

同舟共济踏平崎岖，共建低碳丝绸之路 Making a Joint Effort to Build a Low-carbon Silk Road

李佳
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古代丝绸之路起源于贸易，而丝路带来的文化碰撞和传承更胜于贸易。700多年前，日本僧人圆尔辨圆把中国杭州的径山茶礼沿着海上丝绸之路传到日本静冈。日本茶道，一直保留着许多中国唐宋茶礼的历史传统；同样在静冈，宫城美惠子40年前放下如日中天的演艺事业开设孤儿院，传授茶道让残障的孩子燃点了对未来的希望。经济发展低碳化能够为子孙后代留下美好的自然环境，实践低碳发展需要世界上各主要国家同舟共济克服分歧，同样需要40年如一日对的坚持。低碳丝路很难找到有起点和终点，但默默地共同实践低碳丝路或许比历史上的的丝绸和茶叶贸易和传播更加弥足珍贵。

The ancient Silk Road in China evolved through trading, but the impact of cultural collision and inheritance is far beyond the benefits of trading. More than 700 years ago, a Zenk monk Enni Ben'en brought the Jingshan Tea Banquet etiquette along a marine Silk Road from Hangzhou in China to Shizuoka in Japan. The Japanese Way of Tea still preserves traditions from the Tea Ceremonies of China's Tang and Song dynasties. Also in Shizuoka, Madam Miyagi Mieko gave up her flourishing performing career 40 years ago to build an orphanage for disabled children, passing on the Way of Tea to ignite hope for the children's future. The decarbonisation of the economy could leave a sustainable natural environment for the coming generations; major economies have the same imperative to decarbonise, and need to help each other to overcome differences every day for perhaps as long as four decades. It is hard to identify the starting point or the end point of the Low Carbon Silk Road, but making a joint effort to build a Low-carbon Silk Road is perhaps more precious than the silk and tea trading and communication in the past.

中国和美国占了全球人类活动碳排放的40%以上，两国携手合作或能够加速踏平崎岖的全球碳减排道路。中美低碳合作作为本期主题，我们介绍了中美气候变化及CCUS合作的最新进展，透视白宫如何为应对气候变化达成共识，描述奥巴马提出的清洁电力计划以及分析可能在实现该计划的风险。

去年秋天，广东省省长朱小丹和他的同事访问英国期间，见证了有关成立CCUS中心的备忘录的签署，转眼间中英（广东）CCUS中心踏入第九个月，中心真诚感谢政府，学士机构和企业的支持和各位同事的努力。《近零排放》杂志欢迎刘恒伟博士加入我们的团队，担任执行副主编。刘博士曾经在英国石油公司，沙特国家石油公司/国王石油研究中心，清华大学和哈佛大学从事CCUS技术政策研究工作。相信刘博士会为读者带来更多精彩的报道和研究分析。

The anthropogenic greenhouse gas emissions from China and US contribute more than two fifths of the world's total. Collaboration in carbon reduction between the US and China could accelerate the pace towards a globally agreed pathway to carbon reduction. US-China low-carbon collaboration is the theme of this issue. We review progress towards collaboration in climate change mitigation and CCUS between the two countries, reveal how the White House reached a consensus on climate change, and describe and analyse the uncertainties of the Clean Power Plan proposed by Obama.

Last autumn, when the Governor of Guangdong province Mr ZHU Xiaodan and his colleagues visited the UK, a CCUS MoU was signed and witnessed by both the UK and Guangdong governments. Nine months have passed since the launch of UK-China (Guangdong) CCUS Centre in December 2013. We would like to take this opportunity to express our sincere appreciation of government, academic and industry support and the great efforts made by our colleagues to make these things happen. Near Zero Emission magazine also welcomes Dr LIU Hengwei who has joined our team as an executive deputy chief editor. Dr LIU has been working on CCUS technology and policy studies in BP, Saudi Arab King Abdullah Petroleum Studies and Research Centre, Tsinghua University and Harvard University. We are confident that Dr Liu will bring our readers many more exciting reports and analyses.



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近零排放：重要新闻回顾

NZE: Important News Digest

2014年5月至8月

May to August, 2014



1 美国发布第三次气候变化国家评估报告：5月6日，美国白宫发布了一份名为《美国气候变化影响》的报告，称气候变化所带来的“破坏性”影响正波及美国各地及其主要经济部门，并可能在未来几十年变得更加严重。报告呼吁美国各界采取紧急行动，应对气候变化。这份报告由美国约300名著名气候科学家及技术专家历时3年完成。报告全面分析了气候变化对美国各地区及农业、卫生、能源、交通、水资源、森林和生态系统等各方面的影响，为政策制定者和民众了解气候影响提供了参考。
(来源：中国气象局)

1 Third U.S. Climate Assessment Report Released: On May 6th, the Third U.S. National Climate Assessment Report titled "Climate Change Impacts in the United States" was released. The report confirms that "destructive" impact of climate change is spreading across the country and the main industry sectors, and it could possibly become more serious in the next few decades. The report calls for urgent action from all sectors in the United States to address climate change. The report was completed by about 300 famous climate scientists and technical experts in the United States after three years' research.

The Report was a comprehensive analysis of the impact climate change brought to the U.S. and its agriculture, health, energy, transportation, water, forests, ecological system, and other various aspects, providing information for policy makers and the public to understand the impact of climate.

(Source: China Meteorological Administration)



2 IPCC 第五次评估报告第二、三工作组报告宣讲会召开：5月9日，联合国政府间气候变化专门委员会 (IPCC) 第五次评估报告第二、三工作组报告宣讲会在中国气象局召开。IPCC 中国政府首席代表、中国气象局局长郑国光，中国工程院院士杜祥琬、中国科学院院士秦大河等国家气候变化专家委员会委员，以及来自发改委、外交部、环保部、水利部、农业部、林业局、中科院、社科院、海洋局等单位的代表参加了宣讲会。中国气象局副局长沈晓农主持会议。
(来源：中国气象局)

2 IPCC 5th Assessment Report Briefing Held: On May 9th, the Briefing of the IPCC 5th Assessment Report (Working Group II & III), hosted by Xiaonong Shen, deputy director of the China Meteorological Administration, was held in the China Meteorological Administration.

Briefing speakers include several members from the National Climate Change Expert Committee: Guoguang Zheng, the IPCC China chief representative and head of the China Meteorological Administration, Xiangwan Du, member of Chinese Academy of Engineering, Dahe Qin, member of Chinese Academy of Sciences. Attendees also include representatives from National Development and Reform Commission, the Ministry of Foreign Affairs, Ministry of Environmental Protection, Ministry of Water Resources, the Ministry of Agriculture, Ministry of Forestry, Chinese Academy of Sciences, Oceanic Administration, etc.

(Source: China Meteorological Administration)



3 国际能源署报告强调，未来能源的可持续发展需要 CCS 技术：5月12日，国际能源署发布《2014 能源技术展望》报告。该报告认为，如果我们要过渡到一个“可持续发展的能源未来”，不作出改变是不行的。该报告强调，CCS 技术在实现电力和能源密集型产业脱碳以及提高能效方面将发挥关键作用。国际能源署此前已明确表示，CCS 对于大型化石燃料发电厂和能源密集型行业的脱碳至关重要。该机构此前得出的结论是，理论上，CCS 可

将化石燃料电厂及工业生产全生命周期的碳排放减少 65-85%。
(来源：欧洲零排放化石燃料发电厂技术平台)

4 IEA Report Highlights that CCS Is Needed for a Sustainable Energy Future: On May 12th, the International Energy Agency (IEA) has published the fourth volume of its Energy Technology Perspectives report, which concludes that business-as-usual is not an option if we are to transition to a "sustainable energy future." The report underlines that Carbon Capture and Storage (CCS) has a critical role to play in decarbonizing the power sector and energy intensive industries as well as supporting energy efficiency. The IEA has made clear that CCS is crucial for decarbonizing large-scale fossil fuel use for power generation and in energy-intensive industry. The agency previously concluded that in principle this technology can reduce full life-cycle CO2 emissions from fossil-fuel combustion at power stations and industrial sites by 65-85%.

(Source: the European Technology Platform for Zero Emission Fossil Fuel Power Plants)



4 美国颁布《清洁电力计划》：美国环保署于6月2日提议电力企业到2030年将排放总量在2005年基础上减少30%。要实现这一目标，电力企业每年需要减少二氧化碳排放约5亿吨。这是奥巴马政府为实现控制温室气体增长而推出的第二轮减排标准。上一次是对乘用车和轻型卡车制定减排标准，即从2012年到2025年，要求这些车辆在其使用寿命内，共减少温室气体排放60亿吨。
(来源：科技日报)

5 U.S. Proposed Clean Power Plan: The U.S. Environmental Protection Agency proposed on June 2nd that the total carbon pollution from the power sector should be cut by 30% below 2005 levels. To achieve this goal, the electric power enterprises need to reduce CO2 emissions by about 500 million tons a year. This is the second round of emissions standards released by the Obama administration to control the growth of greenhouse gases. The last was an emission standard for passenger cars and light trucks that requires to cut greenhouse gas emissions from these vehicles by 6 billion tons within their service life in 2012 to 2025.

(Source: Science and Technology Journal)



5 习近平：“推动能源生产和消费革命”：中央财经领导小组组长习近平6月13日主持召开中央财经领导小组第六次会议，研究我国能源安全战略。习近平强调，面对能源供需格局新变化、国际能源发展新趋势，保障国家能源安全，必须推动能源生产和消费革命，并提出5点要求：第一，推动能源消费革命，抑制不合理能源消费；第二，推动能源供给革命，建立多元供应体系；第三，推动能源技术革命，带动产业升级；第四，推动能源体制革命，打通能源发展快车道；第五，全方位加强国际合作，实现开放条件下能源安全。

5 Xi Jinping: Promoting Energy Production and Consumption Revolution: On June 13th, Xi Jinping, Chinese president and head of the central finance leading group, chaired the group's sixth meeting which explored the energy security strategy in China. Xi stressed that in face of new

energy supply and demand structure and new trend of international energy development, it is essential to promote energy production and consumption revolution to ensure national energy security. He also put forward five requirements: first, to promote the revolution of energy consumption and curb unreasonable energy consumption; second, to promote the revolution of energy supply, and build diversified supply system; third, to promote energy technology revolution to drive industrial upgrading; fourth, to promote energy system revolution to get through energy development fast lane; fifth, to strengthen international cooperation in all directions, and ensure energy security in an open market.

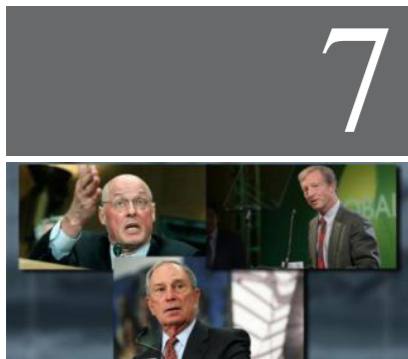


6 中英气候合作：6月17日，两国发表《中英气候变化联合声明》。中英两国认识到必须共同努力来建立采取雄心勃勃气候变化行动的全球框架，这将支持本国实现低碳转型努力。两国特别认识到，2015年的《联合国气候变化框架公约》巴黎缔约方大会为这一全球努力提供了一个至关重要的契机。两国必须加倍努力建立全球共识，以在巴黎通过一个在公约下适用于所有缔约方的议定书、其他法律文书或具有法律效力的议定成果。双方强调，所有国家按照华沙会议决定，在第21次缔约方会议前通报他们的国家自主决定贡献十分重要。
(来源：新华网)

6 UK-China Cooperation on Climate: On June 17th, the two countries issued the UK-China Joint Statement on Climate Change. Both countries realize that they have to work together to establish a global

framework to take ambitious action on climate change, which will support the low carbon transformation efforts in both countries. Especially, the two countries recognized that Paris Conference of the Parties of United Nations Framework Convention on Climate Change which will be held in 2015 provides a crucial opportunity for this global effort. The two countries must put more efforts in building a global consensus to get an agreement that applied for all the parties, other legal documents or valid agreed results approved in Paris. Both sides stressed that it is very important that all the countries report their decisions before the 21st Conference of the Parties in accordance with the decision made in Warsaw meeting. (Source: Xinhuanet)

and two former U.S. Secretary of State Robert Rubin and George Shultz, issued an American version of the Stern Review -Risky Business. The report says that the United States is confronted with a variety of major economic risks caused by climate change. These risks include coastal infrastructure destruction caused by sea level rise, the change of agricultural production and energy demand caused by climate change, and the influence of high temperature on labor productivity and public health. Moreover, these problems can be addressed through risk management. (Source: riskybusiness.org)



7
美国版《斯特恩报告》发布：今年6月24日，包括前纽约市长迈克尔·布隆伯格（Michael R. Bloomberg）、美国前财政部长亨利·保尔森（Henry M. Paulson, Jr.），以及两位前美国国务卿罗伯特·鲁宾（Robert E. Rubin）、乔治·舒尔茨（George P. Shultz）在内的一个重量级跨党派团体发表了一份类似于美国版的《斯特恩报告》——《风险下的商业》（Risky Business）。该报告认为美国正面临多种重大的由气候变化导致的经济风险。这些风险包括由于海平面上升对沿海基础设施的破坏、气候变化导致农业生产和能源需求的变化，以及高温对劳动生产率和公众健康的影响。并且，该报告明确的将这些问题归结为风险管理问题。（来源：riskybusiness.org）

American Edition of the Stern Review Released: On June 24th, a major bipartisan group, including former New York mayor Michael Bloomberg, former Secretary of US Treasury Department Henry Paulson,



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联合国发布《深度减碳出路》15国联合报告：联合国于7月8日发布由15个国家联合参与撰写的《深度减碳出路》报告，报告主张从推广使用可持续能源入手，通过切实可行的途径实现低碳发展之路。联合国秘书长潘基文出席发布会并致辞说，《深度减碳出路》报告为主要碳排放国家如何实现大幅减少碳排放指明了方向。潘基文强调，大幅减少碳排放是可行的，但需要全球致力于推广主要的低碳能源技术。他说，《深度减碳出路》报告强调了三个支柱性领域，即能效、低碳发电和燃料转换。他期待各国根据自身需要、资源和重点采取不同的方法组合，但所有国家都需要踏上低碳发展道路。（来源：新华网）

The United Nations Released a 15-nation Study of Deep Decarbonization Pathway: The United Nations on July 7th issued preliminary findings from a 15-nation study on ways to reduce global warming through carbon emission reduction in a bid to keep the world's temperature

below a 2 degree Celsius increase. "The DDPP report is an effort to demonstrate how countries can contribute to achieving the globally agreed target of limiting global temperature rise to below 2 degrees (Celsius)," UN Secretary-General Ban Ki-moon said at a launch press conference. He stressed that it is feasible to reduce carbon emission sharply, and global effort to deploy major low carbon energy technologies is a necessity. He said, the DDPP report mainly focuses on three pillars, namely energy efficiency, low carbon generation and fuel replacing. He expects that each country uses different combination of methods based on its own needs, resource and emphasis, however, all the countries should apply low carbon development pathway. (Source: Xinhuanet)



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欧盟首个CCS项目获资助：7月8日，欧盟委员会向运营绿色能源项目的19个私人投资者授予10亿欧元的资助。其中的3亿欧元由英国白玫瑰CCS项目的燃煤电厂运营商Drax获得。Drax将和阿尔斯通、英国氧气公司共同运行欧盟首个大型CCS燃煤电厂。多达90%的碳排放将被捕集并通过管道运输至北海的封存点。英国国家电网将负责这些二氧化碳的运输和封存工作。（来源：The Green Optimistic）

The First EU CCS Facility Secures Funding: On July 8th, the European Commission awarded 1bln Euros to nineteen private investors, who run green energy programmes. Out of the total amount, 300 mln euros were given to Drax, the operator of one of the main coal burning power plants, for their UK-based White Rose CCS project. Drax in collaboration with Alstom and BOC will jointly conduct

