

**Feasibility Study of CCS-Readiness in
Guangdong (GDCCSR)
Final Report: Part 5**

**CCS Capacity Building and
Public Awareness in
Guangdong Province, China**

**The GDCCSR-LC Team
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Disclaimer

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The report is written based mainly on publicly available data. While the authors consider that the methodology and opinions in this report are sound, they do not warrant the accuracy or completeness of the reported subjects. The authors are not liable for any loss or damage arising from decisions made on the basis of this report. The views in this report are the opinions of the authors and do not necessarily reflect those of the Universities of Edinburgh, Cambridge or Exeter, nor of the funding organizations.

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Background for the Report

For emerging economies, creating the required information, tools, skills, expertise and institutions is crucial for the implementation of CCS and accelerating its rapid development into commercial operation. These activities are collectively known as “capacity building”, which is a primary focus of the Carbon Sequestration Leadership Forum (CSLF), a ministerial-level international initiative aimed at marshalling worldwide CCUS resources.

Capacity building enhances capacity and capability in people by developing and sharing information, skills, experiences and knowledge across all key CCS areas. Because the technology is relatively new and the capacity for its wide implementation it is not yet adequate in either emerging or industrialized economies, a special focus is needed not only on CCS processes, but also on policy, legal and socioeconomic barriers and challenges.

Based on the outcomes of our study, the GDCCSR project has shown the necessity, and provided feasible solutions, for the development of CCS and CCSR in Guangdong, and drafted a roadmap that includes action plans and policy recommendations. We would like to share our experience in promoting regional CCS developments, enhancing knowledge exchange, and building up local expertise. In order to implement CCS in Guangdong and other parts of China in the future, we consider that extra work is required to disseminate the findings of this project more widely.

The capacity building activities, based on experiences from other researchers, were usually focussed on: workshops; personnel exchange programs; technical assistance for planned pilot CCS activities; information exchange; facilitation of technology transfer; training programs; study tours on regulations and standards; summer school programs; information and knowledge sharing programs; support for feasibility studies; and providing opportunities for engineers to work on CCS demonstration projects. The GDCCSR project team has been working on various activities in Guangdong, such as CCS meetings & workshops, information and knowledge sharing websites & blogs, information exchange with experts from industrial companies, visiting power plants etc. In the future, we are aiming to take further action and employ other methods to continue capacity building activities.

This report forms the fifth part of the GDCCSR final reports. The complete list of the project reports are as follows:

- Part 1 Analysis of CO₂ emission in Guangdong Province, China.
- Part 2 Assessment of CO₂ Storage Potential for Guangdong Province, China.
- Part 3 CO₂ Mitigation Potential and Cost Analysis of CCS in Power Sector in Guangdong Province, China.
- Part 4 Techno-economic and Commercial Opportunities for CCS-Ready Plants in Guangdong Province, China.
- Part 5 CCS Capacity Building and Public Awareness in Guangdong Province, China
- Part 6 CCUS Development Roadmap Study for Guangdong Province, China

1. Information and knowledge exchange network

1.1 CLEAN Partnership

We have established the first registered CCS partnership in China: the China Low-carbon Energy Action Network (CLEAN). Before the GDCCSR project started, stakeholders, industry and academics in Guangdong had limited knowledge of CCS technology, and there was very little industrial participation in CCS. In addition, no formal CCS partnership existed in Guangdong province or indeed the whole of China. By 30 March 2013, CLEAN have 86 members from 55 institutes.

On 7th September 2010, the network CLEAN was launched in Guangzhou, with over 70 people attending the launch meeting. CLEAN provides a communication and cooperation platform for promoting carbon capture and storage readiness in Guangdong and in China. The membership is composed of professional researchers from research institutes and universities, energy economists, decision makers, as well as engineers from relevant industrial bodies covering petroleum, chemical, geology, energy storage and transportation fields.

The CLEAN website (www.clean.org.cn) acts as the main website for the partnership which includes CCS news and events in China, providing useful information and opportunities for members to participant network activities. Linkschina Investment Advisory (“Linkschina”) is responsible for the update and maintenance of the website.



