed to extend its influence and drive others to adopt the same approach. The program would benefit from promotion via newspapers, websites and even social media in order to expand its network of influence.

Gaps in policy and mechanism design

Program target	Good use of revolving fund, effective MRV and financial incentives for qualified projects, and verified energy saving and emission reduction outcomes.
Current status	Demonstration projects and financial mechanisms are implemented as planned but with constraints in policies and financial mechanisms

Gaps faced by the EPP program

Gap	Funding source is limited and highly reliant on international capital
Barriers	• The foundation of the program is low-cost capital from the ADB. Very few channels could provide comparably cheap financing elsewhere. • Varying exchange rates pose a threat to the program

The EPP program relies on a low interest loan from the ADB, which essentially comes from sovereign funds and cannot be supplemented easily. In addition, possible variations in exchange rates may damage the operation of the program. Although the exchange rate of USD has kept appreciating, the substantial long-term depreciation risk of CNY should also be taken into account.

Gaps faced by the management of the EPP program

Gap	Applicable projects are not fully overseen
Barriers	• Financial attractiveness of projects is not treated as being as important as the qualification of enterprises • Long-term monitoring of energy saving effects needs the support of policy and resources

The project selection strategy used by GFTC places much greater weight on the qualifications of applying enterprises than the underlying financial attractiveness of submitted projects. Since many of the submitted projects can only generate solid returns if a financial incentive is offered, substantial risk exists if the incentive is not delivered on time or eventually reduced. If this happens, there is a significant risk of project failure that could have been avoided if project viability was considered more fully during the initial screening process.

Monitoring of energy saving performance after the completion of the project is a one-time offer. The project owner receives the entire incentive package once the ex post verification report demonstrates that energy saving targets have been met. The one-time verification is suitable for retrofits of existing facilities where a one-time step change is achieved, whereas a solar power station, for instance, does not meet the same criteria. The power station is supposed to operate over 25 years with the electricity generated declining gradually due to the aging of equipment. However, the third party verification report assumed average annual electricity generated to calculate the energy savings and emission reductions. To enable energy performance to be monitored over a longer term period, a self-reporting system and a long-term incentive mechanism to encourage enterprises to track their energy performance continuously needs to be established.

Gaps in implementation

Project target	Select qualified enterprises and projects, and ensure the credit is safe after it is allocated.
Current status	With superior standards to filter applied enterprises and projects, the EPP program has created a record of recovering all the credit it issued. The principal and interest for the ADB initial loan is highly secure.

Gaps faced by the GFTC

Gap	Application requirements for enterprises are too high for start-up companies
Barriers	• GFTC has to apply highly rigorous conditions to applicant enterprises to ensure the issued capital is secure, disqualifying those without track record • GFTC puts too much weight on enterprise collateral, restricting the pool of eligible enterprises

As mentioned above, the GFTC is more concerned about the strength of applying enterprises than the quality of the submitted projects. One of the requirements, "operating for at least three years and making profits for two consecutive years", obviously creates barriers to start-up companies which are especially in need of cheap credit. Furthermore, the GFTC puts a lot weight on the collateral assets that the enterprise can provide and shows a preference for real-estate,

stocks and private properties. Small or medium- size companies with high quality projects might be excluded due to their inability to offer this kind of collateral. The standard for applicable enterprises should therefore be adjusted to enable more companies to participate, while the requirements for project quality should be more rigorous.

Gaps faced by the EPP-PMO

Gap	Energy saving performance of projects is not transparent
Barriers	• The assigned third party company does not release the verification reports to their target enterprise and project related stakeholders

Before and after the implementation of a project, the EPP-PMO assigns a qualified third party to validate current energy consumption performance and calculate energy savings. However, the energy performance report written by the third party is not published by the EPP-PMO, making it inaccessible to the enterprises which own or implement the project. Although keeping the report from project owners and implementers reduces disputes over the energy savings achieved, the action results in distrust and raises questions of transparency.

5.6 Conclusions and recommendations to policy makers

After six years of operation, the EPP program supported by the ADB has become a mature platform to finance projects of small or medium size with significant energy savings and emission reduction performance. There are three major advantages of the program that can be replicated in similar schemes.

The organizational structure represents clearly defined rights and obligations

The EPP-PMO, the administration of the program, has established a comprehensive management framework to manage the energy saving performance of projects, while the GFTC has also developed a sophisticated regulatory framework to manage project portfolios and all loan proceeds.

Incentives for enterprises after the energy savings targets are met

The introduction of MRV for energy saving performance linked up with a financial incentive is an innovation in mechanism design. Incentives generated from the interest margin stimulate enterprises to fulfill their responsibility to monitor energy performance, which was neglected previously in similar programs. The program encourages enterprises to set up their own monitoring systems, not only to ensure that energy targets are met, but also to lay solid foundations for participation in the emission trading scheme.

Cycling of low cost capital maximizes the efficiency of the fund

Breaking down the ADB fund and distributing it to several projects with a payback period of 3 to 5 years is the core purpose of the program. Since the loan from ADB has a 15-year term with a grace period of 12 years, recycling the loan means each dollar can be used 3 to 5 times, which raises the true value of the loan to 300 to 500 million USD. With the low interest rate, the fund does not have as much pressure to make a profit, and thus can support industries which have a larger impact on energy savings or emission reductions, but do not produce exceptional financial returns.

The identified capacity building needs from the mapping and interview process are as follows:

Capacity building area	Contents	Government agencies	Financial institutions	Enterprises with energy saving potential
Climate change and emission reduction	• Policy and industry updates • Policy impacts on high emitting industries and projects	X		X
Practice and experience of EPP projects	• General knowledge of EPP projects • Performance analysis of EPP projects	X	X	X
Identifying opportunities for saving energy and reducing emission through EPP projects	• Political opportunities for emission reduction through energy saving projects • Potential development of EPP projects • Technology transfer and related funding needs • Financial attractiveness of EPP projects • Case studies of companies and projects	X	X	X

6 Case Study 2: Financing *Green Truck Technology Demonstrations* in the framework of the *Guangdong Green Freight Program*

6.1 Overview

What is the Green Freight Program?

The *Guangdong Green Freight Program* is the first demonstration program on energy efficiency and emission reduction in freight transportation in China, supported by the GEF and the World Bank. It aims at lowering the deadheading of trucks and improving energy efficiency by utilizing advanced domestic and international technologies and improving the information distribution platform and logistics model. Starting in 2012, the program has a target of 130,000 tons of carbon dioxide emission reductions within 3-4 years.

The *Guangdong Green Freight Program* includes three demonstration projects: *Green Truck Technology Demonstration, Drop-and-Pull Transport Demonstration and Logistics Transaction Information Platform Demonstration,* combined with research support and technical assistance. Of the three, the *Green Truck Technology Demonstration* is financed by the private sector through an industrial Energy Management Contract (EMC) and is the first commercialized emission reduction project in the green freight transportation sector in Guangdong. It has therefore been selected as the second case project in this study, hereinafter referred to as the *case project* in this chapter.

Rationale for the Green Freight Program

Transportation accounts for over 30% of total crude oil consumption[49] in China, following the first and the second largest users, industry and construction sectors. Trucks account for 54% of total fuel consumption in the transport sector but their fuel efficiency in China is 30% lower than in OECD countries[50]. The logistics industry is one of the pillar industries in the Pearl River Delta Economic Zone, and GPG fully recognized the problem and started to take measures to deal with it.

Project Overview

Topic	Description / assessment
Project name	Green Truck Technology Demonstration
Location / area	Dongguan City, Guangdong Province
Sector	Freight transportation
Size of finance	1,000,000 CNY
Scalability	Medium
Leverage ratio	1:1.67

The case project is currently operated in Dongguan City, in the south of Guangdong Province. Freight enterprises have been invited to the project and are supposed to invest in green truck technologies on their own. Subsidies and rewards are provided by the project if the required fuel efficiency targets are met. Three categories of technologies are selected and applied in the case project: aerodynamics, ground resistance lowering technology and energy efficient driving techniques.

[49] Petroleum Consumption (2011), LI Xuewei, MA Nandi, China Center for Energy and Development, available online from: http://www.nsd.edu.cn/cn/userfiles/Other/2012-07/20120726190814688945 13.pdf (accessed 04/10/2014)

[50] [2013-09-13], Improving fuel efficiency and reducing emissions of trucks in China, available online from: http://www.worldbank.org/en/news/feature/2013/09/13/improving-fuel-efficiency-and-reducing-emissions-of-trucks-in-china (accessed 04/10/2014)

The project has been scheduled in two phases, with 335 and 933 trucks equipped with green truck technologies in each phase. The World Bank has granted a total amount of 100,000 USD for the second phase and this sum will be scaled up if positive results are secured from the first phase. A local financial institution, the Industrial Bank, has been involved in the second phase and has issued a loan of 1,000,000 CNY for scaling up the case project. Public investments have leveraged additional private investment at a ratio of 1:1.67.

6.2 Policy and government support

Policy content

At the provincial level, the Special Fund for Energy Efficiency and Emission Reduction in Guangdong was established in 2009 with a main focus on public transportation infrastructure and transportation system construction. The fund has spent around 2 million CNY which was allocated to 13 projects last year[51], only two of which focus on private transportation with the remaining all in public transportation.

Reducing emissions from freight transportation has been a major topic of discussion between the World Bank and GPG since 2007, resulting in the Guangdong Green Freight Program finally being initiated in 2011. A full illustration of the policy context of the transportation sector in Guangdong can be found in Appendix 4, Technical notes for case studies.

Policy impacts on the case project

Under the existing 'business as usual' scenario, no official attention was paid to emissions reduction in green freight transportation in Guangdong. However, the case project has demonstrated that, even without policy support in place, stakeholders were able to form a functional working group to support and implement the *Guangdong Green Freight Program*. Supported by the World Bank, the program successfully invited stakeholders onto its cooperation platform and triggered discussions of emission reduction in the freight transportation sector.

6.3 Management system and stakeholders

The Green Freight Program Agreement is managed through the Green Freight Program Coordinating Group and Project Management Office (see Fig. 10), which are constituted of the following stakeholders:

Department of Transport of Guangdong Province (DoT) and Project Management Office (PMO) (Project lead)

The DoT and PMO are responsible for carrying out daily office work, communication and coordination with the World Bank, and overseeing implementation of the project. DoT also helps to coordinate the Logistics Association to provide technical support and communicate with logistics enterprises.