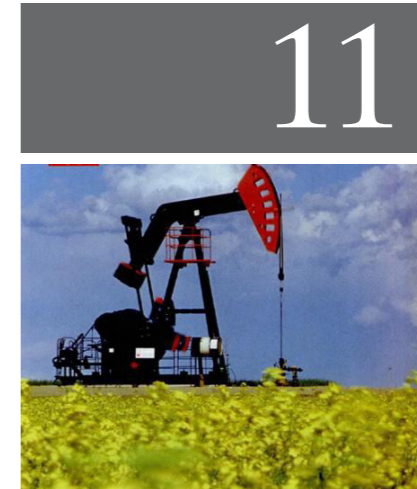
the first one of this kind project in the EU to construct a large-scale coal power plant, which will be equipped with carbon capture and storage technology. Up to 90% of the carbon emissions will be trapped and transport via a pipeline to a reservoir under the North Sea. The transport and storage of carbon dioxide from the plant is provided by the UK National Grid. (Source: The Green Optimistic)



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第六轮中美战略与经济对话在京闭幕，达成近百项成果：第六轮中美战略与经济对话于7月9日至10日在北京举行。中国国家主席习近平的特别代表国务委员杨洁篪与美国总统巴拉克·奥巴马的特别代表国务卿约翰·克里共同主持了战略对话，两国政府有关部门负责人参加。双方回顾了第五轮中美战略与经济对话框架下战略对话成果落实情况，就重大双边、地区和全球性问题深入交换意见，再次确认中美战略与经济对话机制的作用，深化战略互信、拓展务实合作、建设性管控分歧，以构建中美新型大国关系。（来源：中国外交部）

The 6th Round of China-US Strategic and Economic Dialogue Concluded in Beijing: The 6th Round of China-US Strategic and Economic Dialogue was held in Beijing from July 9th to 10th and produced more than 100 specific outcomes and areas for further cooperation. State Councilor Yang Jiechi, special representative of President Xi Jinping, and Secretary of State John Kerry, special representative of President Barack Obama, chaired the Strategic Track, which included participation from senior officials from across both governments. The two sides reviewed the successful implementation of the

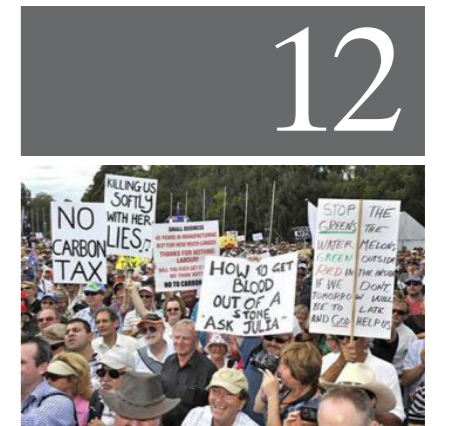
Strategic Track outcomes of the Fifth Round of the S&ED, held in-depth discussions on major bilateral, regional, and global issues, and recommitted to the S&ED's role in deepening strategic trust, expanding practical cooperation, and constructively managing differences to build a new model of relations between the United States and China. (Source: Ministry of Foreign Affairs of China)



11
世界上最大的燃烧后碳捕集项目开始建设：7月15日，美国能源部与NRG能源有限公司、JX日本联合宣布将共同建设美国的Petra Nova燃烧后碳捕集项目，这将是第一个商业规模燃烧后碳捕集改造项目，也是世界上规模最大的此类项目。Petra Nova项目将使用CCS以帮助减少电厂的温室气体排放。建设完成之时，该项目每年将从德克萨斯州现有的燃煤电厂捕集约140万吨的CO2。捕集到的CO2将被用于80英里以外一个早已枯竭的油田中石油的开采，并在此过程中被安全地封存到地底。（来源：美国能源部）

World's Largest Post-Combustion Carbon Capture Project Begins Construction: On July 15th, the U.S. Department of Energy – in partnership with NRG Energy Inc. and JX Nippon – announced that construction has begun on the first commercial-scale post-combustion carbon capture retrofit project in the U.S., the largest such project in the world. The Petra Nova Project will use this cutting edge technology to help decrease the power plant's greenhouse gas emissions. Once completed, the energy technology project will capture

about 1.4 million metric tons of carbon dioxide (CO2) annually from an existing coal-fired power plant in Texas. The captured CO2 will then be used to extract additional, hard-to-access oil from a previously depleted field 80 miles away, safely storing the carbon underground in the process. (Source: U.S.DOE)



12
澳大利亚通过废除碳税法案：澳大利亚联邦议会参议院17日以39票赞成、32票反对通过废除碳税的系列法案，因法案此前已在众议院获得通过，这意味着在澳大利亚实行了两年的碳税法案正式被废止。碳税是工党执政时与绿党联手推出的，2012年7月正式开始实施。按规定，澳大利亚300个最大的碳排放企业每排放1吨二氧化碳须上缴24澳元（1澳元约合0.94美元）。废除碳税法案是自由党—国家党联盟竞选期间提出的主要政策主张，也是执政后的首要任务之一。但由于工党和绿党控制参议院多数席位，执政党前两次废除碳税法案的努力均受阻。今年7月，新一届参议院组成，执政党经过与一些小党派反复磋商，最终获得小党派支持，才使废除碳税法案获得通过。根据主要小党派帕尔默联合党的要求，废除碳税法案增加了一些修订条款，要求受益的大企业必须把节省的碳税在一定时间内全部返还消费者，逾期将面临250%的罚款。

Australia Abolished Carbon Tax: Australia's Senate of Federal Parliament passed the bills relating abolishing carbon tax on July 17th with 39 affirmative votes and 32 against votes. This bill has already been passed by the house of representatives, indicating that carbon tax is officially abolished in Australia

after two years' implementation. The carbon tax was co-published by Australian Greens and Labor Party, and it came into effect in July 2012. According to the regulations, Australia's 300 largest carbon emitters must pay AU \$24 (US \$0.94) per ton of their CO2 emissions.

The abolition of the carbon tax was the main policy proposal of liberal-national coalition during campaign, and also one of the priorities when they were in office. However, as the majority votes in the senate were controlled by the Labor Party and the Greens, the ruling party failed in the first two times to abolish the carbon tax. In July 2014, with the formation of a new senate, the ruling party finally got smaller parties' support and abolished the carbon tax after repeated consultations with the small parties. According to request of the major small party Palmer Alliance, the abolition bill of the carbon tax added some amendments that required benefited large enterprises to return all the saved carbon tax to consumers in the agreed period of time, otherwise they will face penalty of up to 250% of the carbon tax they saved.

CCS 指令为有助于减缓气候变化的安全、环保的二氧化碳地质封存建立了一个法律框架。它的目标是确保不会出现重大的二氧化碳泄露风险或损害公众健康和环境，并防止对运输网络或封存点的安全性带来任何不利影响。该指令制定了覆盖封存点的整个生命周期（包括关闭后的前十年时间）的相关要求。

(来源：欧盟委员会)

European Commission Closes Three Cases of Infringement of the CCS Directive: On July 24th, the European Commission has closed infringement procedures against Cyprus, Hungary and Ireland. In November 2013, the Commission asked these Member States to comply with the Directive on the geological storage of CO2 (CCS Directive). These three Member States have now notified the European Commission that they have taken measures to incorporate the CCS Directive into national law. The CCS Directive establishes a legal framework for the environmentally safe geological storage of CO2 to contribute to mitigating climate change. It aims to ensure that there is no significant risk of leakage of CO2 or damage to health or the environment, and to prevent any adverse effects on the security of the transport network or storage sites. The Directive lays down requirements covering the entire lifetime of a storage site, including the first decades after its closure.

(Source: European Commission)

了履约工作。深圳 635 家控排企业中仅有 4 家未完成履约，北京和天津情况尚未公布。

(来源：中国碳排放交易网)

Five of China's pilot carbon markets completed compliance procedures for the first year of trading: By July 25th, five of China's pilot carbon markets have completed compliance procedures for the first year of trading. Among them, Shanghai has fully finished the compliance. Only four companies in the 635 emission controlled enterprises in Shenzhen and 2 companies in Guangdong did not complete their compliance on time. No such information is available on Tianjin and Beijing carbon markets. (Source: China Emissions Exchange)

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欧盟委员会对三起违反 CCS 指令案件结案：7 月 24 日，欧盟委员会对塞浦路斯、匈牙利和爱尔兰的违法程序结案。2013 年 11 月，欧盟委员会要求这些成员国遵守 CCS 指令中的二氧化碳地质储存的指令。目前，这三个成员国已经通知欧盟委员会，他们已采取措施将 CCS 指令融入到国家级法律中。

14



中国碳交易首年履约顺利。截至 7 月 25 日，首年履约的五个试点市场全部完成了履约工作。其中，上海以 100% 的履约率完成

15



深圳首家获批引进境外投资者参与碳排放权交易：8 月 8 日，国家外汇管理局正式批复同意深圳外汇管理局为深圳排放权交易所及境内外投资者办理跨境碳排放权交易的相关外汇业务。至此，境外投资者参与深圳碳排放权交易市场的外汇管理流程获得国家批准，深圳碳交易市场成为全国首家向境外投资者开放的碳市场。

(来源：深圳碳排放权交易所)

Shenzhen was Approved as the First to Let Foreign Investors Trade Carbon Emission Allowances: State Administration of Foreign Exchange (SAFE) issued an official reply to Shenzhen Branch of SAFE on August 8th 2014, approving foreign investors participating in Shenzhen carbon market, making Shenzhen carbon market the first one open to foreign investors in China carbon market. (Source: China Emissions Exchange)

16



APEC 第三次高官会在京闭幕：8 月 21 日，2014 年亚太经合组织 (APEC) 第三次高官会在京闭幕。此次高官会是今年领导人会议周前各经济体高官最后一次全体会议，核心工作是为 11 月举行的 APEC 领导人会议做好全面准备。

(来源：新华网)

The APEC Third Senior Officials' Meeting Closed in Beijing: On August 21st, the APEC 2014 Third Senior Officials' Meeting closed in Beijing. This officials' meeting is the last plenary meeting of senior officials from all member economies before the leaders' meeting week. It aims to fully prepare for the APEC leaders' meeting in November 2014.

(Source: Xinhuanet)

17



壳牌在阿尔伯塔省首个油砂 CCS 项目安装最后模块 (28/8)：加拿大壳牌公司表示，已将最后的模块安装在阿尔伯塔省的首个油砂 CCS 项目中，并将于 2015 年开始启动该项目。目前已完成 70% 工作的 CCS 探索项目，得到了阿尔伯塔省和加拿大联邦政府的资助，以帮助减少油砂冶炼的温室气体排放。

该项目每年将从壳牌位于埃德蒙顿北部的 Scotford 精炼厂捕集超过 100 万吨的 CO2，并将其注入阿尔伯塔草原下 2 千米深的非渗透性岩层中永久封存起来。(来源：路透社)

Shell Fits Final Module on Alberta Oil Sands' First Carbon Capture Project (28/8): Shell Canada has fitted the final module at the first carbon capture and storage project in Alberta's oil sands, the company said on Wednesday, putting start-up on track for 2015. The Quest CCS project, now 70 percent complete, is being built with funding from the Alberta and Canadian federal government to help mitigate greenhouse gas emissions from the oil sands. It will capture more than 1 million tonnes of carbon dioxide each year from Shell's Scotford upgrader north of Edmonton and inject it 2 km under the Alberta prairies into impermeable layers of rock for permanent storage.

(Source: Reuters)

中美加快二氧化碳捕集、利用与封存合作 China and the United States Accelerate Collaboration on CCUS

Sarah Forbes

今年7月中国与美国签订了削减其温室气体排放的八个新协定。这些公告的一半都聚焦一项单一的气候变化减缓措施——二氧化碳捕集、利用与封存 (CCUS)。

这些公告恰好在第六轮中美战略与经济对话之前公布，该对话是两国讨论其共同的经济和环境挑战与机遇的年度会议。就 CCUS 的研发而论，中国和美国都是世界的领导者之一，本次协议建立在两国之间悠久的 CCUS 合作历史之上。事实上，中美的 CCUS 合作关系目前在许多方面已经从理论上的可行性领域进入到了“实质”阶段。

China and the United States established eight new pacts this July to reduce their greenhouse gas emissions. Half of these announcements focused on a single climate change mitigation measure—carbon dioxide capture, utilization and storage (CCUS).

The announcement came just prior to the sixth U.S.-China Strategic and Economic Dialogue, an annual meeting where both countries discuss their shared economic and environmental challenges and opportunities. China and the United States are among the world's leaders when it comes to CCUS research and development, and this week's agreements build on a long history of CCUS collaboration between the two nations. In fact, China-US partnership on CCUS has in many respects now left the theoretical feasibility realm and entered the "steel-in-the-ground" phase.

中美 CCUS 的合作历史 A History of CCUS in China and the United States

中美之间的 CCUS 合作已经不是新鲜事了。两国各自经营其自己雄心勃勃的研发计划、资助各方面的 CCUS 技术开发——从实验室研究到利用世界上最先进监测技术的大规模示范。美国 CCUS 研究计划开始于 2000 年之前，而中国的研发计划最早可追溯到 2005 年。中美之间的 CCUS 合作在 2005 年也正式开始了。

2009 年，奥巴马总统和胡锦涛主席成立了中美清洁能源联合研究中心，该中心有三个技术联盟，其中一个专注于煤炭与 CCUS。2013 年 4 月，战略与经济对话的气候变化工作组 (CCWG) 的成立，深化和扩展了大规模合作的努力。2013 年 7 月，两国承诺了涉及五个可持续性问题的，包括 CCUS 的新行动举措。今年 7 月签署的谅解备忘录将中美伙伴关系提升到一个更高的水平，通过将美国的项目与中国类似的项目配对，以便企业和研究机构能够分享信息，这有助于彼此解决运

Collaboration on CCUS between the United States and China is not new. Each country operates its own ambitious R&D program, funding various aspects of CCUS technology development—from laboratory studies to large-scale demonstrations employing world's most advanced monitoring techniques. The U.S. CCUS research program began before 2000, and China's R&D program dates back to at least 2005. Collaboration between the United States and China on CCUS also began formally in 2005.

In 2009, President Obama and then President Hu Jintao established the U.S.-China Clean Energy Research Centers, with one of the three centers focused on coal and CCUS. In April 2013, the Climate Change Working Group (CCWG) for the Strategic and Economic dialogue was established to deepen and extend large-scale, cooperative efforts. And in July 2013, the two countries committed to new action initiatives across five sustainability issues, including CCUS. The MOUs signed this July bring U.S.-China partnerships to another level by pairing projects in the United States with similar projects in China so that companies and research institutions can share

营问题。此类合作有助于刺激两国的 CCUS 创新，并加快 CCUS 在全球的示范和早期推广。

information that helps each other solve operational problems. Such collaboration can help spur CCUS innovation in both countries and accelerate the demonstration and early deployment phase of CCUS globally.

新的 CCUS 伙伴关系 New Partnerships on CCUS

两国的公司与研究机构签署了一系列协议，具体如下：

A series of agreements were signed between companies and research entities, including the following:

- 中国华能清洁能源研究院与美国 Summit 电力集团同意进行清洁发电技术如整体煤气化联合循环 (IGCC) 和 CCUS/ 强化石油开采 (EOR) 的合作
- 陕西延长石油公司、空气化工产品公司与西弗吉尼亚大学同意在陕北进行清洁化石能源示范 (EOR) 合作
- 山西国际能源集团同意与空气化工产品公司对于一个 350 兆瓦富氧燃烧电厂使用 CCUS 的可行性研究进行合作
- 胜利油田 (中石化) 与肯塔基大学同意在一个大型 (每年 100 万吨二氧化碳) CCUS 示范项目 (燃烧后捕集和藻类吸收) 方面进行合作
- Huaneng Clean Energy Research Institute and Summit Power Group LLC agreed to collaborate on clean coal power generation technology (IGCC and CCUS/EOR)
- Yangchang Petroleum Corp. Ltd, Air Products and Chemicals, and West Virginia University agreed to cooperate on a clean fossil energy demonstration in northern Shaanxi (EOR)
- Shanxi International Energy Group agreed to work with Air products on a feasibility study for pairing a 350 MW Oxygen Combustion plant with a carbon dioxide capture utilization and storage (CCUS) demonstration
- Shengli Oilfield (SINOPEC) and the University of Kentucky agreed to cooperate on a large—one million tons of CO₂ per year—CCUS demonstration (post-combustion capture and algae)

CCUS：为黄金时间做好准备了吗？ CCUS: Ready for Prime Time?

每个人都想知道装备了 CCUS 技术的电厂什么时候开始为人们提供电力。令人无法满意的回答是，这取决于第一批大规模 CCUS 项目的成功以及政府多么认真地应对气候变化。

许多人指望美国和中国回答这些问题，因为

Everyone wants to know when power plants equipped with CCUS technology will start providing electricity for people. The unsatisfying answer is that it depends on the success of the first batch of large-scale CCUS projects, as well as how serious governments are about tackling climate change.

