Near
ZERO
Emission
近零排放

春季刊 | 二〇一五
SPRING | 2015

Cover Story | 封面故事

中国碳市场

Carbon Markets in China: Review and Suggestions

链接欧盟与广东碳排放交易机制
中国碳市场发展：概览与展望
中国碳市场：风险识别与管理

中英（广东）CCUS 中心
UK-China (Guangdong) CCUS Centre

加快全国碳市场发展

Accelerating the National Carbon Market Development in China

李 佳
LI JIA

最近发布的 IPCC 报告清楚的阐述了给碳定价对于实现全球温室气体减排2℃目标的重要性。尽管对两种主要的基于市场的碳定价机制——总量控制与交易和碳税——存在争议，但总量控制与交易赢得了更多的关注。

The latest IPCC report makes clear the importance of putting a price on carbon to meet the global 2-degree target of GHG mitigation. While there are tradeoffs between the two principal market-based carbon pricing instruments — cap-and-trade and carbon taxes, the cap-and-trade option has attracted far more attention.

理论上讲，总量控制与交易和碳税均可实现具有经济效益的碳减排。两者根本的不同在于碳定价以及实现碳减排的方式。总量控制与交易通过设置明确的排放总量使得排放配额的价格由供需确定。碳税则对排放直接征税而不设置排放总量。因此，通过碳税实现的减排量是不确定的。

通过衔接碳市场建立全球统一碳排放权交易机制是实现国际减排的重要步骤。在中国，建立在七个碳交易试点的基础上，中国计划在 2020 年前建成全国性的碳市场，这也将是全世界最大的排放权交易市场。本期，我们和中央财经大学气候与能源金融中心合作，推出碳市场专刊，对中国的区域碳交易试点市场进行全面评述，并对发展全国碳市场提出政策建议。

In principle, both can achieve cost-effective reductions. The fundamental difference between the two instruments is the way in which they establish a price and reduce emissions. A cap and trade system sets a clear limit on emissions, causing the price of allowances to be established by supply and demand. A carbon tax imposes a direct fee but does not set a limit on emissions. As a result, the emission reductions resulting from tax are uncertain.

Linking carbon markets and establishing a global emission trading scheme is an important step towards international climate action for carbon reduction. After the launch of the seven regional pilot schemes, China plans to roll out its national market for carbon trading before 2020, which will be the world's biggest emissions trading scheme. In this special issue on carbon market, we work together with the Research Center for Climate and Energy Finance at the Central University of Finance and Economics to give a comprehensive review of China's regional carbon markets and put forward policy recommendations for the development of the nationwide carbon market.

目 录
Contents

Near ZERO Emission 近零排放

Spring | 2015
二零一五秋春季号

目 录
Contents

Near ZERO Emission 近零排放

Spring | 2015
二零一五春季号

支持单位：
Support Institute:

广东省发展及改革委员会
Guangdong Provincial Development and Reform Commission

英国驻广州总领事馆
British Consulate-General Guangzhou

主办单位：
Host Institute:

中英（广东）CCUS 产业促进和学术交流中心
UK-China (Guangdong) CCUS Industry Promotionand Academic Collaboration Centre

临时编辑办公室：
Temporary Editorial Office:

英国爱丁堡大学
University of Edinburgh

中国能建广东省电力设计院
China Energy Construction Group GuangdongElectric Power Design Institute

深圳市领先财纳投资顾问有限公司
Shenzhen Linkschina Advisory Company Limited

临时编辑部成员：
Temporary Editorial:

李 佳（爱丁堡大学）
LI Jia (University of Edinburgh)

刘恒伟（领先财纳）
LIU Hengwei (Linkschina)

邓广义（中国能建广东省电力设计院）
DENG Guangyi (GEDI)

江梦菲（爱丁堡大学）
JIANG Mengfei (University of Edinburgh)

杨 晖（中国能建广东省电力设计院）
YANG Hui (GEDI)

张向阳（领先财纳）
Louis ZHANG (Linkschina)

张春文（中国能建广东省电力设计院）
ZHANG Chunwen (GEDI)

黄 华（领先财纳）
HUANG Hua (Linkschina)

Indira Mann（爱丁堡大学）
Indira Mann (University of Edinburgh)

Philip Curry（领先财纳）
Philip Curry (Linkchina)

出版总监：
Publishing Director:

叶碧涵
YE Bihan

视觉统筹：
Visual Design:

赖晓苏
LAI Xiaosu

郁 瀚
YU Han

读者服务与投稿信箱：
Reader Correspondence and Article Submission Email:
CaptureReady@gmail.com

链接欧盟与广东碳排放交易机制：配额分配制度的兼容性

Linking EU ETS and Guangdong ETS: Compatibility of Allocation Methods

吴 倩
QIAN WU

吴倩女士现任 Ecofys 中国办公室高级顾问，中国项目主任，服务政府、研究机构与企业客户。她在碳市场、工业能效和可再生能源领域有着丰富的政策分析和项目管理经验。2009-2013 年，她在英国驻华使馆担任政策顾问，倡导英国在碳排放权交易、电力市场改革方面的措施和经验。

Qian Wu is responsible for managing and implementing projects in China. She is an experienced policy analyst and project manager in the field of renewable energy, industrial energy efficiency and carbon markets. From 2009 to 2013, Qian worked as a policy advisor at the British Embassy in Beijing where she advocated the UK's policies in emissions trading and electricity market reform.

区域碳市场链接是碳排放权交易机制发展的先进阶段。协调机制的相关条例、设计特征可以改善全球碳市场的表现。区域碳市场链接可以强有力地建立规模更大、流动性更强的碳市场，降低整体履约成本，展现对应对气候变化的政治承诺。尽管益处众多，成功链接的案例除了在北美并不多。建立政治意愿、缩小分别建立碳排放交易机制之间的差异仍然十分具有挑战。

Regional linking of carbon markets is an advanced development of emissions trading schemes (ETS). Harmonization of certain key provisions and ETS design parameters could improve the performance of the global carbon market. Carbon markets Linking could potentially create a larger and more liquid market, lower the overall cost of compliance, and demonstrate political commitment to tackle climate change. Despite the benefits, there aren't many successful cases of linking ETS except in North America. Building political will and closing the gap between schemes created separately remain challenging.

中国即将在国家层面推出碳排放交易市场。当前的碳交易试点覆盖了超过 12 亿吨配额（2013–2014），并已经在发挥重大影响。被其他机制要求链接的可能性也存在，并不出乎意料。与国际碳排放权交易机制加强沟通、识别差异并在设计和运行中共同进步对于中国是一件好事。在真实链接之前，就会产生好处。链接的选择也是灵活、可实现的。

China is rolling out the world's largest ETS and the pilot programs covering over 1.2 billion allowances (2013-2014) are already making considerable influence. The possibility of being asked to link would be out of the blue. It will be a rewarding exercise for China to increase communication with other international ETSs, identify differences and improve together while designing and operating. There will be benefits even before the actual linking and there will be options that are flexible enough to accommodate.

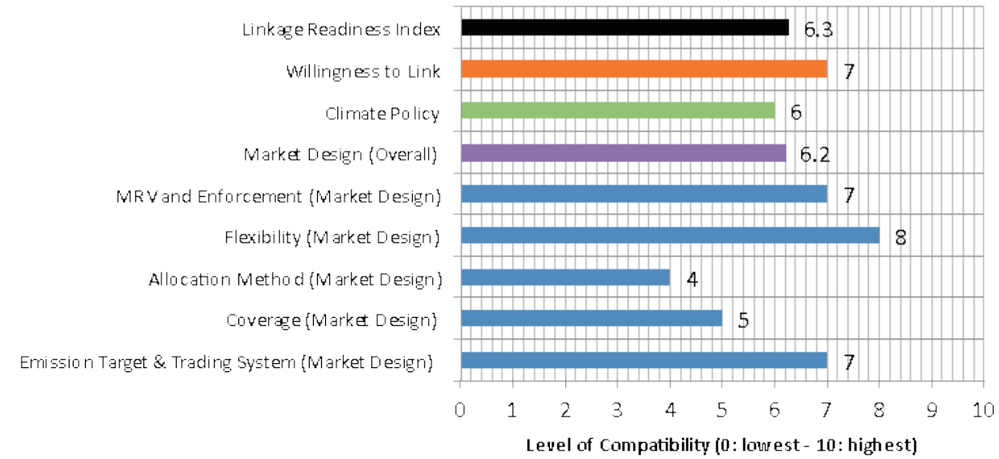
一个来自中国和英国的研究团队评估了广东和欧盟碳排放权交易机制链接的可行性。研究还建立了“链接就绪指数”（LRI 指数）体系，用以展示两个机制的兼容性以及它们距具备链接条件的差距。广东碳市场国际衔接能力研究发现，目前欧盟排放权交易机制与广东排放权交易机制间的 LRI 指数在满分为 10 分的情况下得到 6.3 分（图表 1），

A team of researchers from China and the UK has assessed the possibility of linking Guangdong and EU emissions trading schemes. A Linkage Readiness Index (LRI) system was built to show the compatibility of the two schemes and how far they are from being able to link with each other. The study found the current LRI between the EU ETS and the GD ETS scored **6.3 out of 10** (Figure S1),

这表明适度的兼容性水平，而且需要大量共同的努力来提高这两个市场的兼容性，尤其是分配方法与覆盖范围方面需要更多共同协调。

suggesting a moderate level of compatibility and a substantial amount of joint efforts are required to improve the compatibility of the two markets. This paper takes the allocation which requires the most efforts for harmonization, as an example to illustrate the compatibility of Guangdong and EU ETSs.

图表 S1 欧盟排放权交易机制与广东排放权交易机制间预计的兼容性水平
Figure S1 Estimated Level of Compatibility between the EU ETS and the GD ETS



分配方法（如祖父分配法、基准分配法与拍卖法）对行业竞争力有直接影响，还可明确展示履约企业间碳效率的差异。而且，分配给涉及的实体的免费配额比例影响碳价与市场流动性。单个排放权交易机制的分配已很复杂，一旦确定，将要进行很多年的运营。排放权交易机制链接将把两个地区的不同行业置于分配额度不必相同但要进行仔细审视与认识的比较状态。例如，挪威所分配的免费配额多于欧盟排放权交易机制，但这并不影响双边链接，而且加州与魁北克之间的分配机制也存在细微差别。

Allocation methodologies (e.g. grand-fathering, bench-marking and auctioning) have a direct impact on industry's competitiveness and can clearly show the difference in carbon efficiency among compliance companies. Moreover, percentage of free allowances allocated to covered entities influence the carbon price and market liquidity. Allocation is already complicated in a single ETS, and once set would be operating in a number of years. Linking ETS will put sectors from two regions in comparison where allocations do not have to be identical but need to be carefully examined and recognised. For example, Norway has more free allowances allocated than in the EU ETS but it did not impact the bilateral linkage, and there are also minor differences in the allocation mechanism between California and Quebec.

大多数排放权交易机制始于用免费分配鼓励行业参与，然后逐渐降低免费配额比例，再走向拍卖。欧盟排放权交易机制已运营 10 年，从祖父法发展到基准管理方法。广东排放权交易机制才刚启动，主要采用祖父法作为其主要的分配方法。欧盟排放权交易机制对 40% 以上的配额进行拍卖，而广东排放权交易机制才在 2013 年通过拍卖一小部分配额开始试验。配额成本的巨大差异可能会对碳价统一形成障碍，并可能导致潜在的碳泄漏与对不平等竞争力环境的担忧。

欧盟排放权交易机制中，被认为具有巨大碳泄漏风险的行业可继续接收免费配额。从阶段三开始，大部分配额通过在实现碳效率时识别到最佳实践的基准法（例如每个单位活动中的排放）被分配出去。广东在选出的行业地区内采用基准法，而且还在提升这种方法在分配中的水平。排放权交易机制决策者与行业间仍存在信息差距，而中国排放权交易机制试点所涉及的行业希望看到更高的分配规则透明度 [4]。

就价格管控机制而论，广东省发改委比欧盟委员会在碳市场干预方面具有更强的灵活性。欧盟排放权交易机制指令对设计特征下达了指令。若修正该指令，欧盟委员会只能进行干预或改变规则。这就是欧盟排放权交易机制长期遭遇较低碳价并在过去 10 年内继续分配的原因。自 2013 年来，欧盟委员会就一直在尝试使市场重回轨道与恢复公众信心。2014 年，由欧盟议会、欧洲理事会、欧盟委员会做出的折量拍卖举措与建立市场稳定性储备提案的决定就是证明这一点的证据。虽然欧盟和广东之间干预与稳定碳市场的力度与理念不同，但它们都能通过价格干预规程共识被调整过来。

欧盟排放权交易机制中的配额拍卖可在商业交易平台上进行，现在包括德国莱比锡城的欧洲能源交易平台与英国伦敦的洲际交易平台。广东的拍卖专属于总部位于广州的中国碳交易平台。为实现两个排放权交易机制的双边链接，挑选一个或多个拍卖平台的进程需要由双方协调并同意。履约期与两个体系排放单位的定义已经相容。

Most ETS schemes started with the free allocation to encourage industry participation and gradually lower the percentage of free allowances and move towards auctioning. The EU ETS has been running for 10 years, evolving from grandfathering to benchmarking approach.[1] The GD ETS just started and mainly applies grand-fathering as its main allocation approach. The EU ETS auctioned over 40% of allowances, whereas the GD ETS just started the trial by auctioning a small percentage of allowances since 2013. This significant difference in the cost of allowances[2] could form a barrier for carbon price convergence, and could lead to potential carbon leakage, and concerns over an unequal competitiveness environment.

In EU ETS, industries considered to be at significant risk of carbon leakage can continue receiving free allowances. From the Phase 3, the majority of the allowances are distributed via benchmarking (e.g. emission per unit of activity) that recognises the best practice in achieving carbon efficiency. Guangdong applied bench-marking in selected industrial areas[3] and is increasing the level of benchmarking in allocation. There is still an information gap between ETS policymakers and industry, while industries covered by Chinese ETS pilots would like to see more transparency about the allocation rules[4].

Regarding to the price containment mechanisms, GDDRC has relatively higher flexibility than the European Commission in intervening in the carbon market. The EU ETS Directive gives the mandate to the design features. The Commission can only intervene or change the rules if amendments made to the Directive. It is why the EU ETS suffers from a long time a low carbon price and continues over allocation in the last 10 years. Since 2013, the Commission has been trying to bring the market back on track and restore the public confidence. In 2014, the decisions by the EU Parliament, Council and Commission on back-loading measures and a proposal to create the Market Stability Reserve are efforts to

虽然拍卖主要由欧盟委员会管理，但几乎所有的欧盟排放权交易机制拍卖进程都会被反馈到欧盟成员国，由每个成员国决定如何利用它们。新进入者储备（NER300）计划是个例外。NER300 计划是由欧盟委员会、欧洲投资银行与各成员国共同管理的特殊融资工具。这是欧盟排放权交易机制的拍卖收入被指定为一个特定目的服务的唯一官方行动。2009 年，有 3 亿配额从第三阶段的 NER 计划中被用于补贴大型创新型可再生能源和碳捕集与封存示范项目。

因巨大的分配机制差异与广东排放权交易机制未来交易期的不确定性，欧盟与广东还需共同付出大量努力来协调分配方法差异并确保两个体系中的行业参与者（所涉实体与投资商）都可公开获得当前与未来分配方法的设计与基本原理。为实现两个市场的双边链接，免费配额分配的比例差距需要随时间减少，这就需要广东排放权交易机制快速提高拍卖的配额比例。涉及不同排放权交易机制但同一行业的企业应被尽可能地同等对待。另外，两个体系都需同意新进者在准备双边链接时采用统一的储备信用额分配规则。广东排放权交易机制应考虑从中产生的不同的间接排放，并采用替代性政策措施奖励间接减排。2016 年建立全国性的排放权交易机制后，若消除广东排放权交易机制作用及其未来交易期的不确定性，兼容性得分可能会在短期内适当提高，但因潜在的全国机制允许省级机制有更严格的规则，这个问题应该可以解决。

demonstrate this point. Overall, although the power to, and philosophy of, intervening and stabilising carbon markets are different between the EU and Guangdong, they could be harmonised with a mutual agreement on the price intervention rules.

The auction of allowances in the EU ETS takes place on commercial trading platforms[5], currently the European Energy Exchange (EEX) in Leipzig, Germany and InterContinental Exchange (ICE) in London, UK. The auction in Guangdong[6] is exclusive to the China Carbon Exchange (CCE) based in Guangzhou. To achieve a bilateral linkage of the two ETSs, the process to select one or more auction platforms needs to be harmonised and agreed by both parties. The compliance period and the definition of emission unit in both systems are already compatible.

Although the auction is centrally managed by the Commission, almost all proceeds from the EU ETS auction goes to the EU Member States and it is up to each individual Member State to decide how to use them. The New Entrants Reserve 300 (NER300) is an exception. NER 300 is a special financing instrument jointly managed by the European Commission, European Investment Bank and Member States. It is the only official initiative where auction revenues from the EU ETS are designated for a specific purpose. In 2009, 300 million allowances were took out from the NER of Phase 3 in order to subsidise large-scale innovative renewable energy source and carbon capture and storage (CCS) demonstration projects. [7]

Given the significant differences in the allocation mechanism and uncertainties in the future trading periods of the GD ETS, substantial joint effort between the EU and Guangdong is required to harmonise the differences between allocation methods and ensure industry participants (covered entities and investors) from both systems have transparent access to the design and the rationale of the current and the future allocation methods. To enable a bilateral linkage between two markets, the gap in the

percentage of free allowance allocation needs to be reduced over time, and that will require GD ETS to rapidly increase the proportion of auctioned allowances. Companies covered in different ETS but same sector should be treated as equal as possible. In addition, both systems need to agree a consistent rule for allocating reserve credit for new entrants in preparation for a bilateral linkage. The GD ETS should consider separate indirect emissions from the ETS and apply an alternative policy measures to incentivise indirect emission reduction. The compatibility score may be moderately increased in the short term when the uncertainties regarding the role and the future trading periods of the Guangdong ETS are removed, after the establishment of a national ETS in 2016, but it should be solvable as the potential national scheme allows provincial schemes to have stricter rules.

表格 1 分配方法兼容性
Table 1 Compatibility of Allocation Methods

	GD ETS	EU ETS	Implications for Linkage
Current trading periods **目前的交易期**	Pilot Phase: 2013-2015 Uncertain after the pilot stage 试点阶段：2013-2015 其后不确定	Phase III: 2013 – 2020 Phase IV: 2021 - 2028 阶段 III：2013-2020 阶段 IV：2021 - 2028	There are great uncertainties on how GD ETS may evolve as a part of the National ETS (planned to launch in 2016). There are also uncertainties on how the phases are developed in China. 关于广东排放权交易机制可能如何发展为全国性排放权交易机制（计划 2016 年建立）的一部分，存在较大的不确定性。关于如何在中国发展这些阶段也存在不确定性。
Compliance Period **履约期**	1-year (June to June) 1 年（6 月到次年 6 月）	1-year (May to April) 1 年（5 月到次年 4 月）	Compatible with minor modification of one system 同细微调整的体系相容

Emission unit **排放单位**	Guangdong emission allowance (GDEA), 1 ton GDEA equals to 1 ton CO_2 emission from both direct and indirect emissions 广东排放配额，1 吨广东排放配额等于直接与间接排放源中的 1 吨 CO_2 排放	EU emission allowance (EUA), 1 ton GDEA equals to 1 ton CO_2 emission from direct emissions sources 欧盟排放配额，1 吨欧盟排放配额等于直接排放源中的 1 吨 CO_2 排放	Need to address the double accounting issues in the GD ETS and the schemes covers both direct and indirect emissions 需解决广东排放权交易机制中的重复计算问题，且机制同时涉及直接与间接排放
Allocation methods **分配方法**	97% free allocation through grandfathering and benchmarking, 3% (2013) to 10% (2015) auctioned Auction was mandatory to receive free allocation in the first compliance year 通过不受新规限制方法与基准管理方法实施 97%的免费分配，拍卖 3%(2013)-10% 拍卖是强制的，从而在履约第一年接受免费分配	Phase III: Increasing portion of auction allowance from 40% (100% auctioning for the electricity sector), mainly apply benchmark method Back-loading 900 MtCO2 auction in Phase III from 2014-2016 to 2019-2020 阶段 III：配额拍卖部分从 40%开始提高（电力行业拍卖率为 100%），主要采用基准管理方法 从 2014-2016 到 2019-2020，在阶段 III 折量拍卖 900MtCO2	Due to the state of ETS development, the allocation methods vary greatly in two ETS. However, both share similar allocation principle, have reserves. GD ETS is moving towards tighter rules, EU ETS has much higher transparency in the allocation mechanism. 由于排放权交易机制发展状态，两个排放权交易机制的分配方法差别较大。但共有相似的分配原则，都有储备。广东排放权交易机制的规则正趋向更严格，而欧盟排放权交易机制中的分配机制的透明度更高。

1. A product benchmark is currently applied for the EU ETS, which reflects average GHG (greenhouse gas emission) of the 10% best performing installations in the EU producing the product.