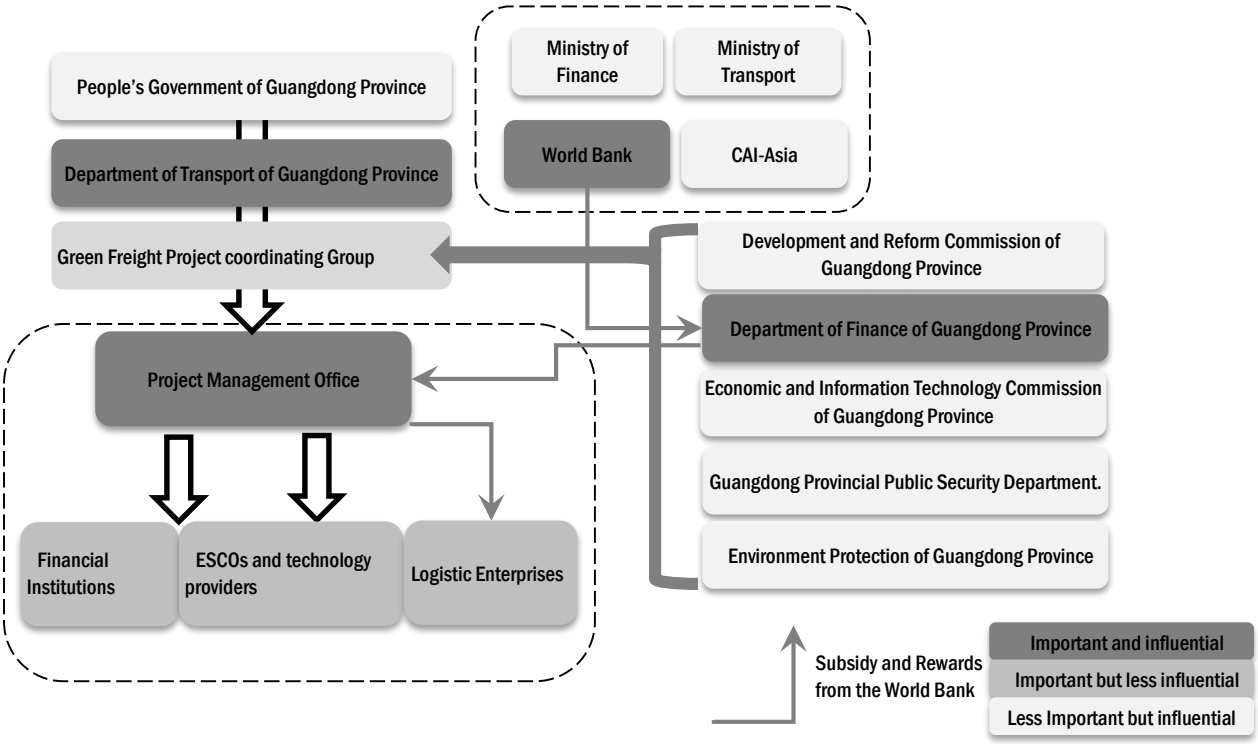
Green Freight Program Coordinating Group and Governmental Agencies

Within the GPG, the Guangdong Green Freight Program is carried out under the leadership of the DoT and the Department of Finance, the DRC, the EITC, the Department of Environment Protection and the Provincial Public Security Department, with support from the Ministry of Transport, Ministry of Finance and CAI-Asia[52]. The Department of Finance is responsible for the centralized management of the World Bank's grants. The figure below illustrates the relative importance of the stakeholders involved in the project.

51 Transportation Bureau of Guangdong Province (2013), Transportation energy conservation and emissions reduction demonstration projects and budget, available online from: http://www.gdcd.gov.cn/tongzhigonggao/20131028094640743_1.shtml (accessed 04/10/2014)

52 Clean Air Asia is a UN recognized partnership of more than 250 organizations in 31 countries in Asia and worldwide and 8 Country Networks, to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

Fig. 10 The Management System of the Green Freight Project, Guangdong[53]



The World Bank

The World Bank is the initiator of the *Green Freight Program*, with high influence in the policy-shaping process and clear impacts on project results. To further engage logistics enterprises, the World Bank has cooperated with local commercial financial institutions to introduce an innovative financial mechanism to scale up the demonstration projects and demonstrate the technologies' economic feasibility.

Financial Institutions, ESCOs, technology providers and logistics enterprises

Implementers are less influential but still significant in impacting projects results. Unlike financial institutions which participate quite willingly, the other parties are mainly selected on a mandatory basis, under the direction of the DoT and PMO.

Impacts on the case project

Overall, the DoT and PMO run a well-functioning team to ensure the project is implemented as planned. However, bilateral cooperation requires time-consuming coordination among government agencies, resulting in delays to project implementation.

6.4 The Financial Mechanism - Industrial EMC

Baseline

According to the project's original plan, logistics enterprises had to invest in the green truck technologies and verify technology performance before receiving subsidies and rewards from the World Bank. However, logistics enterprises are not yet aware of the economic benefits generated by applying these technologies and have little willingness to self-finance. Therefore, the first phase of the case project progressed slowly.

The following barriers affect the participation of logistics enterprises in the project:

[53] Source: perspectives from interviews

- Logistics enterprises are cautious about the one-time initial investment as the technologies cost as much as 25.6% of the full price of a new heavy truck[54].
- The impact of the new technologies on energy efficiency performance and future revenues are uncertain.
- Administrative costs are high when working with the World Bank and government agencies.

Barriers to financial institutions issuing loans to logistics enterprises include:

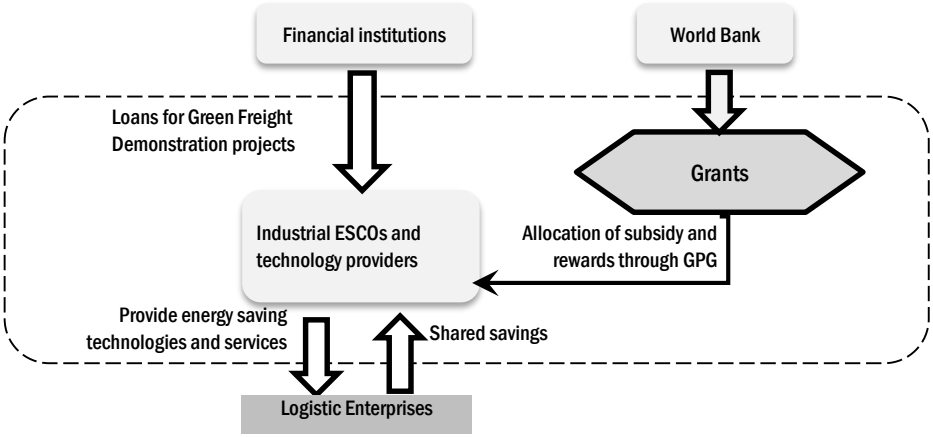
- Logistics enterprises are usually small and decentralized. The small scale of the financing required for each logistics enterprise pushes up the transaction costs and makes it difficult for them to be managed in a standardized way.
- Trucks are the main asset of logistics enterprises. They are normally depreciated at high rate in company books and therefore cannot be used as collateral for commercial banks.
- The poor credit rating of most owners of small logistics enterprises implies high financial risk.

Project scenario: Launch of the Industrial EMC

The World Bank and the Industrial Bank have jointly established an innovative financial mechanism (Fig.11), in which technology providers are assigned and introduced to logistics enterprises as Industrial ESCOs. The ESCOs take on the performance risk and provide project-specific financing while holding the packages of green truck technologies on their balance sheets.

The Industrial Bank has issued loans directly to the Industrial ESCOs that provide energy services to logistics enterprises. A total amount of 100,000 USD in grants from the World Bank is set aside as a risk guarantee for those loans until loan repayments are completed and subsidies are allocated to logistics enterprises. Industrial ESCOs have replaced logistics enterprises as the main financing parties for energy efficiency measures within the enterprises. By providing green freight technologies and technical update plans, ESCOs gain a share in the energy savings of the logistics enterprises. As such, the logistics enterprises do not have to pay for these technical upgrades and still gain financially over the long term from having increased their energy efficiency.

Fig. 11 The Financial Mechanism of Green Freight project, Guangdong[55]



MRV of the financial mechanism

- Experimental data on the performance of green truck technologies is collected and provided in technical reports on a quarterly basis by the South China University of Technology, and shared with the stakeholders involved.
- The emissions report is prepared by a third-party verifier. It is submitted to the PMO and to the World Bank for project approval. Following a compliance document issued by the World Bank, subsidies and rewards to logistics enterprises are released.

[54] Writer's calculation: one new heavy truck cost around 250,000 CNY, Combination of technology A+B+C (Table 1) cost 64,000 CNY
[55] Source: perspectives from interviewees

- The third-party verifier is selected from the Industrial Bank's certified service providers.

Risk control check points

- The risk guarantee provided by the World Bank is the prerequisite for the Industrial Bank to issue any loans. In cases where ESCOs are unable to pay back the loan, the bank is repaid from the 100,000 USD set aside by the World Bank.
- ESCOs and logistics enterprises have to set up corporate accounts in the bank for surveillance purposes.
- The bank checks project performance on a quarterly basis using technical reports that include experimental data.

Impacts of the Industrial EMC Mechanism on the case project: Performance and efficiency

- From the perspective of technology providers, their new mandate as ESCOs allows them to provide logistics enterprises with a package of fuel-efficient solutions and technical upgrade plans. This increases the ESCOs' revenue as they gain a share in the energy savings, while the overall efficiency of the project is improved.
- From the perspective of the financial institutions, the Industrial EMC mechanism offers an opportunity to help finance the development of the green freight transportation sector. Financial institutions only need to deal with one ESCO to process the loans, thus avoiding additional administrative costs and the financial risks incurred from dealing with many small logistics enterprises that have a poor credit rating.
- The Industrial EMC mechanism has successfully leveraged private funding using public resources. This helps to scale up the demonstration project and encourages logistics enterprises to participate.

6.5 Technical and financial performance

Baseline scenario

Based on the feasibility study of the *Guangdong Green Freight Program*, the average baseline fuel economy is 32.00 (km per unit liter of fuel combustion)[56].

Project scenario

Improvements in fuel economy and benefits from energy saving are predicted in the project scenario. Given the assumption of long-haul trucking at 21,000 VKT (vehicle kilometers of travel) per month and a diesel price in Guangdong of 7.59 CNY / liter, the efficiency of selected green truck technologies is calculated in the table below (Table 10). Though the cost of technology varies, most of the technologies show a short payback period of between 3-6 months. Due to the cumulative effects of fuel-saving, the integrated application of those technologies is highly recommended by the PMO in order to achieve the highest possible fuel efficiency.

Impacts of the financial mechanism on performance

The total value of the loans issued is considerably smaller than required to recruit sufficient trucks and collect adequate performance data. The Industrial Bank has issued loans totaling 1,000,000 CNY which is considered to be insufficient for applying integrated technologies in the second phase of the case project as originally planned. According to the cost of technologies listed in Table 10, this amount can only support the upgrading of 15 trucks.