Many are looking to the United States and China for

这两个国家的 CCUS 发展是最快的。根据全球碳捕集与封存研究院的数据，世界范围内有 65 个处于不同规划与建设阶段的 CCUS 项目，有 7 个项目已经开始运营。美国以 19 个大规模项目领先全球发展，中国以 12 个项目居第二位。

虽然美国密西西比州和加拿大萨斯喀彻温省配备 CCUS 技术的电厂预计在 2014 年投入运营，但是 CCUS 努力不限于电力生产。在美国，有许多 CCS 项目在各种工业设施上进行，包括造纸厂和乙醇生产设施。例如，一个位于德克萨斯州的氢气生产项目，刚刚捕集了其第一百万吨二氧化碳。而且，根据美国能源部的说法，他们通过联邦政府资助的公私合作伙伴关系资助的项目已经捕集和封存了将近 750 万吨二氧化碳。

在中国，已运营的 CCUS 示范项目的投资（总数）超过 76 亿元——不包括绿色煤电项目，绿色煤电项目还要增加另外的 99 亿元。绿色煤电的 CCUS 方面的目标定于 2015 年。这些已经运营的示范项目已经实现了每年大约 27 万吨二氧化碳的捕集、12 万多吨的二氧化碳利用、以及 10 万吨二氧化碳的封存。

answers to these questions, as the two countries are furthest along with their own CCUS development. According to the Global CCS Institute, there are 65 CCUS projects in various stages of planning and construction worldwide, with seven already operating. The United States leads global development, with 19 of these large-scale projects, and China comes in second with 12.

Power plants equipped with CCUS in Mississippi and Saskatchewan are scheduled to come on line in 2014, but CCUS efforts aren't limited to power production. In the United States, there are CCS projects taking place at a variety of industrial facilities including paper mills and ethanol production facilities. A hydrogen production project in Texas, for example, just captured its millionth ton of CO₂. And according to the U.S. Department of Energy, projects they've funded have already captured and stored nearly 7.5 million tons of CO₂ through federally funded public-private partnerships.

In China, collective investment in already-operating CCUS demonstrations totals more than CNY 7.6B—not including GreenGen, which adds another CNY 9.9B. GreenGen's CCUS aspects are targeted for 2015. These already-operating demonstrations have resulted in capture of about 270,000 tons of carbon dioxide per year, utilization of more than 120,000 tons of carbon dioxide per year, and storage of 100,000 tons of carbon dioxide per year.



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

CCUS 的未来 The Future of CCUS

随着温度的继续升高，世界各地的人们正在感受到气候变化的影响，这具体表现为海平面上升、极端天气和热浪。如果加快 CCUS 的示范和推广——不仅仅在中国和美国，而是在全球——CCUS 将能够为一个低碳世界作出贡献。

为将 CCUS 应用于世界各地的电厂，需要在怎样有效地和经济地推广此项技术方面进行更全面的合作和信息共享。最近在中国签署的谅解备忘录不仅仅是另一次拍照机会。显而易见的是，CCUS 讨论正在从有可能的项目合作转移到可能很快运营的实际项目的合作上。

As temperatures continue to rise, communities around the globe are feeling the effects of climate change in the form of sea level rise, extreme weather, and heat waves. CCUS will only be able to contribute towards a low-carbon world if demonstration and deployment is accelerated—not just in China and the United States, but globally.

Scaling up CCUS to power plants around the world is going to require greater collaboration and information-sharing on how to both effectively and economically deploy the technology. The MOU signing held recently in China is more than just another photo opportunity. It is evidence that the CCUS discussion is shifting from collaborating on projects that are possible to collaborating on real-world projects that could soon be operating.

Sarah M. Forbes has been a senior associate at the World Resources Institute (WRI) since May 2008. Sarah leads the technology consortium within the climate and energy program, managing the WRI initiatives on shale gas and carbon dioxide capture and storage (CCS) in China.

中美能源气候合作展望与政策建议 Outlook & Policy Recommendations for U.S.-China Collaboration on Energy and Climate Change



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- 未来合作重点将会放在：
- 两国中央政府通过强化政策对话，就 2020 年后温室气体排放目标达成默契，为“后巴厘”减排安排做好准备。
 - 林业合作。新增“气候变化和森林”行动倡议。
 - 清洁煤利用的相关合作。例如常规火力电厂的能效和碳强度合作，燃煤工业锅炉燃料转化和锅炉效率合作等。
 - “绿色”港口的地方政府结对合作。
 - 低碳城市结对合作。
 - 非道路移动机械及配套用柴油机清洁行动合作。

未来中美两国间的气候和清洁能源合作预期将有几方面趋势和特点：

一. 合作主体

由最初的中央政府推动向地方政府合作、科研单位、以及企业合作逐步推开，未来几年，两国相关气候产品和清洁能源企业间的合作有望成为主力，两国气候合作最终要由政府推动转变为由市场推动。由于存在技术瓶颈和成本较高等因素的制约，中美两国清洁能源企业合作的进展与两国政府的支持力度和相关政策、法规是否能够及时跟进、是否具有明确的可预见性、可持续性的关联度较大，对国家政策高度敏感。

二. 合作领域。

现有的五个行动倡议：载重汽车和其它汽车减排、智能电网、碳捕集利用与封存、建筑和工业能效、温室气体信息共享、氢氟碳化物将进一步获得推进。

三. 可再生能源合作。

未来中美两国可再生能源合作的选择主要由几方面因素决定：1. 由技术突破决定的成本可行性；2. 两国可再生能源的资源禀赋；3. 居民消费和市场需求。按照以上标准，未来两国可再生能源合作重点：1. 太阳能；2. 风能；3. 生物质能；4. 智能电网；5. 电动汽车。

四. 政策建议：

1. 温室气体减排方面，两国在多边谈判前首先通过双边政策对话达成适度默契。作为世界排放大国和能源消费大国，在未来的“后巴厘”减排安排的全球气候谈判中，中美两国必定成为减排责任和减排目标关注重点，两国有必要预先充分沟通，达成适度默契，争取发出一致声音。
2. 高度重视技术合作。技术突破在相当程度上决定气候产品、环境产品和清洁能源产品

和市场的成败，美国拥有世界一流的清洁能源技术研发团队，建议未来将先进技术研发、示范、推广合作作为两国气候合作的重点。

3. 国内市场的适度保护。环境产品和及相关服务贸易的自由化将成为两国未来合作需要博弈的一个难题，美国对中国开放气候产品和能源市场的需求将会日益迫切。国内气候产品企业和清洁能源产品企业尚处于初期发展阶段，有必要采取合适措施进行适当保护。

4. 重视市场化的机制安排。中美两国之前的气候合作和清洁能源合作主要由政府靠行政手段推动，未来需要将政府推动逐渐转变为市场推动，长期看，应该由市场机制配置气候产品市场和清洁能源产品市场的优质资源，探讨如何通过税收减免、政府补贴、金融支持、关税优惠等政策鼓励，更多激发企业热情，打造完整的绿色产业链应该成为两国政府下一步的合作重点。

5. 充分挖掘基层乡镇的合作潜力。乡镇是未来气候产品和清洁能源产品的一大潜在市场，乡镇在生物质能、分布式太阳能发展等方面具备先天优势，可以考虑用美国的先进技术合作换取中国的基层乡镇市场，以此带动中国基层乡镇的绿色发展和绿色产业。此外，可以探讨中美两国“绿色乡镇示范”结对合作方式。

6. 在国家能源局下建立国家级的清洁能源实验室。美国能源部有世界最庞大的能源实验室系统，共有 28 个下属实验室，涉及可再生能源、清洁能源、节能、能源技术等方方面面，这些实验室在美国清洁能源技术的创新和突破中发挥了至关重要的作用。鉴于技术突破在未来气候产品市场和清洁能源市场竞争中的决定性作用，中国有必要参考美国经验，整合全国专家和技术资源，建立国家级的清洁能源实验室，进行跨学科、跨部门的协同攻关。美国国家能源实验室数量多、建立时间长、运作经验丰富，可以考虑两国在此议题进行适当方式的合作。此外，建议在中美清洁能源研究中心设立“中美清洁能源联合研究实验室”，为两国间的气候先进技术和清洁能源技术研发合作提供直接平台和渠道。



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7. 做好绿色产业链的预期安排。目前中美气候产品和清洁能源产品主要集中在政策合作、研发、以及生产层面，随着绿色产业的扩展，未来与绿色产品有关的金融产品需求将日益强烈，碳金融、碳交易所、碳期货等相关金融产品和市场需要预先安排和拓展，在此方面，中美两国可以展开合作，交流探讨彼此的能力建设、市场拓展，以及行业监管。

8. 建立“林业碳伙伴基金”。建议在中美两国新增的“气候变化和森林”行动倡议下，建立“林业碳伙伴基金”，为两国的林业可持续发展提供资金支持和激励，并考虑通过适当途径与中美两国、其它国家，以及全球范围内的碳基金和碳交易市场进行对接。

9. 在中美气候变化工作组框架下增设“工商咨询理事会”。该咨询理事会主要由两国气候产品和清洁能源产品企业界人士组成，反映企业需求、提出设想和建议，包括：企业发展困境、绿色产业发展所需的工商环境、两国绿色贸易障碍的解决等，定期向工作组和部长级会议提交咨询报告和政策建议。

10. 两国合作由中央政府层面逐渐向地方政府层面推进。中美两国之前的气候变化和清洁能源合作主要集中在中央政府层面，但从长期看，中央政府的合作政策最终还需要落实在两国地方政府的执行和合作上。建议下一步大力推动中美两国地方政府层面的务实合作，除了现有的“绿色合作伙伴”结对、“低碳城市”结对合作以外，探讨“绿色港口”结对合作、“太阳能示范乡镇”结对合作、“生物质能示范乡镇”结对合作等新的地方政府合作形式。

There are various features of cooperation between the U.S. and China on climate change and clean energy development in the future:

I. The collaborative agents.

In the coming years, the cooperations between enterprises which are related to climate products and clean energy in these two countries are expected to become mainstream. Moreover, the cooperation between these two countries in the field of climate will be ultimately promoted by the market instead of the governments, as the methods of cooperation are transforming from being promoted by the central government to cooperation between local governments, scientific research institutions and enterprises. The progress of cooperation of clean

energy enterprises in these two countries is closely tied to the support of both governments and whether or not related policies and regulations can be updated in time, and if those policies and regulations can be explicitly predicted and sustainable, because of such limitations as technological bottleneck and high cost.

II. The collaborative fields.

Five fields will be carried forward, covering heavy trucks and other vehicles emission reduction; smart grids; carbon capture, usage and storage; energy efficiency of buildings and industries; and sharing information of greenhouse gases, and HFCs.

Collaborative focus in the future will be as follows.

- Through intensive policy dialogues, the two central governments will come to an agreement on the emission target of greenhouse gases after the year 2020, in preparation for the “Post- Bali” emission reduction arrangement.
- Collaboration in the forestry sector. The action proposal of “Climate Change and Forests” has been added.
- Related collaboration in the field of clean coal, such as cooperation in the energy efficiency and in the carbon intensity between the two nation’s regular thermal plants, and cooperation in fuel conversion of coal-fired industrial boilers and in the efficiency of boilers between those plants.
- Partnership cooperation between green ports.
- Partnership cooperation between low-carbon cities.
- Collaboration in the clean actions of non-road motor vehicles and matching diesel engines.

III. Cooperation in the field of renewable energy.

The cooperation in renewable energy between the two countries in the future mainly depends on the following factors:

1. Cost feasibility which will be decided by technological breakthroughs;
2. Resource endowment of renewable energy of these two countries;
3. Household consumption and the market capacity.

Based on the factors mentioned above, the focus of cooperations in renewables between the two nations falls on areas such as solar energy, wind energy, biomass energy, smart grid, and electric vehicles.

IV. Policy suggestions

1. In the field of greenhouse gas emissions reduction, the two countries should come to a kind of tacit understanding through bilateral dialogue,

before global multi-lateral negotiations start. As two main greenhouse gas emission sources and prominent energy consumption powers, it is almost inevitable for China and the U.S. to be the focus of emissions reduction responsibility and emissions reduction target. It is necessary for these two countries to communicate intensively and come to an agreement in advance.

2. Pay more attention to technological cooperation. To a fairly degree, technological breakthroughs are the deciding factors of products and markets of climate, environment and clean energy. Since the U.S. owns the first-class clean energy technological research teams it is advisable to ensure that advanced technological research, demonstration and promotion are the focus of climate and energy cooperation concerning between China and the US in the near future.

3. Proper protection of domestic market. As the liberalization of the environmental product and service trades will be a difficulty in the two nation’s cooperation, the United States is desperate to open the China’s climate and clean energy products. Nevertheless, China’s domestic enterprises producing climate products and clean energy products are still in the early phase of development it is, at the present, necessary to take appropriate measures to protect them.

4. Attaching importance to the market mechanism. At present, the climate and clean energy cooperation between the countries was mainly driven by the governments, but in the future it needs to be promoted by the market instead. In the long run, market mechanism should play a key role in deploying resource of good quality in climate product and clean energy product market. And discussions on how to, by such policy incentives as tax relief, subsidies, financial support and tariff preference, to effectively motivate enterprises, and to build up an integrated green industrial chain should be the core issue of cooperation between the two nation’s governments in the future.

5. The cooperative potential of villages and towns should be fully harnessed. Due to inherent advantages in biomass energy and distributed solar energy development, villages and towns are regarded as a large potential market of climate and clean energy products. It is worth considering exchanging the U.S. advanced climate and clean energy technology with China’s broad village and town market, so that china’s green industry in villages and towns can be driven. Furthermore, the pattern of “Green Villages and Towns Partnership” in both countries can also be discussed.

6. The national-level clean energy laboratories should

be established, which can be subordinated to the National Energy Administration. The 28 laboratories, which are subordinate to the largest energy laboratory system in the world under the leadership of Department of Energy of the United States, have played significant roles in the innovation and breakthroughs of clean energy technologies, including renewables, clean energy, and energy conservation. On account of the decisive role of technological breakthroughs in future climate and clean energy product market competition, it’s necessary for China to establish a national-level clean energy laboratory, by integrating experts and technological sources across the nation, as has been done by the U.S.. Since a significant number of U.S. national energy laboratories have gained rich operational experience over a long period of time, some kind of cooperation between the two countries in this field can be considered. In addition, it’s necessary to establish the China-U.S. Clean Energy Laboratory, which can be subordinated to China-U.S. Clean Energy Research Center. Such national-level clean energy laboratories can provide a powerful platform and direct channel for advanced climate and clean energy technologies research between both countries.

7. Making fully arrangements for the green industrial chain in advance. At present, climate and clean energy products in both countries mainly concentrate on policy cooperation, R&D, and production. However, with the development of the green industry, there will be more demands for green financial products. Therefore, such financial products and markets as carbon finance, carbon exchanges and carbon futures should be arranged and expanded in advance. In this regard, China and the U.S. should strengthen cooperation and exchanges in such fields as capacity building, market expansion as well as industry supervision.

8. Establishing the Forest Carbon Partnership Funds. It is advisable to establish the Forest Carbon Partnership Fund under the Climate Change and Forests Action Initiative recently launched by both China and the U.S.. Such a Forest Carbon Partnership Funds can provide financial support and incentives for the two countries’ forestry development, and also can connect with other carbon funds and carbon exchange market across the world.

9. Establishing the Business Advisory Council in the framework of the China-U.S. Climate Change Working Team. The council should be comprised of enterprise members producing climate and clean energy products, and should reflect the needs of enterprises, put forward suggestions, including how to solve problems of enterprises development, how to offer a favorable industrial and commercial

environment for green industry, and how to overcome green trade barriers etc. In addition, the council should submit consulting reports and policy suggestions to the both party's working team and ministerial meetings at regular intervals.

10. The cooperation between the two countries should be gradually shifting from central government to the local governments. Currently China-U.S. climate and clean energy cooperation mainly concentrate at the central government level, but in the long term, cooperation policies of the central governments need to be implemented by the local governments. So we advise that pragmatic cooperation between China-U.S. local governments should be strengthened. In addition to existing Green Partnership, Low Carbon City Partnership, the both countries should discuss other new kinds of local government cooperation pattern, such as Green Port Partnership, Solar Energy Demonstration Towns and Villages Partnership, and Biomass Demonstration Towns and Villages Partnership.