2.There is no free allowance for electricity generators in the EU ETS. In Phase I, even though existing power plants received allowances for free, installations could pass the cost to customers. Manufacturing industry could receive 80% of allowances in 2013 for free; however this number will decrease to 30% in 2020.
As for the GD ETS, in 2014, the allocation methodology was changed from a free allowance plus mandatory auction to a free allowance plus voluntary auction or purchase principle for these covered entities. Covered entities can either purchase allowances from auction or from the secondary market (GDDRC, 2014). The floor price of the auction will start from lower to higher as orders are placed. This policy aims to incentive new entry covered entities and investors involved in GD ETS.

3. Power, cement and long process steel

4.Ecofys UK Ltd, 2014. Chinese Emissions Trading Schemes - Initial Assessment on Allocation. Available at: http://www.ecofys.com/files/files/ecofys-2014-industry-view-chinese-ets-allocations-english.pdf. Accessed 20/Nov/2014.

New entrants **新进者**	3% new entrants reserve for 2013-2014; 10% new entrants reserve for 2015 2013-2014 期间，3%的新进者储备；2015 年，10%的新进者储备	5% new entrants reserve; no free allocation to closed plants 5%的新进者储备；关闭的电厂无免费分配	A higher reserve for new entrants in GD ETS, as the system is still at its infant stage as the economy growth of Guangdong is much higher than that in the EU. 虽广东排放交易体系仍处于发展初期，但因广东经济增长情况比欧盟的更理想，其新进者储备更多
Price Containment Mechanism **价格控制机制**	Guangdong has a floor price for the auctions. It was CNY 60 initially (2013), and was lowered to CNY 25 and will increase to CNY40 in steps of CNY 5 quarterly. 广东有最低拍卖价。最初(2013)是 60 元人民币，而后降至 25 元，且将以每季 5 元的步伐上涨至 40 元。	No ceiling or floor except UK's Carbon Price Floor in the power and heat sector (starting from £16/tCO_2 in 2013 with the perspective to reach £30 by 2020 and £70 by 2030). Back loading is currently applied in the EU ETS. 除英国发电与供热行业有最低价外，其他无最高价或最低价（始于 2013 年的 16£16/tCO，并有望在 2020 年前达到£30，2030 年前达到£70）。折量拍卖现正用于欧盟排放权交易机制。	There are significantly differences in measures for price intervention. The UK price intervention measure, if not implemented throughout the EU, will affect the price of allowance in the EU ETS and therefore affect the price convergence confidence of two ETSs. GDDRC has a high degree of flexibility in intervening the allowance price. 价格干预举措的差异较大。若不在欧盟范围内实施英国的价格干预举措，将影响欧盟排放权交易机制中的配额价格，从而影响两个排放权交易机制统一价格的信心。广东省发改委对配额价格干预具有较高的灵活度。
Data Source: Environomist, 2014; China Emissions Exchange, 2015; EC, 2015; ICAP, 2015			

5. All auctions are monitored by EU ETS auctioning regulatory rules for an open, transparent and non-discriminatory process. Over eighty-eight per cent of allowances auctioned were based on verified emissions reductions (VERs) in the 2005-2007 period while 10% by volume will be allocated to the least wealthy EU member to help it reduce carbon emissions and adapt to climate change. In the first review of 2014, €3.6 billion revenues from auction and over half of auctioning revenue of €3 billion was used for climate change adaptation and for low carbon investment purposes.

From the year 2013 to 2014, the Guangdong ETS executed a mandatory programme to require covered entities to purchase carbon allowances in the first stage (called 'ticket mechanism'). 97% of allowances were allocated for free to covered entities and only 3% of allowances were required to be purchased in advance. The electricity sector had a different allocation methodology comparing to other industries as electricity accounts for the major carbon dioxide emissions in Guangdong province. Thus 5% of allowances were needed to be purchase based on the policy of the GDDRC (GDDRC, 2013).

6.The auction in Europe is monitored by GDDRC.

7.http://ec.europa.eu/clima/policies/lowcarbon/ner300/index_en.htm

中国碳市场发展：概览与展望
Carbon Markets in China: An Overview and Outlook

王 遥
YAO WANG

王遥，教授，博士生导师，毕业于中央财经大学金融学院。中央财经大学气候与能源金融研究中心主任，澳大利亚南昆士兰大学和维多利亚大学兼职教授。研究领域为低碳经济、气候金融及绿色资本市场。

Professor Yao Wang is the director of the Research Center for Climate and Energy Finance (RCCEF), Central University of Finance and Economics(CUFE). She is also the Adjunct Professor of University of Southern Queensland, Australia, and University of Victoria, Australia. She is interested in low carbon economy, climate finance and green finance.

陈 波
BO CHEN

陈波，中央财经大学气候与能源金融研究中心主任助理及碳金融实验室负责人，国家发改委国际合作中心低碳经济研究室副主任。中国人民大学经济学博士，爱丁堡大学碳金融硕士（志奋领学者），浙江大学控制科学与工程硕士。

Bo Chen, senior fellow and Director Assistant of Research Center for Climate and Energy Finance(RCCEF),Central University of Finance and Economics(CUFE). He holds a PhD in Economics at Renmin University of China and two master degrees in Carbon Finance at University of Edinburgh (Chevening Scholar) and Control Engineering at Zhejiang University.

饶 若水
RUOSHUI RAO

饶若水，中国科学技术大学硕士，中央财经大学气候与能源金融研究中心研究人员，拥有碳市场或低碳领域近七年工作经验。

Ruoshui Rao, Master of University of Science and Technology of China, Research fellow of Research Center for Climate and Energy Finance in Central University of Finance and Economics, owning nearly 7-year work experience in carbon market or low carbon.

2011 年 10 月 29 日，国家发改委正式下发《关于开展碳排放权交易试点工作的通知》，批准北京、天津、上海、重庆、湖北、广东、深圳“两省五市”开展碳排放权交易试点工作。2013 年 6 月 18 日，深圳碳交易的启动标志着我国碳交易走向实践。我国的碳交易试点不仅是为了形成地区碳交易体系和实现市场化减排目标，更重要的目标是通过在政策法规、技术标准、市场运行等方面进行尝试与探索，为建立和培育更大规模的市场积累经验。

The National Development and Reform Commission released the Notice on Carrying Out the Work of Carbon Emissions Trading Pilot Program on October 29, 2011, which has approved five cities (Beijing, Tianjin, Shanghai, Chongqing, and Shenzhen) and two provinces (Hubei and Guangdong) to test carbon trading. The start of carbon trading in Shenzhen on June 18, 2013 marked the progress in carbon trading tending towards practice in China. Carbon trading pilots in China not only attempt to build up regional carbon trading systems and to achieve the target of emission reductions, but also aim at accumulating experience for the construction and cultivation of larger-scale markets through exploration in aspects such as policies and regulations, technological standards and market operations.

中国碳市场概况
An overview of the carbon market in China

1. 碳交易体系初步搭建，但各项机制仍不完善

各试点地区均设计了一整套碳交易体系，包括覆盖范围、总量和配额分配、核算体系、注册登记系统、交易系统、信息披露、市场监管等一系列核心机制。然而，由于我国碳试点自 2011 年底开始部署到 2013 年仓促启动，以及缺乏碳排放统计核算数据等原因，导致政策设计、能力建设等基础工作不够扎实，政策制度缺乏连续性，基础性制度立法层次较低，约束力较弱。另外，由于碳市场信息不透明，市场监管体系尚未健全，碳交易市场仍具有明显的政策性，大大增加了交易成本，也降低了交易效率，交易行为也缺乏有效规范。

1.The pilots are still in the very early stages of development

A set of carbon trading systems has been designed in all pilot regions, which consists of a series of mechanisms, including thresholds for carbon trading, allowance allocation, MRV, registry, trading system, information disclosure and market supervision. A lack of carbon emission statistical data in the carbon pilots from the initial deployment at the end of 2011 to the hasty start of the carbon market in 2013 leads to weakness in such basic work as policy planning and capacity building, discontinuity of policies and mechanisms, lower legislative levels and weaker constraint forces of basic systems. In addition, due to the lack of transparency of information in the carbon markets and an unsound market supervision system, there exists policy-type characteristics in the carbon market which significantly increases trading costs and also reduces trading efficiency, and there are no effective standards for trading behaviors.

2. 配额分配进行了有益的尝试和创新，但仍是最大难题

配额分配是碳交易体系中的第一大难题。七大试点中，除重庆采取自主申报的分配方法，其余六个试点则分别对历史法、基准法和拍卖法三种主流配额分配方法进行了有益地尝试和创新。

除了重庆和深圳之外，其余五个试点都选用了基于历史排放强度或历史排放量的免费分配方法，虽然具备可接受性强、MRV 的运行效率高、利于低初始成本减排等优点，但是也出现了显著的公平问题。各试点为此进行了事前限定和事后调整的尝试和探索，但效果并不十分明显，甚至产生了新的问题。

与上述五个试点不同，深圳试点采用基准法在电力、供水、燃气三个行业进行配额分配，对制造业及其他工业行业探索建立了基于价值量的碳强度指标。虽然体现了行业内的公平性，鼓励企业的能效和减排行动，但是缺点在于难度较大、主观因素相对影响较大。在其他试点地区的电力行业也广泛使用了基准法，但也发现存在不同地区之间基准差异较大的情况，以及激励作用发挥受限的问题。

与历史法和基准法相比，拍卖被认为是最有利于价格发现的分配方式，但同时拍卖会增加企业的履约成本，其可接受度在市场建设初期并不高。从广东、湖北、上海和深圳的拍卖情况来看，拍卖机制的灵活设计十分重要，只有充分考虑企业参与成本等因素涉及相应的拍卖方式，才能够有效调动参与主体的积极性。

2. Allowance allocation is still the greatest challenge

Allowance allocation is the greatest challenge in the pilot carbon trading markets. Except for the use of independent declaration as the allocation method for Chongqing, the three main allocation methods - the historical method, the benchmark method and the auction method – have been tried and tested in the pilots.

Except for the pilots in Chongqing and Shenzhen, the other five pilots have chosen the free allocation method based on emission intensity or historical emissions. Although this has advantages such as strong acceptability, high operation efficiency of MRV, and low initial cost for emission reductions, there exists an obvious issue around fairness for which those pilots make constraints beforehand and adjustments hereafter. But the effects are not significant, even resulting in new problems around fairness.

Different from those of the five pilots, Shenzhen pilot allocated the allowances in the power generation, water supply and residential gas sectors by the benchmark approach, and set up a carbon intensity index for the manufacturing and other sectors. It allows for fairness within an industry, and encourages businesses to improve energy efficiency and to increase emission cuts. But its disadvantages lie in the difficulty and relative impacts of subjective factors. Although the benchmark method is widely used in the power sectors of the pilot regions, there also exist problems such as significant differences of benchmarks among regions and the limited effectiveness of incentives.

Compared with the historical method and the benchmark method, the auction method is considered as the most favorable allocation for price discovery. However, the performance costs of business can be increased through the auction method and its acceptability is not high in the early stage of market construction. According to auction situations in Guangdong, Hubei, Shanghai and Shenzhen, flexible design of the auction mechanism is the key. As long as auction methods related with the involvement costs of business are fully considered, subjects' activity can be efficiently motivated.

3. 市场规模和价格区间形成，但流动性不足且价格信号不准确

目前，各试点地区二级市场已初具规模，市场整体价格波动幅度基本处于 20 元 / 吨到 70 元 / 吨之间，这对未来全国碳市场的价格波动区间有很强的示范作用。但是，市场上交易品种仅限于配额现货，市场参与者多集中于控排企业，投资机构仍对碳市场保持观望态度。自启动之日至 2014 年 8 月 22 日，各试点地区的交易量总计不足 1300 万吨，交易额总计不足人民币 5 亿元。

在这种交易氛围下，各试点地区不仅价格比较悬殊，且有数据表明大部分交易集中发生在最后一个月，以履约为主要目的，交易集中度过高，市场有效性不足，因此难以形成公允的价格。

4. 企业逐渐认识减排的紧迫性，但碳资产管理意识仍薄弱

通过各地碳试点的交易规则的制定、推广和能力建设，以及一年多的交易，绝大多数纳入控排体系的企业初步树立了减排意识。但由于碳交易是新生事物，而试点工作推进速度过快，且利益相关方协商工作较为欠缺，一些企业还未完全理解此政策的意义和目的，不可避免地存在一定的排斥情绪，不仅体现在参与碳市场交易不够活跃，甚至还有一些企业对碳排放报告核查工作的配合不够积极，碳资产管理意识也十分薄弱。

目前企业普遍未建立有效的碳资产管理体系，只有少数企业专门成立了碳资产管理公司，对集团下的控排企业的碳资产进行统一管理。当前企业对碳资产存在不同的管理方式，管理部门不同，有财务部管理，有节能减排管理办公室管理，也有行政办公室、综合办公室管理。同时缺少专业性的人才，大部分企业指派部门经理或者副总经理负责，由工程师或能源环保管理人员构成，这些人员缺乏参与市场交易的知识、经验和信心。

3. Market liquidity is poor and price signals are inaccurate

So far, secondary markets in the pilot regions have taken shape, with fluctuation in integrated prices mainly ranging from 20 yuan to 70 yuan a ton, which sets a good example for price fluctuation ranges in a national carbon market in the future. But trading carbon on the market is limited to spot allowance. Market participants are mainly the emitters, while investment institutions still hold a wait-and-see attitude towards the carbon market. From the opening of the carbon trading market to August 22, 2014, trading volumes equated to less than 130 million tons, less than RMB 500 million in total across all the pilots.

Under this trading circumstance, carbon price gaps are significant in all the pilots. Moreover, data shows that most of transactions are conducted in the last month before the deadline of compliance, which leads to a high trading concentration ratio and insufficient market efficiency. As a result, fair prices are not easily found.

4. The capacity to manage carbon assets is still weak

Through the carbon trading pilots in more than a year, the majority of the enterprises which are covered by the carbon trading scheme build up a consciousness on reducing emissions. However, carbon trading is a new concept, and the progress in the pilots is too fast and negotiation among shareholders is not sufficient. Therefore, some enterprises do not fully understand the meanings and purposes of this policy, and some rejection cannot be avoided, which is reflected by their inactivity in transactions on the carbon market, inactivity of cooperation in the check on carbon emission report and a weak sense of carbon assets management.

So far, enterprises have not built up carbon assets management systems in general. Only a few enterprises have purposefully established carbon assets management companies, which are responsible for the unified carbon assets management for their own business which control emissions. Currently, there are various ways to manage carbon assets in enterprises, in which administrative departments are different, including the financial department, the energy conservation and emission reductions management office, the executive office and the general office. In the meantime, there is a shortage of professional talent. Most enterprises assign department managers or the vice-general managers to be in charge of the carbon trading, with a team usually comprised of engineers or energy and environment administrative staff who do not have the knowledge, experience and confidence to manage trading on the carbon market.

对中国碳市场的展望
An outlook for the carbon market in China

发展中的问题，必然要依靠发展来解决。在当前的顶层设计阶段，通过分析区域碳试点的经验教训，结合全国市场区别于区域市场的特点，力争在公平与效率、流动性和稳定性等方面取得平衡，是推动全国碳市场健康发展的应有之义。

1. 推动“自上而下”和“自下而上”的双重发展路径

尽管碳试点主要是为全国碳市场提供经验，但全国碳市场的建设并不意味着区域碳试点“一刀切”结束，而是允许既包含全国性的二级交易市场，也包括区域性的一级市场以及碳金融市场等。地方政府在后者的建设中应当发挥重要的作用。因此，全国碳市场的构建可存在两条路径：一是自上而下的碳市场。即国家发改委从中央政府的角度构建全国性的减排目标体系、履约体系、MRV体系、市场运行体系、监管体系等，建立统一的市场规则，在新的框架下进行市场交易。二是自下而上的碳市场。即允许区域碳市场获得更大的自主权限，包括与其他非试点区域的连接，与全国碳市场的逐步连接，配额的自主分配，拍卖资金的灵活应用等。

Problems in the development stage need to be resolved. In the current top-level design stage, through analyzing the experience and lessons learnt from the regional carbon pilots, a balance between justice and efficiency as well as between liquidity and stability should be achieved. Balancing these is necessary for the healthy growth of a national carbon market, along with a combination of the different characteristics of a national market and regional markets.

1. Promoting both “bottom-up” and “top-down” approaches

Although the regional carbon pilots are mainly aimed at providing experience for a future national carbon market, building a national carbon market does not mean the regional carbon pilots must come to an end, but rather it allows for the establishment of a national secondary trading market, a regional primary market and a carbon financial market. Because regional governments play a crucial role in the development of the regional primary markets, there are two ways to set up a national carbon market. The first is top-down approach, which means that the National Development and Reform Commission must establish an emission reduction target system, a performance system, an MRV system, a market operating system and a supervision system, make unified market rules from the perspective of the central government and conduct transactions within a new framework. The other is bottom-up approach, which gives independent authorities more access to the regional carbon markets, including linking with other non-pilot regions, gradually linking with national carbon market, independent allocation of allowances, and flexible use of auction money.

2. 制度设计愈加完善，且效果评估及时准确

全国碳市场发展必然要求成立全国碳市场顶层设计工作小组，由相关政府部门、学术界、交易机构、第三方机构以及各试点市场的相关代表组成，形成联合工作机制，在现有区域碳市场发展经验基础上，建立定期评估机制，做好政策效果的评估工作，不断完善顶层设计。有了多层次主体的广泛参与，不仅能使碳交易相关立法层次进一步提高，在较高的立法层面上明确碳排放权权属性质，加强碳交易管理办法的法律约束力，也能够加强与碳税、节能减排政策、新能源政策的协同作用，促使形成共同推进低碳转型的政策组合。在立法和政策协调的基础上，市场的信息披露机制也将得以改善，从而增加政策长期稳定性和市场可预期性，各层次参与者的基础能力建设也将随之逐步提高。

3. 二级市场交易更为活跃，流动性更为充裕

全国碳市场发展必然要求成立全国碳市场顶全国碳市场必然需要通过活跃的交易、充足的流动性才能发现公允的价格，借以实现减排成本的最小化，最终实现减排的根本目标。首先，全国碳市场将在现货交易的基础上，进一步丰富交易产品，通过发展大宗交易（协议交易）、非标准化的衍生品以及更高层次的碳排放权期货和期权产品等，并逐步提高产品的吸引力，在成熟市场中充分发挥衍生品市场的套期保值和发现价格的作用。为市场发展的需要，碳交易平台也将更加便于交易，操作规则也将逐渐简化。另外，随着参与碳交易的主体不断丰富，尤其是逐渐开放个人投资，做市商和经纪服务也会出现并逐渐成熟。

在公共资金机制的支持下，各地可以通过拍卖、财政补贴、社会募集的方式筹集资金，构建地方碳基金体系，并最终形成一支国家气候变化基金和多支区域碳基金并存的格局。国家气候变化基金会发挥引导作用，释放稳定的政策信号，而地方碳基金可以结合区域特点及其优先发展方向，建立符合地方特色的公私合作平台。在碳基金的带动下，各类型金融机构能够开发出包括碳资产抵押贷款、碳债券、碳资产证券化、碳信托、碳保险等产品。

2. Strengthening efforts on top-level design and policy effects assessment

Developing the national carbon market definitely requires the construction of a top-level design working team, which comprises related government departments, academic circles, trading agencies, third parties and related representatives from various pilot markets to form a coordinating work mechanism. Based on the experience in the regional carbon markets, a regular appraisal mechanism should be established, while appraisal work on policy effects should be undertaken and top-level design needs to be constantly perfected. Multi-level subjects’ involvement not only enables related legislative levels with carbon trading to be further improved, on which the nature of carbon emission permits can be identified and the legal binding of carbon trading administrative methods can be strengthened, but it also consolidates synergy with carbon tax, energy conservation and emission reduction policy, and renewable policy, so as to promote the synergy to transit to a low-carbon economy. On the basis of the balance between legislation and policies, the market information disclosure mechanism will be improved and, as a result, long-term policy stability and predictability of the market and construction of the basic abilities of multi-level participants can be gradually enhanced.