Table 10 Fuel efficiency and simple payback period of three green truck technologies[57]

Category	Category	Fuel Efficiency (%)	Cost per heavy truck (average in CNY)	Simple payback period (month)
A. Aerodynamics	Side skirt	3	4,560	3
	Faring	2	5,040	5

[56] Data is provided by the World Bank and integrated from the bank's analysis of experimental data and technical papers. (Dec. 2013)

[57] Application Guideline for Green Freight Project, available online from: http://www.gdlshy.com/Front/JiShu/BuTieDetail.aspx (accessed 04/10/2014)

	Nose cone	3	4,200	2.7
B. Ground resistance lowering technology	Low resistance tire	3	32,700	21.3
	Tire pressure monitor	2	6,240	6.1
C. Energy efficient driving technique	Driving behavior diagnose and operation supervision system	2	4,650	4.6

6.6 Impacts of the Case Project

Financial impacts

Credit guarantee is an essential prerequisite for enterprises to be receiving loans from commercial banks and other financial institutions. The financial mechanism in the case project, however, has provided indirect funding to small logistics enterprises and controlled the risks through working with ESCOs. Alternative forms of guarantee, such as a combination of personal credit and risk guarantees by the World Bank, are also accepted, easing access to loans for ESCOs.

A representative of one of the ESCOs participating in the case project stated that "the model has opened another door for small technology providers and provided us access to an additional and large amount of funding to scale up our business."

Environmental impacts

Based on the financial calculations**,** the green truck technologies have been applied to 165 trucks in total, resulting in overall monthly energy savings of around 2 tons of diesel oil and an estimated emission reduction of 20 tons of carbon dioxide.

Social impacts

As one of the rapidly emerging sectors in China, the energy conservation and environmental protection sector is growing at an average of 15% per annum[58] and is becoming one of the pillar industries in China's economy. However, business models for various categories of projects have not yet been recognized or well promoted in this sector. The case project, though still in the implementation phase, has demonstrated an innovative model and potential opportunity for financing green transportation projects to financiers and investors in China.

Scalability

- **Policy readiness - medium**

Guangdong has set up operational bodies and coordinated relevant government agencies to lead and facilitate the implementation of the *Green Freight Program*. All stakeholders are equipped with well-defined mandates and have contributed to the smooth operation and interim success of the project. However, some policy barriers still exist, which prevent the case project from reaching the agreed targets for scaling up the demonstrations. This will be further explored later on.

- **Economic performance – high**

The green truck technologies have been selected from a global pool of efficient technologies that take into account the current status of the logistics industry and the specific geographic characteristics of Guangdong Province. The selected technologies are widely recognized in the international market and have performed well in the first phase of the case project.

- **Implementer readiness - medium**

[58] The Central People's Government of People's Republic of China (2013), State council: Speed up the development of energy conservation and environmental protection industries, available online from: http://www.gov.cn/zwgk/2013-08/11/content_2464241.htm (accessed 04/10/2014)

Financial institutions have transplanted the experiences from ESCO projects in other sectors to the case project in order to build a financing mechanism that is able to meet their own requirements and share risks among stakeholders. Risk control check points and the MRV system have supported the proper operation of the mechanism, but might need to be improved as the mechanism grows in scale.

Technology providers taking on the role of an ESCO in the case project benefit from the provision of a business model that increases the financial performance of technologies and reduces operating risks. However, their readiness to participate in the project is relatively low in terms of knowledge and capacity, which leaves a question mark over the further development of the project. This point will be further clarified in the next chapter.

Overall, the project is economically successful and ready to be replicated by more project owners if barriers in policy and implementer readiness are overcome. The case project is considered scalable in Guangdong Province and in other areas of China, where there are no significant geographic challenges.

6.7 Gap analysis and needs assessment

Gaps in awareness and perceptions

Expectation of case project	Raise awareness of green freight technology; implement the case project with financial support from local financial institutions with the possibility of up-scaling.
Current status	High-level cross-government cooperation on project implementation; uncertainty with regard to willingness to scale the project up.

Although the case project has been led and developed by the DoT of Guangdong Province along with other relevant institutions, stakeholder awareness gaps are still slowing down the project's implementation. Gaps related to the technical barriers that prevent the development of green truck technology in the freight transportation sector can be found in Appendix 4, Technical notes for case studies.

Gaps caused by government agencies

Gap	Lack of government role in financing the project
Barriers	• Energy efficiency in the green freight transportation sector is not a top priority for the provincial government. • No elements of the fiscal budget are allocated to green freight projects.

Although Guangdong has dozens of green transportation projects in operation with funding from both the national and provincial authorities, 90% of them are in the public transportation sector and shipping industry[59]. Promoting emission reduction is not a policy priority for the DoT of Guangdong Province.

The Green Freight Program is an international cooperation project between Guangdong Province and the World Bank, which requires strong governmental endorsement rather than providing the right policy incentives. The engagement of the provincial government was discussed in the early stages of project preparation; however this was never followed through. A weak government role with regard to the financing of the project has led to uncertain further policy support and resource allocation, which harms stakeholder confidence in promoting the sector.

Gaps faced by financial institutions

Gap	Lack of confidence in financing the freight transportation sector
Barriers	• Limited experience in financing the green freight transportation sector in Guangdong Province and the rest of China; • Limited knowledge of the ESCOs in the freight transportation sector;

[59] [2013-05-15], List of projects supported by "Special funds for energy conservation and emission reduction projects in transportation industry in 2013", available online from: http://www.moc.gov.cn/xinxilb/xxlb_fabu/fbpd_guangdong/201305/t20130515_1412114.html (accessed 04/10/2014)

	• Lack of knowledge and capacity in identifying emission reduction technologies in the freight transportation sector; • Uncertainty over the potential development of energy conservation in the freight transportation sector
Gap	Lack of consensus on the performance of selected green freight technologies
Barriers	• No access to verified data on technology performance • Implicit costs are hidden in actual economic calculations

China's banks and other financial institutions have issued green credits as large as 4.9 trillion CNY in 2013[60], with a focus on clean energy and energy efficiency in industries and buildings. However, green freight transportation projects are rarely promoted as green credit projects; therefore, financial institutions acquire little knowledge of financing this sector or relevant risks for the projects and ESCOs involved.

Financial institutions are quite uncertain about the energy conservation potential in the freight transportation sector, though the case project is performing well. Only large logistics enterprises with a strong track record are selected to participate in the case project to reduce potential operating risks that may lead to a failure of the demonstrations. However, these larger firms account for only 10% of Guangdong's total freight market, with the other 90% being small enterprises consisting of less than 10 trucks, which are operated at relatively high market risks.

Though experimental data is provided to show the economic performance of the selected technologies, the data has not been verified by an acknowledged third party. According to calculations by technology providers and financial institutions, hidden costs – including opportunity costs, additional human resources for market analyses, cost of maintenance, and cost of training for truck drivers among others - make up 10%-15% of the total cost, which may swallow up the savings from energy conservation.

Gaps faced by logistics enterprises and project owners

Gap	Lack of incentives for applying green freight technologies
Barriers	• Small amount of subsidy and rewards • Low awareness of social responsibility for emission reduction

According to the on-site interviews, the social responsibility for emission reduction is rarely considered by micro and small logistics enterprises. Therefore, paying for green freight technologies may still be a difficult decision for them. Although logistics enterprises can benefit from energy conservation with the help of ESCOs and receive subsidies and rewards totaling as much as 30% of the purchasing price of green truck technologies, they have to share the energy efficiency earnings with ESCOs.

Gaps in policy and mechanism design

Project target	Full implementation of the demonstration projects for upgrading the freight transportation sector and boosting energy efficiency in the sector.
Current status	The demonstration projects and the financial mechanism are implemented as planned but with many policy and mechanism constraints.

Gaps in policies

Gap	Lack of incentives for scaling up energy saving services in the transportation sector
Barriers	• The small scale of the demonstration project • No further plans or policies exist on emission reduction in the freight transportation sector

As illustrated in Chapter 6.2 and in this chapter, the lack of a substantial role for government in financing the project leads to policy gaps in financing green truck technologies, which in turn results in the case project only being

[60] [2013-11-14], Speech at the meeting of overcome overcapacity and green credit, available online from: http://www.cbrc.gov.cn/chinese/home/docView/E571772E24584293BB405F0AA67148DA.html (accessed 04/10/2014)

operated at a small scale. Although decision makers had promised to scale up the demonstrations during the inception of the project, no further plans or policies seem to have been issued.

Gaps in the financial mechanism

Gap	Small scale of credit
Barriers	• Low leverage ratio • Small scale of demonstration project as determined by the government
Gap	Small chance of bankability without the World Bank's risk guarantee
Barriers	• Mechanism is heavily reliant on the third party
Gap	Lack of a standard MRV process
Barriers	• No standard monitoring and verification process • Experimental data provided on a quarterly basis only

The commercial loans leveraged by the World Bank grants are small and affected by multiple factors including the cost of green freight technologies and their payback period, as well as the risk guarantee provided by the World Bank. However, without the guarantee, the loans would not be issued due to insufficient risk identification and the low credit ratings of the ESCOs. The World Bank's high credit rating has helped the case project pass due diligence tests. If the technologies perform as expected, the loans will be extended to the logistics enterprises directly by providing a similar EMC without guarantee from a third party.

Though the bank has completed the procedures for this loan application and is ready to approve the loan for the ESCO, the credits have not been issued due to the high complexity in the process of receiving foreign grants from the World Bank as a risk guarantee. This is mainly a result of staff turnover that prevents the project from its success. The details can be found in Appendix 4, Technical notes for case studies.

Despite the fact that experimental data is supposed to be collected by the South China University of Technology, a monitoring plan for the third-party verification process has so far not been developed by the project. Furthermore, for a project with one year duration, quarterly reporting is insufficient to monitor project progress adequately.

Gaps in implementation capacity

Project targets	Green freight technology demonstration of 335 trucks in the first phase (2012-2013), 933 trucks in second phase (2013-2014)
Current status	• 145 trucks in the first phase (June 2013)[61] • 20 trucks are already are signed up for the demonstration project in the second phase, and more than 1,000 trucks are still expected to be upgraded in the framework of the project in 2014.

The above table indicates that there is a delay in installing green truck technologies in the project. This is most likely the result of insufficient implementation capacity among key stakeholders.

Gap	Lack of knowledge and capacity of ESCOs in providing energy services to the transportation sector
Barriers	• Selected ESCOs' limited knowledge of implementing EMC projects • Selected ESCOs' limited understanding of the integrated application of green truck technologies. • Lack of awareness of the knowledge gaps that ESCOs currently have.

Interviews have shown that although technical support has been provided by the *Green Freight Program* in the past two years, the selected ESCOs, which are normally the providers of only one certain selected green truck technology,

[61] Implementation Status & Results -GEF Guangdong Green Freight Demonstration Project, available online from: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/EAP/2013/12/21/090224b082165ffd/1_0/Rendered/PDF/China000GEF0Gu0Report000Sequence004.pdf (accessed 04/10/2014)

are not sufficiently aware of the other two technologies which need to be integrated into each truck. Moreover, the ESCOs have limited understanding of the EMC, in particular with regard to the mechanism for sharing the energy efficiency gains and the profits they can make as a result. This is another aspect which is not yet fully clear to the PMO and therefore puts the operation of the case project as well as potential further funding from banks at risk.