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奥巴马如何塑造美国的气候共识? How Did President Obama Build the Climate Consensus?



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气候变化问题一直是奥巴马想要有所作为的领域。奥巴马上台后, 意识到美国面临的最紧要的问题就是建立气候共识。对美国而言, 从最基础的科学共识建设, 到决策层面的政策共识建设, 奥巴马政府任重道远。总的来看, 奥巴马主要做了两件工作来引导美国国内各界形成气候共识, 一件是在科学研究中创造新知识, 一件是在政策实践中培育共识。

塑造美国气候共识, 最重要的工作当属 2014 年 5 月白宫发布的第三次《气候变化国家评估报告》。该报告同意 IPCC 在 AR5 中的结论, 即地球正在变暖、且主要是因为人类活动所导致。这基本上解决了前面提到的困扰美国气候行动的三大问题中

自上世纪 90 年代开始, 美国国内质疑或反对气候变化的声音不绝于耳。美国国内质疑或反对气候变化的理由关乎三个基本问题: 全球变暖真的存在吗? 全球变暖主要是由人类活动引起的吗? 如果是这样, 美国应该做什么, 即用多少成本实现多大目标? 美国国内关于气候变化的相关辩论显示, 从学术研究成果、到政策分析专家的主张、再到国会听证会的政策辩论, 美国国内各界针对上述三大问题远未形成共识, 这严重阻碍了美国的气候行动。2009 年以来, 上述情况开始发生变化。

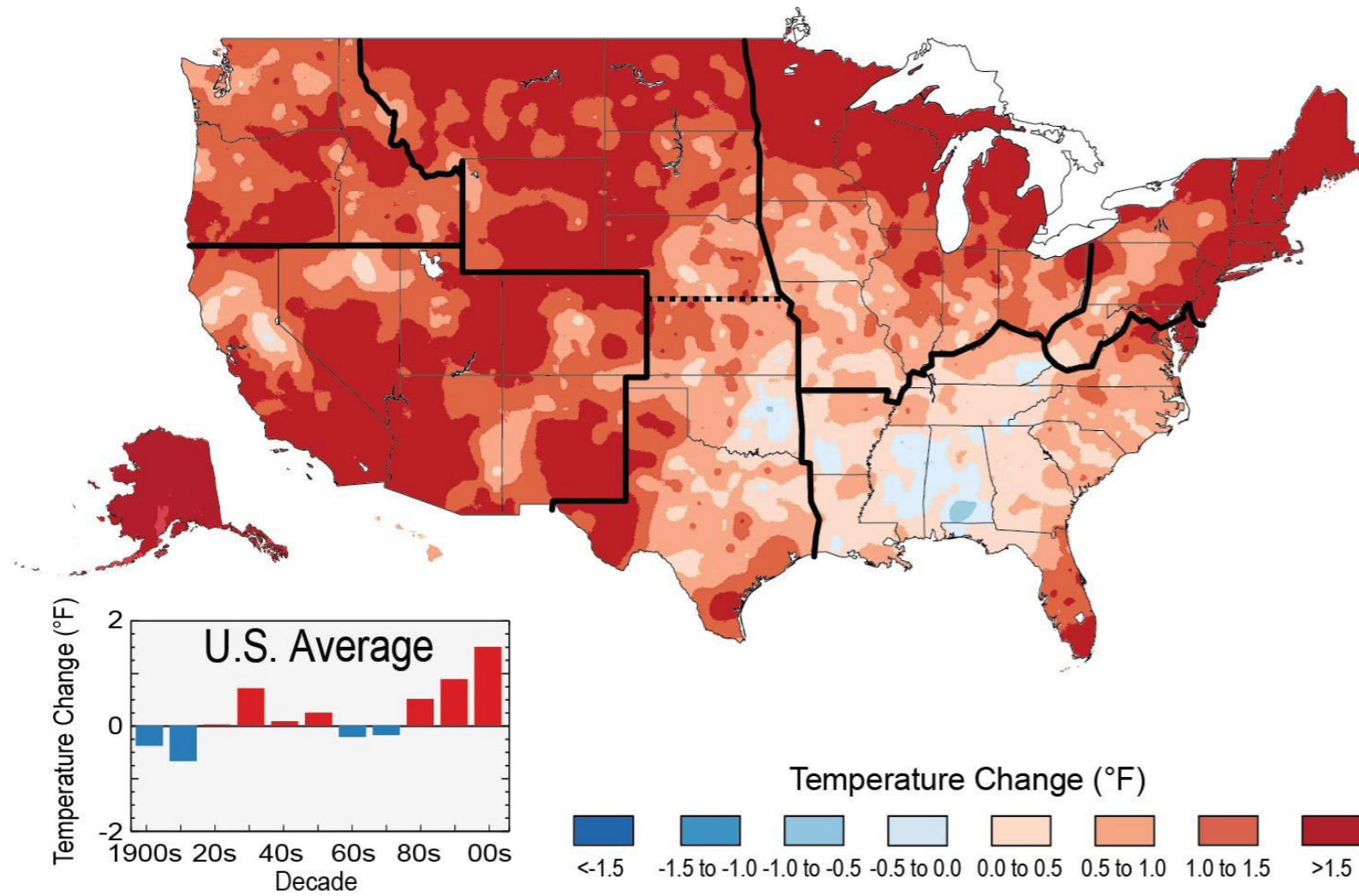
Since the 1990s, climate change has been challenged and questioned within the United States. The voice of the opposition is largely related to three basic questions: Does the global warming really exist? Is climate change mainly caused by human activities? If so, what should the United States do and at what cost? Debates around climate change in the United States show that all circles in the United States, from academic research conclusions to policy analysts proposals, and to congressional hearings debates, are far from consensus around the above three questions, which has seriously hindered climate actions in the United States. Since 2009, the above situation began to change.



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The issue of climate change has been an area that Obama has been dedicated to taking action on. After he came to power in 2009, Obama realized that the most urgent task facing the United States is to build up consensus around climate change. The Obama administration, however, has a long way to go in terms of building consensus amongst scientists and policy makers respectively in the United States.. Overall, Obama did two key things to lead all circles in the United States to form the consensus around climate change. The first is to create new knowledge in scientific research, the second is to cultivate consensus in policy practice.

The third "National Climate Change Assessment Report" released by the White House in May 2014, should be considered the most important work for



的前两个。同时，除了气候变化对美国主要经济部门（包括水资源、农业、林业、能源、交通等）产生的重要影响外，该报告还深入分析了气候变化对美国不同地区带来的严重影响，这为各州、地方采取具体的气候行动提供了坚实的科学依据。此外，该报告由美国 300 多位专家历时 4 年完成，并得到美国国内外公众和专家的广泛审评，是迄今最全面、权威和透明的美国气候变化影响评估报告，这种报告组织和撰写过程使得气候共识的塑造过程显得更为客观、可信。

除了从科学知识方面构建气候共识外，奥巴马还在实践中运用“化整为零”方法，利用宪法赋予的行政机构的权力，来分部门、多步骤的调整和修订现有的联邦政府法规来监管碳排放。具体而言，奥巴马将美国碳排放的大系统划分为一个个小单元，为各个经济部门设立独立的减排或能效目标。比如，奥

巴马政府依据《清洁空气法》分别对机动车、煤电厂和炼油厂等的温室气体排放进行规制。“化整为零”方法既克服了共识不足的障碍，从而提高了实效性，同时又能不断出新，最终形成规模效应。“化整为零”方法对塑造气候共识的作用在于，它将关注的焦点集中在传统的污染大户上，凸显出联邦政府保护美国公众健康权利的功能，增强了美国公众对相关制度和政策的认同，巧妙的将气候共识塑造过程隐蔽化为美国公众的自主选择。

奥巴马塑造气候共识已经初见成效。皮尤研究中心的调查显示，近几年，尽管认为气候变化由人为活动引起的美国人仍未形成主流，但是，美国人中相信气候变化已经发生的比例上升，同时，相信气候变化主要是人为活动造成的比例也上升了。一项政策必须得到公众的支持，至少也要得到公众的了解和关切，否则必然遭到失败。奥巴马任期内，美国的二氧化碳排放量下降趋势显著。与 2005 年美国 59.99 亿吨的排放量相比，2012 年美国温室气体排放量已下降了近 12%，2013 年美国温室气体排放量下降了 10.7%。可以预见，在美国国内气候共识不断深化的趋势下，在气候外交和国际气候谈判中，奥巴马也将进一步采取积极进取姿态。

shaping US climate consensus. The report agreed with the conclusion in AR5: the globe is warming and it is mainly caused by human activities. The report well answers the first two of three questions mentioned above. The report explores the significant influence on major US economic sectors (including water resource, agriculture, forestry, energy, transportation, etc.) by climate change, as well as analyzes the serious impacts on different geographical areas caused by climate change, which provided the solid scientific evidence for various states and local areas to adopt specific climate actions. It took more than 300 American experts four years to complete this report and it was reviewed extensively by experts inside and outside US. It is the most comprehensive, authoritative and transparent assessment report on US climate change impacts, and the way of organizing and writing the report makes the process of shaping climate consensus more objective and believable.

Besides building scientific climate consensus, in

practice, Obama also regulates carbon emissions through adjusting and revising existing federal government laws and regulations sector with the method of “breaking up the whole into parts”, because the power of the executive agency has been endowed by the constitution. Specifically, Obama divided the large system of US carbon emissions into small units and then set up independent emission reduction or energy efficiency targets for various economic sectors. For example, the Obama Administration, on the basis of the Clean Air Act, plans to regulate the greenhouse gas emissions from motor vehicles, coal-fired power plants and oil refineries. The method of “breaking up the whole into parts” not only overcomes barriers to consensus, but also show a scaling effect by promoting new advances. The advantage of this method to build climate consensus is that it highlights the role of the federal government in protecting the public health by monitoring and regulating the traditional large polluters, which further strengthens the American public support and identification of the climate change related policies and institutions. Thus, building climate consensus intentionally has been hidden and shifted as the consequence of an independent choice by the American public.

Obama’s efforts to build climate consensus has achieved initial success. The Pew Research Center’s survey shows that, in recent years, although Americans who believe climate change is caused by human activities has not become mainstream yet, the proportion of American’s view on climate change is happening and the proportion of American’s view on human-caused climate change have grown. A policy must be supported by the public, at least understood and concerned by the public, otherwise it will inevitably fail. US carbon dioxide emissions have declined significantly during the presidency of Obama, falling by nearly 12% between 2005 and 2012. Under the trend of constantly deepening climate consensus in the United States, it is expected that Obama will have a positive attitude in climate diplomacy and international climate talks.

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2014 APEC 可再生与清洁能源 贸易投资首次公私对话评论 A Review of the First Public Private Partnership on Environment Goods and Services (PPEGS) in APEC

2014年8月11日，亚太经济合作组织（APEC）第一次环境产品与服务公私伙伴关系对话会议在北京召开。来自APEC近20个经济体和其他国家组织的90多位政府官员、企业领袖和专家学者参加了会议。笔者有幸参与到本次重要会议并对有关问题发言。本次对话会以促进APEC地区可再生和清洁能源的贸易投资为主题，是2014年APEC第三次高官会议的一场重要会议，也是APEC贸易与投资委员会批准的APEC环境产品与服务公私伙伴关系对话平台的第一次对话活动，其核心工作是为今年11月在北京举行的APEC领导人非正式会议奠定基础。

The first Public-Private Partnerships Dialogue Meeting for Environmental Products and Services of Asia-Pacific Economic Cooperation (APEC) was held in Beijing on August 11, 2014. More than 90 government officials, business leaders and experts and scholars, from nearly 20 economies and other nations and organizations, attended the meeting. The theme of the dialogue is to promote renewable and clean energy trade and investment across the APEC region. It is the third Senior Officials' Meeting of APEC in 2014, and it is also the first Public-Private Partnerships Dialogue for Environmental Products and Services platform which was approved by the Trade and Investment Commission of APEC. The core work of the Public-Private Partnerships Dialogue for Environmental Products and Services of APEC is to lay the foundation for the APEC Leaders' Unofficial Meeting which will be held in this November in Beijing.

对话推动清洁能源产品贸易与投资 To Promote RCE Trade and Investment

本次会议旨在通过APEC地区公私领导人对话，预防和减少可再生与清洁能源（RCE）产品领域的贸易与投资摩擦，促进和便利本区域经济体之间RCE的贸易投资，推动产业健康发展。与会的各经济体的贸易与能源官员，产业领袖和学者围绕“促进亚太地区RCE的贸易投资”这一主题进行了深入地讨论。专家学者们就亚太地区RCE贸

The meeting aims at preventing and reducing the trade and investment frictions in the renewable and clean energy (RCE) product field, promoting and facilitating the REC trade and investment within the regional economies, and driving the industry to develop healthily through the public-private leaders dialogue in the APEC region. With the participation of trade and energy officials, industry leaders and scholars from various economies, the meeting has carried



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易投资的背景、现状、未来趋势，以及政府和私营企业在其中的角色做出了深入的分析。政府官员和企业代表就：1 如何通过政策创新促进RCE的贸易投资和技术推广；2 如何加强各经济体之间在RCE产品的补贴和财税支持政策上的协调与合作，以预防和避免贸易摩擦；3 如何通过公私对话、二轨对话（企业协会之间的协调与沟通）等手段促进RCE贸易与投资；4 如何在亚太地区统一RCE产品质量认证标准，降低跨界RCE贸易和投资成本提高RCE产品质量和可靠性等议题进行了充分的探讨。

致力降低低碳和清洁能源贸易壁垒

根据会议的共识，APEC贸易与投资委员会在2014年的第三次会议上通过了中国提出的《推动可再生和清洁能源贸易与投资的APEC宣言》。宣言提出APEC成员一致同意采取行动推动建立一个开放透明的RCE市场，反对一切形式的贸易保护主义和贸易壁垒，在对贸易保护主义的监控和抵制上加强合作；加强经济体之间的协调与合作，通过定期举行公私对话等措施，增进理解，建立互信，预防RCE跨境贸易与投资领域的摩擦；确保在与WTO规则一致的前提下各经济体政府对RCE（环境）产品与服务项目的支持与激励做到透明公开；推动APEC经济体之间的RCE产业贸易与投资相关法规的协调与合作，研究建立行业标准和认证体系，促进RCE贸易与投资，提高产品质量；加强对RCE产业的知识产权保护，支持RCE的科技创新；鼓励各经济体在RCE领域的科技合作；加强与私营部门和学术界的合作，调动各利益相关者的力量和积极性推动APEC经济体在RCE行业的政策创新，促进RCE产业的发展等。

合作有助降低使用低碳/清洁能源的成本

这是继APEC在2012年领导人会议上决定“将风电设备等列为环境产品清单，在2015年年底对这些产品的实施税率将降到5%或5%以下”[2012年亚太经合组织（APEC）第二十次领导人非正式会议达成了包含54个6位海关税号的环境产品清单，21位APEC成员在2015年年底对这些产品的实施税率将降到5%或5%以下。在这一清单中，风电设备作为环境产品在列。]

on thorough discussion around the topic of "promoting RCE trade and investment in the Asia-Pacific region". Experts and scholars conducted in-depth analysis around the background, present situation and future trends, of RCE trade and investment in the Asia-Pacific region and the roles of government and private enterprises. Government officials and industry representatives discussed the following topics adequately: 1. How to promote RCE trade and investment and dissemination of technology by policy innovation; 2. How to strengthen coordination and cooperation on subsidies and fiscal and taxation support policy of RCE products within various economies to prevent and avoid trade frictions; 3. How to promote RCE trade and investment through means of public or private dialogue, such as the second rail dialogue (coordination and communication between enterprises and associations); 4. How to unify RCE products' quality certification standard, lower the cost of cross-border RCE trade and investment, and improve the quality and reliability of RCE products in the Asia-Pacific region.