Figure 1 Screenshot of CLEAN website

1.2 Weibo (Chinese Twitter)

Weibo is the Chinese word for "microblog", and refers to mini-blogging services in China, using a format similar to the American counterpart Twitter. Weibo is a major source for modern information sharing and commentating on a wide range of topics; in 2012, there were 309 million people microblogging in China. We consider this as a popular and practical tool for delivering project results in China.

Linkschina has created a Chinese Weibo account in Tencent and Sina, named “*captureready*”, and focused on increasing followers in Sina Weibo. By April 2013, we had 94,384 followers from such areas as electricity, oil, clean energy, investment, and NGOs. The number continues to increase.



Figure 2 Screenshot of weibo account

2. Meetings, Visits & Workshops

2.1 Meetings

2.1.1 The GDCCSR Launch meeting

On March 18 2010, the launch of the project “Feasibility Analysis of CCS-Readiness in Guangdong (GDCCSR)” was announced in Guangzhou, China. The launch meeting was attended by over 100 participants from research institutions, industry, and governments including the Director-General of the British department of Energy and Climate Change, Mr Cavendish; the ambassador of the British Embassy in Beijing, Mr Wood; and the vice secretary-general of the Guangdong Provincial Government, Yong Chen. Zhaoli Jiang, the Head of the Climate Change department of Chinese National Development and Reform Commission (NDRC), addressed the meeting. Chinese academicians Shu Sun and Weidou Ni, leaders of major Chinese CCS projects, and experts from Chinese, British, Australian, and American institutions and NGOs presented their findings on CCS, and the GDCCSR team leader Di Zhou outlined the nature of project. The meeting was reported widely in major newspapers and websites in the province.

2.1.2 GDCCSR Quarterly Meetings

Linkschina hosted quarterly meetings for team members to discuss the progress of the project. In total, we organised 10 small scale quarterly meetings dedicated to team members with excellent attendance rates. Attendants included each subproject leader, officials from the British Consulate General, Guangzhou and the Global CCS Institute. In addition to reporting and discussing the progress for each institute, we set a specific theme for each meeting. For example, we hosted the

storage-theme meeting at CNOOC together with experts from the oil company; the capture-theme meeting took place at Yudian Power Company, Shenzhen Energy; and the economic-theme meeting was held at the Guangdong Energy Institute. During these meetings, experts from industry were invited to share their opinions on a specific technology. Different focus groups were also constructed to make sure that the GDCCSR project developed as planned.

In the last three meetings we mainly focussed on a discussion of the main outcome of our study – the CCS development roadmap - which includes the action plan and policy recommendation for Guangdong to the year 2030.

2.2 Introduction to Selective Visits

Shenzhen Energy

Linkschina organised two trips for team members to visit Shenzhen Energy. The first trip formed part of the introductory tour for Dr Mathieu Lucquiaud from Edinburgh to understand the background to the electricity markets in Shenzhen. The second trip focused on exchanging views on capture ready design solutions for Shenzhen Energy's 4*1GW power plants.

We also assisted Shenzhen Energy in submitting their proposal to NDRC on the Capture Ready design for its planned power plants in China.

Shenzhen Baochang Natural Gas Power plant

Shenzhen Baochang natural gas plant was replacing its turbines from oil fired to gas fired during the course of our project. Our visit to Baochang not only helped engineers there to understand CCS, but also allowed us to understand more about natural gas power plants in Shenzhen. This has a direct link to the construction of a Capture Ready Hub.

Yuedian Pinghai Power Plants

Three visits were made to Yudian Pinghai Power Plant during the study. The Pinghai Power plant currently has 2 *1 GW units onsite, but with the potential to extend to 6 *1GW units in the future. These power plants form an excellent opportunity for deploying the Capture Ready Hub concept alongside Shenzhen Energy's new proposed power plants.

Foshan Hengyi Power Plant

This was the first power plant Linkschina visited in this study. At the time of our visit, the onshore storage potential in Guangdong was unclear, particularly the part of the province in which the power plants are located, where highly concentrated natural CO₂ wells existed in the past. The newly constructed 2*600MW power plants were at the start of construction. We managed to encourage them to re-consider the location of the chemical storage site for the plant. However, due to funding reasons, and the decrease in onshore CO₂ storage possibilities in Guangdong, no follow up meeting was made.