6.8 Recommendations to policy makers

Based on the identified gaps and barriers to financing green freight technologies and the Industrial EMC mechanism, a set of policy recommendations has been developed:

Promote provincial climate finance policies:

- Scale-up the *Green Truck Technology Demonstration Project* in order to explore opportunities for leveraging more capital from the private sector.
- Strengthen communication among key stakeholders by developing a communication plan, identifying all relevant stakeholders in advance and designating a specific entity to be responsible for delivering the communication plan.
- Design a specific plan and draft a fiscal budget for emission reduction in the freight transportation sector.

Ensure that green freight technologies are eligible for large-scale financial support:

Timeframe: urgent in the short term

- Improve data transparency with regard to the performance of the technologies as well as hidden project costs.
- Review applicable laws and regulations and remove barriers to the adoption of green freight technologies.
- Provide better channels to improve stakeholders' access to information.
- Simplify the processing procedures.
- Provide more technology solution options within the framework of the project.

Timeframe: medium to long-term

- Utilize alternative public or private financial mechanisms to support the development of industrial EMC mechanisms, such as a joint guarantee with the World Bank to enlarge the scale of funding.
- Provide strong incentives for emission reduction in freight transportation.
- Establish industrial standards on the deployment and performance of selected green truck technologies.

Expand funding from financial institutions to the green freight transportation sector:

Timeframe: urgent in the short term

- Scale up the financing for the *Green Truck Technology Demonstration Project*, with the possibility of an additional 20 billion CNY[62] in loans from the Industrial Bank to all green industries.
- Standardize monitoring and verification processes in the green freight sector.

The below capacity building needs have also been identified following the gap analysis and interview process:

Capacity Building Area	Contents	Government agencies	Financial institutions	ESCOs and project owners
Climate change and emission reduction	• Policy and industry updates • Policy impacts on high emission industries and projects • Knowledge of the EMC mechanism			X
Practice and experience in	• Overall understanding of the green freight	X	X	X

[62] Pipeline projects have not been identified yet but the loans have been allocated.

the transportation sector	transportation sector • Knowledge of ESCOs • Knowledge and performance analysis of green freight technologies			
Identifying opportunities for emission reduction in the transportation sector	• Policy environment for emission reduction in the transportation sector • Potential developments in the transportation sector • Funding requests from technology developers • Demand for loans from projects and companies • Case studies of companies and projects	X	X	X

7 Case Study 3: *Industrial LED lighting Project* - A case with a service-oriented LED ESCO

7.1 Overview

What is an LED?

Up to 80% of energy consumption and 90% of energy costs can be saved with LED lighting compared to conventional lighting technologies[63]. LED lighting technology presents long-lasting performance, while the design and construction of LED lights are free from mercury, lead and glass.

Rationale for LED lighting project

The LED industry is planned to be one of three leading strategic emerging industries[64] in Guangdong Province. Deployment of LED lighting helps the region to meet its emission reduction targets and promote the optimization and upgrading of the industrial structure.

LED lighting is also efficient in helping to reduce utility costs and improve energy efficiency in the commercial and industrial environment; as a result, it is selected as a case project in this chapter. Company C[65], the project owner of the case project, has set a goal of all its factories running on 100% renewable energy and all products and packaging using 100% recycled materials. As a climate friendly technology, LED lighting plays an essential role in meeting realize the 100% renewable target.

Project Overview

Topic	Description / Assessment
Project name	Industrial LED lighting Project
Location / Area	Zhongshan City, Guangdong Province
Sector	Lighting
Size of finance	4,400,000 CNY
Scalability	High
Leverage ratio	1:1.43[66]

The case project is a LED lighting retrofit in a factory complex in Zhongshan City, in the south of Guangdong Province. A total amount of 20,256 lights are retrofitted across the whole factory complex, including workshops, offices, the canteen and the connecting streets, resulting in total reduction in power of 460,250W and in electricity consumption of about 16,915,901 kWh, equivalent to 5,582 tons of standard coal.

The project features an EMC model with a five-year period of shared savings with an energy service provider. The service-oriented ESCO has provided its client with a package of solutions including project design, procurement, installation, maintenance and a warranty covering the period of the contract, as well as processing of waste lights. The ESCO was provided with a loan of 4,400,000 CNY with a payback period of four years. Considering the possible subsidy granted by the government, the leverage ratio in this case is 1:1.43.

63 [2013-11-11], Lighting Choices to Save You Money, available online from: http://energy.gov/energysaver/articles/lighting-choices-save-you-money (accessed 04/10/2014)

64 [2010-04-12], Guangdong Province will implement 100,000 LED lights along 1500 km road, available online from: http://news.qq.com/a/20100412/002330.htm (accessed 04/10/2014)

65 Source requested to remain anonymous.

66 Take the possibility that the case project is earning the Government subsidy of 2,790,000 CNY for cutting consumption of 5582 tons of standard coal.

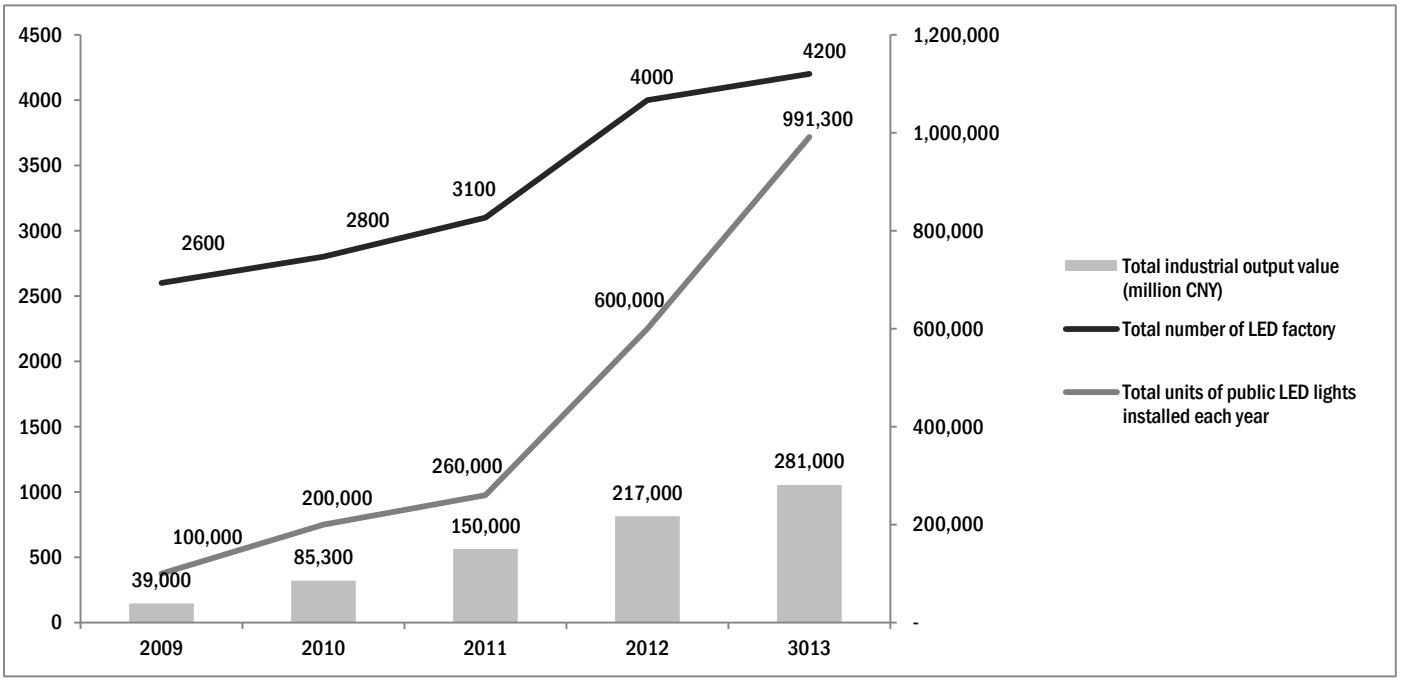
7.2 Guangdong LED deployment policy

Policy and government support for LED lighting

In 2009, Dongguan City and Shenzhen City were selected as two of the 21 pilot projects listed in the National LED lighting Initiative '*Ten Cities, Ten Thousand Lights*', consistent with Guangdong's *12th Five-Year Plan for strategic emerging industries* in which the LED industry was named as one of three leading strategic and emerging industries[67].

The '*Implementation Plan for the promotion and application of LED lighting products in Guangdong Province*' has opened up a huge publicly funded LED lighting market: Since 2012, the procurement of lighting for public purposes has been opened to all companies manufacturing LEDs. As a result, 2,000,000 street lights and 2,100,000 indoor lights have been installed in Guangdong[68]. Furthermore, all state-owned facilities are required to be equipped with LED lighting technology by 2015. As a result, government agencies have drawn up a retrofit plan to install LED lights and included the estimated emission reductions as one of the top-listed indicators of the governments' performance assessment. Moreover, to facilitate the implementation of LED lighting, policies aimed at market readiness and fairness have been issued. A figure on policy evolution in the LED lighting sector in Guangdong can be found in Appendix 4, Technical notes for case studies.

Fig. 12 Development of Guangdong LED installation and industry[69]



Policy Incentives

LED lighting technology and projects are eligible for support from the provincial Special Fund for Energy Conservation, which encourages business and industrial enterprises to adopt energy-saving LED lighting technology and products. Meanwhile, the government has increased the subsidy as a payment for emission reductions from 240

[67] [2010-04-12], Guangdong Province will implement 100,000 LED lights along 1500 km road, available online from: http://news.qq.com/a/20100412/002330.htm (accessed 04/10/2014)

[68] [2013-06-13], Guangdong Province promoting LED products, saving 1 billion kWh via 800,000 LED Lamp, available online from: http://www.gd.chinanews.com/2013/2013-06-13/2/252796.shtml (accessed 04/10/2014)

[69] Data obtained from:
[2012-09-26], Statistic of LED industry in Guangdong Province, available online from: http://led-display.cnledw.com/info/newsDetail-31564.html (accessed 04/10/2014);
[2011-05-13], New path for LED industry in Guangdong Province, available online from: http://gczx.gdstc.gov.cn/ShowNewsDetails.do?newsId=6105 (accessed 04/10/2014);
[2013-06-26], LED industry output break 21 billion CNY, available online from: http://www.most.gov.cn/dfkj/gd/zxdt/201306/t20130626_106757.htm (accessed 04/10/2014)

CNY / ton of standard coal equivalent to 400 CNY / ton. In 2012, 7 LED lighting retrofit projects were organized by this Fund, for which a total amount of 24 million CNY was granted. In 2013, the EITC and the Department of Finance increased the subsidy for EMC projects from 320 CNY / ton of standard coal equivalent to 500 CNY / ton. Five EMC LED lighting deployment projects were approved that year.

Policy Impacts on LED lighting projects

Deployment of LED technology is efficiently and successfully promoted by various provincial policies on LED street lighting and EMC projects, which have strongly boosted the LED industry in Guangdong (Fig. 12).