To Remove RCE Trade Barriers

According to the consensus of the meeting, the APEC trade and investment commission passed the APEC Declaration of Promoting Renewable and Clean Energy Trade and Investment which was put forward by China during the third meeting in 2014. The declaration proposed that APEC members agree to the following: take action to promote the establishment of an open and transparent RCE market, by opposing all forms of protectionism and trade barriers and strengthening the cooperation on the monitoring and resistance of trade protectionism; strengthen the coordination and cooperation between the economies, by promoting understanding, building mutual trust, and preventing the frictions in the field of cross-border RCE trade and investment by holding regular public-private dialogues; ensure the support and incentives from the governments of various economies on RCE (environment) product and service projects are transparent and open in line with the WTO rules; promote the coordination and cooperation of RCE industry trade and investment between the relevant laws and regulations within APEC economies, by studying ways to establish industry standards and certification systems, promoting RCE trade and investment and improving product quality; strengthen the protection of intellectual property rights of RCE industry and support RCE scientific and technological innovation; encourage various economies to cooperate in the field of RCE science and technology; strengthen the cooperation with the private sector and academia, arouse the enthusiasm

之后，再次成功地尝试将能源问题与环境问题有机地结合起来，将贸易投资与环境和发展有机地统一起来，克服长期以来将贸易与投资与应对气候变化机械地割裂或对立起来的问题。自上个世纪九十年代开始的气候变化谈判以来，一方面一些政客将减排责任机械地理解为零和游戏，为各国减排的责任和义务讨价还价，甚至激烈争吵。另一方面，在国际贸易领域，一些国家和经济体从狭隘的个体利益出发，对减少温室气体排放的可再生和清洁能源产品和服务附加各种壁垒，在客观上不利于温室气体排放的减排，与减缓全球气候变暖的共同使命格格不入。可再生能源和清洁能源的发展实践证明，国际贸易与投资的自由化极大地促进了全球资源的合理配置，风电，太阳能的规模效应和技术创新等成本的显著降低。2008年以来，由于风电设备的成本也降低了29%太阳能薄膜的成本降低了20%。

本次会议将可再生及清洁能源产品与服务纳入环境产品与服务的范畴，将为未来新一轮的环境产品与服务清单谈判奠定基础，进一步降低和减免RCE相关产品与服务的关税，将进一步降低交易成本，促进RCE产业的发展。RCE产业的进一步发展极大地促进能源结构的改善，降低化石能源在能源消费中的比重，从根本上减少二氧化碳等温室气体排放，同时满足人类社会发展的基本能源需求，实现可持续发展。

本次会议另一个重要共识是加强各国在政府对RCE产业的支持措施上的协调与合作，一方面，各利益相关者均认为政府对RCE产业的激励政策对RCE产业的发展至关重要；另一方面，均认为激励政策要与WTO规则一致，要透明公开。这样才能建立互信，建立公平公正的市场秩序。这有助于预防RCE贸易摩擦。

本次会议的另一个意义是政策制定者与产业界领袖和专家学者沟通机制的建立。本次会议公私对话的机制性安排为未来RCE产业政策和贸易投资政策创新提供了一个有效的平台。APEC经济体政府的贸易投资政策的官员可以与RCE产业领袖面对面地讨论产业发展中的具体问题，从而使决策的目标更加明确，措施才可能更加有效。本次会议的一个有意思的现象是总部在发达经济体的RCE产业对

and power of the various stakeholders to promote the policy innovation of APEC economies in the RCE industry, and promote the development of the RCE industry.

To Reduce RCE Costs Through Cooperation

Following APEC's decision to "rank wind power equipment as an environmental product list on the third leaders meeting in 2014 and reduce the applied tariffs for these products to 5% or below 5% by the end of 2015"², it combined energy and environmental problems and unified trade and investment with the environment and development organically, overcoming the problem of mechanically isolating or opposing trade and investment with tackling climate change. Since the beginning of the climate change negotiations in the 1990s, some politicians understood emission reduction responsibility as a zero-sum game and bargained for their responsibilities and obligations, even quarrelling with each other fiercely. Meanwhile, in the field of international trade, some countries and economies with their narrow individual interests added various barriers on renewable and clean energy products and services that can reduce greenhouse gas emissions, which is objectively not conducive to emissions reduction and is against the grain of the common mission of mitigating global warming.

The development practice of renewable and clean energy has proved that the liberalization of international trade and investment greatly promoted the reasonable allocation of global resources, improved the scale effects of wind power and solar energy and significantly decreased the cost of technological innovation. Since 2008, the cost of solar thin film fell by 20% as the cost of wind power equipment reduced by 29%.

The meeting incorporated renewable and clean energy products and services into the category of environmental products and services which will lay the groundwork for a new round of negotiations around environmental products and services listing in the future, further reduce and derate the tariff of RCE-related products and services and will further reduce the transaction cost and promote the development of the RCE industry. The further development of the RCE industry greatly promotes the improvement of energy structure, reduces the proportion of fossil energy in the energy consumption mix and radically reduces carbon dioxide and other greenhouse gas emissions, while still meeting the demand of basic energy needed for human social development and realizing sustainable development.

Another important consensus of the meeting is to strengthen coordination and cooperation on the



美国政府针对亚洲的光伏太阳能产品的反倾销调查的反对声音最大，论据也更有说服力。随着全球经济一体化程度进一步加深，尤其是新兴经济体近年来的快速发展使得全球价值链中的分工和产业布局也更加复杂，跨国企业的国籍属性越来越难以判定，这使得传统的贸易保护主义措施越来越不得人心，损人亦伤己。企业作为最先进生产力的代表对与贸易产业政策制定者的对话是推动政策创新的之间动力。

APEC作为亚太地区机制最完善、层级最高、影响最大的经济合作论坛，自1989年成立以来在促进地区贸易与投资的多边自主合作领域做出了重要贡献。目前除了APEC之外，全球包括WTO在内的其他多边经济组织还没有能就环境产品与服务减免关税清单达成协议。鉴于APEC领导人对环境产品与服务贸易与投资自由化的高度共识及对RCE作为环境产品与服务项下的重要内容，有理由乐观地期待APEC在未来新一轮环境产品与服务减免税清单谈判中将有更多的RCE产品与服务被纳入其中，推动RCE产业的进一步发展，成为全球应对气候变化和可持续发展的示范。

national governments' support measures of the RCE industry. On the one hand, stakeholders believe that the governments' incentive policies on the RCE industry are very important for the development of the RCE industry; on the other hand, stakeholders believe that incentive policies should be consistent with the WTO rules and should be transparent and open. Through these two elements, trust can be built and a fair and just market can be established, helping to prevent RCE trade frictions.

Another meaning of the meeting is the establishment of a communication mechanism between policy makers, industry leaders and experts, and scholars. The institutional arrangement of public-private dialogue of the meeting provides an effective platform for the RCE industry and trade and investment policies officials from APEC economies' governments can discuss specific issues in the development of industry with RCE industry leaders face to face, thereby making the goal of decision-making more clear and measures more effective. An interesting phenomenon of the meeting is that the developed economies-based RCE industry have the maximum opposed voice and the most persuasive arguments against the anti-dumping investigation from U.S. government for the Asian photovoltaic solar products. As global economic integration further deepens, especially the rapid development of emerging economies in recent years, the division of labor and industry layout in the global value chain is more complicated, and the nationality properties of multinational enterprise are increasingly difficult to determine. This makes the traditional trade protectionism increasingly unpopular, as you can hurt others but also hurt yourself. Enterprises, as the representative of the most advanced productive forces to dialogue with the trade industry policy makers, are the direct driving force to promote policy innovation.

APEC as the economic cooperation forum with the most perfect mechanism, the highest level, and the biggest impact in the Asia-Pacific region, has made important contributions in promoting regional multilateral autonomous areas of cooperation in trade and investment since it was founded in 1989. Currently, in addition to APEC, other global multilateral economic organizations, including the WTO also failed to reach an agreement on environmental products and services list of tariff concessions. In view of the consensus of the APEC economic leaders on the environmental products, trade and service and the liberalization of trade and investment, and RCE as an important content under the item of environmental products and services, there are reasons for optimistically looking forward to APEC including more RCE products and services in

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he new round of tax reduction listing negotiations for environmental products and services, thereby boosting the further development of RCE industry and becoming the demonstration of globally tackling climate change and sustainable development.

中国应推动非二氧化碳类温室气体排放控制 China's Climate Change Efforts Needs to Focus on Non-CO2 Mitigation



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非二氧化碳类温室气体（指甲烷、氧化亚氮等其他温室气体，简称“非二”）具有减排成本低、短期温控效果明显、对经济发展影响小等优势，是欧盟、日本等国家履约《京都议定书》的优先领域和主要途径。然而，由于中国巨大的二氧化碳排放总量和增量，对非二排放控制的关注很少。鉴于此，本文针对中国“非二”减排提出了一些建议。

Non-CO2 greenhouse gases (GHGs), such as methane and nitrous oxide, have the advantages of lower emission reduction costs, show a significant short-term emissions reduction effect, and have less impact on economic development. Due to these factors, reducing non-CO2 GHGs is a field of priority and major pathway for countries such as the EU and Japan to meet their targets of Kyoto Protocol. However, China pays little attention to non-CO2 emissions due to their insignificance in volume compared to CO2 emissions. In view of this, this paper presents some suggestions aimed at China's non-CO2 GHGs emission reduction.

1、“非二”减排意义与国际趋势

(1) “非二”减排短期温控效果明显。二氧化碳寿命相对较长，其温室效应能够持续上百年，而甲烷等部分非二氧化碳类温室气体则寿命相对较短；而且非二的全球增温潜能是二氧化碳的几十倍甚至上万倍，因此，减少非二排放更有利于短期实现全球气温控制。

(2) “非二”减排社会经济影响小。非二氧化碳类温室气体主要源于化石能源开采，农业生产，废弃物处理，制冷、铝和镁生产等少数工业生产过程，减排影响部门较少，减排成本和社会经济影响较小。

(3) 美国、欧盟等国家先后制定了包括“非二”在内的强制性报告制度。2010年1月1日生效的美国《温室气体强制性申报：最终

1. The Significant and International Trend of Non-CO2 GHGs Emission Reduction

(1) The short-term emissions reduction effect of non-CO2 GHGs is significant. CO2 is relatively long-lived, will continue to cause warming for hundred years, whereas some non-CO2 GHGs, such as methane, are short-lived. However, the global warming potential (GWP) of non-CO2 GHGs is dozens or even tens of thousands of times than that of CO2. Therefore, reducing non-CO2 GHGs emissions is essential to achieving global temperature control in the short-term.

(2) Social and economic impacts of non-CO2 GHGs emission reduction are less than those of CO2 emissions reduction. Non-CO2 GHGs mainly derive from a few industrial production processes, such as fossil energy exploitation, agricultural production, waste disposal, refrigeration, and aluminum and magnesium production. There are fewer sectors impacted by non-CO2 emission reduction compared

条例》，明确提出了“非二”排放的核算方法，并要求每年提交包括“非二”在内的温室气体排放年报。欧盟委员会《601/2012 温室气体监测与报告条例》于 2013 年 1 月 1 日开始施行，要求对二氧化碳和氧化亚氮、全氟化碳进行监测和报告。

(4) “非二”减排已成为发达国家实现《京都议定书》减排目标的优先领域。1990 至 2011 年间，欧盟 27 个成员国温室气体排放总量下降了 18.37%，其中甲烷、氧化亚氮、六氟化硫和全氟化碳等“非二”气体分别下降了 35.04%、35.91%、41.36%、82.32%；日本“非二”分别减排了 36.72%、31.49%、95.72% 和 46.80%，其减排量相当于同期二氧化碳增加量的 61.30%。

2、中国“非二”排放和控制现状

(1) 中国“非二”排放总量居世界首位。根据《中华人民共和国气候变化第二次国家信息通报》，2005 年“非二”排放量为 14.92 亿吨二氧化碳当量，比世界第五大排放国家日本 2010 年的二氧化碳排放高 27.41%。从未来趋势来看，到 2030 年“非二”排放仍将居世界首位，占 17.14%；相对于 2010 年的增量约占全球增量的 28.54%。

to CO₂, and the cost and social and economic impacts of reduction are less.

(3) The United States, the European Union and other countries successively formulated mandatory reporting systems which included non-CO₂ greenhouse gases. The US “Mandatory reporting of greenhouse gases: Final Rule”, which took effect on January 1st 2010, clearly put forward the specific calculating methods for non-CO₂ emissions and required the submission of an annual report on GHGs emissions, including non-CO₂ GHGs in the measurements. The EU Commission “601/2012 Greenhouse Gases Monitoring and Reporting Rules” came into force on January 1st 2013, requiring the monitoring and reporting of CO₂, PFCs and N₂O.

(4) Non-CO₂ emission reduction has become the primary field for developed countries to achieve the emission reduction targets set in the Kyoto Protocol. The total GHGs of 27 member states of EU decreased by 18.37% from 1990 to 2011, in which non-CO₂ GHGs such as methane, nitrous oxide, sulfur hexafluoride, and perfluorocarbon dropped 35.04%, 35.91%, 41.36% and 82.32% respectively. In Japan these non-CO₂ GHGs reduced 36.72%, 31.49%, 95.72% and 46.80% respectively, equivalent to 61.30% of the CO₂ increment during the same period.

2. The Emission and Control Status of China's Non-CO₂ GHGs

(2) “非二”排放控制尚未纳入国家温室气体控制目标。“十二五”和 2020 年温室气体控制目标仅限于单位国内生产总值的二氧化碳排放分别下降 17% 和 40%-45%，对于“非二”减排既没有强度下降要求，也没有总量控制目标。目前备受关注的二氧化碳排放峰值研究，仅限于二氧化碳排放，没有考虑非二，及其对温室气体排放总量的影响。

3、关于推动中国“非二”排放控制的建议

作为温室气体第一大排放国家，面临的是温室气体排放总量减排，而不仅仅是二氧化碳总量减排，未来几乎占全球 1/5 的非二排放对全球及我国减缓气候变化的贡献也是不容忽视的。因此，提出如下几点建议：

一是尽早制定“非二”控制计划。制定“非二”减排的短期和长期计划与目标，根据成本高低、技术成熟水平、减排潜力等，建议“十三五”期间优先考虑氢氟化碳减排，2020 年以后逐步考虑其他含氟气体，以及能源开采、垃圾填埋处理、畜禽养殖的甲烷、工业生产氧化亚氮、以及种植业甲烷和氧化亚氮减排，分阶段明确监管范围和减排目标。

(1) China is the largest emitter of non-CO₂ GHGs in the world. According to the Second National Information Bulletin of Climate Change of the People's Republic of China, the non-CO₂ GHGs emission was 1.492 billion tons of CO₂e in 2005, which was 27.41% higher than the CO₂ emissions of Japan in 2010, the top fifth emitter. In 2030, China was the source of 28.54% of global non-CO₂ GHGs increase compared with the emission level in 2010, and future trends project that it will remain the largest non-CO₂ emitter with the share of 17.14%.

(2) Non-CO₂ GHGs emission control has not been included in national greenhouse gas control objectives. The “Twelfth Five Year Plan” and 2020 greenhouse gas control targets are limited to carbon dioxide emissions per unit of gross domestic product, fell by 17% and 40%-45% respectively. Furthermore, neither intensity reduction requirements nor total control targets have been included. Current research which focuses on carbon dioxide emissions peak, have no regard for non-CO₂ GHGs emission and their influence on total GHGs emissions.

3. Suggestions on Promoting China's Non-CO₂ Emissions Control

(1) The control plans for China's non-CO₂ GHGs should be formulated as soon as possible. Formulating the short-term and long-term plans and targets for non-CO₂ GHGs emission reduction involves their costs, technological maturity levels,



二是建立“非二”排放强制性上报制度。“非二”统计核算相对二氧化碳基础非常薄弱，尽管2005年排放清单纳入了这3种气体，但是在活动水平、排放因子方面仍存在较大的不确定性，而且数据仅限于国家宏观层面。因此，建议开展“自下而上”的“非二”排放统计核算，参照美国、欧盟经验，建立基于重点企业的“非二”排放强制性上报制度。

三是制定“非二”控制技术指南和政策措施。目前我国的“非二”管理主要是依托清洁发展机制开展国际交易，受气候变化国际谈判走势影响较大。同时，由于缺乏明确的减排政策和措施，企业减排积极性较低。建议针对不同排放源的不同“非二”种类制定相关排放标准和技术指南，研究提出专项补贴、财政补贴等配套政策措施，鼓励企业和个人在生产过程中加强对非二气体的收集、回收、利用和减排。

四是加强基础研究。针对“非二”的减排成本、减排潜力、社会经济影响评估、减排技术与政策措施等关键科学问题加强基础研究，科学预测我国温室气体排放峰值，合理制定“非二”控制技术指南和路线图。

and emission reduction potentials. Some key suggestions to confirm regulation scope and targets are to give priority to hydrofluorination emission reduction during the “Thirteenth Five Year Plan” period; to consider the emission reduction of other fluoride gases and the methane from energy exploitation, landfill treatment and poultry breeding; nitric oxide from industrial production, and methane and nitrous oxide from industrial process step by step after 2020, to confirm regulation scope and targets in stages.