3. Increasing the liquidity of the secondary market

Fair prices can only be found by virtue of active transactions and sufficient liquidity in the national carbon market, through which emission reduction costs can be minimized to achieve the basic target of cutting emissions. At first, based on spot transactions, the national carbon market can further enrich trading goods through developing block trades (trades by agreement), non-standard derivatives, futures of carbon emission permits and option products at higher levels. Meanwhile, attractions of products should be gradually increased, and the roles of hedge and price discovery of the derivatives market in the mature market should be fully played. To meet the development of the market, the carbon trading platform should be more convenient for trading, and its operating rules should be simplified. In addition, with constantly abundant subjects involved in carbon transactions, especially gradually extending personal investment subjects, market makers and brokerage services will come into being and will gradually mature.

With the support of a public capital mechanism, regions can raise money by means of auction, subsidy and raising funds from the public to construct regional carbon foundation systems for the final purpose of forming a structure in which a national climate change foundation coexists with regional carbon foundations. The former can play the leading role, sending stable signals on policies, while the latter can set up a cooperation platform between public and private subjects in line with local characteristics in association with regional characteristics and its own prior development direction in the region. With the leadership of a carbon foundation, various types of financial agencies can develop such products as carbon assets mortgage, carbon bonds, carbon assets securitization, carbon trusts and carbon insurance.

图片来源：碳捕集与封存全速发展，www.consulfrance-chengdu.org

中国区域碳市场发展评述
A Review of China's Regional Carbon Markets

王 遥
YAO WANG

王遥，教授，博士生导师，毕业于中央财经大学金融学院。中央财经大学气候与能源金融研究中心主任，澳大利亚南昆士兰大学和维多利亚大学兼职教授。研究领域为低碳经济、气候金融及绿色资本市场。

Professor Yao Wang is the director of the Research Center for Climate and Energy Finance (RCCEF), Central University of Finance and Economics(CUFE). She is also the Adjunct Professor of University of Southern Queensland, Australia, and University of Victoria, Australia. She is interested in low carbon economy, climate finance and green finance.

经国家发改委批准，北京、天津、上海、重庆、湖北、广东、深圳“两省五市”自 2011 年起开展碳排放权交易试点工作。目前，深圳、上海、北京、广东和天津完成了第一年的履约。毋庸置疑，区域碳交易试点在一定程度上实现了市场化减排的目标，各地在政策法规、技术标准、市场运行等方面进行了不同的尝试与探索，奠定了坚实的技术基础和能力，碳市场定价功能也初步实现，但同时试点过程中发现的一些问题也值得关注和反思。

The National Development and Reform Commission approved carbon emission trading pilots in Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong and Shenzhen in 2011. By far, Shenzhen, Shanghai, Beijing, Guangdong and Tianjin have completed the first year's compliance. There is no doubt that to some degree regional carbon emission trading pilots have achieved market-oriented emission reductions target, and that all regions are carrying out various trials and explorations in aspects of policies and regulations, technological standards and market operation. Trials and explorations have laid a solid foundation of technologies and abilities and shows that the pricing function of carbon market starts to work. However, some problems around continuing with these pilots should be noted and reflected upon.

对中国碳市场的展望
An outlook for the carbon market in China

当前，各试点地区均设计了整套碳交易体系，包括覆盖范围、总量和配额分配、核算体系、注册登记系统、交易系统、信息披露、市场监管等一系列核心机制。然而，碳交易制度是一项非常复杂的政策体系，而我国碳试点自 2011 年底开始部署到 2013 年市场启动，在缺乏基础的前提下准备不够充分，大部分试点的启动均较为仓促，主要问题表现在：

第一，缺乏政策连续性

由于准备工作并不完全充分，政策设计、能力建设等基础工作不够扎实。一些试点在第一年履约期后，频繁修订相关政策和调整交易制度，缺乏政策连续性。

A set of carbon trading systems has been designed in all trial regions, which consist of a series of kernel mechanisms, including coverage areas, cap and allowance allocation, an accounting system, a registration system, a trading system, information disclosure and market supervision. The carbon trading system is a complex system of policies, and if preparations are not well made on the condition of a lack of basis, the operation of most of pilots consequently tend to be hasty. Major problems are shown as follows:

1. Discontinuity of policies

planning and capacity building, some pilots frequently revise related policies and adjust trading rules after one year of compliance,

第二，法律约束力较弱

碳交易得以实施的基础是必须要有强制法律约束力的保障。在立法层次方面，各试点地区中只有深圳、北京和重庆通过了地方性立法，对排放单位的约束力相对较强，而其它试点地区相对立法层次较低，基本以政府规章为主进行规制。从对未履约情况的处罚力度来看，各试点总体处罚力度较弱，有的试点处罚仅限于限期改正和中止享受地方优惠政策，其他试点地区使用的罚款措施的惩罚力度也较为有限。

第三，碳排放统计核算数据基础差

碳交易得以实施的基础是必须要有强制法律约束力的保障。在立法层次方面，各试点地区中只有深圳、北京和重庆通过了地方性立法，对排放单位的约束力相对较强，而其它试点地区相对立法层次较低，基本以政府规章为主进行规制。从对未履约情况的处罚力度来看，各试点总体处罚力度较弱，有的试点处罚仅限于限期改正和中止享受地方优惠政策，其他试点地区使用的罚款措施的惩罚力度也较为有限。

第四，碳市场信息不透明

当前各碳试点均存在信息不透明的问题，主要表现在纳入企业排放数据、配额总量的确定、配额分配方案、交易数据等信息的不透明，其原因在于企业、地方政府和交易所均不愿意把相关数据公布于众，使得市场政策性明显，同时也大大增加了交易成本，降低了交易效率。

第五，市场监管体系尚未健全

目前，监管部门存在“重设计，轻监管”的现象，一直在忙于出台政策、应付问题，无论是对市场主体，还是交易行为，都缺乏完善的市场监管体系，其中包括对市场参与方资质的认证、管理和监督，以及对内幕交易、市场操控等违规行为的识别、防范及处罚等。

leading to discontinuity of polices.

2. Weak legally binding legislation

Conducting carbon trading must be based on the protection of enforced legally binding legislation. In respect of legislative level, among those pilots, only Shenzhen, Beijing and Chongqing, have passed local legislation, in which binding effects on emission units are relatively strong. The legislative level is relatively lower in rest of the pilots which are generally governed through government regulations. In terms of the intensity of punishment against compliance failures, it is generally weak in all the pilots. Punishments are limited to correction within a time limit and the ineligible for regional preferential policies in some pilots, while very limited fine payments are used in other pilots.

3. Poor data

Before conducting carbon trading pilots, China had no accounting system on greenhouse gas emissions at an enterprise level, therefore in the early stage all pilots were faced with the problem of a shortage of historical data. Most of the pilots had access to some data through seeking out historical data on emissions. But due to the relatively poor quality of the recalled data and uneven quality and disparate standards of verification institutions, related policies based on the data might be inaccurate.

4. Lack of transparency of carbon market information

So far, a lack of transparency of information exists in all pilots, which is reflected by the lack of transparency of emission data, the confirmation of total allowance, the allowance allocation plan and trading data from enterprises which are classified into a system that controls emissions. The reason is that enterprises, local governments and exchanges are all unwilling to release related data, which makes a policy-driven market, and meanwhile significantly increases trading costs and reduces trading efficiency.

5.Underdeveloped market supervision system

In supervision agencies, supervision system design is emphasized while supervision is overlooked. They focus on introducing policies and dealing with problems rather than developing sound market supervision system for market participants or for transactions. A sound market supervision system should include verification of qualification, administration and supervision of market participants and recognition, precaution and punishment targeted at illegal behaviors such as insider trading and market manipulation.

配额分配方法有所创新，但仍存困局

There exists innovation in allowance allocation methods, but it is still faced with predicaments.

配额分配是碳交易体系中的第一大难题，其代表的是控排单位在履约年度的排放权利，是交易的主要标的物，如何分配决定了控排单位的减排和履约成本。除重庆采取自主申报的分配方法，其余六个试点针对三大主流配额分配方法，即历史法、基准法和拍卖法，各自进行了有益地尝试和创新。主要经验及问题在于：

第一，历史法的显失公平

除了重庆和深圳试点以外，其余五个试点都选用了基于历史排放强度或历史排放量的免费分配方法。该方法具有操作简单、MRV运行效率高、控排单位初始成本减排较低等优点，但也带来了显著的公平问题，例如行业景气周期发生结构性变化导致配额分配不公，未考虑早期减排行动和企业检修、事故意外等突发情况等问题。对此，各试点主要通过事前限定和事后调整两种途径进行尝试和探索，但效果并不十分明显，甚至造成了新的不公平现象。

Allowance allocation is the greatest challenge in the carbon trading system. It symbolizes in compliance years the emission permit of emission entities and is a main issue in trading. How to allocate allowances decides the emission reduction costs and performing costs of emission entities. Except for Chongqing which uses an independent declaration method, the other six pilots are targeted at three main allocation methods, consisting of the historical method, the benchmark method and the auction method. The pilots conduct helpful trials and innovation. Key experiences and major problems are as follows:

1. Obvious unfairness of the historical method

Except pilots in Chongqing and Shenzhen, the other five pilots chose a free allocation method based on emission intensity or historical emissions. Although it has advantages such as easy operation, high operational efficiency of MRV, and low initial emission reduction costs for the emission entities, an obvious issue is about fairness. For example, structural changes during industry business cycles leads to unfairness in allowance allocation, and emission reduction actions in

第二，基准法的主观因素影响

深圳是唯一全面采用基准法的试点，对电力、供水、燃气三个行业采取基准值方法进行配额分配；对制造业及其他工业行业探索建立了基于价值量的碳强度指标（单位工业增加值碳排放）。其他试点在基准法方面的尝试还局限于电力和热力行业，以及其他个别行业。基准法最大的优点是体现了行业内的公平性，鼓励企业的能效和减排行动；缺点在于难度较大、主观因素相对影响较大。目前，电力行业基准法在试点中应用最广，但也存在不同地区、不同基准的情况，以及激励作用发挥受限的问题。

第三，拍卖机制设计不够灵活

拍卖被认为是最有利于价格发现的分配方式，但同时拍卖会增加企业的履约成本，其可接受度在市场建设初期并不高。这一点在广东试点反应明显，“门票制度”（需先拍卖 3% 有偿配额获得“入场门票”，再获得 97% 免费配额）提高了企业参与碳市场的门槛，一次性支付 3% 的配额资金也遭致了较强的抵制。目前，广东已优化拍卖制度，取消“门票制”，大幅降低拍卖底价，并允许非控排企业参加拍卖。湖北、上海和深圳也各进行了一次拍卖。其中，湖北是公开竞价拍卖政府预留配额的 30%，使非控排企业获得一级市场进入渠道。上海和深圳都是为了帮助企业完成清缴而进行拍卖，上海的拍卖底价设为拍卖前 30 个交易日成交均价的 1. 2 倍，这一措施促进了企业积极参加二级市场交易实现履约。与之相反，深圳是市场价的对折拍卖，却并没有吸引到足够的控排企业参与。

the early stage and emergent situations such as maintenance of enterprises and accidents are not taken into account. As part of this, all the pilots conducted trials and exploration through putting in place constraints beforehand and adjustments hereafter. But the effects are not significant, even resulting in more unfairness.

2. Subjectiveness of the benchmark method

Shenzhen is the only pilot fully applying the benchmark method to allocate allowance in power, water supply and residential gas sectors. It sets up a carbon intensity index of carbon emissions per industrial added value for manufacturing and other industries. Trials in the other pilots of the benchmark method are limited to the power sector, heating industry and other industries. The biggest advantage of this method is the reflection of fairness within an industry, and it encourages the improvement of energy efficiency and emission reduction of enterprises, while its disadvantages lie in impacts of subjective factors. At present, the benchmark method in the power sector is the most widely used method in pilots, but there are also problems (e.g. different standards in different regions and limited effects of incentives).

3. Inflexible design of auction mechanism

The auction method is considered as the most favorable allocation method for price discovery. However, the compliance costs of business increase in the use of the auction method, and moreover, its acceptability is not high in the early stage of market construction, which is evident in Guangdong pilot. The “ticket system” (need to firstly auction 3% allowance for obtaining the "entrance ticket", then get the 97% free allowance) increases the threshold of enterprises participating in the carbon market, and paying the fund of 3% allowance one-time leads to their strong resistance. Guangdong currently optimizes the auction mechanism and the “ticket system” has been abolished, in which floor price are significantly reduced and non-emission

entities accessible to the auction for 30% of allowances reserved by the government. Both Shanghai and Shenzhen auctions help enterprises accomplish settlement and payment, in which Shanghai set the base price at 120% of average trading price in advance of 30 trading days. This measure facilitates enterprises to actively participate in transactions in the secondary market, so as to ensure compliance. In contrast, the Shenzhen auction does not attract sufficient participation of enterprises that control emissions, which is an auction with the half price on the market.

市场规模和价格区间形成，但流动性不足且碳价信号不准确

Market scale and price range are shaped, but liquidity is not sufficient and signals on carbon prices are inaccurate.

经过一年的运行，各试点地区二级市场已初具规模，市场整体价格波动幅度基本处于 20 元 / 吨到 70 元 / 吨之间，这对未来全国碳市场的价格波动区间有很强的示范作用。但是，流动性严重不足的问题，同时也影响到碳价的准确性。

第一，流动性严重不足

自启动之日至 2014 年 8 月 22 日，各试点地区的交易量总计不足 1300 万吨，交易额总计不足人民币 5 亿元。目前各试点的配额适用范围仅限本地区，总量大小和配额发放松紧直接影响该地区的交易活跃度，且市场上交易品种单一。截至 8 月 22 日，CCER 尚未投放市场，而且各试点地区均限制了抵消比例，预计 CCER 交易量非常有限。

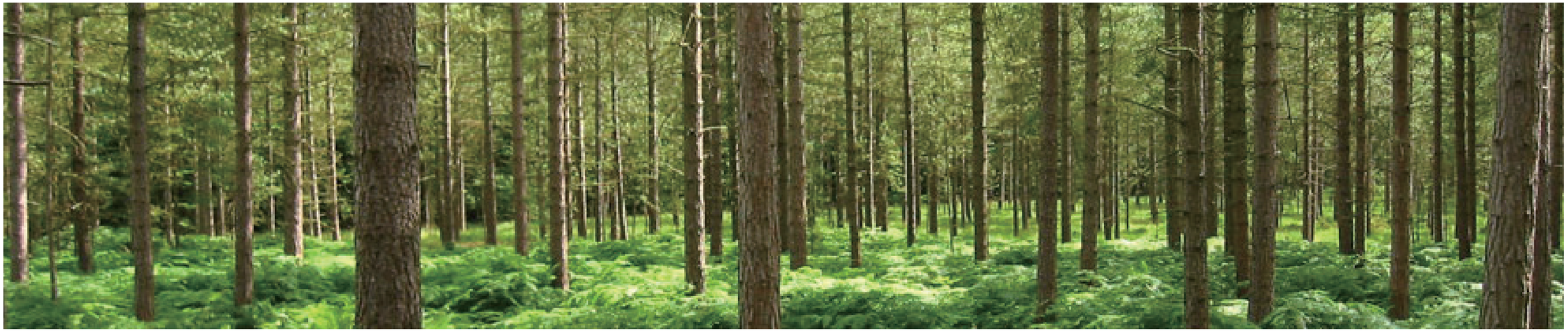
另外，目前市场参与者多集中于控排企业，控排企业属于实体产业，对交易的接受度较低，企业内部管理流程也限制了其参与交易的积极性。虽然试点地区基本均已对投资机构开放，但碳市场的不确定性以及微弱的流动性导致投资机构保持观望态度。除了率先引入个人投资者，深圳近期成功引入境外投资机构，但深圳在试点地区中市场总量最小，恐难以大规模地提高交易量。

Though a year of operation, secondary markets in pilot regions have taken shape, where fluctuation in integrated prices mainly ranges from 20 yuan to 70 yuan a ton, which sets a good example for price fluctuation ranges for a national wide carbon market in the future. A serious shortage of liquidity also impacts the accuracy of carbon prices.

1. Severely short of liquidity

From the launching of the carbon trading market to August 22, 2014, trading volumes come up to less than 130 million tons, less than 500 million yuan in total in all pilots. Allowances in each pilot are only applicable for the region. Moreover, total quantity and the extent of allowance issuance is directly decided on the activity of trading in the region, and there is just one single trading category on the market. Until August 22, CCER has not been put on the market, and all pilots make restraints on the proportion of offsets. It is predicated that the trading volume of CCER is very limited.

In addition, current market participants are mainly emission enterprises. Those enterprises are entity industry that have low acceptability for trading, and their participation in transactions is restrained by their own management process.



第二，碳价信号不准确

目前各试点地区价格悬殊，截至 2014 年 8 月 22 日，市场价格最高达到 130. 9 元 / 吨（深圳），最低为 20. 74 元 / 吨（天津），成交均价最高为 70. 2 元 / 吨（深圳），最低为 29. 6 元 / 吨（天津）。从价格波动上来看，深圳波动幅度最大，达到 +80%~-62%，上海和北京市场波动幅度相对较小。各试点省市基本将履约期设定在每年 6 或 7 月份，2014 年履约前最后一个月的成交量占总成交量的比重，除天津之外均超过了 65%，这说明大部分交易集中发生在最后一个月，以履约为主要目的，交易集中度过高，市场有效性不足，难以形成公允的价格。

企业减排意识增强，但碳资产管理意识依旧薄弱

通过各地碳试点的交易规则的制定、推广和能力建设，以及一年多的交易，绝大多数纳入控排体系的企业初步树立了减排意识。但企业对碳交易政策意义的理解仍需要一个过程，不仅体现在参与碳市场交易不够活跃，碳资产管理意识也十分薄弱。目前企业普遍未建立有效的碳资产管理体系，只有少数企业专门成立了碳资产管理公司，对集团下的控排企业的碳资产进行统一管理。但是，目前企业对碳资产存在不同的管理方式，管理职能划分和管理人才专业化程度都不利于充分挖掘碳资产价值，制约了企业参与市场交易的积极性。

Although pilots are generally open to institution investors, uncertainty of the carbon market and poor liquidity result in a wait-and-see attitude. Besides the initial introduction of individual investors, Shenzhen recently successfully introduced overseas institution investors. But Shenzhen is the smallest of all the pilots in terms of market volume, and it is difficult to increase trading volume on a large scale.

2. Inaccurate signals on carbon prices

Carbon prices are currently disparate in all the pilots. Until August 22, 2014, the highest price on the market reached 130.9 yuan/ton in Shenzhen, while the lowest price on the market was 20.74 yaun/ton in Tianjin. As for average transaction prices, the highest price was 70.2 yuan/ton in Shenzhen, while the lowest price was 29.6 yuan/ton in Tianjin. In terms of the price fluctuation range, Shenzhen has the biggest fluctuation range at +80%~-62%, while those in Shanghai and Beijing are relatively smaller. All the pilots generally set their own periods of performance to June or July. Except Tianjin, trading volume in the last month before the period of performance in 2014 accounts for more than 65% of total trading volume, which indicates that the majority of transactions occurred in the last month, meaning the main purpose of transaction is compliance. High transaction concentration leads to poor market efficiency, and consequently, fair prices cannot easily be formed.

The awareness of emission reductions of enterprises is strengthened, but the awareness on carbon asset management is still weak.

Through developing and generalizing trading rules, capacity building in all the pilots and trading carbon in more than a year, the majority of enterprises which are covered by the pilots initially build up a consciousness on reducing emissions. But it takes time for enterprises to understand carbon trading policies, which is reflected by inactivity in carbon market transactions and weak consciousness on carbon asset management. So far, enterprises have not built up carbon asset management system in general. Only a few enterprises have established carbon assets management companies, which are responsible for the unified carbon asset management for their sub-enterprises. Currently, there are various ways to manage carbon asset in enterprises. The division of management functions and the specialization of management personnel are not helpful in fully exploring values of carbon assets, which restricts participation willing of enterprises in market transactions.