Yuebao Cement Plant

Linkschina and the project team members visited Yuebao cement plant. Yuebao cement is a modern rotary kiln cement plant, locates in Huadu district of Guangzhou. A discussion on CCS

process for cement manufacture was held with the chief executive of the plant operator (Century Cement). The project team members also designed a post-combustion CO₂ capture process for the cement plant and conducted a preliminary techno-economic analysis.

CNOOC

The project team has been keeping close contact with CNOOC, in particular in relation to the CNOOC Phase II gasification plant for hydrogen production. SCSIO and other project team members visited CNOOC Shenzhen branch, and discussed with CNOOC engineers opportunities for offshore CO₂ storage in depleted oil fields while utilizing existing infrastructure. They also visited CNOOC New Energy in Beijing.

Ordos CCS Demo Project

The project team organized a 3-day visit to the integrated CCS demo project in Ordos in August 2011 using additional funding from GCCSI. A group of 18 members from CLEAN joined this trip, including GDCCSR partners, officials from the Agenda 21 Centre of MOST, Guangdong DRC, Guangzhou DRC, the British Consulate General in Guangzhou, reporters, and university professors. During this trip we also invited the professionals from the microalgae-oil project of Xin' Ao Group to describe their progress.

UK CCS Tour

Near the end of project, in order to understand and learn from the successful experience of UK CCS development and policy and regulation setting, using additional funding from BCG the project team and BCG together organized a one week visit to the UK during 21-26 Jan 2013. Participants included GDCCSR project team main members; the deputy director of DRC, (??which RDC??) Lu Xiulu; the principal investigator of the UK CCS Community Network, Jon Gibbins; and other CCS related UK experts.

The delegation visited Edinburgh University (the department concerned with low carbon instruments), and met Scottish government and DECC officials and Shell Company employees to discuss and to compare CCS developments in China and the UK.

2.3 CCS Workshops

Annual project workshops

Three CCS workshops were organized in August 2010, 2011 and 2012 in Guangzhou. In these workshops international and domestic experts from local governments, industries, and academies presented the latest developments in CCS demonstration projects around the world and reported the intermediate outcomes of the GDCCSR project. Those invited to present at the meetings included Andrew Minchener (IEA Clean Coal Centre), Tore Amundsen (the Managing director of TCM), Rick Causebrook (project leader of the Greenhouse Gas Storage project and a petroleum exploration geologist), Zhonghe Pang (Chief of the CCS project in the Chinese 863 program), and those from the ENN Group, Shenhua Group, CNOOC Shenzhen, and several power plants in Guangdong.



Figure 3 GDCCSR and CLEAN activities

Final GDCCSR Meeting and Workshop

The final GDCCSR meeting and workshop was held in Guangzhou as part of the “UK Low Carbon Week” activities. Participants included project team members, CLEAN network members, officials from Guangdong development and reform commission (DRC), GCCSI and BCG, other CCS experts, and other stakeholders. The meeting split between morning and afternoon sessions for the announcement of results and open discussion. During the meeting, participants expressed their strong desire for this project to continue, particularly since this is the first project in South China with offshore storage potential, and the project covered overall planning at the regional level rather than just a single capture to storage project.

3. Conclusions and Recommendations

Drawing from the successful experience of the GDCCSR project, Linkschina strongly suggests the following points for all future project leaders.

1. Understand the local market. Each market considers things differently; solid local experience will boost the rate of success in targeting the right industries for CCS.
2. Acquire strong background knowledge on CCS. Unlike other conference or event organisers, Linkschina hosts the biggest bilingual English/Chinese website www.captureready.com. Therefore, no time was wasted when the project first started.
3. Be prepared and continue to prepare! Always have all relevant materials checked by CCS experts in advance of meetings, workshops and visits.

Guangdong has just made its first step into CCS. Continuous capacity building is essential for its development in Guangdong.