(2) A non-CO2 emissions mandatory reporting system should be established. The statistical accounting of non-CO2 GHGs emissions is very weak compared to CO2. Although non-CO2 GHGs were included in the emission inventory in 2005, there is uncertainty in activity level and emission factor, and the data is only limited to national macro level. Therefore, the suggestion is to carry out bottom-up statistical accounting for non-CO2 emissions, with reference to the experience from United States and the European Union, to establish a non-CO2 emissions mandatory reporting system based on key enterprises.

(3) A control technology guideline and policy measures for non-CO2 GHGs should be formulated. At present, China's non-CO2 GHGs management mainly relies on the clean development mechanism to carry out international trade, which is greatly influenced by the trend of international negotiations on climate change. Meanwhile, emission reduction enthusiasm of enterprises is low due to the lack of clear emission reduction policies and measures. To study and present supporting policy measures, such as special subsidies and financial subsidies, and to encourage enterprises and individuals to strengthen the collection, recycling, utilization and emission reduction of the non-CO2 gases during the production process, relevant emission standards and technical guidelines aimed at non-CO2 GHGs from different emission sources could be formulated.

(4) Fundamental researches focusing on key problems, such as the emission reduction cost, emission reduction potential, social and economic impact assessment, emission reduction technologies, and policy measures, should be strengthened. This research can help to scientifically forecast greenhouse gas emissions peaks in China, and to formulate reasonable control technology guidelines and roadmaps for non-CO2 greenhouse gases.

英国绿色投资银行：分享给中国的经验教训

The UK Green Investment Bank: Lessons and Experiences for China

2012年，英国政府拿出37.5亿英镑作为启动资金成立了绿色投资银行（UKGIB），以帮助完成成为低碳经济转型带来新投资的目标。迄今为止，绿色投资银行投资了33个项目，调动了49亿英镑资金，其中已作出承诺的就有14亿英镑。该银行在运营两年之后，成为英国绿色经济中最活跃的参与者。在财政方面，中国更加迫切地需要推动绿色和低碳经济转型。那中国是否可以借鉴英国绿色投资银行的经验？我们能得到的经验教训有哪些？

In 2012, the UK government established a Green Investment Bank (UKGIB) with GBP 3.75 billion initial capital to help meet the objective of bringing in new investment to assist the transition to a low-carbon economy. To date, UKGIB has invested in 33 projects, mobilising £4.9bn with a commitment of £1.4bn. The bank, after 2 years operation, has become the most active player in the UK's green economy. China has a significantly higher financial need to drive a green and a low-carbon economic transition. Is the UKGIB a transferrable model to China? What lessons and experiences can the UKGIB teach us?

英国绿色投资银行是如何运作的？

在英国绿色投资银行成立之前，英国政府内部的商业、创新与技能部举行了一次英国绿色投资团队会议。2012年秋，欧盟委员会批准英国绿色投资银行开始运营，并对其提出两条约束条件：绿色投资银行的干预不能排挤掉私人投资；在辅助性市场融资缺乏的情况下，绿色投资银行不能进行干预。2012年底，英国绿色投资银行获得英国政府资助的38亿英镑启动资金，作为一家上市公司而成立，目标是加速英国的绿色经济转型。绿色投资银行在爱丁堡注册成立，独立于政府进行运作。

绿色投资银行与传统投资银行或政府直接投资不同，它的财政项目或投资工具都严格遵循

How does the UKGIB operate?

Prior to the establishment of the UKGIB, there was a UK Green Investment Team sitting in the Department for Business, Innovation & Skills within the UK government. In autumn 2012, the European Commission (EC) granted their approval for the operation of the UKGIB subject to two criteria: UKGIB interventions should neither crowd out private investment nor be approved in the absence of complementary market financing. In late 2012, with £3.8 bn initial funding from the UK government, UKGIB was formed as a public company with the mission to accelerate the UK's transition to a green economy. The UKGIB is registered in Edinburgh and operates independently of government.

Unlike a conventional investment bank or direct government fund, the UKGIB finances project or investment vehicles strictly in accordance with



梁希
Xi Liang

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Dr Xi Liang is the Secretary General of the UK-China Guangdong CCUS Centre, and a senior lecturer in Energy Finance at the University of Edinburgh. His main research area was economics, financing and risk management in low carbon technologies, incl. CCS.



Philip Curry

Philip Curry先生创立了Curry Consultants，为清洁科技公司或机构提供财务或者管理服务。他也是中国深圳领先财纳投资顾问和中国低碳能源行动网络的高级顾问。

Mr Philip Curry is the founder of Curry Consultants which provides financial/managerial services to clean technology companies/entrepreneurs. He is senior adviser to Linkschina Investment Advisory (Shenzhen, China), and the China Low-carbon Energy Action Network.

GIB's investments (at 31 March 2014)

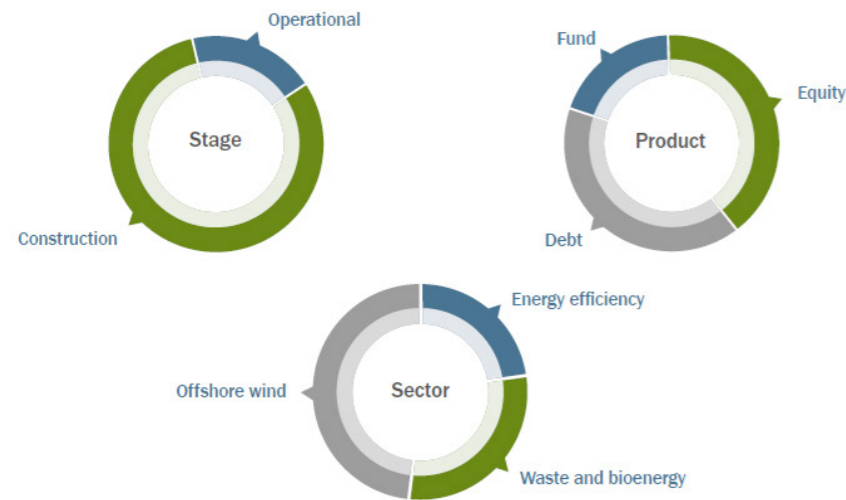


图 1 英国绿色投资银行投资的项目的行业、生命周期以及地理分布
Figure 1 Sectoral, Lifecycle and Geographical Distribution of Projects invested in by UKGIB

两个核心原则（被称为“双重底线”）：（1）绿色环保影响和（2）财务业绩。绿色投资银行的所有投资都应对以下 5 个环保目标中的至少一个做出实质性贡献：（i）温室气体减排；（ii）效率提升；（iii）自然环境保护；（iv）生物多样性提升；（v）环境可持续性的维护。尽管和私有银行相比，回报率可能更低，风险可能更高，但所有投资都要有完整的商业条款。到 2013 年底，英国绿色投资银行现有的投资组合所产生的总体收益率是 8%。

英国绿色投资银行是一个灵活的投资者。该银行的投资范围覆盖整个资本结构，包括从债务、股权、夹层融资到担保金；投资期限有长有短；投资的项目既有新项目建设也有已有项目的再融资（如图 1 所示）。该银行也在废弃物以及能效行业直接投资大型项目或通过基金投资较小的项目。

英国绿色投资银行 80% 的预算都优先用在了四个行业：能效、海上风电、废弃物回收以及废弃物发电。剩余 20% 的预算的使用涵盖了以下行业：生物运输燃料、生物质发电、碳捕集与封存、海洋能和可再生能源。

two core principles (called 'double bottom lines'): (1) Green Impact and (2) Financial Performance. All of the UKGIB's investments should make a material contribution to at least one of five green purposes: (i) greenhouse gas reduction; (ii) enhanced efficiency; (iii) protection of the natural environment; (iv) enhanced biodiversity; (v) the protection of environmental sustainability. All investments are made on full commercial terms, though it may accept a lower level of return or a higher degree of risk than privately owned banks. By the end of 2013, the current portfolio of UKGIB investments generated an overall return of 8 percent.

The UKGIB is a flexible investor. The bank invests across the full capital structure, from debt to equity to mezzanine to guarantees; it invests either over short or long periods; it invests in the construction of new projects or in the refinancing of existing projects (as shown in Figure 1). The bank invests in large projects directly and in smaller projects through funds in the waste and energy efficiency sectors.

80% of the UKGIB's budget has been spent in four priority sectors: Energy Efficiency, Offshore Wind, Waste Recycling, and Energy from Waste. The remaining 20% cover the following sectors: Biofuels for Transport; Biomass Power; Carbon Capture and Storage, Marine Energy, and Renewable Heat.

局限性及经验教训

英国绿色投资银行在其最初两年的运营中达成了具有重大意义的里程碑。但是，尽管该银行有一个成功的开始，下文所示的一些重大挑战仍可能会阻碍其发展壮大。

英国绿色投资银行最大的局限性是缺乏筹集资金的权力。任何一家金融机构都需要多样化和可持续的资金来源来满足长期的融资需求。筹集资金的权力缺乏会让英国绿色投资银行最终变成一个封闭式基金。2011 年，英格兰及威尔士绿党领袖 Caroline Lucas 在卫报中强调过这一点，她表示，“缺乏贷款和借款权力，基金使用完后就永远无法收回。”

专注于财务业绩和底线的需要让绿色投资银行集中于投资相对较成熟的绿色技术。尽管绿色投资银行在 2012 年肯定了“示范效果”的三大主要作用（即提升技术信心，削减成本，以及转移知识和信息），这一财务业绩要求仍限制了该银行投资新兴技术（例如海浪、潮汐能或碳捕集与封存）的范围。

目前，绿色投资银行由英国政府 100% 持股，其员工薪酬的竞争力比不上私有商业银行。确定国家通过绿色投资银行进行干预的合适程度以及该银行在英国低碳和能源政策框架中的作用将会非常有趣。

从风险及多样化角度来看，能源和基础设施行业所有主要的私人投资银行都在商业和风险管理目标上有着跨国影响力。英国绿色投资银行在英国的重心可能会让其失去政策和宏观经济风险地位上的优势。

中国绿色投资银行（CGIB）？

中国目前有三个国家性政策银行：中国发展银行、中国进出口银行和中国农业发展银行。另外，世界银行和亚洲开发银行这两个多边发展银行也通过拨款和优惠贷款支持在中国的绿色融资活动。中国还有五个大型国有商业银行以及一系列国有企业控股的大型商业银行。然而，中国只有一个银行签署了赤道原则（管理项目融资中的环境与社会风险的一个金融行业基准）。中国绿色投资银行在中国的金融行业能起到什么作用，并将怎样补足其它现有的国有银行？

Constraints and Lessons

The UKGIB achieved significant milestones in the first 2 years of operation. However, in spite of a very successful start, a few major challenges could constrain the development and growth of the UKGIB, as below.

The most significant constraint for the UKGIB is the lack of powers to raise money. Any financial institute needs diverse and sustainable sources of capital to achieve long-term financial needs. Without the power to raise money, the UKGIB will eventually become a closed-end fund. This was highlighted by Caroline Lucas, the leader of Green Party of England and Wales, in the Guardian newspaper in 2011, where she wrote, 'without the lending and borrowing power, it would be a fund, a pot of money that, once used up, is gone forever'.

The need to concentrate on financial performance and the bottom line makes the UKGIB focus on investments in relatively mature green technologies. This financial performance requirement limits the scope for UKGIB investment in emerging technologies (such as wave, tidal, or carbon capture and storage), even though the three major benefits of the 'demonstration effect' (i.e. increase confidence in a technology; cost reduction; knowledge and information transfer) was recognised by the UKGIB back in 2012.

The UKGIB is currently 100% owned by the UK government, and its employees are remunerated less competitively compared to private commercial banks. It would be interesting to identify the right level of state intervention through UKGIB, as well as the role of UKGIB within the UK low-carbon and energy policy framework.

From the risk and diversification perspective, all major private investment banks in energy and infrastructure have multi-national footprints for commercial and risk management goals. The UK focus of the UKGIB could disadvantage it on policy and macro economy risk positions.

Chinese Green Investment Bank (CGIB)?

China currently has 3 national-level policy banks: China Development Bank, China Import Export Bank, China Agricultural Development Bank. In addition, two multilateral development banks, the World Bank and Asian Development Bank are also supporting green financing activities in China through grants and concessional loans. In addition, the country has five large state-owned commercial banks and a number of major commercial banks controlled

从2007年起，中国国家政府就已尝试通过引入绿色信贷和绿色证券政策来鼓励绿色融资。但是，就如中央财经大学的王遥教授所指出的，过去的证据表明，中国大量的“绿色贷款”都只是给现有的活动重新贴上“绿色”的标签，并没有激励新的绿色投资。目前还没有大型银行为开发一套稳健的管理绿色信贷或绿色证券的系统做出实质性投资。中国绿色投资银行的缺失可能会让中国无法累积达到政府要求的绿色转型所需的人力资源和制度资本。

中国是最大的绿色投资市场。如果适当运作，中国绿色投资银行可能会成为对低碳和绿色融资领域感兴趣的基金的主要绿色融资平台。中国当前鼓励工业进行海外投资，而能源行业在中国海外投资组合中所占比例最大。因此，中国绿色投资银行可在提升中国海外投资的环境竞争力方面发挥至关重要的作用，并能减轻中国工业在进行国际扩张时的社会压力。

从制度方面来说，英国绿色投资银行由商业、创新和技能部发起，并得到了能源与气候变化部和财政部的明确支持。在中国的国情下，很难为中国绿色投资银行找到一个合适的政府部门进行初期投资并建立有效的制度框架，因为国家发展和改革委员会、财政部、中国银行业监督管理委员会以及环保部都可能参与到绿色投资银行的活动。中国绿色投资银行的建立还需要中国关键性利益相关者的进一步讨论。中国绿色投资银行可以作为一个新的机构而成立，但这一实体也可在现有的政策银行或低碳基金（例如中国发展银行和清洁发展基金）的已有团队和能力基础上进行开发。英国的经验告诉我们，作为一家银行，中国绿色投资银行应被授予在公共融资市场中举借和筹集资金的权力，并且它还负责达到调动私人投资和避免排挤现有绿色投资中的私人资本的严格目标。初始阶段应对两层投资者引入两种不同的股份：国有机构投资（优惠）股份和私人机构（一般）股份。此外，可对完成绿色以及财务成果的情况给予商业奖金，确保长期、可持续性的绿色增长。

by state-owned enterprises. However, only one Chinese bank signed up to the Equator Principle (an environment and social risk management protocol for project finance). What role could CGIB play in China's financial sector and how it might complement other existing state-own banks?

Since 2007, the Chinese national government has tried to encourage green financing through introducing green credit and green securities policies. However, as indicated by Prof WANG Yao (Central University of Economics and Finance), past evidence suggests that a large number of 'green loans' in China were just the result of re-labelling existing activities as "green" and was not encouraging new green investment. No large bank has yet made a substantial investment for developing a robust procedure to manage green credit or green securities. In the absence of a CGIB, China may not be able to accumulate human resources and institutional capital required for the green transition proposed by the government.

A CGIB, if established, might manage and carry out due diligence for 'green credit' allowances from state-owned banks, and adopt a strict 'Green Impact' assessment model.

若能建立一个中国绿色投资银行，将能管理和执行国有银行“绿色信贷”权的尽职审查，并采用一套严格的“绿色影响力”评估模型。

China is largest market for green investment. If properly functioning, CGIB could be a major green financing platform for international funds interested in the low-carbon and green financing areas. China is encouraging industry to invest overseas and energy is the largest sector within Chinese overseas investment portfolio. Consequently CGIB could play a critical role in improving the environment competitiveness of Chinese overseas investment, and reduce social pressure for Chinese industry's international expansion.

The international dimensions could be a major driver for setting up CGIB.

国际维度的影响可能会成为建立中国绿色投资银行的主要驱动力。

On the institutional side, the UKGIB was initiated by the Department for Business, Innovation and Skills, with explicit support from the Department for Energy and Climate Change and the Treasury. In the Chinese context, it is hard to identify the government department appropriate for the initial investment and to set up an effective institutional framework for CGIB, because the National Development and Reform Commission, Ministry of Finance, China Banking Regulatory Commission, and Ministry of Environmental Protection may all link into activities in a CGIB.

investment (concessional) share and a private institute (normal) share. In addition, commercial bonuses could be given for achieving both green and financial outcomes, and to enable sustainable green growth in the long-term.