图片来源：(europeanclimatepolicy.eu)
SOURCE:(europeanclimatepolicy.eu)

中国碳市场试点：启示与建议

China's Pilot Carbon Trading: Insights and Suggestions

陈 波
BO CHEN

陈波，中央财经大学气候与能源金融研究中心主任助理及碳金融实验室负责人，国家发改委国际合作中心低碳经济研究室副主任。中国人民大学经济学博士 ,爱丁堡大学碳金融硕士(志奋领学者)，浙江大学控制科学与工程硕士。

Bo Chen, senior fellow and Director Assistant of Research Center for Climate and Energy Finance(RCCEF),Central University of Finance and Economics(CUFE). He holds a PhD in Economics at Renmin University of China and two master degrees in Carbon Finance at University of Edinburgh (Chevening Scholar) and Control Engineering at Zhejiang University.

自2013 年 6 月份深圳排放权交易所正式开盘交易以来，我国 7 个试点碳交易市场相继投入运行。各个试点规则设计差别较大，成交量和交易额也有较大差别，呈现出多元化的区域碳市场发展格局。其中深圳和上海是二级交易最为活跃的市场，累计成交量均超过 150 万吨，深圳成交额超过 1 亿元，是交易量最大的市场。各市场成交均价在 29. 6–70. 8 元 / 吨之间，呈现出较大的成本差异。尽管各个市场在要素设计上存在显著的不同，但存在一些共性的问题亟待解决。

Since the start of the Shenzhen carbon trading pilot in June 2013, there have been 7 pilot carbon trading markets in operation in China. There are significant difference in trading volumes and turnovers due to the obvious difference of various pilot rules, presenting a diversified pattern of regional carbon market development. Among these carbon trading markets, Shenzhen and Shanghai markets have the most active secondary trading markets, the cumulative trading volume both exceeded 1.5 million tons, Shenzhen is the largest trading market for its turnover more than 100 million yuan. The average transaction prices of various markets are between 29.6 yuan/ton and 70.8 yuan/ton, which presenting obvious cost difference. Although there is significant difference on element design in various markets, there are some common problems to be solved.

碳价格范围日益明朗

试点市场已经初步探明了未来全国碳市场的合理碳价格区间。对六个试点碳市场 2014 年的价格波动情况的分析表明，各个试点碳市场的价格波动幅度基本上处于 20 元 / 吨到 90 元 / 吨之间，这意味着未来全国碳市场的价格很可能也处于该区间内。我们进一步对控排企业进行了成本分析，发现：在不采取拍卖的情况下，企业承担的碳成本如果高于 90 元 / 吨，则会对其利润和现金流产生重大影响，显著影响企业的竞争力；如果采取少量拍卖（如 3%），则该价格调整为 60 元 / 吨。同时，值得关注的是 20 元 / 吨已经成为各个试点碳市场心理底线，在这个价格的支撑力较强，企业承受的成本压力较小。

20 元 / 吨对未来碳税的实施也会产生重要的影响。尽管碳税和碳交易是两个不同的政策路线，但是从效率和公平上来讲，碳税相对于碳交易是一个重要的补充。例如，全国碳市场实施之后，由于覆盖范围的限制，可能会扭曲控排企业和非控排企业之间、国内与国外企业之间的竞争力。碳税可以对此进行有效的补充，使得非控排企业纳入到减排体系之中，而 20 元 / 吨可以成为未来碳税征收的重要基数。

The Range of Carbon Price Increasingly Clear

Pilot markets have preliminarily proved the reasonable range of carbon price for future national program. The analysis of price fluctuations in 2014 of these six pilot markets show that the price fluctuation range of various markets are basically between 20 yuan/ton and 90 yuan/ton, which means the price of future national carbon market is likely at this range. We further conducted the cost analysis to emission-control enterprises and found that: In the case of no auction, if the carbon cost enterprises born more than 90 yuan/ton, that will heavily influence their profits and cash flows and significantly impact the competitiveness of enterprises; in case of a few auction (for example 3%), the price is adjusted to 60 yuan/ton. Meanwhile, it is notable that 20 yuan/ton has become the psychological bottom line of various pilot carbon markets.

历史法对市场公平产生较大影响

由于数据条件约束，大多数控排企业实际上仍然以历史法为主，这些企业普遍反映采用历史法导致配额分配与实际情况差距较大，其主要原因有三类：

第一，行业景气周期发生结构性变化。在基准年前后，钢铁和水泥行业较为萧条，停产停工现象较为突出，而电力行业恰恰相反，处于满负荷运行阶段。因此导致钢铁和水泥行业配额分配较紧，电力行业分配较松。当前，钢铁与水泥行业处于利润较低甚至亏损阶段，无法承担较高的履约成本。排放密集型行业的经营状况发生了很大的逆转，导致企业碳成本承受能力发生变化，使得部分企业面临较大的困难。

第二，早期减排行动未被考虑，导致“劣币驱逐良币”。被调研的许多国有企业和外资企业，在“十一五”和“十二五”期间已经进行了较多的节能改造活动，进一步减排的空间相对较小，成本较高。这些早期的贡献并未在配额分配方案中考虑，使其获得较少的配额。此外，一些环保类项目能耗较高，导致当前排放增加，与碳减排政策产生了一定的冲突，也制造了一定的不公平性。

第三，企业检修、事故意外等突发情况未被考虑。大部分生产型企业每 2–3 年进行一次大规模检修，检修时间 1–3 个月不等。而如果采用历史法计算平均值时，若未将其剔除，使得配额分配过少。此外涉及能源安全的行业，如石化等，会面临政府安排的计划外生产任务，使得企业面临额外的排放成本。

历史法虽然提高了监测报告核查体系（MRV）的运行效率，降低了初始成本，但是带来了显著的公平问题，极大增加了市场运行成本。这些公平问题一部分是由于经济周期等外部客观因素造成的，一部分则是因为

The price of 20 yuan/ton will also have vital impact on the future implementation of carbon tax. Although carbon tax and carbon trading are two different policies, in terms of efficiency and fairness, carbon tax relative to carbon trading is an important supplement. For example, after the implementation of national carbon market, it could distort the competitiveness between emission entities and non-emission entities, domestic and foreign enterprises because of the limitation of coverage. A carbon tax can effectively supplement to this, it makes small entities be incorporated into ETS, and the price of 20 yuan/ton can be the basis for carbon tax.

Grandfathering Distorted Market Fairness

Due to data constraints, most emission entities actually still are given priority to grandfathering, these entities generally reflected that the use of grandfathering resulted in great difference between allocation and actual situation, its main reason has three categories:

First, economic situation has structural changes. Before and after the base year, steel and cement industries are relatively depressive, production stoppage phenomena are serious, and on the contrary, the power industry in the stage of full load operation. Therefore, it leads to the allowance allocation for steel and cement industries are tighter, and the allocation for power industry is looser. At present, steel and cement industries are in the stage of lower profits or even losses, unable to bear the high carbon cost. The operation of emission-intensive industries is reversed, making enterprises face greater difficulties.

Second, early actions to reduce emissions are not considered, which leads to 'bad money drives out good money'. Many investigated state-owned and foreign enterprises have conducted many energy saving renovation activities during the period of 11th FYP and "12th FYP, the space of further reduction is relatively small, and the cost is higher. These early contributions were not considered in the allowance allocation, leading to fewer allocation. In addition, some environmental

MRV 方法学体系缺乏自我纠错机制，无法适应复杂的企业状况。不合理的分配结果贡献了市场上的部分交易量，个别企业甚至抱怨其交易活动完全是由于分配不合理造成的。

企业风险偏好影响其交易行为

国有企业在参与一级市场和二级市场上的意愿明显不同。国有企业普遍将参与一级市场有偿分配活动视为政治义务，而对二级市场的交易活动缺乏积极性。除极少数具有碳资产管理意识的企业外，国有企业内部复杂的管理决策流程和风控手段，降低了其参与二级市场的灵活性和可行性，这一局面短期内无法解决。这意味着在国有企业主导的碳市场中，一级市场相较二级市场更具有吸引力。

protection projects with high energy consumption show some conflicts with carbon emission reduction policy, distorting fairness.

Third, the operating emergencies of enterprises such as maintenance, accident are not considered. Most manufacturing enterprises proceed a major overhaul every 2 to 3 years for 1 to 3 months. And in case of using grandfathering to calculate the average value, it makes the allowance allocation too few. In addition, the industries involved in energy security, such as petrochemical, etc., will face the unplanned production tasks assigned by the governments, which implementing additional emission cost.

Though grandfathering improves the efficiency of MRV system, it has brought remarkable fairness problems, greatly increased the market operating cost. Part of these fairness problems are caused by the external objective factors, such as economic cycle, and partly because the MRV methodology system lacks of self-correcting mechanism and cannot adapt to economic changes. Unreasonable allocation methodology has also contributed part of the trading volume to the market, individual companies even complain their trading activities are caused by unreasonable allocation entirely.

Enterprises' Risk Preference Affect Their Trading Behavior

The motivation is significantly different when state-owned enterprises participate in the primary market and secondary market. State-owned enterprises prefer the auction in the primary market as social responsibility whilst lacking of enthusiasm for secondary market trading. Except few enterprises with carbon asset management consciousness, the complex management and decision-making process of the state-owned enterprises, has reduced the flexibility and feasibility of participating in the secondary market. This situation cannot be resolved in the short term. This means that in the carbon market led by state-owned enterprises, the primary market is more attractive than the secondary market.

由于国有企业在碳市场的主导地位，其风险偏好显著影响到了参与二级市场的积极性。在调研中，我们发现控排企业参与二级市场存在以下障碍：担心未来配额不足，希望留存配额，生产型企业普遍担心未来配额紧缺，因此倾向于储蓄现有的配额共未来使用；普遍未建立有效的碳管理体系，只有少数企业成立了工作小组，应对政策风险，但是这些工作小组并未获得授权进行二级市场的交易；缺少专业性人才，大部分企业指派部门经理或者副总经理负责，由工程师或能源环保管理人员构成，这些人员缺乏参与市场交易的知识、经验和信心；政策不稳定，使得参与市场的风险较大，过高的风险迫使各个企业采取了观望的态度，决策人员不愿承担潜在的风险和责任。

目前的场内交易进入了一个恶性循环：由于市场缺乏流动性，企业认为市场风险过高采取观望态度，这又进一步加剧了市场不活跃的问题。要从根本上破解流动性不足，必须要进行市场的深入改革，在短期内，试点碳市场的场内交易仍将处于不活跃的状态。我们建议重点完善协议交易或大宗交易市场，开发远期合约，为企业提供更加灵活的履约工具。

Because of the leading role that state-owned enterprises in the carbon market, their risk preferences significantly affects their positivity of participating in the secondary market. We found the following barriers when emission-control enterprises participate in the secondary market:

(1)Worrying about the allowance insufficiencies in the future and hope to keep them;

(2)Having not established effective carbon management systems. There are only a few enterprises setting up the carbon management team but they have not been authorized to trade in the secondary market;

(3)Lacking of professional staff. Most enterprises designate engineers or energy environmental protection management staff to take charge of it and these staff lack of knowledge, experience and confidence of participating in trading;

(4)Policies are not stable. It leads high risks in participating in the market, forcing companies take a wait-and-see attitude, and decision makers are reluctant to undertake the potential risks and responsibility.

The secondary market has entered a vicious cycle: As the market lack of liquidity, enterprises take a wait-and-see attitude because they considered that the market risk is too high, which further exacerbated the problem of market inactiveness. To fundamentally resolve liquidity shortage, we must undertake in-depth reform of the market, but in the short term, the secondary market of the pilot carbon markets will remain in low liquidity.

全国碳市场发展要点
Key Issues on Rolling out China's National Carbon Market

饶 若水
RUOSHUI RAO

饶若水，中国科学技术大学硕士，中央财经大学气候与能源金融研究中心研究人员，拥有碳市场或低碳领域近七年工作经验。

Ruoshui Rao, Master of University of Science and Technology of China, Research fellow of Research Center for Climate and Energy Finance in Central University of Finance and Economics, owning nearly 7-year work experience in carbon market or low carbon.

自2013年6月18日深圳碳交易启动起算，中国碳交易试点已运行一年有余。毋庸置疑，我国碳交易试点在一定程度上实现了市场化减排的目标，在政策法规、技术标准、市场运行等方面进行了不同的尝试与探索，积累了宝贵的经验。几乎与试点同步的是，全国碳市场建设已迅速提上日程，将于2016年在全国范围内试运行。在当前的顶层设计阶段，通过分析区域碳试点的经验教训，结合全国市场区别于区域市场的特点，全国碳市场将着力在公平与效率、流动性与稳定性、政策可接受性与实践可操作性等方面取得平衡。

Carbon trading pilot has been running in China for more than one year, since carbon trading started in Shenzhen on June 18, 2013. There is no doubt that China's carbon pilots contribute to achieving the target of emissions reductions as the market mechanism. Seven pilot regions made different trials and exploration, and accumulated valuable experience in terms of cap-setting, allowance allocation, MRV trade and etc. Meanwhile, the construction of national carbon market is quickly placed on the agenda. It's forecasted that national carbon trade will run in test in 2016. In the current top-level design stage, it's significant to the healthy development of national carbon market that the balance between fairness and efficiency, between liquidity and stability, and between policy acceptability and practice feasibility could be sought for through learning the lessons from regional carbon pilots and analyzing the differences between regional and national markets.

一、中央与地方双管齐下构建多层次的全国碳市场
Firstly, the multilevel national carbon market must be constructed.

尽管碳试点主要是为全国碳市场提供经验，但并不意味着全国碳市场的建设需要根本性地结束区域碳试点。相反，全国碳市场应当是一个多层次的市场体系，既包含全国性的二级交易市场，也包括区域性的一级市场以及碳金融市场等。地方政府在后者的建设中应当发挥重要的作用。为了有效处理好当前试点市场如何与全国碳市场对接的问题，应允许地方政府具有一定的灵活性。

因此，全国碳市场的构建可以从两个方向同时着手：一是中央统筹安排下形成的碳市场。即国家发改委从中央政府的角度构建全国性的减排目标体系、履约体系、MRV体系、市场运行体系、监管体系等，建立统一的市场规则，在新的框架下进行市场交易。二是整合区域碳市场而形成的全国性碳市场。即允许区域碳市场获得更大的自主权限，包括与其他非试点区域的连接，与全国碳市场的逐步连接，配额的自主分配，拍卖资金的灵活应用等。

在这一市场结构的构建过程中，必须要平衡中央与地方权力的合理分配，既要统一配额非配规则，又要赋予地方政府灵活分配配额的权力。同时，还要解决现有试点碳交易所转型问题，在建立全国碳交易所后，试点交易所可考虑发展为地方拍卖平台，或转型为碳金融服务机构。

Although the main purpose of the regional carbon pilots is to provide experience to the national carbon market, it doesn't mean that the construction of the national carbon market must lead to the closure of the regional carbon pilots. In contrast, the national carbon market should be a multilevel market system which includes not only national secondary trading market but also regional primary market and carbon finance market. The local government should play an important role in the construction of the carbon finance market. In order to effectively deal with the problem of how the current regional pilot markets can link with the national carbon market, local governments should be allowed to have some flexibility.

Therefore, the construction of the national carbon market could start simultaneously from two directions. The National Development and Reform Commission can build the national system in terms of emissions reductions target, compliance mechanism, MRV system, market operation system, the regulatory system, and from the perspective of the central government, the establishment of unified market rules and market transactions in the new framework. In the process of building this market structure, the distribution of power between central and local government should be balanced, not only to unify with the rules of non-quota, but also to give local governments the power to allocate the quota.

二、建立配套的制度设计及效果评估体系
Secondly, mechanism design and evaluation system must be improved

（一）建立顶层设计工作小组

碳市场机制设计决定了未来碳市场能否健康发展，而决策者不仅要对碳市场有深刻认识，还要熟悉经济、金融以及市场运作。全国碳市场需要由相关政府部门（国家发改委和试点发改委、证监会、财政部等）、学术界、交易机构（包括控排企业和投资者）、第三方机构以及各试点市场的相关代表共同参与，形成联合工作机制，在现有区域碳市场发展经验基础上，建立定期评估机制，做好政策效果的评估工作，不断完善顶层设计。

（二）加强法律约束力

尽早出台碳交易立法，并在该法约束下，对碳排放权进行确权，增强碳交易管理办法的法律约束力，提高违约成本。同时严格市场的信息披露机制，提高市场透明度，增加政策长期稳定性和市场可预期性，包括政策设计、配额数量、排放数据、交易数据等。

I. Setting-up the top-design working group

Carbon market mechanisms determine the future of the healthy development of the carbon market, so policy-makers should not only have deep understanding of the carbon market, but also be familiar with the economic, financial and market operations. The national carbon market needs the relevant government departments (National Development and Reform Commission, Local Development and Reform Commission in pilot regions, China Securities Regulatory Commission, and the Ministry of Finance, etc.), academia, trade organizations (including controlled discharge companies and investors), third-party agencies and relevant representatives to participate in the pilot markets to form a joint working mechanism. Based on existing regional development experiences, this allows for regular evaluation of the mechanism and assessment of policy effectiveness, and for constant improvement of the level design.

（三）协同其他政策工具

一是与碳税的协同。碳交易和碳税是两种碳定价手段，各有优劣，可以进行混合设计，碳交易没有覆盖的行业，可以考虑利用碳税进行调节。

二是与节能减排政策、新能源政策的协同。避免各政策之间互相掣肘，同时在机制设计上注重各政策互相促进的效果，形成共同推进低碳转型的政策组合。

II. Strengthening the legally binding force

Carbon trading legislation must be completed as early as possible. Under the legislation the emissions rights and the default cost should be verified and clarified. Meanwhile the information disclosure mechanism of the market must be perfected to enhance market transparency and increase long-term stability and predictability of the policy including quota, emissions data and transaction data.

III. Harmonizing with other policy instruments.

Carbon trading could harmonize with the following policy instruments:

1.With carbon tax. As the carbon pricing instruments, carbon trading and carbon tax have their advantages and disadvantages. Carbon trading could be supplemented with carbon tax. Carbon tax can adjust the small emitters which are not covered by carbon trading.

2.With energy-saving & emissions-reducing policy and new energy policy. To avoid potential conflicts among these policies, we must focus on the synergistic effect of various policies in the mechanism design to promote low-carbon transition.

三、设置富有充足弹性的总量控制
Thirdly, the quality of emissions data must be improved.

中国仍处在工业化中期，“共同但有区别责任”决定了中国在短时间内不需要承担明确的绝对减排量。但没有逐渐收缩的总量控制就难以创造出排放的稀缺性，国内碳市场便难以形成。借鉴于欧洲的经验教训，要注意以下两方面：

Emissions data is the foundation of carbon market, which not only has impact on the living space and development rights of the firms, but also the achievement of energy-saving & emissions-reducing target in the nation.

图片来源：(qdcaijing.com)
SOURCE:(qdcaijing.com)

I. Accuracy.

From technical perspective, MRV standards can stand up and emissions data can be accurate. On the one hand, MRV standards are harmonized all over the nation. On the other hand, MRV standards could be realized internationally and could link with international society step by step.

II. Reliability.

From moral perspective, favoritism or cheating must be prohibited during the process of MRV. Specifically, lying about emissions data from the emitters, covering up emissions data from third-party institutions and rent-seeking from the regulators should be severely punished.

III. Transparency.

Emissions data is the object of the transactions in carbon market. Public data is useful for social monitoring and keeping just, impartial and fair. It’s necessary to set up an independent third-party emissions data statistics and registry institution in the right time.

Fourthly, enough elasticity of cap-setting must be considered.

中国仍处在工业化中期，“共同但有区别责任”决定了中国在短时间内不需要承担明确的绝对减排量。但没有逐渐收缩的总量控制就难以创造出排放的稀缺性，国内碳市场便难以形成。借鉴于欧洲的经验教训，要注意以下两方面：

China is still in the middle of industrialization. The “common but differential" responsibilities show that China mustn’t assume the clear and absolute emissions reductions target in the recent time. However, without gradual contraction of quota and thereafter emissions scarcity it is difficult to produce domestic active carbon trade market. Learnt from EU ETS, we should pay attention to the following two issues:

（一）慎用抵消机制。结合市场总量、减排目标和市场预期，合理地控制抵消比例和减排量计入期。结合产业结构调整和区域生态补偿，循序渐进地放宽抵消项目类型和项目来源地的限制。

I. Keeping cautious to use the offset mechanism. It's reasonable to control the proportion of offset and crediting period of emission reduction by comprehensively considering the cap, emission reduction targets and market expectations. The type of and the origin of offset projects could be broadened gradually according to industrial restructure and regional ecological compensation.