- After LED retrofits of two million public lights are completed in 2014, the technology will help save 1.2 billion kWh of electricity annually, reducing 420,000 tons of standard coal equivalent consumption, sulfur dioxide emissions by 3,555 tons and carbon dioxide emissions by 1.1 million tons.
- The public-funded LED street lighting retrofit Guangdong Province is scheduled to be completed by the end of 2014.
- While the LED public lighting market is reaching saturation, industrial and commercial LED lighting will be considered as the next major growth area. There is the opportunity for similar case projects in the near future.

7.3 Stakeholders and financial mechanisms

Governmental agencies

The Department of Science and Technology (DoST) and the EITC are the two departments that issue policies and allocate subsidies for LED lighting. They are quite influential in the policy-making process but less important in the context of specific projects in which the project owners are mainly from the private sector.

ESCO A[70]

ESCO A is a privately owned pure service provider, founded in 2008. It is not yet recorded in the national list of ESCOs but possesses a team of professionals with expertise on energy efficiency projects and LED technology. Unlike the other two categories of ESCOs, ESCO A is a small-scale company which, without external financial support, would be unable to develop a large-scale project requiring a large one-time investment at the project's inception.

Table 11 Comparison of the three main categories of ESCOs in the Guangdong LED lighting market

Category of LED ESCO	Main features
ESCOs with own products	Sell own products and services but are quite limited in choosing LED lighting products according to clients' requirements
ESCOs with certification on installation and construction	Normally attached to public utility companies to provide energy-saving services to users but have little knowledge of LED products or integrated energy efficiency solutions
Service-oriented ESCOs	Provide neither LED products nor installation services but a comprehensive strategy for energy-saving depending on clients' facilities and requirements. Free to choose products and service that are best suited for the planned project.

Bank B[71]

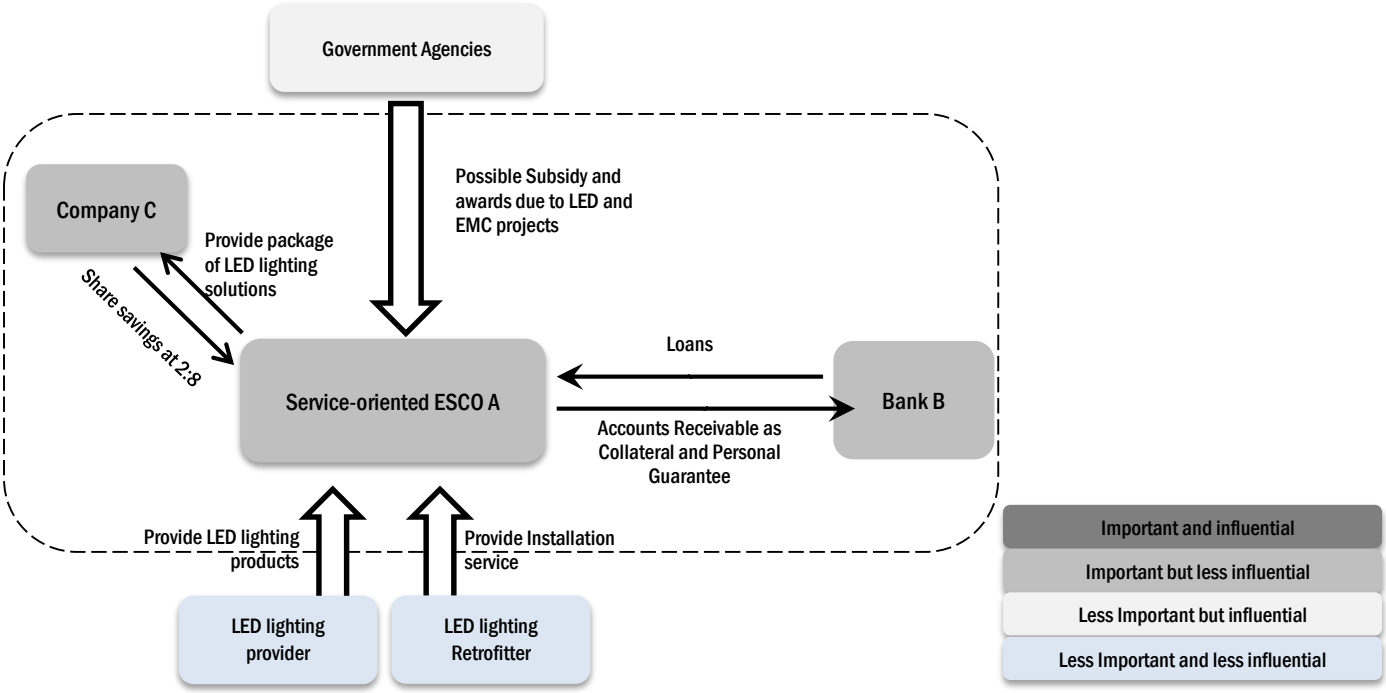
Bank B is a leading commercial bank in China that is allocating funds as large as 120 billion CNY for projects in line with green credit standards each year. The case project is counted as another milestone in the bank's business scope as it introduces a workable mechanism that expands cooperation with small ESCOs and industrial LED lighting projects that would be the next major growth area in the Guangdong LED market.

70 Source requests to keep on anonymous
71 Source requested to remain anonymous

Company C

Company C is a Fortune Global company with a vision that all its factories will run on 100% renewable energy by 2020. In addition, the company aims have its products and packages using 100% recycled materials by 2020. The LED retrofit project is a key component in its sustainability strategy and thus the company has put strict requirements on LED lighting performance to be maintained during the contract life.

Fig. 13 Management systems and financial mechanism of the case project[72]



LED lighting provider and LED lighting retrofitter

Technology providers and retrofit service providers are contracted by ESCO A, based on product standards and the requirements of the case project. These stakeholders are less important and less influential as they have a less direct connection to the case project.

Financial mechanism: EMC-based Industrial LED lighting Project

Bank B has issued a loan of 4.4 million CNY over a term of four years[73] and the loans are strictly to be used under the project contract between ESCO A and Company C. The loan is approved subject to ESCO A using its accounts receivable as collateral[74] and a personal guarantee provided by ESCO A's owner. Bank B provides ESCO A with:

- A benchmark loan interest rate which is 3%-12% lower and less risky than that of the local finance companies.
- An innovative form of guarantee under which ESCO A uses its accounts receivable, in other words the shared savings from Company C, as collateral for the loan.

MRV system

- ESCO A conducts a one-time baseline audit and one-time energy audit after the LED retrofit is completed.
- ESCO A provides Bank B with regular technical reports on LED lighting performance for its monitoring and risk control purposes.

Risk management

[72] Source: perspectives from interview

[73] Though the contact period is five years, return on investment is 3.8 years, according to which a four year loan period was decided upon.

[74] Accounts receivable is a legally enforceable claim for payment from a business to its customer/clients for goods supplied and/or services rendered in execution of the customer's order. These are in the form of contacts raised by a business within an agreed time frame in this case project. Companies can use their accounts receivable as collateral when obtaining a loan.

- Verification of the certifications of the LED lighting provider and LED lighting Retrofitter as well the project working plan is required.
- Bank B uses an ex ante control risk management process including overall evaluation of the case project's performance and state of operation.
- Bank B conducts an evaluation of the credit rating of Company C
- Bank B verifies the authentication of the contract between A and C to ensure that the proceeds of the energy savings are shared.

Impacts of the project

- The low financial cost of loans provided by Bank B has greatly increased the capability of ESCO A to scale up current projects and develop its new business.
- The due diligence and risk management process conducted by Bank B plus expertise provided on credit processing has helped ESCO A to understand market risks and improve its overall management system.
- With the successful case project operated by a service-oriented ESCO and a low-cost loan issued by commercial banks with accounts receivable pledging, a large number of peer ESCOs have been encouraged to expand their business in the LED lighting market and activity in applying for big-scale projects is increasing.

7.4 Financial performance

Baseline and project scenario

1. Energy savings

Energy savings achieved in the project scenario compared to a baseline scenario are illustrated in the following table (Table 12). With 24 workshops and 12 offices as well as other factory areas equipped with LED lights, the project has achieved an integrated electricity saving rate of 56.79%.

Table 12 Energy savings in the case project

		In total
Baseline	Total Power (W)	810,501
	Annual electricity consumption (kWh)	6,054,219.03
	Cost of electricity (CNY)[75]	4,540,664.27
Project scenario	Total Power (W)	350,245
	Annual electricity consumption (kWh)	2,671,038.66
	Cost of electricity (CNY)	2,003,279.00
Reduction in total power (W)		460,256
Reduction in annual electricity consumption (kWh)		3,383,180.37
Reduction in cost of electricity (CNY)		2,537,385.28
Energy Saving rate		56.79%

2. Saving on light replacement materials

Based on the baseline data that Company C provided, the annual cost of lighting replacement materials in the project area is over 150,000 CNY. After the installation of LED lights, this cost will be avoided and responsibility for maintenance and replacement of dysfunctional lights, if any, has transferred to ESCO A.

[75] Electricity Price in the location of the case project: 0.75 CNY /kWh

3. Sharing the savings

The revenue savings on energy and light replacement materials are shared between ESCO A and Company C in an agreed 80-20. After deducting the cost of the initial investment, Company C receives a net saving of around 2.5 million CNY in the project period of five years. ESCO A receives a net income of over 4 million CNY, as well as an internal rate of return of 18.99% and a return on investment of 3.83 years.

Financial calculations on revenues of ESCO A and Company C based on shared savings

Compared to the baseline, the overall performance of the case project is encouraging, mainly benefiting from the high economic performance of LED lighting.

7.5 Impacts of case project

Financial impacts

The case project has expanded the bank's capacity for cooperation with commercial and industrial LED projects, and a large number of potential small service-oriented ESCOs in Guangdong Province.

The case project has also built good examples on how service-oriented ESCOs can obtain low-cost funding that will further help them build access to mid-large scale projects.

Environmental impacts

After the case project is completed in five years, it will have reduced electricity consumption by about 16,915,901 kWh in total, approximately 5,582 tons of standard coal equivalent. The case project will also bring other climate-friendly and environmental benefits such as:

- Reduction of carbon dioxide emissions by about 13,913.75 tons;
- Reduction of sulphur dioxide emissions by approximately 418.67 tons;
- Reduction of nitrogen oxide emissions by approximately 209.33 tons;
- Reduction on dust emissions by about 3795.93 tons;
- Replacement of 142,145 fluorescent lamps, which helps reduce a huge amount of solid waste as well as a variety of emissions of harmful elements and substances such as lead, mercury, cadmium, hexavalent chromium, biphenyl and biphenyl ether invite.

Scalability

Overall, based on its achievement, the case project is economically successful and there is high policy readiness in Guangdong Province where the LED industry is actively encouraged and promoted. ESCOs are taking full advantage of policy resources and the convenience of a well-developed supply chain in the province.