Building an effective institutional framework could be the most significant barrier for setting up CGIB, but it could fit in a framework with multiple policy goals (e.g. environment investment, industry development, technology demonstration, and innovation).

建立一个有效的制度框架可能会成为建立中国绿色投资银行的最重要障碍，但其可能适合一个设立多重政策目标（如环境投资、工业发展、技术示范和创新）的框架。

The establishment of CGIB would require further discussions within Chinese key stakeholders. CGIB could be founded as a new institute, but the entity could also be developed building on established teams and capacity at through an existing policy bank or a low-carbon fund (such as China Development Bank and Clean Development Fund). The lesson from the UK is that CGIB, as a bank, should be given the power to borrow and raise capital in the public financial markets, and it should also be tasked with meeting the strict goal of mobilising private investment and avoiding crowding out existing private capital for green investment. The establishment of CGIB would require further discussions within Chinese key stakeholders. CGIB could be founded as a new institute, but the entity could also be developed building on established teams and capacity at through an existing policy bank or a low-carbon fund (such as China Development Bank and Clean Development Fund). The lesson from the UK is that CGIB, as a bank, should be given the power to borrow and raise capital in the public financial markets, and it should also be tasked with meeting the strict goal of mobilising private investment and avoiding crowding out existing private capital for green investment. Two tiers of investors should be introduced initially with two types of share, a state-owned institute

统一全国碳交易市场，需加强顶层设计 ——专访碳金融学者王遥

An Interview with Prof. Yao Wang
on China's Carbon Trading



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》，批准率先在北京、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，标志着我国碳交易从规划走向实践。目前，中国试点碳市场刚刚完成了第一年的履约，碳交易市场普遍存在交易不活跃的问题。同时，全国碳市场建设已提上日程。如何提高当前碳交易市场的流动性？如何推动未来我国统一的碳市场建设？针对这些问题，本刊专访了中央财经大学气候与能源金融研究中心主任、碳金融学者王遥教授。

On October 29, 2011, the National Development and Reform Commission issued the Notice on Carrying Out Pilot Carbon Trading, according to which that Beijing, Tianjin, Shanghai, Chongqing, Shenzhen, Hubei and Guangdong would take the lead to pilot carbon trading. This symbolized China's carbon trading has shifted from the planning stage to the practice phase. By far, five pilots saw a high degree of compliance by the included emitters in their first year, although a lack of liquidity prompted concerns of the exchanges. Next step, how to boost the liquidity of the carbon markets? How to roll out China's national market for carbon trading? To understand the future of China's carbon market, we interviewed Prof. Yao Wang, who is the director of the Center for Energy and Climate Finance at Central University of Finance and Economics, China.

碳交易市场的流动性很重要，但预期不能过高

《近零排放》：碳交易市场的流动性为什么重要？

王遥：二级市场具有流动性十分重要，因为碳交易是市场化减排手段之一，碳市场因碳交易而产生，可实现国家减排目标、企业低成本减排和引导资源配置、促进低碳投资等功能，为此要形成合理的碳价，而流动性是形成

《近零排放》：当前参加试点的碳交易大都不活跃，您如何看？

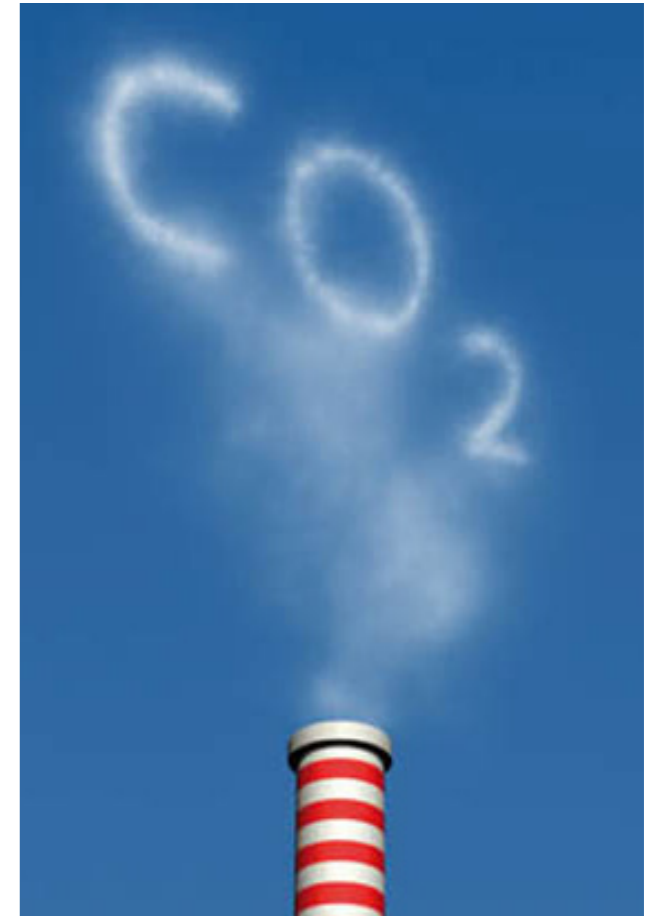
王遥：我们对区域碳市场的流动性预期不要过高。区域碳交易市场在交易活跃性上存在先天不足，这本质上是由政策制度的设计、控排企业的风险厌恶特征、行业覆盖范围和交易主体数量所决定的，而且当前只有现货市

合理碳价的重要前提。

《近零排放》：还有哪些因素影响企业参与碳交易的积极性？

王遥：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。企业参与二级市场存在以下障碍：（1）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。（2）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，但一些工作小组并未获得授权进行二级市场的交易。（3）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。（4）政策不稳定，使得参与市场的风险较大。过高的风险迫使多数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。上述因素决定了交易会大量集中在清缴之前。而唯一平时表现较为活跃的湖北市场，其有量无价的走势，存在“对敲”的可能，也很类似股票市场的筑底吸筹，若配额发放从紧，等履约期到来之前，可能会有强劲拉升，一定要谨防市场操纵。

场，交易产品和交易主体的缺乏，必然影响市场流动性。事实上，政府部门推动碳交易试点的主要目标是探索未来全国碳市场的经验，包括平台建设、交易机制、交易品种设计、市场监管与调控等，对区域市场的交易活跃性不能带有不切实际的期待。目前重点要考虑的是，已存在的各区域碳市场如何与拟建中的全国碳市场实现成本最小的对接。



一级市场的重要性有待提高

《近零排放》：如何改善当前的碳交易制度以发挥碳市场的作用？

王遥：成熟的碳市场具有发育完善的一级市场和二级市场，两个市场的价格紧密相关，反映出碳市场当前的供

《近零排放》：您曾负责广东省碳排放权配额拍卖平台建设研究，其中有什么经验可借鉴？

王遥：广东是唯一在二级市场缺乏流动性的预期下，重视一级市场的试点

求关系和减排成本。但在二级市场先天缺乏流动性难以形成合理碳价的背景下，我认为应重视一级市场的建设。一级市场即配额的发放，以免费或拍卖形式。首先，配额分配应合理。履约期市场价格走势可以在一定程度上反映出配额发放是从紧还是从松，如果价格放量走低，则说明剩余配额较多；而价格走高，则说明配额从紧，各试点可根据实际情况进行事后调整。其次，可采取部分配额有偿拍卖机制，并逐步扩大拍卖范畴，拍卖价格可成为市场参考底价。控排企业的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。



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SOURCE: (qdcaijing.com)

省。在市场发展之初就实行部分配额有偿发放，是很有价值的尝试。广东已经形成全国规模最大的一级市场，但拍卖制度在实施过程中也出现了若干问题，尤其是“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，对于那些因行业发展周期原因而经济效益差的企业，一次性支付 3% 的配额资金给其现金流带来巨大影响，也遭致了较强的抵制。此外，其拍卖资金如何使用一直悬而未决，更增加了企业对制度的不解。在这种情况下，应当集中优势力量攻克一级市场的阻力，进一步优化其拍卖制度，打通资金流通环节，为二级市场的发展奠定良好的基础。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。同时，正在设计创新的拍卖资金使用机制，力图市场化使用资金，发挥资金对社会资本的杠杆作用，促进广东省的减排及低碳投资，这一创新机制也将对未来全国碳市场有偿配额拍卖收入使用具有重要的示范作用。

除广东外，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，在一定程度上推动了二级市场活跃。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，配额拍卖公告后，多数未履约企业不想承担过高拍卖价格，积极参加二级市场交易，10 个交易日的成交量占总成交量 38%，企业履约率 100%。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。由此可见，拍卖机制的灵活设计，对于推动

二级市场的流动性十分重要。

建议成立全国碳市场顶层设计工作小组

《近零排放》：您对未来一、二级市场的建设有什么具体的建议？

王遥：对一级市场有如下四个建议：

第一、组合运用配额分配方法。应根据 ETS 不同的发展阶段，针对不同的行业部门采取不同分配方法组合运用。在 ETS 推进的时间维度上，历史法在交易体系初期最受欢迎，但需采取适当激励来补偿“鞭打快牛”的现象，有数据基础的地区在中早期则更青睐基准分配法，而拍卖则是推进减排市场长期健康的最佳选择。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采用拍卖法，其他行业依据面临的竞争程度酌情予以免费分配。

第二、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。

第三、引入机构投资者，适当放开一级市场。允许一定比例的配额流入到投资者手中，有助于市场活跃性。

第四、资金分配是一级市场改革突破口，拍卖收入的合理使用可以帮助企业降低履约成本，鼓励减排活动，促进碳金融业务的发展。

二级市场可采取以下措施促进流动性：一是大力发展协议交易，以满足企业履约的紧迫需求；二是探索可行的非标准化的衍生品，并将碳保险产品植入衍生品合约，提高产品的吸引力；三是适当引入金融投资者，考虑做市

《近零排放》：还有其他方面的建议吗？

王遥：还有很多，比如，应推动“碳市场收入”纳入政府收支科目。在新公布的 2015 政府收支分类科目中，新增了“应对气候变化管理事务”项，这是应对气候变化工作的重大突破，发改委可在该项下增加应对气候变化管理事务的预算支出，并推动把“碳市场收入”作为预算内收入，用于碳市场工作的各项支出。由于企业难以迅速减排，因此无法吸收高昂的碳成本。建议将有偿分配资金的一部分用于支持企业减排活动。

其次，应尽快构建第三方中介市场的信用体系。MRV 的公信度较差，能力水平参差不齐，没有形成一个独立的第三方市场，建议尽快构建中介信用体系，并引入严格的第三方惩罚机制。

当然，还需大力发展碳金融。要促进企业的减排，需围绕碳市场，充分发挥金融作用，起到融通资金、减低成本、发现价格的作用。同时，还需推动标准化工作，包括碳会计标准、碳信息披露等。

《近零排放》：政府部门应该如何推动未来全国性碳市场的建设？

王遥：我认为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。应成立全国碳市场顶层设计工作小组，由相关政府部门（国家发改委和试点发改

商制度，活跃和稳定市场；四是各试点市场需尽快制定自愿减排交易相关规则。

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，不断完善顶层设计。

SETTING APPROPRATELY HIGH EXPECTATION FOR CARBON MARKET LIQUIDITY

Near Zero Emission: Why is the liquidity of carbon market important?

Yao WANG: The secondary market liquidity is very important. Carbon trading is one of the market-based approaches used to cut emissions, minimize mitigation costs, optimize resources allocation, and promote low-carbon investment by providing reasonable carbon prices. Liquidity is the base to form reasonable carbon price.

Near Zero Emission: Are there any other factors which have an impact on enterprises' activity in carbon trading?

Wang Yao: Because of the predominated role of state-owned enterprises in the carbon market, their appetites for risks significantly affects the enthusiasm of participation in the secondary market. There are following barriers for enterprises to participate in the secondary market: (1) Enterprises worry about the future allowances quotas are not enough and hope to keep allowances quotas. Productive enterprises generally worry about a shortage of quotas allowances in the future, hence they tend to saving the existing allowances quotas. (2) Enterprises generally have not established effective carbon management systems. Only few enterprises set up the working groups to response policy risks, but some working groups have not been authorized to trade in the secondary markets. (3) Enterprises lack of

Near Zero Emission: What do you think of the inactivity in current carbon trading pilots?

Wang Yao: we shouldn't expect the liquidity of regional carbon markets too high. There are congenital deficiencies for regional carbon markets in trading activity, which essentially determined by the design of the policy system, risk aversion characteristics of enterprises that control their emissions, industry coverage and the number of trading subject. Currently, there exists merely spot market in which lack of trading products and trading subjects has inevitably exerted an impact on the liquidity of carbon market. As a matter of fact, the major targets of promoting carbon trading pilots initiated by the government is to explore the experience for national carbon market, including platform construction, trading mechanism design, trading products design, market supervision and regulation and so on, we cannot have unrealistic expectations to trading activity in regional markets. At present, what should be seriously considered is how the existing carbon market in all districts achieves to link with the national carbon market that will be built up in the future in a way with minimized costs.

talents. Most enterprises appointed their department managers or deputy general managers to take charge the working groups which consisted by engineers or energy and environment administrative staffs, but these staffs lack of the knowledge, experience and confidence to participate in market trading transactions. (4) Policies are not stable, which makes higher risk to participate in the market. High risk force most companies to take a wait-and-see attitude, decision makers are reluctant to bear the potential risks and responsibilities.

The above factors determine the carbon trading will be substantially centered before settlement and payment of allowances. With its tendency of high trading volume and low transaction price in Hubei market, there possibly exists a phenomenon that two parties who pretend to be buyers and sellers of securities and make a unreal deal through conspiracy intent to influence the securities market, in this only one active market at ordinary times, much similar to buying stocks at floor price in stock market. If the issued allowances is tight, there may be a strong raise before the period of performance. At that time, we must beware of market manipulation.



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SOURCE: (people.com.cn)

PAY MORE ATTENTION TO THE PRIMARY MARKET

Near Zero Emission: How do we improve the carbon trading system to make the carbon market functional?

Yao WANG: With sound primary market and secondary market, a mature carbon market in which the price in one market closely connects with that in the other reflects the current supply-demand relationship and emission reduction costs in carbon market. But on the condition that it is difficult to form reasonable carbon prices due to the congenital absence of liquidity in secondary market, I insist that the primary market should be paid more attention. The primary market, that is the issuance of

Near Zero Emission: You have been responsible for building up the auction platform for carbon allowances from which what can be learned?

Yao WANG: Guangdong is the only pilot province which pays attention to primary market under the expectation of lacking of liquidity in the secondary market. It is a valuable attempt to implement the paid issuance of partial quota. A largest primary market in the country has been shaped in Guangdong, but the auction system also appeared some problems in the implementation process, especially the "ticket

allowances, either with free or auction. Firstly, the quota issued should be reasonably distributed. The market price tendency at the period of performance can, to some extent, reflect whether the issuance of quotas is tightened or loosened. If the price declines with a high trading volume, it shows the remaining quota would be more; if the price raises, it shows the quota would be tightened. In a word, all pilots can be later adjusted based on practical conditions. Secondly, the auction mechanism with payment for part of quotas should be implemented, and the auction scope can be gradually widened, the auction price in reference to that in the market. All the quotas of enterprises which control the emission are finally supposed to be obtained with payment, which will be a way to promote carbon emission reduction. But in the first phase, it needs to be slowly developed.



system" (need to firstly auction 3% allowances for obtaining the "entrance ticket", then to get the 97% free allowances) improving the threshold of enterprises participating in the carbon market, for those enterprises with poor economic benefits due to the reason of industry development cycle, to pay the fund of 3% allowance one-time bringing huge impact to their cash flow and leading to their strong resistance. In addition, the problem on how to use the auction money remains unsolved, which increases enterprises' misunderstanding for the system. Under this circumstance, we should concentrate our superior forces to conquer the primary market resistance and connect the links of fund circulation, and lay a good foundation for the development of the secondary market. So far, the auction system has been improved, in which the ticket system has been canceled with greatly cut of upset prices. Moreover, non-enterprises that control their emissions have been approved to auction. Meanwhile, the innovated system for using auction capital, which will make a crucial example for earnings use of paid allowance auction in national carbon market in the future, has been under design, in an attempt to play a role of leverage for social capital and make progress in the emission reduction and low-carbon investment in Guangdong through market-oriented capital use. The innovative mechanism will play a vital demonstration effect for using the allowances auction revenues from future national carbon market.