（二）防备极端情况。在BAU（情景正常）情况下，要不断收缩市场总量（或增长量），通过创造稀缺性来促进交易。同时，要做好应对经济过热或萧条的防范措施，效仿央行公开市场操作的方式，设立平准基金和建立拍卖规则，有效地应对需求量的大幅波动。

II. Taking precautions against the extreme situations. Under BAU (Business As Usual), the cap (absolute or relative) could gradually shrink and therefore stimulate transactions by creating scarcity. Meanwhile, in order to protect against economic overheating or depression, following open market operations of the central bank the stabilization fund and auction rules can be established to deal with huge volatility of the demand

五、采取灵活的配额组合分配方法
Fifthly, the combination of allowance allocation methods must be taken.

配额是否发放合理，会对未来二级市场的碳价以及流动性产生很大影响。应根据市场不同的发展阶段，针对不同的行业部门采取不同分配方法进行组合运用。

Whether allocating allowance is reasonable or not will have great impact on the carbon price and secondary-market liquidity. Based on the different stages of market development, we should use corresponding allocation methods for different industry sectors.

（一）免费分配的灵活使用

免费分配的历史法和基准法在不同阶段和行业组合使用。历史法在交易体系初期最受欢迎，但需采取优化措施，灵活应对地区差异和行业差异，科学、合理地选择历史排放数据的适用水平、早期减排行动的鼓励，以及新增产能的履约成本分摊等问题。基准法的选用除了考虑行业特性和数据基础外，还需兼顾行业内减排激励的传递性。

I. Using free allocation flexibly

Historical method and baseline method could be combined and used in different periods and industries. The historical method is the most popular in the early stage of the trading system. But we must make optimizing measures, respond flexibly to regional differences and industry differences, choose rationally historical emission data applicable to different levels, and encourage early action to reduce emissions, as well as

（二）有偿拍卖的逐步推进

拍卖是推进减排市场长期健康的最佳选择。可采取部分配额有偿拍卖机制，并逐步扩大拍卖范畴，配额最终需全部有偿获得，这是推动碳减排的未来路径，但在发展初期需循序渐进。从行业维度来讲，面临外部竞争较小、容易传导成本的行业应较早采用拍卖法，其他行业依据面临的竞争程度可酌情在早期予以免费分配。

（三）配额发放可偏紧

配额的发放可偏紧，而政府应留有储备配额，当市场配额供给少时出售，配额供给多时购买注销，类似平准基金的作用。

early action to reduce emissions, as well as new capacity compliance cost sharing and other issues. Except for industry features and database, the baseline method needs to take the transitivity of the reduction incentives inside one industry into consideration.

II. Advancing paid auction gradually

Auction is the best choice to promote the long-term healthy development of the emission reduction market. The paid auction could be adopted in part and gradually expand to larger scopes. Eventually the allowance needs to be all paid, which is the future path of promoting carbon reduction, but in the early stages it could be step by step. The industry, facing less external competition and transferring easily the cost, can adopt the paid auction early. Other industries can obtain free allocation in the early stages according to the degree of competition.

III. Controlling allocated allowances tightly

The quotas could be tighter. However, the government should have reserved allowance. The government could sell the reserved allowance when the supply is low and recycle surplus allowance when the supply is outstripping the demand

六、多手段促进二级市场流动性
Sixthly, various means to promote the liquidity of the secondary market can be taken.

（一）丰富交易产品

大力发展大宗交易（协议交易）。大中型控排企业普遍存在一定的协议交易需求，希望通过更加有效的方式实现大宗配额的转移，低成本完成履约目标。建议重视协议交易市场的建设，放开政策约束，允许不同交易市场之间的替代性竞争，使得企业具有更强的履约灵活性。同时，加强碳排放权期货和期权的研究并尽快推出相关产品。在期货市场建立时机尚未成熟以前，可先探索可行的非标准化的衍生品，如远期合约、碳互换等，并将碳保险产品植入衍生品合约，提高

I. Increasing the number of products

The large transactions (agreement transfer) can be vigorously developed. Meanwhile, we must accelerate the research on carbon emissions futures and options and launch them as soon as possible. Before that we can explore the feasibility of non-standardized derivatives, such as forward, swaps, etc. Insurance could be involved in derivatives contracts to intensify the attractiveness of the product. When spot market develops to certain extent, we should vigorously develop the futures and options market and give full play to the role of derivatives in risk hedging and price discovery.

提高产品的吸引力。待现货市场发展到一定程度，要大力发展期货、期权市场，充分发挥衍生品市场的套期保值和发现价格的作用。

（二）培养做市商

控排企业是碳市场交易主体，但交易意识和能力较低。交易平台要重点培养做市商，鼓励做市商为控排企业提供交易服务。逐步放开个人投资者。为控制风险，提高个人投资者的进入门槛，或安排经纪会员为个人投资者提供代理交易服务。

II. Facilitating the ways of trade.

Carbon exchange can provide perfect and convenient facilities for the trade, carry out simple and easily-understood operation rules. It's advised that China Securities Regulatory Commission cancels the restrictions of Document 37/38 on carbon exchanges, and allows carbon exchanges centralized trade and continued listing transaction.

III. Cultivating the market makers.

Emitters are the subjects of carbon trading, but their awareness and abilities of transaction are very low. Carbon exchanges can find and cultivate the market makers and encourage them to provide emitters with trading services. The trade can be gradually open to individual investors. To control the risk, we can increase the barriers of entry for individual investors, or arrange broker members to provide them with agency services.

Seventhly, carbon finance needs the support from the policy.

Carbon finance is immature. In the initial stage, its growth requires the support of preferential policies like discount interest rate and tax deductions which could reduce the cost of financers and increase the profit of investors.

I. Implementing tax deductions or exemption

Following tax exemption of national bonds, the tax of investors who buy carbon finance product can be deducted or exempted. For example, if institution investors buy carbon bonds or securitized product, the tax of their interest gains can be exempted.

II. Adopting interest subsidy

The government can arrange specialized funds and provide part or full interest subsidy to the firms which get the loan in the name of emissions reductions. For example, if compulsory emitters apply for the loan to save their internal energy, local government can offer 50% interest subsidy .

图片来源 ;(nwtclimatechange.ca)
SOURCE:;(nwtclimatechange.ca)

中国碳市场：风险识别与管理

China's Carbon Market: Risk Identification and Management

刘 倩
QIAN LIU

刘倩，中国南开大学环境经济学博士，中央财经大学财经研究院副研究员，气候与能源金融研究中心副主任，主要从事碳市场、碳金融、环境自愿协议方面的研究。

Dr. Qian Liu is an Associate Professor at the Central University of Finance and Economics. Prior to the current work, she earned her Ph.D. degree in Environmental Economics at Nankai University. Her research interests include carbon market, carbon finance, and environmental voluntary agreement.

2013 年中国七省市的区域碳交易试点陆续启动，并确定了建立全国碳市场的发展方向。由于碳市场相对发展还不成熟，预期寿命不确定，波动性较强，且由于碳市场发展历史较短，缺乏长期的定量数据记录，市场上几乎没有为参与者提供风险管理工具。因此，为保护碳金融市场的健康发展，应识别碳金融市场的风险，并尽早设计碳金融市场风险管理体系。

Regional carbon trading pilots in seven provinces/cities of China were launched in 2013, and China plans to roll out its national carbon market in 2016. Participants by far are not provided with risk management tools in the market, not only because the carbon market develops immaturely with its uncertain life expectancy and its high volatility, but also because it develops over a short time period which leads to a lack of long-term quantitative data records. Therefore, in order to promote the healthy development of the carbon finance markets, it is suggested that the risks should be identified and a risk management system should be developed as early as possible.

一、识别碳金融市场风险

（一）机制设计风险

1. 配额供给风险

实践证明，配额过度分配或是分配不足都会打击市场信心。此外，部分金融市场参与者担心如果未来衍生品的数量迅速增长，以至于金融合约数量超过了发放的配额数量的总和也会对碳金融衍生品市场产生不利影响。

2. 履约目标偏离风险

碳市场设计的初衷是应对气候变化，高效的实现经济体的节能减排目标。因此，对于市场主要参与者，即需要履行减排目标的企业、投资者、金融工具的设计者而言，碳市场发展与节能减排总体目标之间的关联度尤为重要。任何来自碳市场的微观市场行为以及宏观发展上与节能减排的总体目标背道而驰的评价都有可能对市场长期、有序发展带来不利的影响。

I.Identifying risks in carbon finance markets

A.Risks from the market design

a.The risk of allowance allocation

There is proof that both insufficient allowance allocation and over-allocation will damage market confidence. Moreover, some participants from the financial market worry that if the number of derivatives grows so rapidly that the number of financial contracts exceeds the total number of allowance, the carbon financial derivatives will be adversely affected.

b.Market integrity risk

The initial goal of carbon market design is to tackle climate change and effectively achieve the target of energy savings and emission reductions. Therefore, for major participants from the market such as enterprises who need to fulfill emission reduction targets and investors and designers of financial tools, the connection between the development of the

3. 市场链接风险

分散发展的市场不可避免的要面临各市场之间缺乏联系的问题，这也被认为是限制市场进一步发展的主要障碍。分散交易体系面临的一个重要问题就是如何围绕共同的标准发展，以增加整个碳市场的流动性、透明度和市场发展的深度。当前，在全国碳市场顶层设计阶段，七个区域碳市场在未来将执行怎样的角色值得关注。未来，整个碳市场的流动性有望随着在国际市场间建立有效链接，以及在各地区、各政府间实现更广泛的注册链接而得到提高，这些链接的容量和有效维护对于市场的有序运作至关重要。

（二）市场供给风险

1. 参与主体风险

碳市场发展历史较短，缺乏有规律性的数据积累和成熟的避险工具，对参与企业的风险管理带来了更多的不确定性。同时，对于一个年轻的市场，无论是市场设计者、操作者的经验积累都非常有限，受管制的公司和

the carbon market and the target of energy saving and emission reduction is very important. Micro-market behavior from carbon markets as well as the evaluation of the macro development and energy conservation are likely to run counter to the overall goal of bringing long-term adverse impacts into the orderly development of the market.

c.The risk of market links

Markets which develop separately inevitably face the problem of a lack of communication. This is considered as a major obstacle limiting further development of the market. An important issue of the decentralized trading system is on how to focus on the development of common standards in order to increase the liquidity, transparency, and market maturity. Nowadays, during the top-level design stage of a national carbon market, the kind of role that the seven regional carbon markets play is worthy of attention. In the future, the entire carbon market liquidity is expected to establish effective links with international markets, as well as in all regions, leading to broader and improved registration links. The capacity of these links and effective maintenance of the orderly operation of the market is essential.

B.Market infancy risk

a.The major risk of participation

Carbon markets have a short developing history and there is a lack of regular data accumulation and sophisticated hedging tools which brings more uncertainty to the relevant enterprises' risk management. Meanwhile, as for an immature market, the market designer or operator experience accumulated thus far is very limited. Companies, investors and regulatory advisory bodies lack the appropriate talent pool and the ability to prepare for risks. These factors may lead to mistakes in market operation or a higher probability of accidents, thus damaging the interests of investors.

b.The risk of product supply

Nowadays, global carbon trading includes rationing transactions and project credit. Program trading includes the first-level,

投资、咨询机构也缺乏相应的人才储备和能力准备。这些因素都可能导致市场操作失误或出现事故的几率较高，从而损害投资者利益。

2. 产品供给风险

目前，全球碳交易包括配额交易和项目信用两种。项目交易包括一级、二级 CDM 交易和联合履约（JI）交易。CDM 和 JI 二级市场主要是由碳基金的投资行为建立的规模庞大的不受国际法约束的碳金融市场。在不同机制形成了不同产品的同时，又形成了在交易所等平台上完成的场内交易和交易平台之外的场外交易，且衍生出包括远期、互换、期货、期权等产品，呈现出碳货币证券化和发展为套利交易产品的趋势。如何衡量这些金融产品的质量将会成为方法和评估技术上的难题，这种技术上的不确定性将使碳衍生品交易变得更加不透明，更易于隐藏和传递风险。

3. 流动性风险

流动性风险将很可能是中国碳金融市场发展将面临的最大问题之一。一般情况下，市场围绕着具有较高流动性的交易所运行。这取决于市场本身的商品化程度，参与者的多少，以及产品是否足够丰富，从而使较多的参与者针对丰富的产品寻求风险管理解决方案。如果市场的发展致使交易工具可替代性低，进而导致流动性分散，则会有损市场信心。低流动性阻碍了参与者自由交易，会给市场和潜在投资者带来风险。

4. 信息不对称风险

市场发展有序性很大程度上取决于市场参与者以及公众是否能够及时、准确的获得对于交易规模、质量、价格等方面信息。在不成熟的碳金融市场，会大量存在信息不对称的情形，市场交易一方利用掌握信息的便利条件，使自身获益而使交易另一方受损的风险大量存在。

second-level CDM trade and Joint Implementation trade. CDM and JI in the secondary market are mainly composed of carbon funds investment behavior established on a large-scale, but international law is not binding in the carbon finance market. Different mechanisms form different products, meanwhile exchange transactions in the stock exchange and curb exchange outside the venue, including forwards, swaps, futures, options and other products, show carbon currency securitization and development of products for the carry trade trends. Measuring the quality of these financial products will be done through the evaluation of technical problems. Such technical uncertainties make carbon derivatives trading more transparent, and easier to hide and transfer risk.

c.The risk of fluidity

The risk of fluidity is likely to be one of the biggest risks that the carbon market in China will face. Under normal circumstances, market runs around exchanges that have a higher fluidity.

The level of fluidity depends on the degree of commercialization of the market itself, the number of participants, as well as whether the product is rich enough so that more participants seek risk management solutions for abundant products. If the development of a market leads to low fungibility of trading tools this leads to disperse fluidity and further damage to market confidence. Low fungibility prevents free trade between participants and it brings risks to the market and potential investors.

d.The risk of asymmetric information

The order of market development largely depends on whether participants and the public can efficiently and accurately obtain information about the size, quality and price of a transaction. Under the immature carbon financial market, a great deal of information is asymmetric: one party in market trading uses the mastered information to benefit leaving counterparties damaged and with high risks.

（三）违规操作风险

除了市场发展初期这些有代表性的市场滥用行为之外，未来有可能出现的违规操作风险一般可以分为以下几类：第一，利用碳市场作为工具的严重犯罪行为，比如欺诈、洗钱、为恐怖活动筹资等。第二，以碳市场为目标的盗窃犯罪行为，包括利用网络钓鱼或者黑客攻击登记系统来盗取账户中的配额或减排信用。第三，金融市场违规行为，包括操纵市场和内幕交易等。

二、碳金融监管的侧重点

无论是从碳金融市场的可持续发展、相关经济部门和市场稳健发展还是从公共利益出发，碳金融监管必须能够保证有效的交易和定价机制、避免欺诈和价格操纵、平衡信息透明度及保密程度。

（一）保证有效的交易和定价机制

有效的交易和定价机制是市场成熟发展的根本，因为碳市场价格及其传导机制直接影响排放企业、碳市场投资者及相关能源、高新技术等市场的投资决策。因此市场是否能够形成一个权威的价格信息放射源成为关键。一个流动性更强的市场上，众多的交易者通过其买卖行为将信息带到了价格决定过程之中，形成的价格发现机制是最有效的。

按照我国目前的碳市场推进安排，在全国并未出现统一的交易机制和具体标准时，会出现一些竞争性的交易所。如我国现有的期货交易所和发展的比较好的环境能源交易所，先后介入碳市场交易机制的设计和运作。竞争使得市场交易成本逐步下降，进入市场方式更加简洁，市场运行系统和交易流程更加高效。一般情况下，市场交易发展的规律是交易额逐渐集中于一个中心市场之上，从而达到更强的流动性。随后一些市场竞争者逐步降级成为次级的小众市场，中心市场通过电子设备与若干次级市场建立链接或通过兼并的方式逐渐减少参与的交易所数量，从而逐步实现市场的整合。

C.The risk of operation violation

Except the representative market abuse in the early period of market development, the risk of violation to operation that may appear in the future can be divided into the following groups: firstly, the use of the carbon market as a tool for serious crimes such as fraud, money laundering and financing for terrorist activity; secondly, using the carbon market as the goal of theft crime, including the use of phishing or hacking to steal account registration system quotas or emission reduction credits; thirdly, irregularities in financial markets, including market manipulation and insider trading.

II.The focus of market regulation

Whether it is from the sustainable development of carbon finance markets, the relevant economic sectors and stable development of the market or public interest, carbon market regulation must be able to ensure effective financial supervision of trading and pricing mechanisms to avoid fraud and price manipulation, balancing transparency and the confidentiality of information

A.To ensure effective trading and pricing mechanisms

Effective trading and pricing mechanisms are the bases of the mature development of a market because the price of the carbon market and its transmission mechanism directly affects the investment decision-making of emitting enterprises, investors in the carbon market and relevant energy and advanced technology. Therefore, whether the market can form an authoritative price information source becomes critical. In a more mobile market, many traders bring information into the process of price decision by buying and selling, during which the formation of the price discovery mechanism is most effective.

According to the advancing arrangement of the current carbon market in China, some competitive exchanges will appear before the appearance of unified trading mechanisms and specific criteria. If the existing futures

（二）平衡信息透明度与保密性

如何在碳市场信息透明度和保密性之间找到平衡，这是政策制定者较难把握的问题。当市场透明度超过一定程度，信息的披露可能会超过投资者可以负担的合理成本，或者破坏了交易参与方的保密性而对市场有害。例如，在很多交易市场上，大型交易者为了防止其他交易者

在其进行交易的时候也跟风、模仿其交易决策进行交易，会选择匿名交易，从而避免增加交易成本。为了及时监管市场风险，很多监管机构必须要掌握市场参与者不愿意提供的信息。在碳交易市场，政府部门可以获得大量的价格敏感信息，比如负责设定和分配配额的部门将掌握所有有关配额数量的信息，也将会获得企业现实排放量的信息，这些信息都会对市场价格信号产生关键的影响。对这类信息需要设计披露程序和相关法律条款以保证不会产生提前泄露信息的问题。

（三）避免欺诈、内幕交易和价格操纵

对排放权交易的监管需要考虑欺诈、内幕交易和价格操纵行为，交易者或中介商对其他投资者的欺诈、内幕交易以及长期持续的价格操纵，会损害市场参与者和消费者的利益，危机整体市场发展。

通常指定交易所或其他交易平台进行的交易在传统金融监管部门的监管之下，可依靠原有的证券市场和衍生品市场的监管经验及其监管功能的延伸以防止投资者诈骗。但场外市场的碳交易参与者一般在该领域不具备丰富的投资经验，因此，对这一市场参与者的监管和保护需要有针对性地设计更为详尽的监管框架，完善相关的法律法规。

在我国碳市场试点时期开始应确保市场免于信息提早披露、滥用对市场价格的冲击。同时，也需要根据不同市场类型明确内部碳市场“内部消息”、“局内人”的具体定义，进而修改相关的立法或者单独设立法律法规，明确对拥有实质未公开信息的企业的信息披露的具体要求。

exchange and environmental exchange develop well successively they will be involved in the design and operation of the trading mechanism of the carbon market. Competition makes the cost of market trading gradually decrease thus it achieves stronger fluidity. Some market competitors then gradually degrade into secondary niche markets while the central market, by establishing links with a number of electronic devices, gradually reduces the number of secondary markets or exchanges through mergers, so as to gradually integrate markets.

B.To balance transparency and confidentiality of information

How to find a balance between carbon market transparency and confidentiality is a question that policymakers have long struggled to grasp. When transparency exceeds a certain degree, disclosure of information may exceed the reasonable cost that investors can afford or damage the confidentiality of trading participants thus it would damage the market. For instance, in many trading markets, in order to prevent other traders to follow suit when they conduct their transactions, they imitate their trading decision transactions. Large-scale traders will choose anonymity to avoid increasing the transaction costs. For the sake of supervising market risk efficiently, many supervision organizations must get hold of information that participants are unwilling to provide. In a carbon trading market, government departments can obtain sensitive information about price such as all the information about the amount of quota from the department that sets and allocates quota. Government departments can also get business realities emissions information that will be key in influencing the market price signal. This kind of information needs be disclosed to design programs and related legal provisions to ensure that no information is leaked ahead of the problem.

配额市场同样会面临垄断和市场挤压的风险，这一点不言自明。但是具有更加复杂的一面是，由于能源市场与排放权市场是紧密联系的，未来也有可能存在跨市场的价格操纵问题。对这类问题的监管也应该通过与能源市场监管部门的协调尽早考虑到市场监管框架之中。由于一般有操作市场意图的交易者会通过在 OTC 市场积累市场势力，因此预防透明度普遍不高的 OTC 市场的价格纵也必须在监管政策制定者的考虑之内。

C.To avoid market abuse

Fraud, inside trading and price manipulation must be considered in the supervision of emission trading. Fraud, inside trading and price manipulation of traders or intermediaries would damage the interests of participants and consumers and it would further damage the development of the whole market.