- **Policy readiness - high**

Policies on LED public lighting have helped and accelerated the replication and promotion of LED technology in Guangdong Province. Similarly in the ESCO industry, the Guangdong Government is very supportive in terms of increasing subsidies and creating public funding driven markets.

However, when considering the possibility of scaling up the case project to other regions in China, it is clear that the propitious conditions in Guangdong may not be found elsewhere. Unlike the solid LED industry base in Guangdong, there may not be sufficient sources of LED products and maintenance services in other areas of China. Moreover,

policy readiness for LED lighting and EMC projects varies significantly. Research into market acceptance would also be required if the case project is to be scaled up in regions outside Guangdong Province.

- **Economic performance – high**

LED technology has been widely recognized in China as have high performance and major energy efficiency benefits. It is suitable for scale up, especially where utility and electricity costs are high.

- **Implementer readiness - medium**

From the perspectives of financial institutions, it is very encouraging that an EMC-based industrial LED financing mechanism has been built up and functions well for LED lighting projects while giving extensive and sustained interactions among stakeholders. However, ESCOs report that the LED lighting technologies are considered expensive and unstable by their clients, implying that additional time and resources need to be allocated to raising public awareness and addressing concerns by users.

7.6 Gap analysis and needs assessment

Gaps in awareness and perceptions

Expectation of ESCOs	Access to more and large-scale projects
Current status	Large public-funded LED market open to ESCOs but small volume of single business

While the market opportunity for LED lighting is huge, ESCOs face fierce competition due to the availability of similar products and cheap service. Given the existence of numerous ESCO companies, not all of them have access to large projects.

Gaps faced by ESCOs

Gap	Lack of confidence in project development
Barriers	• Low confidence in private sector LED lighting projects • No experience with long-period projects

As publicly funded projects are due to be completed by the end of 2015, some ESCOs feel less confident about commercial LED lighting projects in terms of their payment schedule and product durability. Many ESCOs have little or no experience in developing and managing long-term projects. They are of the opinion that there are high risks associated with payback periods over three years and therefore might refuse to provide service to these kinds of project.

Gaps faced by project owners

Gap	Lack of awareness on emission reduction in lighting sector
Barriers	• Limited awareness on addressing climate change and emission reduction behavior • Wrong impression that LED lighting projects are expensive

State-owned enterprises and foreign corporations have been aware of the need to address climate change and the benefits of climate-friendly LED lighting. In comparison, small private-owned companies are short of knowledge of LED technology and the significance of its energy saving potential.

Gaps in policy and mechanism design

Policy target	Full implementation of demonstrations in public LED lighting in the form of EMC projects
Current status	A larger number of public street lighting projects are implemented by large state-owned ESCOs

Gaps in Policies

Gap	Information asymmetry
Barriers	• Low capacity and high opportunity cost facing small ESCOs • Low transparency on the rewards issued by government
Gap	Lack of fair process for project bidding
Barriers	• Too many unnecessary requirements in the government procurement standard • Low transparency in the procurement process
Gap	Lack of special policies or incentives for private sector to adopt LED lighting technology
Barriers	• No further policies on private LED lighting or for end-use consumers • No government fund encouraging the personal use of LED lighting

The publicly funded LED street lighting market is open to all ESCOs as specified in the original policy. However, despite of the other supporting policies and an open market, state-owned ESCOs are taking as much as 90% of market, leaving only a small portion for the smaller private sector ESCOs. This is largely a result of the information asymmetry in respect of the subsidy and project bidding process. Small ESCOs also face significant barriers to entry from the prerequisite that bidders have large amounts of registered capital.

Gaps in Mechanisms

Gap	Lack of sufficient risk control check points
Barriers	• No standardized MRV process for LED products and projects • Uncontrolled warranty of LED products • Uncontrolled operational risks among technology providers

The efficient lighting solution is provided by ESCOs, but risk controls and the MRV process are not included in the package. There is no standardized MRV process and so uncontrolled product lifetime and uncontrolled operation risks all affect a project's economic performance.

Gaps in implementation

Gap	Lack of low-cost finance for scale up
Barriers	• ESCOs face difficulties financing themselves through stable cash flow • High risk and high cost associated with private lending • No other fund or financial mechanisms available

A large amount of the setup investment in LED EMC projects requires ESCOs to invest at the very beginning of the project, whereas they have limited access to low-cost financial resources. Inappropriate selections of LED products also pose threats to the operation of projects and thereby increase the cost of operation.

Gap	Lack of a standardized process on purchasing LED lighting technology and installation services
Barriers	• Financial and ethical risks: poor operating conditions of project owners and disputes over energy saving performance • Operational risks: unexpected changes during the operation of projects • Mounting maintenance costs due to inappropriate LED product selection

As pure service-providers, service-oriented ESCOs are supposed to choose LED products and services depending on the design of the proposed project and clients' requirements. However, the process is based on knowledge and experience only, rather than any quantitative criteria. This may lead to potential risks with LED products, which negatively impact the economic performance of the entire project.

Gap	Lack of communication channels to related stakeholders
Barriers	• Poor communication with policy makers • ESCOs have little impact on the policymaking process

Though the LED Lighting Association and ESCO Association in Guangdong act as the bridge between ESCOs and policy makers, few ESCOs expect to be able to change the adverse situations they are confronted with via communication with officials from key sectors of the government.

7.7 Recommendations to policy makers

Based on the gaps and barriers in both LED industrial development and the financing mechanism for technology deployment, the following policy recommendations have been developed:

For promoting LED technologies eligible for large-scale financial support:

- Develop a Sourcing Guideline on applicable products.
- Develop fair-to-all procurement standards for all ESCOs and ensure their full access to publicly funded project bidding processes.
- Develop agile financing mechanisms with financial institutions and promote financial innovations when providing services to ESCOs.
- Establish a risk sharing mechanism to support ESCOs dealing with the risks that exist in the operation and financing processes.

For driving finance in the LED sector:

- Start conversations with commercial sectors to find more opportunities for working with ESCOs to promote LED applications.
- ESCOs and LED manufacturers should be linked more closely to integrate the supply chain of LED products and further reduce the cost of LED implementation.

The below capacity building needs have also been identified following the gap analysis and interview process:

Capacity building area	Contents	Government agencies	Financial institutions	ESCOs and project owners
Climate change and emission reduction	• Policy and industry updates • Policy impacts on high emission industries and projects • Knowledge of LED technology			X
Practice and experience in the LED lighting sector	• Overview on LED lighting sector • Knowledge of ESCOs • Knowledge and performance analysis of LED lighting technologies		X	X
Identifying opportunities for emission reduction in the LED lighting sector	• Policy environment for emission reduction in the LED lighting sector • Potential development of LED lighting • Funding requests from technology developers • Demand for loans from projects and companies • Case studies of companies and projects	X	X	X

8 Main findings of this study

The development and implementation of climate finance policies and related mechanisms have made a huge contribution towards achieving Guangdong's policy target of addressing climate change. Guangdong's *Leading Group in Addressing Climate Change and Energy Efficiency* is based in two powerful departments, the Guangdong DRC and the EITC, and they have led the work on energy efficiency and emission reduction in six main policy areas. With financing flows from multi-financial institutions and intelligent outputs from research institutions, the province has made significant progress on reducing emissions.

However, the government of Guangdong Province is still facing challenges in building up a sound policy system that will drive the actions needed to meet agreed targets. At a micro-level, these challenges have had a negative influence on economic and environmental performance. The analysis of several case studies has shown that comprehensive policies and actions are required to scale up climate finance and project development in specific industries smoothly and rapidly. The current gaps in the institutional arrangements and the policy framework for climate finance at both the provincial and project levels are summarized in the table below.

Gaps in the institutional arrangements and policy framework for climate finance in Guangdong

Areas	Gaps
Institutional arrangements at the provincial level	• Communication and coordination barriers exist in the Guangdong Leading Group Addressing Climate Change and Energy Efficiency based in Guangdong EITC and DRC • Unbalanced budget allocation to mitigation and adaptation
Scale of public finance	• Small scale of finance available compared to the large scale of demands to tackle climate change issues • There are limitations on spending the public funding
Lack of efficient mechanisms through which government funds can be spent	• 'One-transaction' subsidy leads to uncontrollable risks in supervision and verification • Subsidies do not lead to sustainable impacts • The nature of the fiscal budget prevents it from being an efficient mechanism for climate finance
Cooperation between the Public and Private Sector from the private sector perspective	• The government only uses a unidirectional method to facilitate cooperation between the Public and Private Sector • Transparency of government information is poor
Building an active carbon market	• From the market participants' perspective: uncertainty in market future and weak interest due to the uncertain future of low-carbon technologies • From an institutional perspective: the Carbon ETS in Guangdong is still far from a mature market and the legal status of carbon credits is unclear

Gaps in the policy framework and in the implementation of climate finance at the project level in Guangdong

Projects	Gaps in Awareness and Perceptions	Gaps in policy and mechanisms	Gaps in implementation and capacity building
Guangdong Energy Efficiency and Environment Improvement Investment Program	Lack of public exposure to the project	Funding sources are limited and the program relies highly on international capital; Applicable projects are not fully overseen	For GFTC: Application requirements for enterprises are too high for startup companies
			For EPP-PMO Energy saving performance of projects is not transparent
Financing Green Truck Technology Demonstrations in the framework of the Guangdong Green Freight Program	For government agencies: Lack of government role in financing the project	In Policies: Risk of non-compliance in deploying green freight technology at a larger scale; Lack of definition of and industrial standards on green freight technology; Lack of incentives for scaling up energy saving services in the transportation sector	Lack of personnel stability
	For financial institutions: Lack of confidence in financing the green freight transportation sector; Lack of consensus on green freight technology performance		For ESCOs Lack of knowledge and capacity for delivering energy services to the transportation sector
	For Project owners: Lack of access to information; For logistics enterprises and project owners: Lack of incentives for applying green freight technologies	In Mechanisms: Small scale of credit; Heavily reliant on a third party; Lack of standard MRV process;	
Implementing an Industrial LED lighting Project- A case with service-oriented LED ESCO	For government agencies: Inappropriate role of government in developing projects	In Policies: Information asymmetry; Lack of fair process for project bidding; Lack of special policies or incentives for private sector to adopt LED lighting technology	Lack of low-cost finance to scale up the projects
	For ESCOs: Lack of awareness and ability to resist risks		Lack of standard process on purchasing LED lighting technology and installation service
	For Project owners: Lack of awareness on emission reduction in the lighting sector	In Mechanisms: Lack of sufficient risk control check points	Lack of communication channels to relevant stakeholders

The main findings at the provincial and project levels suggest that there are consistent gaps in climate policies and implementation in Guangdong Province. An irrational institutional arrangement for providing climate finance is the fundamental problem and leads to inefficient policy and implementation, as well as insufficient funding allocations. Although major policies towards financing climate related projects have been issued and are consistent in the long run, regular updating of policies and specific incentives are necessary to solve the typical barriers which emerge in policy implementation. From the perspective of stakeholders and projects, effective channels for communication with policy-makers and government aiming at transparent access to information and better understanding of the policy environment are quite limited, leaving a lot of room for discussion on potential approaches and recommendations that the government could adopt. The gaps related to climate policies and their implementation at the provincial and project levels are summarized in the table below.