Generally, trades in the referred exchange or other trading platforms under the supervision of the traditional financial regulatory system, can be relied upon to extend the existing regulatory experience of the securities markets and derivatives markets and their regulatory functions in order to protect investors from fraud. But participants of carbon trading in overseas markets generally have no abundant investment experience on this scale, thus regulation and the protection of market participants needs to be designed to target a more detailed regulatory framework, and relevant laws and regulations need to be improved.

In the pilot period of the carbon market, we should ensure that the market avoids information disclosure and misuse which influences the market price. Meanwhile, we also need to confirm the specific definition of “inside information” and “inside man” according to various market types, and then amend related laws or set up separate laws and regulations to confirm the specific requirements of companies that have disclosed information.

An allowance-free market will face the same risks of monopoly and market squeeze, which is not self-evident. However, at a more sophisticated level, there may be a problem of cross-market price manipulation in the future, due to the close connection between the energy market and the emission rights market. Regulation of such issues should also be coordinated with the energy market by the regulatory authorities and the market regulatory framework must be taken into account as soon as possible.

As traders who intend to operate in the market accumulate market power through OTC markets, regulatory policy makers must consider prevention of the price of OTC markets which have low transparency.

建立多元化碳基金体系，助推低碳经济

Promoting Low-Carbon Economy through a Diversified Carbon Funding System

王遥，教授，博士生导师，毕业于中央财经大学金融学院。中央财经大学气候与能源金融研究中心主任，澳大利亚南昆士兰大学和维多利亚大学兼职教授。研究领域为低碳经济、气候金融及绿色资本市场。

王 遥
YAO WANG

Professor Yao Wang is the director of the Research Center for Climate and Energy Finance (RCCEF), Central University of Finance and Economics(CUFE). She is also the Adjunct Professor of University of Southern Queensland, Australia, and University of Victoria, Australia. She is interested in low carbon economy, climate finance and green finance.

陈波，中央财经大学气候与能源金融研究中心主任助理及碳金融实验室负责人，国家发改委国际合作中心低碳经济研究室副主任。中国人民大学经济学博士，爱丁堡大学碳金融硕士（志奋领学者），浙江大学控制科学与工程硕士。

陈 波
BO CHEN

Bo Chen, senior fellow and Director Assistant of Research Center for Climate and Energy Finance(RCCEF),Central University of Finance and Economics(CUFE). He holds a PhD in Economics at Renmin University of China and two master degrees in Carbon Finance at University of Edinburgh (Chevening Scholar) and Control Engineering at Zhejiang University.

融资是应对气候变化行动和生态文明建设的重要环节之一，发挥着不可或缺的保障作用。但由于市场失灵与公共政策失灵问题交织存在，解决我国应对气候变化、推动节能减排相关的融资需求存在构成复杂的障碍性因素。为实现我国应对气候变化目标，未来 10 年要填补每年超过 2 万亿元的资金缺口，必须要重构资金供给和运用体系，以规模化的融资和管理方式提高资金利用效率。其中，通过构建多元化的碳基金体系强化碳市场的价格激励作用，结合利用“公私合作”模式（PPP）撬动私人部门资金，是当前促进节能减排的重要融资手段。

Financing is one of the important measures and necessary insurances to combat climate change and promote a conservation culture. But due to market and public policy failure, complex impediments exist with financing requirements which can help combat climate change and push for energy conservation and emission reduction. The funding gap of more than 2 trillion yuan per year must be filled in the next 10 years, and fund supply and utilization mechanism should also be restructured with scaled financing and management methods to improve the efficiency of fund utilization, thus allowing China to realize its climate change goal. One of the important financing means to promote energy conservation and emission reduction is to build a diversified carbon fund system to strengthen the carbon market price incentives, combined with "public-private partnership model" (PPP) to leverage private sector funds.

一、节能减排面临巨大资金缺口

First, energy conservation and emission reduction is faced with a huge funding gap.

要实现 2020 年单位 GDP 二氧化碳排放较 2005 年水平降低 40%–45% 的应对气候变化的行动目标，中国 2020 年度融资需求为 27, 503 亿元，（能源工业需求 11, 853 亿元，节能需求为 15, 650 亿元），而目前每年的气候融资供给规模仅为 5, 256 亿元。以此计算，2020 年度缺口超过 2 万亿元，相当于 2012 年 GDP 的 3. 8%。

The research conducted by domestic institutions shows that in order to realize the goal of climate change action, which is a 40%-45% reduction in carbon dioxide emissions per unit of GDP in 2020 compared to that in 2005, China's 2020 annual funding needed is 2.7503 trillion yuan (1.1853 trillion yuan for the energy industry, and 1.565 trillion yuan for energy conservation). However, the current annual climate financing supply is 525.6 billion yuan. Based on the above data, the funding gap in 2020 will exceed 2 trillion yuan, which is equivalent to 3.8% of the total GDP in 2012.

造成巨大资金供应缺口的主要原因包括：一是现有政策设定和体制安排造成大规模资本介入面临较多的投资障碍；二是技术的多样性特征和应用领域分散造成的信息不对称；三是作为低碳技术大规模应用前提的基础设施投资成本高、风险大、周期长；四是应对气候变化政策安排不确定给私人资金进入造成的系统性风险；五是应对气候变化的适应活动产生的经济效益估值困难，对资金的吸引力不足。

The huge funding gap is mainly caused by the following: first, the investment barriers for large-scale capital resulting from the existing policy and system framework; second, the information asymmetry caused by dispersion of diversity of the technical characteristics and their application fields; third, high cost, high risk, and a long cycle of infrastructure, which are the foundation of large-scale application of low carbon technology; fourth, the systemic risk of private funding entering caused by the uncertainty of climate change policy; fifth, the insufficient ability to attract funding because of the immeasurable economic benefits of adaptive activities to combat climate change.

二、政府和市场共同作用不容忽视

Second, the combined effect of government and market should not be underestimated.

首先要充分发挥政府的引导作用。与采取行政措施类似，公共资金早期参与能够在一定程度上降低市场的风险预期，在实施本国的气候变化战略过程中发挥关键性作用。例如，政府以补贴或优惠资金形式投向基础设施和公用事业建设，可显著改善低碳经济发展的环境，降低私人投资的不确定性和风险。同时政府补偿机制可以产生杠杆效果，或通过融资担保、补贴等形式吸引私人投资，或用直接出资的形式对私人投资的亏损或收益进行补偿，平衡其风险与收益的关系，形成多种类型的公私合作模式，促进私人投资的进入。

First is to give full play to the guiding role of the government. Similar to the administrative measures, early participation of public funding can reduce the expectations of market risk to a certain extent, and play a key role in the implementation of the country's climate change strategy. Government, for example, invests infrastructure and public utilities construction in the form of subsidies and preferential funds can significantly improve the environment of low carbon economy development and reduce the uncertainty and risk of private investment. At the same time, the government compensation mechanism of attracting private investment through, for example, financing guarantee and subsidies, or using direct investment to make compensation for the losses or gains on private investment may bring a leverage effect and balance the

同时也要发挥市场的资源配置作用，通过金融体系体现碳排放权具有的商品属性，利用价格的信号传递功能，影响到企业的项目选择。例如，当碳市场配额分配采用拍卖形式时，要将拍卖资金有效的返回给控排企业，

同时形成激励机制，促进低碳活动的开展；资金的分配主体应该具有良好的灵活性，提高资金使用效率；资金分配与控排行业特征结合起来，平衡灵活性和公平性。

三、构建多元化的碳基金体系

（一）“国家—地方”公共碳基金

由于碳市场发展仍处于初级阶段，大量低碳领域的技术开发和应用尚未达到商业化阶段，相关低碳投资风险较高，因此必须注重发挥公共资金的示范和引导作用。

1. 建立或将已有国家扶持型基金转型为国家气候基金。国家气候基金可以混合多种资金来源，包括公共资金，私人资金，多边及双边资金来共同支持应对气候变化的行动，在国家层面将筹集到的资金更有效的、系统的运用于国家应对气候变化的行动，同时更好的协调气候变化利益相关者之间的关系。

2. 建立地方与国家合作的区域碳基金。在机制创新方面，区域性公共碳基金将发挥重大作用。国家气候基金可与各试点省份联合成立区域性碳基金，形成公共资金合作机制，通过转移支付、股权投资等方式构建“一支国家气候变化基金和多支区域碳基金并存”的格局。其中，国家气候基金可以充分发挥其引导作用，释放稳定的政策信号，确保国家低碳经济与气候变化目标的顺利完成，催化并加速绿色与低碳经济的发展。地方碳基金可以结合区域特点及其优先发展方向，建立符合地方特色的公私合作平台，确保公共资金可以有效发挥政策效应同时降低其挤出效应，减少私人部门在同一领域的重复投资。

3. 设立周转碳基金。在国家气候基金和区域碳基金下，均可设立周转碳基金，为地方商业银行等投资者提供免息贷款额度。较高的投资风险预期及对低碳领域不熟悉是金融性资金不愿意投资低碳项目的根本原因。若能够获得具有专项支持作用的周转碳基金的支持，银行就能够向低碳项目提供低息贷款。随着该基金项目的实施，地方商业银行

the relationship between the risks and benefits, thus to set up various public-private partnership models and drive private investment to enter.

Market allocation of resources should be given full play at the same time. The commodity property of carbon emissions should be displayed in the financial system, and the signal transmission function of the price shall affect the enterprise's choices on projects. For example, when the carbon market emission allowances are allocated by auction, the auction funds should be efficiently returned to the emissions controlled enterprises, and an incentive mechanism should also be established in the meantime to promote low-carbon activities. The funding allocation organization should work with flexibility to increase the efficiency of funding utilization. Capital allocation should be combined with the characteristics of emissions controlled industry during allocation to balance flexibility and fairness.

等投资者提供免息贷款额度。较高的投资风险预期及对低碳领域不熟悉是金融性资金不愿意投资低碳项目的根本原因。若能够获得具有专项支持作用的周转碳基金的支持，银行就能够向低碳项目提供低息贷款。随着该基金项目的实施，地方商业银行对于低碳项目的理解以及融资能力都得到了提高，周转基金也就可以逐步退出，地方银行也可以凭借逐渐积累的能力建设自行为上述项目提供贷款。

（二）“公共 - 私人”混合碳基金

1. 设立政府引导碳基金

在我国碳市场陆续使用拍卖手段有偿分配配额后，可从碳市场拍卖所得中提取一定比例资金，与私人资本共同成立碳金融引导基金。该基金作为连接碳市场与金融市场的主要渠道，充分发挥公共资金的引导作用，引导社会资本进入低碳领域，成为碳金融市场发展的支点。

在减排和营利的双重目标下，制定相关投

Third, establish a diversified carbon fund system.

1. “national-regional” public carbon fund

As the carbon market development is still in its infancy, a significant amount of technology development and application in the low carbon field has yet to reach commercialization scale. Furthermore, the risk of related low carbon investment is relatively high, therefore we must pay attention to the demonstrating and guiding role of public funds.

(1) Set up or turn existing national support funds into a national climate fund. A national climate fund can have mixed sources of public capital, private capital, multilateral and bilateral funding to support climate change action though efficient use of funds raised at the national level to combat climate change, and better coordinate the relationship between the stakeholders of climate change.

(2) Set up regional carbon funds with the cooperation of local and national government. Regional public carbon funds will play an important role in mechanism innovation. A national climate fund can set up regional carbon funds jointly with the low carbon pilot provinces to establish the mechanism of public funds cooperation, and build the framework for the "co-existence of a national climate change fund and multiple regional carbon funds" through transfer payments and equity investment. A national climate fund can give full play to its guiding role, and release stable policy signals to ensure that national low-carbon economy and climate change goals can be successfully accomplished, and catalyze and accelerate the development of a green and low-carbon economy. Local carbon funds can set up public-private cooperation platforms in accordance with local characteristics based on regional characteristics and its development priority to ensure that public funds can effectively work on the policy and reduce the extrusion effect, and reduce overlapping investment from the private sector in the same field.

资策略和绩效指标，以达到在风险固定的条件下，追求减排效应和投资收益最大化的目标。在设计基金的投资组合及其他相关策略时，应结合基金自身的能力，对投资地域、行业、阶段进行有效决策。

2. 设立技术碳基金

由于普遍缺乏对现在和未来气候风险认识导致政府支持不足，先进的减排技术转移发展经常面临资金障碍。减排技术在解决长期环境问题时可能面临的风险，在市场价格中并没有得到充分反映。这就意味着投资减排技术需要面临额外的风险，致使此类技术在利用市场机制寻找私人部门投资的过程中面临更大的困难。为此，建议设立专门的技术碳基金，主要发放优惠性、长期的、低利率贷款，致力于促进低碳技术的示范、应用和扩散。同时，作为引导类基金，该基金可引导其他公共部门或私人部门投资减排技术。

3. 设立行业碳基金

与引导碳基金和技术碳基金项目相比，行业碳基金的“行业性”首先体现在其资金投入的行业领域上，即为电力、煤炭、化工等高排放行业的节能减排提供资金支持，并根据特定行业的实际情况设计不同投资模式，从而在支持行业节能减排的同时，获得相对平均的投资回报。其次，可考虑把高排放型行业的节能减排投资作为资金来源，在公共资金的支持下汇总产生规模效应，应用于行业内部的节能减排，既满足自身减排需要，又可以产生金融收益，一定程度上抵消企业因投资节能减排产生成本。

（三）私人碳基金

根据现有研究，私人资本设立的私人基金的数量多于公共基金，且管理资金规模基本与公共资金持平，在相对成熟的国际碳市场中发挥着较为重要的作用。

与公共型和混合型碳基金相比，私人碳基金的投资标的基本相同，获取超额投资收益的经营目标使其采用的投资方式更为灵活，倾向于参与碳市场高利润领域的竞争甚至投机。私人碳基金作为竞争主体参与碳市场，能够显著提高市场活跃度，激发市场主体自我创新能力。同时，作为完全市场化主体，私人碳基金的参与有利于市场环境的成熟和监管机制的完善。

(3) To set up a circulation carbon fund. A circulation carbon fund can be set up under the national climate fund and regional carbon funds to provide interest-free loans to the local commercial banks and other investors. High investment risk expectation and the unfamiliarity with low carbon sector are the main cause of reluctance of financial capital to invest low carbon projects. With the support of a circulation carbon fund, the banks will be able to offer low-interest loans to low carbon projects. The local commercial banks would gradually improve their understanding of low carbon projects and financing ability through the implementation of the funded project, allowing them to then gradually withdraw circulation funds and provide loans for those projects on their own based on their capacity building.

2. “Public-private” mixed carbon fund

(1) Setting up a government guided carbon fund

After the paid allocation of emission allowances by auction, a certain proportion of the auction fund can be extracted from the carbon market to establish a carbon finance guidance fund together with private funds. As the main linkage between the carbon market and the financial market, a guidance fund should give full play to the guiding role of public funds to bring social capital into the low carbon field and make it the development fulcrum of the carbon financial market.

Under the dual goal of emission reduction and making profit, relevant investment strategy and performance indicators should be formulated in order to achieve the goal of maximum emission reduction and investment profit with a fixed risk level. In the designing of the fund portfolio and other relevant policies, the ability of funds should be considered to make efficient decisions on the investment region, industry and phases.

(2) Setting up a technological carbon fund

After the paid allocation of emission allowances by auction, a certain proportion of the auction fund can be extracted from the carbon market to establish a carbon finance guidance fund together with private funds. As the main linkage between the carbon market and the financial market, a guidance fund should give full play to the guiding role of public funds to bring social capital into the low carbon field and make it the development fulcrum of the carbon financial market.

Under the dual goal of emission reduction and making profit, relevant investment strategy and performance indicators should be formulated in order to achieve the goal of maximum emission reduction and investment profit with a fixed risk level. In the designing of the fund portfolio and other relevant policies, the ability of funds should be considered to make efficient decisions on the investment region, industry and phases.

(3) Setting up industry carbon funds

Compared to a guidance carbon fund and a technological carbon fund, the “industry property” of an industry carbon fund is firstly embodied in the sector of investment, that is to provide funding support for the electric power, coal, chemical industry and other heavy emitters and design different investment modes according to specific situations in different sectors to support industry in energy conservation and get the relative average investment return at the same time. Moreover, the investment from heavy emission industries on energy conservation can be considered as a kind of fund resource, which can be used for energy conservation and emission reduction in the industry with the support of public funds to produce a scale effect. To a certain extent, the cost of energy conservation and emission reduction can be offset because of the financial revenue brought by a scale effect.

3. Private carbon funds

According to research conducted by international institutions, private capital has set up more private funds than public funds, and the capital they are managing is almost the same as that in public funds. Also, they have played a more important role in a relatively mature international carbon market .

Private carbon funds have basically the same investment fields compared to public and mixed carbon funds. Their business objective of gaining more profit than investment enables greater flexibility of investment methods, which tend to participate in the high profit carbon market competition and even speculation. The participation of private carbon funds in carbon market competition as a competing party will significantly improve the market activity, and motivate the market players to innovate. Meanwhile, as a completely market-oriented player, a private carbon fund will improve the maturity of the market environment and the supervision mechanism.

中国商业银行亟待建立低碳信贷标准

China Needs to Develop Low Carbon Credit Standards for Commercial Banks

许 寅硕
YINSHUO XU

许寅硕，澳大利亚南昆士兰大学环境金融学博士，现为中央财经大学财经研究院助理研究员，气候与能源金融研究中心研究人员。

Dr. Yinshuo Xu is an Assistant Professor at the Research Center for Climate and Energy Finance (RCCEF),Central University of Finance and Economics (CUFE). She earned her PhD degree in Environmental Finance at the University of Southern Queensland.

当前社会经济生产与消费活动，正对我们人类赖以生存的环境产生着极大的影响，粗放型的经济生产模式使得大量温室气体排入大气，全球气候变化带来的极端天气事件层出不穷，且越来越频繁，应对气候变化已成为全球共识。如何更有效地减少温室气体排放，实现低碳经济转型，成为制约各国经济社会可持续发展的瓶颈问题。

The current social economic production and consumption influence the natural environment significantly. A large volume of greenhouse gases (GHGs) has been emitted into the atmosphere, and moreover, extreme climate disasters have been continuous emerging and are becoming increasingly frequent. Under these circumstances, there is a global consensus of addressing climate change. How to reduce GHG emissions and achieve a low carbon economy transition has become the key issue for the sustainable development in many countries.

借力低碳信贷，商业银行助推低碳经济转型

Commercial banks promote low carbon economy transition through low carbon credit

商业银行在实现低碳与可持续发展中占据重要地位。商业银行在社会经济中肩负着信用中介和金融服务的基本职能，当这些职能被频繁地用于对气候、环境和社会有害的活动时，商业银行也会成为导致气候变化、环境破坏的行为主体。反之，若商业银行的职能被广泛运用于保护环境的活动中，将会对融资主体的行为产生积极影响。这是因为商业银行通过其所提供的一系列金融服务与资金支持，可对其所支持的企业与客户施加影响，甚至有能力左右项目最终是否能够得以施行。因此，商业银行在通过控制资金流向引导企业扭转污染环境、浪费资源的粗放经营模式，助推低碳经济转型中起着不可替代的作用。

当前全球诸多商业银行已开始关注其业务造成的环境和可持续性的影响。在我国，为响应大力开展节能减排的政策号召，满足低碳经济发展对商业银行的金融需求，我国商业银行开始设计与开展低碳信贷业务。低碳信贷通过“信贷 + 低碳”的金融杠杆作用，将环境问题、经济问题、金融问题落脚到银行业最细微的信贷环节。低碳信贷业务为我国银行业转型、参与低碳经济提供了重要机遇，并将有望成为商业银行业务拓展和盈利可持续增长的重要源泉。

Commercial banks play an important role in regards to the realization of low carbon and sustainable development. Commercial banks' fundamental functions in social economy are demonstrated through their role as credit intermediaries and the provider of financial services. When these functions are frequently used in activities imposing adverse effects on the climate, the environment and the society, commercial banks will be, to a certain degree, responsible for climate change and environmental pollution. In circumstances where these functions are widely used for environmental protection, commercial banks can influence their clients in a positive way, and in some cases they can even be decisive for the implementation of a project. Hence, commercial banks are necessity in promoting low carbon economy transition, and enterprises' environmental polluting and resource wasting operational model transformation.

Many commercial banks are concerned about the impact of their business on the environment and sustainable development. In China, in order to respond to the government's emission reduction policy and satisfy the financial requirements of low carbon economy transition, commercial banks have begun to design and operate low carbon credit. Low carbon credit can position environmental, economic and financial issues into the credit business of the banking sector through the leverage effect of "Credit + Low carbon". Low carbon credit provides opportunities for China's banking sector transformation towards and engagement in low carbon economy. Furthermore, low carbon credit is likely to become a significant driver for commercial banks' sustainable development.

我国商业银行应制定实施低碳信贷标准
Chinese commercial banks should develop and implement low carbon credit standards

当前我国低碳信贷业务尚处于起步阶段，商业银行在开展低碳信贷业务方面面临着诸多问题和挑战，可操作性亟待提高。例如：如何界定低碳项目？如何评估项目的环境与社会影响？如何测算项目的风险和可行性等。同时，虽然一些商业银行尝试提出了自己的低碳或绿色信贷标准，但是这些标准对低碳项目的审核方式与内容设定各不相同，它们之间缺乏统一可比的内容，成为低碳信贷发展的一大阻力。

缺乏体系的低碳信贷标准将增加行政与运营成本，限制商业银行开展低碳信贷业务；向市场传递错误信号，低碳项目开发者无法获悉最准确的内容，这将会降低其投资开发低碳项目的积极性。同时，商业银行自定的低碳信贷标准缺乏科学性和有效的监督方法，导致低碳信贷业务鱼龙混杂，一些不属于低碳的项目也能够获得低碳信贷的扶植；监管机构缺乏对商业银行在低碳信贷方面所开展工作的清晰掌握，无法制定相应的支持政策。

图片来源 ;(www.euractiv.com)
SOURCE:;(www.euractiv.com)

只有在业务操作中构建统一的可操作性的低碳信贷标准，并将其制度化，在相关业务和部门中透明地和有效地加以实施，通过商业银行有效遏制其支持的企业与项目对环境、气候所产生的负面作用，推进低碳技术的开发与应用，才能真正有效发挥商业银行在助推低碳经济转型中不可替代的作用。

So far China's low carbon credit business is at the initial stage and faced with many problems and challenges, and its feasibility need to be improved. For instance, how do banks identify low carbon projects? How do they evaluate a project's environmental and social effect? How do they measure a project's risks and feasibility? Meanwhile, despite the attempt by some commercial banks to launch their own low carbon or green credit standards, these standards have different content and evaluation mechanisms. Moreover, there is a lack of consistency among these standards. These issues are the main barriers for low carbon credit development.

Low carbon credit standards that lack consistency and comparability will increase operational and administrative costs, and thus limiting the implementation of low carbon credit and delivering the wrong signal to the market. In this case, low carbon project developers are not able to obtain the most accurate information regarding low carbon credit, which will decrease the incentives for them to invest in low carbon projects. On the other hand, there is an absence of legitimacy and effective supervision in low carbon credit standards designed by commercial banks lack, which means quality management of low carbon credit operations will be difficult. As a result, some environmental-unfriendly projects receive low carbon credit support. Additionally, without systematic and comprehensive understanding of low carbon credit, policy makers will have difficulties in working out appropriate supporting policies.

Commercial banks' function in promoting low carbon economy transition can only work if feasible and unified low carbon credit standards are established and institutionalized, as well as implemented with sufficient transparency and efficiency.

国际项目融资低碳信贷标准
Low carbon credit standard for international project finance

当前，国际上项目融资的低碳信贷标准以赤道原则(Equator Principles,EPs)为代表。EPs 是金融机构在识别、评估和管理项目融资中的社会和环境风险时自愿遵守的一套标准，被视作金融行业发展可持续项目融资的“黄金标准”。EPs 不是国际法，不具备法律约束力，但是它已成为国际项目融资的行业标准和行业惯例。

EPs 要求金融机构对于适用范围内的项目融资，按照潜在的环境与社会影响程度将项目分为高风险（A）、中风险（B）、低风险（C）三类，并结合项目风险分类审查项目的环境和社会风险，与借款者签订契约，聘请独立的环保专家负责审查项目的社会和环境评估报告、行动计划以及磋商披露的记录等资料，对项目建设和运营实施持续性的监管，并定期披露银行赤道原则的实施情况。

可能严重改变环境原状且产生的不良环境和社会后果不易消除的项目将被评定为 A 类项目，例如大型油气开发项目，油气开发可能会严重影响开发区域海洋生物的生活环境，且油气管道的铺设可能会导致大规模的移民搬迁，影响重大且后果难以恢复。B 类项目是指会对环境或社会造成一定不利影响，但大部分影响是可以通过减缓措施加以消除的项目，例如纺织印染项目，其污水排放和噪音污染问题突出，但往往可以通过污水回收处理系统和噪音控制措施对问题加以控制和解决。不会对社会或环境产生明显不良后果的项目属于 C 类项目，比如咨询、保险等金融服务业项目等，无需银行在环境与社会风险管理方面给予重点关注。

图片来源 :(assets.inhabitat.com)
SOURCE:(assets.inhabitat.com)

The Equator Principles (EPs) represent international low carbon credit standards. The EPs is a voluntary standard for financial institutions in identifying, evaluating and managing social and environmental risks in project finance. The EPs is deemed as the “Gold standard” for the sustainable project finance of financial institutions. The EPs is not an international law, and thus there is no legislative binding. However, the EPs has become an industrial standard and the convention of project finance.

The EPs requires financial institutions to categories applicable projects into High Risk (A), Middle Risk (B) and Low Risk (C) based on their potential environmental, climate and social effects. Following the risk categorization, financial institutions should evaluate the projects' environmental and social risks in a more specific way, contract with borrowers, hire independent environmental experts to review the projects' social and environment evaluation reports, action plans and records of disclosure negotiations. It is necessary for financial institutions to monitor projects' construction and operation consecutively and periodically disclose their implementation of the EPs.

Projects that may seriously change the environment and have catastrophic adverse environmental and social consequences that are difficult to eliminate will be marked as category “A”. Take big oil & gas plant deployment project as an example, which may have a serious negative impact on the ocean environment and result in large scale immigration due to deployment of pipelines. Category “B” refers to projects that have limited negative consequences on the environment or the society, and the majority of negative influence can be eliminated. For example, the water pollution and noise problems caused by textile dyeing and printing projects are usually significant, but they can be controlled and

even eliminated by implementing wastewater recycling systems and noise control approaches. “C” projects refer to those that will have negligible negative consequences on the environment and the society such as consulting and insurance. Projects of category C do not need to be highlighted by the banks when dealing with environmental and social risks.

我国商业银行低碳信贷标准
Low carbon credit standards of Chinese commercial banks

低碳信贷标准一般应包括以下四个方面：低碳信贷风险识别、低碳信贷项目分类、低碳信贷项目评估以及低碳信贷项目管理。

Low carbon credit standards generally include low carbon credit risk identification, low carbon credit project categorization, low carbon project evaluation and low carbon credit project management.

为确定低碳信贷标准是否适用某一项目，银行首先需要设计项目过滤机制，过滤机制下留存的项目再按照低碳信贷标准进行。常用的过滤机制包括：

To ensure whether low carbon credit standards are applicable in a project, banks should start with project screening mechanisms. Main project screening mechanisms include:

- 第一，禁贷名录：列示于名录内的经济行为或项目不能获得银行贷款。
- 第二，项目融资方经营活动的规模：如果经济活动不包含在禁贷名录中，经营活动也需达到特定规模才会被纳入评估过程。
- 第三，敏感行业：银行可以根据需要决定将某些会带来一定程度环境和社会影响的活动纳入敏感行业范围。

- Blacklist: Projects or economic activities listed in the blacklist are not qualified for bank loans.
- Scale of the clients’ operation: Even if projects and economic activities are not listed on the blacklist, operations should satisfy scale requirements to be included in the evaluation process.
- Sensitive industries: Banks can define environmental and social sensitive industries based on their policies and specific concerns.

图片来源 :(i.dailymail.co.uk/)
SOURCE:(i.dailymail.co.uk/)

过滤机制留存的项目进入低碳信贷风险识别阶段。这一阶段，银行将识别项目或贷款活动可能带来的环境、气候和社会风险。为此， 将对融资方的业务活动环境、流程以及投入要素进行分析，并对融资方用于防止和降低环境和社会影响所必需的控制和管理措施进行详细分析。

Projects remaining after the screening mechanism will enter the credit risk identification phase. In this phase, banks will identify potential environmental, climate and social risks resulting from the projects. To achieve this, banks will analyze clients’ business activities, procedures and inputs of borrowers, as well as borrowers’ environmental and social risk management system. .

在低碳信贷项目分类阶段会通过初步筛选进行项目风险分类，从而决定项目需要的环境和社会评估的性质和程度。根据项目或业务活动的类型、所在地、敏感性以及规模，项目可以被分为高风险（A ）、中风险（B ）和低风险（C）（A 类、B 类、C 类项目的定义同 EPs）。如果项目具有显著的经济、社会和环境影响，应该召集外部专家进行评审；当对项目的环境、气候和社会影响产生质疑时，有必要使用现场核查手段。

In the low carbon credit project categorization phase, preliminary evaluation will be the first step in allocating projects into the appropriate risk category, and thereby identifying appropriate environmental and social evaluation activities. According to the projects’ risk category, location, environmental and social sensitivity and scale, projects can be divided into high risk (A), medium risk (B) and low risk (C) (definitions of A,B,C, are the same as those in the EPs). For projects with significant economic, social and environmental consequences, external experts should be invited to participate in evaluation or verification. When there are uncertainties regarding environmental, climate and social consequences, on-site inspections are necessary.

项目风险类别不同， 商业银行进行低碳信贷项目评估的工具和程度也不相同。对于 A 类项目，需要对其进行 1）环境影响评估，识别并评估项目的环境、气候和社会影响，设计减缓、管理和监督措施；2）环境行动计划，确定项目实施阶段需要采取的减缓、管理、监督以及制度措施；3）环境审计，对项目环境、气候和社会影响的程度和性质进行诊断，确定合适的减缓措施，评估其成本，证明合理性和可行性，并为减缓措施的实施

规划进度表；4）公众咨询和信息披露计划，明确咨询和信息披露的地区性需求，识别主要利益相关者，提供信息共享以及向利益相关者咨询的策略和时间表，明确实施该计划所需的资源和应承担的责任，并出示报告，记录咨询和披露活动。

B 类项目对应的评估工具包括环境管理分析、合规性评估，纠正行动计划以及公众咨询及信息披露计划。环境管理分析使得银行能够确定可能对环境、气候和社会产生有害影响的活动性质和范围，同时，银行还能够借助该工具确定项目融资方的环境社会风险管理体系或活动的类型。合规性评估能够识别潜在债务（对项目融资方现金流的潜在影响）、员工以及社区的环境和社会顾虑，项目融资方管理环境管理分析过程中识别出的风险以及遵循环境与社会标准的能力。纠正行动计划使得银行能够确定项目的环境、气候与社会影响对融资方财务状况的影响程度，该计划为每个潜在风险设计解决措施。

低碳信贷项目管理阶段，银行将监督减缓、控制和制度性措施的实施。低碳信贷项目管理应该贯穿信贷的生命周期，以确保融资方到期还款及定期支付利息责任的兑现，并确保银行面临的环境和社会风险在可接受范围内。

For projects with different risk categories, commercial banks' low carbon credit project evaluation tools and the extent of evaluation will vary. In terms of category "A" projects, there are four necessary tools.

(1) Environment Impact Assessment. This refers to the process of identifying and evaluating a project's environmental, climate and social effects and designing approaches to mitigate, manage and monitor these effects.

(2) Environmental action plan. This is where the required mitigation, management, monitoring and institution measures in project implementation process will be identified and clarified.

(3) Environmental auditing. This refers to the approach to auditing the severity of the impact a project can have on the environment, the climate and the society. It is also used to ensure that appropriate control methods are put in place and their costs and feasibility are evaluated.

(4) Public consultation and information disclosure plan. This means clarifying the regional demand of public consultation and information disclosure, identifying key stakeholders, providing strategy and schedule for information sharing and consultation. These are to identify required resources and responsibilities, and to record consultation and disclosure activities.

Environmental management analysis, compliance assessment, corrective action plans and public consultation and information disclosure plans are the major evaluation tools of category "B" projects. Environmental management analysis enables banks to identify the nature and the scope of the activities with adverse effects on environment, climate and society. Banks are also able to understand borrowers' environmental and social risk management system by means of environmental management analysis. Compliance assessment can identify potential liability, environmental and social concern of staff and the community, borrowers' capacity of conducting environmental and social risk management and compliance. A corrective action plan enables banks to understand the financial consequences resulting from projects' environmental, climate and social impact. A corrective plan also involves the designing of solutions for each identified potential risk.

In the phase of low carbon credit project management, banks will supervise the implementation of mitigation, control and institutional measures. Low carbon credit project management should sustain throughout the lifecycle of loans, and thereby ensuring the fulfillment of borrowers' responsibility in repaying loans and interest and limiting environmental and social risks within acceptable level.

将碳捕捉和强化驱油结合：一个加速 CCS 产业发展的机会

Combining CCS with EOR: a CCS Market Launch Opportunity

杨 颖霞
YINGXIA YANG

杨颖霞，博士，Brattle 咨询公司电力咨询部门研究员。擅长运用经济模型对能源环境问题进行经济和政策的分析，尤其是电力以及天然气行业。

Dr. Yingxia Yang is an Associate at The Brattle Group. She specializes in developing and using economic models to conduct the economic and policy analysis of energy and environmental issues in the energy industries with a focus on the power and natural gas sectors.

刘 恒伟
HENGWEI LIU

刘恒伟，博士，曾在中国、美国和沙特从事能源、气候变化与技术创新政策研究。

Dr. Hengwei Liu has worked on energy, climate and innovation policy in China, Saudi Arabia and the United States.

陈 雷
LEI CHEN

陈雷，美国麻省理工学院机械工程博士，斯伦贝谢休斯顿研发中心模拟工程师，曾在通用电气全球研发中心和麻省理工学院从事富氧燃烧、煤气化和强化采油等二氧化碳捕集和利用埋存技术研究。

Dr. Lei Chen is a Modeling & Simulation Engineer at Schlumberger Sugar Land Research Center. Prior to the current work, he earned his Ph.D. degree in Mechanical Engineering at MIT, and worked as a research scientist at GE Global Research for oxy-fuel combustion, gasification, and enhanced oil recovery in Carbon Capture Utilization and Sequestration technologies.

CCS 与 EOR 结合是双赢方案

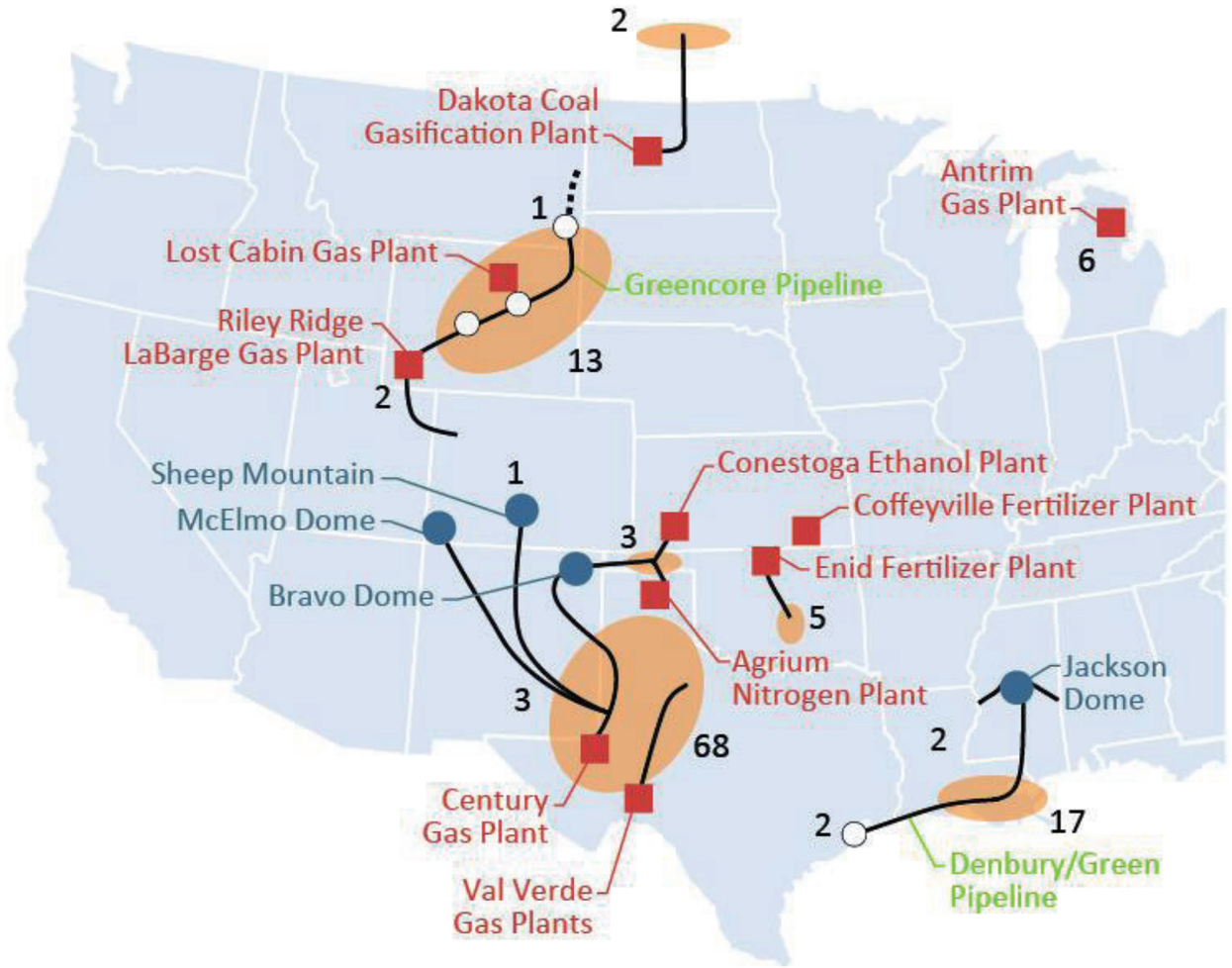
二氧化碳捕集与埋存（CCS）是目前大规模直接减少化石能源利用导致的温室气体排放的唯一有效技术。燃煤发电厂是最大的二氧化碳单一排放源，因而也是 CCS 技术的主要潜在应用市场。由于捕集二氧化碳通常需要额外投资和消耗大量能源，从而导致该技术成本高昂——这也成为当前阻碍 CCS 技术规模发展的关键。因此，CCS 工业亟需通过碳捕捉盈利以使得 CCS 项目经济上可承受，并且较其它低碳技术更具竞争力。同样重要地，CCS 工业还需要安全、公众可接受的 CO2 埋存地点。

使用二氧化碳驱油以提高采收率（CO2-EOR）是一项石油工业已经应用了几十年的成熟技术。长期以来，缺乏稳定、可靠和经济的二氧化碳来源是阻碍 CO2-EOR 大规模发展的主要限制因素。

因此，二氧化碳捕集、埋存和提高采收率技术相结合（CCS-EOR）可实现石油增产和 CCS 成本降低的双重目的，是目前加快 CCS 技术部署的最具前景的双赢解决方案。

美国 CCS-EOR 项目现状

据统计，2010 年全球范围使用提高采收率方法（EOR）获得的石油产量达每天 300 万桶，占全球产量的 3.5%。其中利用二氧化碳驱油（CO2-EOR）的产量占所有强化石油开采石油产量的大约 10%。美国已经有约 3600 英里二氧化碳输运管线，每年输送约 5000 万吨二氧化碳