Level of the gaps	Awareness and related institutional arrangement	Financial scale	Financial mechanism	Other issues
On Provincial Level	Institutional arrangement at provincial level causes communication and implementation barriers	Scale of public finance is limited	Lack of efficient mechanisms for government to raise funding	Expectations of the private sector on Guangdong government agencies are not met
On Project Level	Lack of awareness of addressing climate change and technologies	Scale of public finance is limited	Lack of specific policies or incentives to help remove key barriers	Lack of communication channels; Energy saving performance of projects is not transparent; Lack of access to information

9 Policy recommendations for policy makers and other relevant stakeholders

On the basis of the in-depth analysis of climate finance related policies and practices implemented in Guangdong Province, several recommendations for decision makers emerge, aimed at helping them improve the climate finance environment in support of current policy goals and targets.

9.1 Policy recommendations for decision makers on promoting climate finance at Guangdong Provincial level

To address the gaps and barriers identified in the Guangdong Province climate finance policy mapping exercise in Chapter 3, policy recommendations have been developed across five areas.

Bridging the institutional gap
Timeframe: Medium/long
Regulator: State Council

The *Guangdong Leading Group Addressing Climate Change and Energy Efficiency* is separated into two working groups, resulting in communication and coordination barriers between them, as well as an imbalance in budget allocation. The two working groups, *Energy Efficiency and Emission Reduction* and *Addressing Climate Change*, should be merged and operated by a new task force under the Guangdong DRC in accordance with its mandate. This would be a major policy improvement for decision makers on the national and provincial levels but it could only be expected after a long discussion.

The suggested task force would lead climate related policy making and funding distribution in Guangdong Province and could be based in the Bureau of Climate Change of the Guangdong DRC.

New financial mechanisms and funding expansion by providing incentives
Timeframe: Short
Regulator: Department of Finance; Financial institutions

The scale of finance for climate-related energy efficiency projects is small compared to the large scale of the industry and the demand for such projects. Certainty of political support from government is essential to capture the interest of private sector actors. It is suggested that the government reshape its subsidy policies and provide incentives to guide the various participants involved in climate finance. The government should:

- Establish a mechanism, such as a carbon fund, using off-budget government funding and private capital to invest in climate-related projects. Off-budget funding can subsidize the return on investment of private capital.
- Utilize revenue from carbon allowance auctioning, for instance to 1) provide equity investment in climate related projects, 2) securitize Carbon-Assets; 3) subsidize off-exchange emission reduction projects with sufficient additionality; 4) develop carbon finance products with financial institutions; 5) support knowledge exchange and management.
- Encourage commercial banks to develop innovative financing mechanisms by providing subsidies.

Expansion in funding sources through Public-Private Partnerships and multi-cooperation
Timeframe: Medium/long
Regulator: Provincial Finance Bureau; Guangdong DRC

A lack of efficiency in the use of public funding results in a further shortage of government support for climate-related projects. While public funding has its assigned functions and distribution channels, Public-Private Partnerships represent an optional mechanism in which public funding is partnered with private funding in providing multiple financing functions such as loans, guarantees and risk sharing. To supplement fiscal budgets and off-budget funding for financing climate related schemes, the government should also seek multiple funding sources including China's sovereign wealth funds, private capital, and funding from policy banks from developed countries.

Enhancement of communication channels among Guangdong government agencies and the private sector
Timeframe: Medium/long
Regulator: Guangdong DRC; Department of Finance

The current lack of communication channels results in information asymmetry that further leads to deviation of policy implementation and limited cooperation among stakeholders. It is suggested that the environmental and emissions data of projects be shared or disseminated on certain platforms on a regular basis, for example on a government website.

This would provide transparent information to financial institutions and key stakeholders. It would also be valuable to build up channels for information sharing on bankable climate-friendly projects and their funding requirements in order to match projects and potential funders in an efficient way.

Promote the carbon market as the most promising finance resource
Timeframe: Short
Regulator: Guangdong DRC; GZEEX

The government has to overcome many restrictions and gaps in all dimensions of institutional design and participants' awareness to build a liquid and sustainable carbon market in a short period of time.

- The primary suggestion is to actively engage stakeholders to activate the market. The GZEEX should communicate with all investing institutions and investors from the system of Guangdong ETS, Guangdong Province and around the world. GZEEX should provide continuous capacity building support to enterprises subject to Guangdong ETS so as to encourage them to trade allowances and activate the market.
- Clear regulations should be established as the basis for the carbon market. The government should then issue laws and regulations covering all aspects of Guangdong ETS, especially on the official recognition of carbon credits as assets (to be held on balance sheets) through the approval of Guangdong Provincial Committee of the Communist Party of China.
- To create a vibrant market, carbon markets need to gradually expand their financing functions. Financial derivatives are to be introduced under the guidance of NDRC and CSRC and a futures market, together with the development of derivative products, are expected by investors. They could help to gather investors' interests and increase the volatility of markets. Derivative products would allow businesses to hedge and lower risks by controlling the cost of carbon allowances and even making profits from trading.
- Preparation for cross-province trading is another optional strategy for an expansion in trading volume through linking of trading systems and trading platforms.

9.2 Policy Recommendations for Guangdong Decision makers in promoting the case projects

Based on the gaps and barriers analysis conducted in earlier case study chapters, the following policy recommendations are made across three main areas.

Expansion in funding sources by providing incentives
Timeframe: Medium/long
Regulator: Provincial Finance Bureau; Guangdong DRC; Transportation Bureau; Commercial Banks

A shortage in finance is one of the major barriers in implementing the three case projects, especially when there are plans to expand projects in the short-term. To stimulate investment in energy efficiency projects in specific sectors, private funding sources should be expanded through public incentives or even by using public funding as leverage.

Although finance is always an urgent issue for industries, mid to long term tools could be introduced by provincial governments to aggregate the flows sustainably. Subsidies or rewards could be allocated for preferential rates provided by commercial banks, if the banks are more involved in allocating resources to energy efficiency projects. That would be helpful in lowering the risks and encourage the banks to invest in project scale-up. To enlarge funding channels, external funding sources from bilateral or multilateral collaboration are worth consideration. Other public or private financial mechanisms could be introduced if a local matching fund is approved. Continuous communication and mechanisms for knowledge sharing are also important to ensure that financial institutions understand the current situation in respect of industrial policies and understand the substantial business opportunities from investment.

Improvement in program management to ensure the project development
Timeframe: Short
Regulator: EITC; PMO; GFTC

In order to maximize the performance and minimize the risks of the case projects, the management of the project should be reinforced in all aspects, especially in terms of project management procedures, MRV system and other issues raising the hidden costs. These measures would need to be taken up in the short run or otherwise the success of the case projects will be at risk.

The procedures for public-funded projects should be re-evaluated and adjusted to reduce project hidden costs and to improve the accuracy of the financial calculation. Risks have placed a pressure on the banks to strictly stick to the

MRV system, which needs to be more transparent to all stakeholders. MRV reports should be available to all public and project stakeholders and they should be kept informed on a monthly basis. A standardized monitoring and verification process is to be developed and unified among the government, the banks, ESCOs and project owners. For public procurement projects, the government should apply fair-to-all procurement standards and allow for a joint bid for one large project to ensure full access to the projects for all market players.

Supplementary measures to ensure the scale-up of case projects
Timeframe: Short
Regulator: Guangdong DRC, ESCOs and Commercial Banks

To ensure a sound policy environment for the further development of the case projects and their sectors, additional measurements are required to bridge the existing gaps in information transparency, technology development and deployment, and others. All of those will assist the projects and their sectors to be feasible for further financial support.

In the short term, improving transparency and accessibility of information, as well as designing the platform which provides that information, should be the first step that the government should take. The information should include the economic and environmental performance of certain technologies, the market needs on emission reduction and various funding sources available to all. That will allow the banks, businesses and ESCOs to compare different technologies and mechanisms and thus to consider the best strategy for their project development. The government will also have to help remove all the barriers in deploying energy efficiency technologies. For newly developed energy efficiency technologies or products, industrial standards on their deployment and performance evaluation are crucial for financial institutions to compare the performance and risks with other technologies.

Timeframe: Medium/long
Regulator: Provincial Finance Bureau; Guangdong DRC; EITC

To avoid certain market and technology risks associated with newly-developed projects, risk management procedures should be improved. In the short-term, public funding would be the best option for achieving this, taking the successful example of the EPP program. With the introduction of a risk sharing pool, public funding can play the role of guarantor jointly with other financial institutions. This helps to quickly reduce the risks that banks are taking and enhance the bankability of projects, thereby converting emission reduction potential into real benefits.

Appendix

Appendix 1
Abbreviations

ADB	Asian Development Bank
BIPV	Building-Integrated Photovoltaic
CAS	Chinese Academy of Science
CBRC	China Banking Regulatory Commission
CCER	Chinese Certified Emission Reduction
COD	Chemical Oxygen Demand
CSRC	China Securities Regulatory Commission
DoST	Department of Science and Technology
DoT	Department of Transportation
DRC	Development and Reform Commission
EITC	Economic and Information Technology Commission
EMC	Energy Management Contract
ESCO	Energy service company
EMCA	Committee of China Energy Conservation Association
EPP	Efficiency Power Plant
EPP-PMO	Efficiency Power Plant Project Management Office
EPPSC	Efficiency Power Plant Steering Committee
ESCO	Energy Service Company
ETS	Emission Trading System
FIRR	Financial Internal Rate of Return
FYP	Five-Year Plan
GEF	Global Environment Facility
GFTC	Guangdong Finance Trust Company
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPG	Guangdong Provincial Government
GZEEX	Guangzhou Emission Exchange
HVAC	Heating, Ventilation and Air Conditioning
LED	Light Emitting Diode
LNG	Liquefied Natural Gas
MEP	Ministry of Environmental Protection
MFF	Multi-tranche Financing Facility
MoF	Ministry of Finance
MRV	Monitor, Report and Verify
NDRC	National Development and Reform Commission
OECD	Organization for Economic Co-operation and Development
SMEs	Small and medium enterprises
SOEs	State-owned enterprises
SPDB	Shanghai Pudong Development Bank
VKT	Vehicle Kilometers of Travel

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Appendix 4
Technical notes for case studies

Case Study 1: *Rooftop Photovoltaic Power Station Demonstration Project* in the framework of Guangdong EPP

Scopes of applicable projects

The GPG established a policy framework for improving energy efficiency and reducing pollutants in such key sectors including:

- Energy-intensive manufacturing industries
- Commercial and government facilities
- Building construction
- Electric equipment manufacturing
- Transportation.