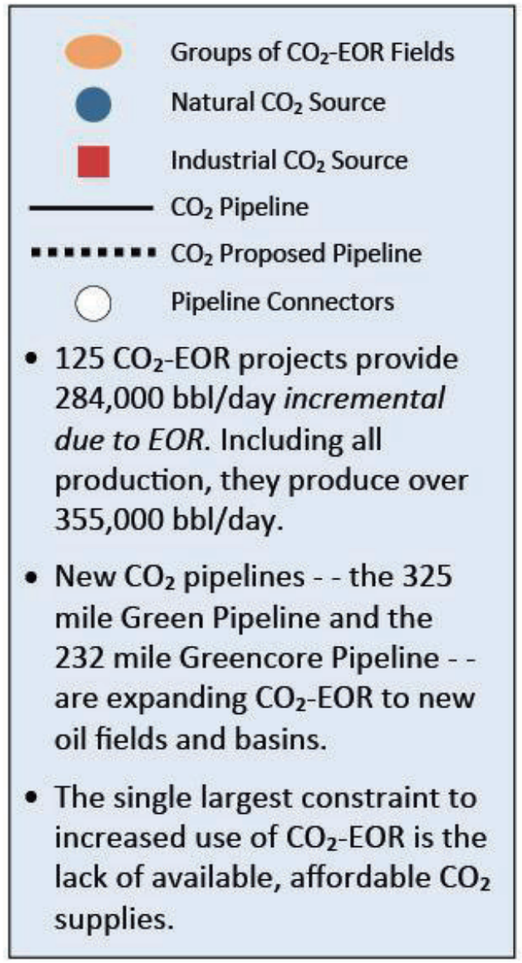


图 1. 美国已投运的 CCS-EOR 项目

用于提高采收率，增产超过每天 28 万桶原油。图 1 显示了美国已投运的大规模自然源和工业源 CCS-EOR 项目，包括捕集源，输运管线和应用提高采收率油田的地理位置。位于美国德克萨州西部和新墨西哥州东南部的西德克萨斯盆地是世界上最大的二氧化碳提高采收率油田，同时也是世界上最大的以二氧化碳为商品的买卖市场。全美约有 125 个二氧化碳提高采收率项目（包括混相气驱和非混相气驱技术），其中的 60 多个集中在西德克萨斯盆地，每天出产 18 万桶原油。其中的一些油田已经使用二氧化碳驱油技术长达 30 多年。位于北达科他州的大平原煤制天然气工厂从 2000 年开始通过长达 315 千米的二氧化碳输运管线，将每年 3 百万吨二氧化碳运输到加拿大萨斯喀彻温省的 Weyburn 和 Midale 油田进行提高采收率。与此同时，该项目还进行了从 2000 年至 2011 年长达 10 年以上的 Weyburn-Midale 油田二氧化碳埋存监测研究，测量了二氧化碳埋存位置，烟羽迁移和扩散速度等，这也是世界上最大的全规模 CCS 现场研究。另外，怀俄明州、堪萨斯州、路易斯安那州、伊利诺伊州也都有这项技术的使用。

从二氧化碳的采集源看，主要有 Sheep Mountain, McElmo Dome, Bravo Dome, 以及 Jackson Dome 等四处主要的自然源二氧化碳气田，以及分散在适用二氧化碳驱油地点附近的人为源，如天然气处理和工业过程中的二氧化碳捕集项目。其中自然源 CO2 仍然是用于 EOR 项目的主要来源，比如 McElmo Dome 单一二氧化碳气田每年向西德克萨斯盆地供气量 2200 万吨，几乎相当于所有美国人为源捕集二氧化碳供应量的总和。

根据全球 CCS 研究院（Global CCS Institute）的定义，大规模二氧化碳提高采收率项目是指年捕集、运输和埋存量在 80 万吨以上的燃煤电厂 CCS 项目，以及年捕集量 40 万吨以上的其他工业项目。据统计，截至 2014 年在美国正在运行的大规模二氧化碳提高采收率项目有 8 个，正在建设调试的 2 个，另外还有一些处于前期预研阶段。

表 1 列出了大规模二氧化碳提高采收率项目的基本信息。在这些大规模人为源的二氧化碳捕集和提高采收率项目中，有 4 个是在开采的天然气中分离出二氧化碳用于提高采收率，而另外 4 个项目则是从化工过程捕集二氧化碳。比如位于奥克拉荷马州的 Enid 化肥项目，位于达科他州的大平原煤制天然气项目，位于德克萨斯州的空气化工（Air Products）蒸汽天然气重整制氢项目，和堪萨斯州的 Coffeyville 石油焦气化项目。有趣的是，到目前为止，已投运的 CCS-EOR 项目中，二氧化碳的捕集源并没有燃煤发电厂，而主要是化工过程。原因主要是在这些化工过程（比如在天然气制氢，煤制天然气，石油焦制氢）中，二氧化碳的捕集技术更成熟，成本更低。

	名称	地点	捕集源	捕集方式	输运距离（km）	CO2 利用方式	捕集量（百万吨 / 年）	投运时间
1	Val Verde Natural Gas Plant	德克萨斯州	天然气井	天然气处理	132	EOR	1.3	1972
2	Enid Fertilizer CO2-EOR Project	奥克拉荷马州	化肥生产	工业分离（天然气制氢）	225	EOR	0.7	1982
3	LaBarge Gas Plant	怀俄明州	天然气井	天然气处理	403	EOR	7	1986
4	Great Plain Synfuel Plant and Weyburn-Midale Project	美国达科他州，加拿大萨斯喀彻温省	煤气化合成气生产	燃烧前捕集（煤气化过程）	315	EOR	3	2000
5	Central Plant	德克萨斯州	天然气井	天然气处理	69	EOR	8.4	2010
6	Air Products Steam Methane Reformer EOR Project	德克萨斯州	氢气生产	天然气制氢	101-150	EOR	1	2013
7	Coffeyville Gasification Plant	堪萨斯州	化肥生产	工业分离（石油焦制氢）	112	EOR	1	2013
8	Lost Cabin Gas Plant	怀俄明州	天然气井	天然气处理	未知	EOR	0.8-1.0	2013

表 1. 美国已投产大规模 CCS-EOR 项目列表

美国燃煤发电厂 CCS-EOR 项目现状

为了减小成本对燃煤电厂 CCS 的发展带来的阻力，美国能源部（DOE）希望通过对 CCS-EOR 技术的大规模示范来降低其成本。在 DOE 资助下，目前有如下在燃煤电厂中捕集二氧化碳的 CCS-EOR 项目正在建设施工或者预研阶段：

- **Kemper County IGCC（整体煤气化联合循环）项目得到 DOE 洁净煤电行动计划（Clean Coal Power Initiative ，CCPI）2.7 亿美元资助，采用南方公司（Southern Company）的气化技术燃烧前捕集二氧化碳，计划于 2015 年投入运行，年捕集量将达 3.5 百万吨用于提高采收率。**

- **NRG Energy Parish CCS 项目得到 DOE 洁净煤电行动计划 1.67 亿美元资助，使用燃烧后捕集技术，计划于 2016 年投入运行，年捕集量达 1.4-1.6 百万吨用于提高采收率。**

- **Texas Clean Energy IGCC 项目得到 DOE 洁净煤电行动计划 4.5 亿美元资助，将使用 Siemens 气化技术燃烧前捕集二氧化碳，计划于 2017 年投入运行，年捕集量将达 2.7 百万吨用于提高采收率。**

- **FutureGen 2.0 富氧燃烧项目得到 DOE FutureGen(未来煤电)计划 10 亿美元资助，采用 Babcock & Wilcox 富氧燃烧技术捕集二氧化碳，计划于 2017 年投入运行，年捕集量达 1.1 百万吨，用于深部盐水层封存。**

- **Hydrogen Energy California IGCC 项目得到 DOE 洁净煤电行动计划 4.08 亿美元资助，使用 MHI 气化技术燃烧前捕集二氧化碳，计划于 2018 年投入运行，年捕集量达 3 百万吨用于提高采收率。**

总结

二氧化碳捕集、埋存和提高采收率技术相结合（CCS-EOR）可实现二氧化碳减排和提高原油采收率增效的双重目的。美国能源部希望通过实施大规模一体化 CCS-EOR 商业示范项目，以加快 CCS 产业发展。

声明：该文中所有观点仅为作者个人的观点，不代表所在公司的观点。

参考文献：

[1] Howard Herzog, Jan Eide, 二氧化碳捕集与封存技术的再思考——在不确定中前行，基石杂志，2013 年第一期 .

[2] Global CCS Institute, The Global Status of CCS 2013, http://www.globalccsinstitute.com/publications/global-status-ccs-2013.

[3] Peter Folger, Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy, Feb 10, 2014.

CCS-EOR: a Win-Win Solution

CCS is currently the only technology available to directly reduce large-scale greenhouse gas emissions from fossil energy use. As the largest single source of CO2 emissions, coal-fired power plants are a major potential sector for CCS application. The primary barrier for the deployment of CCS is that capturing CO2 requires additional investments and energy consumption, making the technology much more expensive. Thus, the CCS industry needs revenues from the captured CO2 to make CCS projects affordable and competitive with alternative low-carbon options. As important, the CCS industry requires secure, publically acceptable places to store CO2.

On the other hand, CO2 EOR has been a mature technology applied in the oil industry for many decades. The biggest barrier to achieving increased levels of CO2-EOR production is the lack of access to sufficient and steady supplies of affordable CO2.

As such, combining EOR with CCS projects can be a win-win solution to the CO2-EOR industry and the CCS industry, by increasing oil production while partially offsetting higher CCS costs.

The Status of CCS-EOR in the United States

Worldwide oil production using EOR comes up to 3 million barrels a day in 2010, which accounts for 3.5% of the total crude production across the world. Production through carbon dioxide flooding is about 10% of total production by using all kinds of EOR technologies. There are about 3,600 miles of CO2 transporting pipelines in the United States, transporting about 50 million tons of CO2 for EOR per year, which contributes to an incremental oil production by 280,000 barrels per day. Figure 1 shows the large-scale CCS-EOR projects in operation in the US, from both natural and industrial sources, including capture sources, transporting routes and geological site of oil fields applying EOR. Located in the west of Texas and southwest of New Mexico, US, the West Basin is the largest oil field with CO2-EOR in the world. At the same time, it has become the world's biggest CO2 trading market. North America has about 125 CO2-EOR projects (including technology of miscible drive-gas displacement and immiscible drive-gas displacement) among which 60 projects concentrate in the West Basin, producing 180,000 barrels of oil per day. Some of these oil fields have been using CO2 flooding technology for 30 years. The Great Plains' coal-to-natural gas plant in North Dakota transports 3 million tons of CO2 per year to Weyburn and Midale oil fields in Saskatchewen, Canada for EOR through 315 kilometers of pipelines. From 2000 to 2011, the project conducted the sequestration monitoring studies of Weyburn-Midale oil fields which lasts for more than 10 years. The project, which is the world's largest full-scale CCS field project, measured the CO2 storage sites and the speed of plume migration and proliferation. There are other projects in Wyoming, Kansas, Louisiana and Illinois oil fields.

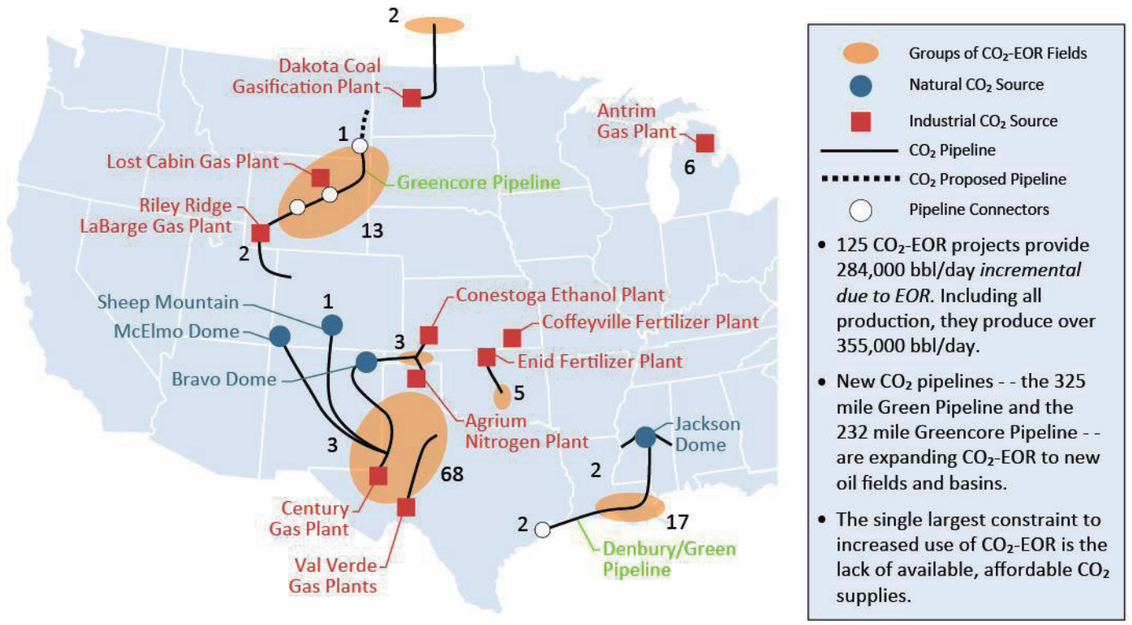


Figure 1. The Operational CCS-EOR Projects in US.

From the CO2 capture sources perspective, there are four main natural CO2 fields, including Sheep Mountain, McElmo Dome, Bravo Dome, and Jackson Dome, as well as anthropogenic sources distributed in nearby locations that are suitable for CO2-EOR, such as natural gas processing and industrial processes. The natural source CO2 remains the main source for CO2-EOR. For instance, the single CO2 field, McElmo Dome, annually supplies 22 million tons gas to the West Basin, which is almost equivalent to the sum of all the anthropogenic carbon dioxide supplies in the US.

According to the definitions of the Global CCS Institute, large-scale CO2-EOR Injection Projects refer to those that involve the capture, transport and storage of CO2 at a scale not less than 800,000 metric tons of CO2 annually for a coal-based power plant and not less than 400,000 metric tons of CO2 annually for other emission-intensive industrial facilities such as natural gas-based power generation. In the US, as of today, there are eight large-scale CO2-EOR projects are under operation, two projects under construction and some projects in their early pre-feasibility study stages.

Table 1 lists the basic information about these large-scale CO2-EOR projects. Among these CO2-EOR projects of large-scale anthropogenic source, four of them separate CO2 in the process of natural gas production for EOR, while the other projects capture CO2 from chemical process, i.e., the Enid chemical fertilizer in Oklahoma, the Great Plains coal-to-natural gas project in North Dakota, the Air Products steam methane reforming for hydrogen production project in Texas and the Coffeyville petroleum coke gasification project in Kansas. Interestingly, so far in the CCS-EOR projects that have become operational, none of the CO2 capture sources is from coal-fired power plants, but mainly in the chemical processes.

The reason for that is during chemical processes (such as natural gas-to-hydrogen, coal-to-natural gas and petroleum coke-to-hydrogen), the CO2 capture technologies are more mature and therefore, have lower capture costs.

	Project Name	Location	Capture Source	Capture Type	Transport distance（km）	CO2 Utilization	Capture Capacity（mt/year）	Operation Since
1	Val Verde Natural Gas Plant	Texas	Natural gas wells	Natural gas processing	132	EOR	1.3	1972
2	Enid Fertilizer CO2-EOR Project	Oklahoma	Fertilizer production	Industrial separation（Natural gas to hydrogen）	225	EOR	0.7	1982
3	LaBarge Gas Plant	Wyoming	Natural gas wells	Natural gas processing	403	EOR	7	1986
4	Great Plain Synfuel Plant and Weyburn-Midale Project	Dakota, US Saskatchewan, Canada	Coal gasification syngas production	Pre-combustion（Coal gasification process）	315	EOR	3	2000
5	Central Plant	Texas	Natural gas wells	Natural gas processing	69	EOR	8.4	2010
6	Air Products Steam Methane Reformer EOR Project	Texas	Hydrogen production	Natural gas to hydrogen	101-150	EOR	1	2013
7	Coffeyville Gasification Plant	Kansas	Fertilizer production	Industrial separation（Petroleum coke gasification）	112	EOR	1	2013
8	Lost Cabin Gas Plant	Wyoming	Natural gas wells	Natural gas processing	unknown	EOR	0.8-1.0	2013

The Status of CCS-EOR with Coal Power Plants

To help address the cost barrier to the deployment of CCS-EOR with coal power plant, the U.S. Department of Energy (DOE) has provided funds aiming at lowering the cost of CCS through large scale demonstration projects. Currently, under the DOE funding, the following CCS - EOR projects to capture CO2 in the coal-fired power plants are under construction or in feasibility study stage:

- *NRG Energy Parish CCS project received 167 million dollars from the DOE under CCPI. Using post-combustion technology, it is planned to become operational in 2016, with an annual capture capacity up to 1.4-1.6 million tons of CO2 to be used for EOR.*
- *Texas Clean Energy IGCC project received 450 million dollars from the DOE under CCPI. Siemens gasification technology will be used for pre-combustion CO2 capture, and it is planned to be put into operation in 2017, with an annual capture capacity up to 2.7 million tons CO2 to be used for EOR.*
- *FutureGen 2.0 Oxy-fuel project received 1 billion dollars from the DOE under the FutureGen Initiative. Using Babcock & Wilcox's oxy-fuel combustion technology to capture CO2, it is planned to operate from 2017, with an annual capture capacity up to 1.1 million tons of CO2 to be stored in deep saline aquifers.*
- *Hydrogen Energy California IGCC project received 408 million dollars from the DOE under CCPI. Using MHI's gasification technology for pre-combustion CO2 capture, it is planned to be put into operation in 2018, with an annual capture capacity up to 3 million tons of CO2 to be used for EOR.*
- *Kemper County IGCC project received 270 million dollars from the DOE under Clean Coal Power Initiative (CCPI). Adopting Southern Company's gasification technology for pre-combustion CO2 capture, it is planned to operate in 2015, with an annual capture capacity of up to 3.5 million tons of CO2 to be used for EOR.*

Summary

Combining EOR with CCS is mutually beneficial to the CO2-EOR industry and the CCS industry, by increasing oil production while significantly offsetting CCS costs. The U.S. DOE aims to launch CCS industry by demonstrating the commercial viability of CO2 capture, transport, and storage with EOR at large-scale in a fully integrated chain.

Disclaimer: The views expressed in this article are strictly those of the author and do not represent the opinion of the companies they work for.

中英（广东）CCUS 中心
UK-China (Guangdong) CCUS Center

2009年，中国国务院提出2020年温室气体排放行动目标，并在2010年把广东省列为低碳试点省份。英国能源与气候变化部与广东省发展及改革委员会在广东省省长朱小丹的见证下于2013年9月在伦敦签订了推动低碳合作的联合声明，以深化双方合作，其中强调了开展碳捕集与封存（CCS）合作的重要性。2013年12月18日中英（广东）碳捕集，利用与封存产业促进与学术交流中心，即中英（广东）CCUS中心正式成立。中心致力于推动大型CCUS项目的示范，应对人类面临的温室气体排放的挑战，为中国面对的雾霾、水污染的问题提供国际合作平台，催化清洁化石能源技术产业化，以及培养相关专业人才。

In 2009, China's State Council proposed its 2020 goal for greenhouse gas emissions, and then in 2010 made Guangdong a low carbon pilot province. Guangdong has made remarkable achievements in greenhouse gas emission control to which the UK-China low carbon cooperation has contributed significantly. In September 2013 the UK Department of Energy and Climate Change (DECC) signed a joint statement in London with the Guangdong Development and Reform Commission, witnessed by governor Zhu Xiaodan of Guangdong Province, to strengthen low carbon cooperation. The joint statement highlights the importance of collaborating in Carbon Capture and Storage (CCS). Supported by the Guangdong and UK governments, the UK-China (Guangdong) Carbon Capture, Utilisation and Storage Industry Promotion and Academic Collaboration Centre (the "Centre") was officially founded on December 18th, 2013. The Centre is committed to promoting the demonstration of large-scale CCUS projects to tackle greenhouse gas emissions. At the same time, the Centre will also provide an international collaboration platform for solutions to other local pollution problems (such as haze, water pollution) caused by coal utilization, and to accelerate the industrialization for clean fossil energy technologies and to train qualified professionals.

支持单位：
Supporting Institutes

中华人民共和国国家发展和改革委员会 National Development and Reform Commission

广东省发展和改革委员会 Development and Reform Commission of Guangdong Province

英国驻广州总领事馆

Scottish Enterprise

Department of Energy & Climate Change

The Scottish Government

中心发起会员：
Founding Members

中国能建广东院 Energy China GEDI

UKCCS Research Centre

SCCS

華潤電力 CR Power

cnooc

中国科学院南海海洋研究所

linkschina 领先财纳

Howden

Shell Cansolv

中国科学院广州能源研究所

ALSTOM

DNV·GL

中英（广东）CCUS产业促进与学术交流中心，中国能建集团广东省电力设计研究院大楼，广东省广州市萝岗区天丰路1号
UK-China (Guangdong) CCUS Industry Promotion and Academic Collaboration Centre
Guangdong Electric Power Design Institute Building 1 Tianfeng Road Guangzhou, Guangdong, China