Among them, applicable technologies and projects are selected from the following list:

- Optimization of power distribution system
- Optimization of power system
- Green lighting
- HVAC optimization
- Energy saving of air compression and pumping system
- Industrial waste heat recovery
- Combined cold and heat industrial boilers
- Other energy saving projects in line with national and provincial plans.

In addition to the eligibility criteria on the industrial sector and technologies, applicable projects should also comply with high environmental and social standards. Qualified projects must not involve land acquisition and involuntary resettlement, or have negative impacts on local residents. The project location must be outside of any specific environmental preservation area. Design and implementation of the projects must be in compliance with national and local regulations concerning environmental protection.

The 10 MW *Rooftop Photovoltaic Power Station Project*, though not in the list of major sectors as above mentioned, falls into the category of "other energy saving projects in line with national and provincial plans" as solar energy is regarded as a new energy industry and is in line with China's[76] and Guangdong's development plan[77].

Criteria of financial indicators

Applicable projects should follow a series of financial principles which maintain the financial viability of projects so as to speed up the circulation of funding:

- Approved projects should be implemented within a year
- Amount of applied fund should not exceed 70% of the total investment
- Payback period should be within five years
- The total revenue should exceed the total investment
- FIRR (financial internal rate of return) should be higher than 12%.

Apart from the financial soundness of project applications, EPP-PMO and GFTC also pay special attention to the sustainability of enterprises applying for the loan. Financial indicators are used to identify eligible enterprises which could provide solid collateral assets or have a sound credit history and good reputation, so as to secure long-term loan repayment. Detailed criteria include:

- No bad credit history, based on the People's Bank of China credit history database
- Debt–to-equity ratio: < 75%
- Debt service coverage ratio: > 1.2
- Current ratio: no less than 1.2
- Has been in operation for at least three years and making profits in two consecutive years

[76] Central People's Government of People's Republic of China (2012), National 12th 5-year Plan of Solar Photovoltaic Industry, available online from: http://www.gov.cn/gzdt/2012-02/24/content_2075802.htm (accessed 04/10/2014)

[77] People's Government of Guangdong Province (2011), Guangdong 12th 5-year Plan of Economic and Social Development identified Solar Photovoltaic Industry as Key Strategic New Industry, available online from: http://zwgk.gd.gov.cn/006939748/201105/t20110513_86534.html (accessed 04/10/2014)

- Able to provide collateral or guarantee is a plus.

Besides sound credit history and healthy financial indicators, EPP-PMO and GFTC also examine the management structure and assets of the enterprises. Operation performance and profitability are treated as the prerequisites for project approval. In addition, any significant changes in the management structure of the enterprises (which could in turn affect the sustainability of the concerned enterprise) on loan, must be reported.

Case Study 2: Financing *Green Truck Technology Demonstrations* in the framework of the *Guangdong Green Freight Program*

Policy background for transportation sector in Guangdong

Fig. a 14Policies related to emission reduction in the transportation sector in Guangdong

Time	Issuing Parties	Green Freight Program	Guangdong provincial level[78]
Dec. 2007	World Bank, GPG	Consensus of developing the Green Freight Program	‘
2009	Department of Transport of Guangdong Province(DoT)		Special Fund for Energy Efficiency and Emission Reduction in Guangdong’[79]
Jan. 2010	DoT	Green Freight Project Coordinating Group and Project Management Office (PMO) founded	
June 2011	World Bank, GEF and DoT	Approval on Green Freight Project; Project Agreement and Grant Agreement signed;	
Sept. 2013	DoT, Guangdong, Industrial Bank Guangzhou Branch	‘Green Freight Project Cooperation Agreement’	

Gaps and technical barriers in awareness and perceptions

Gaps and technical barriers that hinder the development of green truck technology in the freight transportation sector are listed below.

Gaps faced by ESCOs and technology providers

Gap	Lack of access to information
Barriers	• Long timeframe of the application procedure • Complexity of the application for subsidies and rewards

ESCOs and logistics enterprises recruited for green freight demonstration projects are encouraged by subsidies and rewards granted by the World Bank. However, they have to wait nearly 24 months before the contracts for the demonstration projects have been signed by all parties.

Gaps in implementation

Gap	Lack of staff continuity
Barriers	• Institutional risks due to the staff turnover of project managers in the World Bank. • Inadequate support from government due to high-level staff turnover in PMO

At the end of 2013, two key staff members, the project managers from the World Bank and from the Project Management Office, resigned. Though new officers have been assigned to those two positions, contacts between Guangdong Province and the World Bank were interrupted and it will likely require time to rebuild functional teams. During the transition period, concerns were raised by financial institutions and ESCOs due to staff turnover. Although it is clear that the *Green Freight Program* will definitely be implemented as the program agreement was signed in September 2013, prolonged processes of fund transfer from the World Bank and delays in implementation might raise the costs for the implementers.

Gaps in policy and mechanism design

In Policies

Gap	Risk of non-compliance with official regulations when deploying green freight technology on a larger scale
Barriers	• None of the regulations in Guangdong Province are related to external adaptations of vehicles that apply green freight

[78] Guangdong Transportation Bureau (2012), Notice: Key points of Energy conservation and emissions reduction for transportation industry, available online from: http://www.gdcd.gov.cn/jtkj/20130418104937855_1.shtml (accessed 04/10/2014)

[79] Guangdong Transportation Bureau (2013), Notice: Funds for Energy saving and emission reduction demonstration projects in transportation industry, available online from: http://www.gdcd.gov.cn/tongzhigonggao/20131028094640743_1.shtml (accessed 04/10/2014)

	technology. • Trucks applying 'nose cone' technology are at risk of being punished.
Gap	Lack definition of and industrial standards on green freight technology
Barriers	• The scope of 'green freight technology'has not been identified by the authority, making it difficult to justify whether a technology should be categorized as 'green freight technology' • No mandatory performance requirements are stipulated to guide manufacturers producing qualified products.

Technically, trucks applied with nose cone technology are considered illegal by the Department of Motor Vehicles since they are externally fitted onto those vehicles[80]. While trucks participating in the case project are exempted from punishments with papers issued by the Department of Transport of Guangdong Province, other trucks equipped with nose cone technology are still at risks of being punished. The absence of an industrial standard on the deployment and performance of the three technologies (Table 10) may lead to misuse of these technologies, preventing their further commercialization. On the macro scale, the relatively small scale demonstration project (20 trucks only) will further prevent the prevailing of the practice.

Case Study 3: *Industrial LED lighting Project*- A case with service-oriented LED ESCO

Policy evolution in LED lighting sector in Guangdong

Fig.b Policy evolution in LED lighting sector in Guangdong

Time	Issuing Parities	Policy contents
Aug. 2010	DoST	Notice on the promotion and application of an evaluation benchmark system for LED lighting products[81]
June 2011	Housing and Construction Office	Number of installed LED lights in municipal public facilities construction included in the performance assessment on emission reduction targets in Guangdong Province
Apr. 2012	EITC	'Record management on energy-saving service providers'[82]
May 2012	Government of Guangdong Province	Implementation Plan on promoting the use of LED lighting products in Guangdong Province[83]
Aug.2012	DoST	Notice on the issuance of implementation plan on promoting the use of LED lighting in the transport sector[84]
Sept. 2012	Economic and Information Technology Commission	Provision of the subsidies for LED projects and EMC projects in LED lighting
Apr. 2013	Department of Transportation	Working plan on energy conservation in Guangdong Provincial transport sector 2013: Further promote road tunnel lighting energy-saving technology demonstration pilot[85]
Apr. 2013	GPG	Number of installed LED lights included in the performance assessment on emission reduction targets
Sept. 2013	Quality Supervision Bureau	Establish LED lighting standard technology alliances and LED lighting industry standard system planning and roadmap

[80] 'Nose cone' is the technology that is installed on the heads of trucks for fuel saving purposes.

[81] Guangdong DoST (2010), Notice: Promoting application of benchmark system for LED lighting products, available online from: http://www.gdstc.gov.cn/HTML/led/zcfg/134146610563057268313708555524674.html (accessed 04/10/2014)

[82] Guangdong DoST (2012), Notice: Record management on energy-saving service providers, available online from: http://www.gdei.gov.cn/flxx/jnjh/zcfg/201204/t20120419_107314.html, (accessed 04/10/2014)

[83] Guangdong DoST (2010), Notice: Promoting implementation of LED lighting products, available online from: http://www.gdstc.gov.cn/HTML/zwgk/zcfg/swszfzc/133844879011472724894751234735558.html (accessed 04/10/2014)

[84] Guangdong Transportation Bureau (2012), Notice: Promoting implementation of LED lighting products in transportation industry, available online from: http://www.gdcd.gov.cn/tongzhigonggao/20120809151352420_1.shtml (accessed 04/10/2014)

[85] Guangdong Transportation Bureau (2012), Notice: Key points of Energy conservation and emissions reduction for transportation industry, available online from: http://www.gdcd.gov.cn/jtkj/20130418104937855_1.shtml (accessed 04/10/2014)

Appendix 5
Interviewee List

Advisors on the board

National Level	
LI Xiaowen	Director at Division of Statistic, CBRC
Dr. WEN Gang	Deputy Director, CDM Fund
ZHANG Minsi	Project Officer, National Center for Climate Change Strategy and International Cooperation, NCSC
TANG Maoheng	Former Chief Manager at Credit Division, Bank of China
LIU Xinjian	Senior Project Officer (Energy), ADB

Provincial Level	
CHEN Yijun	Deputy Director at Division of Resource Conservation, Environment Protection and Climate Change, Guangdong DRC
CHEN Peiyuan	Director at Trade and Industry Division, Department of Finance, Guangdong Province
LUO Zhigang	Team Leader of Carbon Market, Energy Strategy Research Center, Guangzhou Institute of Energy Conversion, CAS
WEN Juan	Deputy Director of Guangdong Energy Conservation & Monitoring Center, Guangdong ADB Loan EPP project Office
LI Yuan	Senior Manager, China Emission Exchange (Guangdong)

Interviewees in this study

Financial Institutions	
ADB	Dr. ZHENG, Kangbin, Private Fund Specialist
Industrial Bank	ZHAO Jianxun, Senior Researcher YANG Zhe, Specialist at Carbon Finance Division LUO Yifeng, Deputy Manager at Marketing Department LIU Wenzhen, Specialist at Marketing Department
Shanghai Pudong Development Bank	Dr. XIE Yuting, Product Manager at Investment Banking Department
Guangdong ADB Loan EPP Project Office	LING Zhichao, Deputy Director DENG Huihua, Accountant HUANG Can, Project Assistant
Guangdong Finance Trust Corp. Ltd.	ZHAO Zhiling, Deputy Manager
Research Institutes	
NCSC	Dr. DOU Yong, Officer at CDM Management Center
CDM Fund	TIAN Chen, Project Officer at Research & Development Department
Energy Strategy Research Center, Guangzhou Institute of Energy Conversion, CAS	Dr. WANG Peng, Deputy Researcher LUO Yaojun, Assistant Researcher
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