Besides Guangdong, there are auctions going on in Hubei Province, Shanghai and Shenzhen, among which an auction that makes non-enterprises controlling their emissions accessible to the auction for 30% of allowances reserved by the government in Hubei Province has enhanced the activity in the secondary market to a degree. Both Shanghai and Shenzhen auction to 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. After the auction allowance is released, the majority of enterprises which do not complete

compliance are unwilling to afford the costs for the auction, and actively participate in the secondary market. In result, the trading volume in 10 trading days is 38% of the total volume, and the rate of enterprises' performance reaches 100%. In contrast with the condition in Shanghai, the action that Shenzhen auctions at the half of the price in the market, does not attract enough participations of non-enterprises that control their emissions. It can be noted that the flexible design of auction system plays a crucial role in the enhancement of the liquidity in the secondary market.

ROLLING OUT NATIONAL CARBON MARKET URGES FOR TOP-LEVEL DESIGN

Near Zero Emission: What suggestions do you have for the establishment of future primary and secondary markets?

Yao WANG: The suggestions on building up primary market:

Suggestion 1: To use the combination of allowance allocation methods. We should take a different allocation method combination under the different development stages of ETS and according to different industry sectors. In the time dimension of advancing ETS, at the preliminary stage of trading system, the historical method is the most popular, but need to adopt suitable incentives to compensate the phenomena of "whipping the fast and hardworking", areas with data base prefer the benchmark distribution method at the early and medium stages, and auction is the best choice for boosting the long-term health of emission reduction market. From industry dimension, the industries that faced smaller external competition and easily conducting costs should adopt auction method, other industries can take into consideration the circumstances to be free allocated quota according to the degree of competition faced.

Suggestion 2: The issuance of allowances can

Near Zero Emission: Are there any suggestions in other respects?

Yao WANG: Yes, there are.

(1) Promoting "the revenues of carbon market" to incorporate into government revenues and expenditures subject.

In the recently released 2015 Government Revenues and Expenditures Subject, the item of "management affairs of tackling climate change" has been incorporated. This is a major breakthrough for the work of tackling climate change. DRCs can add the budget expenditure for addressing climate change under the item to finance climate change related activities. Enterprises can not undertake valuable carbon cost due to they are difficult to reduce emissions rapidly. I'd suggest using part of the fund to support the enterprises' emission reduction activities.

(2) Building a market credit system for the third-parties

The public trust of MRV is weak and its ability level is uneven. It has not formed an independent third party market yet. I suggest introducing third-party punishment

be tightened, and governments should leave reserve allowances, to sell them out when the allowances supplied shortage on the market and purchase them to be cancelled when allowances supplied too many, which is similar to the function of stabilization funds.

Suggestion 3: To introduce institutional investors and proper open the primary market. Allowing a certain percentage of allowances to be transferred to the investors, it helps to improve the activity in the market.

Suggestion 4: Capital allocation is the key of primary market reform, reasonable use of auction revenues can help enterprises to reduce compliance costs, to encourage emission reduction activities, and to promote the development of carbon finance business.

Following actions can be taken to boost the liquidity of the Secondary Market.

(1) Firstly, developing trading by agreement to meet the urgent demand for the compliances of enterprises; secondly, exploring feasible non-standardized derivatives, and adding carbon insurance products into the agreement related with derivatives as so to increase attraction of products; thirdly, properly introducing financial investors and using the market-maker system to enliven and stabilize the market; fourthly, making trading rules on voluntary emission reduction for all pilot markets as soon as possible.

mechanisms as soon as possible.

(3) Developing carbon finance energetically

To promote the emission reduction of the enterprise, we need to give a full play to finance in a bid to reduce costs.

(4) Promoting the standardization, including the carbon accounting standard and the standard for carbon information disclosure

Near Zero Emission: How should government promote the national carbon market in the future?

Wang Yao: I hold that the design of carbon market mechanism decides whether the carbon market will be soundly developed or not in the future. Policymakers should not only have a deep understanding on the carbon market, but also know the economy, finance and market operation well, and need to establish the top-level design working group which is constituted by related government agencies (National Development and Reform Commission, the Development and Reform Commissions of those pilot provinces and cities, China Securities Regulatory Commission and the Ministry of Finance), academia, trading agencies (including enterprises that control emissions and investors), third parties, and the related representatives from various pilot markets for national carbon market to form a coordinating work mechanism. Based on the experience on the regional carbon markets, the top design needs to be constantly perfected.

沙特计划在世界最大油田 示范二氧化碳埋存和强化石油开采 Saudi Arabia Plans to demonstrate CCS-EOR in the World's Largest Oil Field



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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.

沙特目前主要致力于对基础的 CCS 技术和政策进行研究。CCS 主要在关键利益相关者和专家之间论及。沙特主要的 CCS 研究机构包括：阿卜杜拉阿齐兹国王科技城 (KACST)、法赫德国王石油与矿产大学 (KFUPM)、阿卜杜拉国王科技大学 (KAUST)、沙特阿拉伯国家石油公司以及阿卜杜拉国王石油研究中心 (KAPSARC)。

阿卜杜拉国王石油研究中心曾对 CCS 技术、经济和政策进行初步研究。其“沙特 CCS 实施战略”项目致力于在对该国 CCS 的发展潜力进行初步评估的基础上，发展一套行之有效的 CCS 实施战略，以在沙特推广 CCS。

此外，沙特的一些著名大学和研究中心，包括阿卜杜拉阿齐兹国王科技城、法赫德国王石油与矿产大学和阿卜杜拉国王科技大学，正在进行 CCS 的基础技术研究。例如，阿卜杜拉阿齐兹国王科技城已对法赫德国王石油

Current CCS activities in Saudi Arabia are primarily focused on basic technical and policy research. CCS is mainly discussed by key stakeholders and experts. Several institutions in Saudi Arabia are engaged in CCS research, including the King Abdulaziz City for Science and Technology (KACST), King Fahd University of Petroleum & Minerals (KFUPM), King Abdullah University of Science and Technology (KAUST), Saudi Aramco, and King Abdullah Petroleum Studies and Research Center (KAPSARC).

KAPSARC has adapted an early stage approach to conduct research focused on CCS technologies, economics and policies. One of its inaugural projects “CCS Implementation Strategies for the Kingdom of Saudi Arabia” aims to develop a robust CCS implementation strategy through a first order assessment of the potential for CCS to be deployed in Saudi Arabia.

Additionally, several leading Saudi universities and research centers, including KACST, KFUPM, and KAUST, are conducting basic technical research on CO2 capture and storage. For example, the Technology Innovation Center for CCS (KACST-TIC CCS) at KFUPM has been awarded KACST baseline funding of SAR 10 M/year (US\$ 2.7 M/year) for a 5-year period (2011–2015). The ongoing research of the KACST-TIC CCS has been focusing on oxy-fuel combustion, mobile capture, site assessment and measurement, and monitoring and verification (MMV) of CO2 storage.

CCS for EOR Demonstration in Saudi Aramco

Saudi Aramco has been actively engaged in carbon management initiatives within the oil industry. A comprehensive research framework has been developed for CCS, including CO2 capture (mobile capture, oxy-fuel combustion, and chemical looping combustion), storage, and EOR technologies.

EOR is of particular interest to Saudi Aramco as it can be a win-win solution to the challenges of rising world energy demand and climate change, by increasing oil production while reducing CO2 emissions.

与矿产大学 CCS 技术创新中心 (KACST-TIC CCS) 提供为期五年 (2011 年至 2015 年)、每年至少 1000 万里亚尔 (270 万美元) 的资助。法赫德国王石油与矿产大学 CCS 技术创新中心正在进行的研究重点包括富氧燃烧捕集、移动捕集、封存点评估与测量, 以及二氧化碳封存的监测与核证。

沙特国家石油公司用于强化石油开采的 CCS-EOR 大型示范项目

沙特国家石油公司一直在积极参与石油工业的碳管理。该公司已经为 CCS 开发了一个综合研究框架, 包括二氧化碳捕集 (移动捕集、富氧燃烧捕集以及化学链燃烧捕集) 技术、封存技术和 EOR 技术。

沙特国家石油公司对 EOR 特别感兴趣, 因为这项技术可通过在减少二氧化碳排放的同时增加石油产量, 将 CCS 与 EOR 结合是满足日益增长的世界能源需求和应对气候变化挑战的一种双赢解决方案。

沙特国家石油公司目前正在进行该国的首个

Saudi Aramco is working on the first CO₂-EOR demonstration project in Saudi Arabia. This project will be implemented in a small part of the 'Uthmaniyah area of the giant Ghawar field, which was discovered in 1948 and started to produce oil in 1951. Ghawar, with over 88 billion barrels of remaining reserves, is by far the world's largest and most productive oil field with daily crude production of 5 million barrels on average. Geologically, the field is categorized as a fairly simple structure with a complete closure, a typical Middle East reservoir of porous limestone and dolomite. The oil comes almost entirely from a producing zone known as Arab D, about 2100 m, on the average, below the surface.

While Saudi Arabia has abundant conventional oil reserves and EOR is not required at production scale for decades to come, the main objective of the CO₂-EOR project is to assess the applicability to sequester CO₂ in a mature zone within an oil reservoir.

The project includes four injection wells, four production wells, and one observation well. It will use 40 million standard cubic feet a day (MMscf/d) of CO₂ that will be captured and processed at the Hawiyah NGL Recovery Plant, and transported to the 'Uthmaniyah field', through a dedicated 80 km pipeline.



CCS-EOR 示范项目。该项目位于全球最大的加沃油田的一个很小的区域。加沃油田于 1948 年被发现并于 1951 年开始生产石油, 目前该油田拥有超过 880 亿桶剩余储量, 日均原油产量为 500 万桶。从地质学角度来说, 该油田具备一种完整封闭的十分简单的构造, 一种典型的中东多孔石灰石和白云石储层。石油几乎全部来自被称为“阿拉伯 D”的生产区域, 在地下大约平均 2100 米的深处。

沙特拥有充裕的常规石油储量, 在未来几十年该国的石油开采并不需要采用 EOR 技术。该 CCS-EOR 示范项目的主要目的是评估在一个油藏的成熟区域封存二氧化碳的适用性。该项目包括四个注入井, 四个采油井和一个观测井。该项目的二氧化碳将在哈维亚液化天然气回收厂捕集和处理, 年捕集能力为 80 万吨, 然后通过一条 80 公里的专用管道输送至加沃油田进行二氧化碳强化石油开采并埋存。

该 CCS-EOR 项目的设计是建立在油藏模拟研究和拥有一个全面的监测和监控计划基础上的。智能油田的理念使单井性能和油藏整体性能的持续监测和优化成为可能, 也被在本项目中采用以提高石油采收率、改善健康、安全性和环境、以及降低运营成本。

该项目的运营期限预计为四到五年, 计划于 2015 年投入运营。

参考文献: 刘恒伟等人《CCS 在沙特未来能源系统中的作用》。《国际温室气体控制期刊》, 2012 年 11 期: 163—171 页。
(Reference: Liu Hengwei, et al. The role of CO₂ capture and storage in Saudi Arabia's energy future. International Journal of Greenhouse Gas Control, 2012, 11: 163-171.)

The design of the CO₂-EOR project is based on a reservoir simulation study and has a comprehensive monitoring and surveillance plan. The concept of the intelligent field, which enables continuous monitoring and optimization of individual wells and overall reservoir performance, has been introduced to enhance oil recovery, improve health, safety and environment (HSE), and reduce operation cost.

The project duration is expected to be four to five years, starting in 2015.

第六轮中美战略 与经济对话下的气候变化合作重点 Key Achievements of U.S.-China Climate Change Cooperation Under the 2014 Strategic and Economic Dialogue

《中美气候变化工作组提交第六轮中美战略与经济对话的报告》介绍 An Introduction to the Report of the U.S. – China Climate Change Working Group to the 2014 Strategic and Economic Dialogue

科学界认识到气候变化在不断加速的共识。加强全球温室气体减排有着紧迫需要，中国和美国占有全球超过 40% 的碳排放量，两国合力应对气候变化非常重要。在 2013 年 4 月 13 日，中美成立了中美气候变化工作组。2013 年 7 月，工作组启动了强化政策对话和五个合作倡议，包括载重汽车和其他汽车减排，智能电网，碳捕集利用和封存，建筑和工业能效，温室气体数据收集和管理。2014 年 7 月 9 日至 10 日举行的第六轮中美战略与经济对话中，中美气候变化工作组宣布五个工作组取得的进展，并且正式宣布了四个大规模碳捕集，利用，与封存示范项目。本文分析了五个合作倡议、强化政策对话以及氢氟碳化物合作的进展情况，并提出了新的和未来可能的合作领域。

Given the latest scientific understanding of accelerating climate change and the urgent need to intensify global efforts to reduce greenhouse gas emissions, the United States and China established the U.S.-China Climate Change Working Group (CCWG) on April 13, 2013. In July 2013, the CCWG launched an enhanced policy dialogue and five action initiatives, including: Emission Reductions from Heavy-Duty and Other Vehicles; Smart Grids; Carbon Capture, Utilization, and Storage; Energy Efficiency in Buildings and Industry; and Collecting and Managing Greenhouse Gas Emissions Data.

本文总结了五个合作倡议、强化政策对话以及氢氟碳化物合作的进展情况，并提出了新的和未来可能的合作领域。

This article outlines progress made on the five initiatives and in the enhanced policy dialogue, as well as collaboration on hydrofluorocarbon (HFCs), and highlights new and possible areas of cooperation.

五个行动倡议进展

A. 载重汽车和其他汽车减排

中美同意在以下三个子领域开展合作：

(1) 提高载重汽车和其他汽车燃油效率标准

美国计划为中型和载重汽车开发 2018 年后新的温室气体排放和燃料经济性标准，并将于 2016 年底前完成。中国计划为载重和轻型汽车开发 2020 年后新的燃油效率标准，并将于 2016 年底前完成。

(2) 清洁燃料和汽车排放控制技术

美国计划于 2016 年底前实施新的超低硫 (10ppm) 汽油标准。中国已同意于 2015 年底前在京津冀、珠三角和长三角三个主要地区加快实施国五标准 (10ppm)，并于 2017 年底之前在全国实施汽油和柴油的国五标准。并且，中国将大致于 2017 年底前制定重型和轻型汽车的国六标准。

(3) 推广高效、清洁的货运

美国环保局、交通部和交通运输部正合作支持拓展中国的绿色货运倡议 (CGFI) (该倡议类似于美国环保局的“智能交通项目”)，以提高运输效率、运载量并实现节能减排。

B. 智能电网

双方计划开展四个合作示范项目并为完成每个项目计划确定了时间表 (包括项目范围、时间表、重要节点、成果、团队人员和各自职责)。有意向的项目包括位于费城的一个智能分布式电网项目，深圳前海的一个智能电网项目，加州的一个示范项目，以及在天津生态城的一个综合性智能电网示范项目。

C. 碳捕集、利用与封存 (CCUS)

两国宣布四个合作示范项目，分别是华能清洁能源研究院与美国 Summit 电力集团关于部署了碳捕集，利用与封存设备的煤气一体化循环电厂和二氧化碳强化驱油的信息交流项目；延长石油与美国研究机构和公司合作，包括西弗吉尼亚大学、怀俄明大学与美国空气化学品公司；山西国际能源集团与美国空气化学品公司等富氧燃烧发电碳捕集利用

Progress on the Five Action Initiatives

A. Emission Reductions from Heavy-Duty and Other Vehicles

The United States and China agreed to cooperate in three areas:

1. Enhanced heavy-duty and other vehicle fuel efficiency standards:

The United States intends to develop new greenhouse gas emissions and fuel economy standards for medium- and heavy-duty vehicles for post-2018 model years, to be finalized by the end of 2016. China intends to develop new fuel efficiency standards for heavy- and light-duty vehicles for 2020 model years, to be finalized by the end of 2016.

2. Clean fuels and vehicle emissions control technologies

The United States intends to implement new ultra-low sulfur (10 ppm) gasoline standards by the end of 2016. China has agreed to fast-track the implementation of China V fuel quality standards (10 ppm) in three major regions, including Beijing, Tianjin, Hebei province and the Pearl River and Yangtze River Delta regions, by the end of 2015, and to implement China V fuel quality standards for gasoline and diesel nationwide by the end of 2017. Further, China will develop the China VI emission standards for light- and heavy-duty vehicles, to be finalized approximately by the end of 2017.

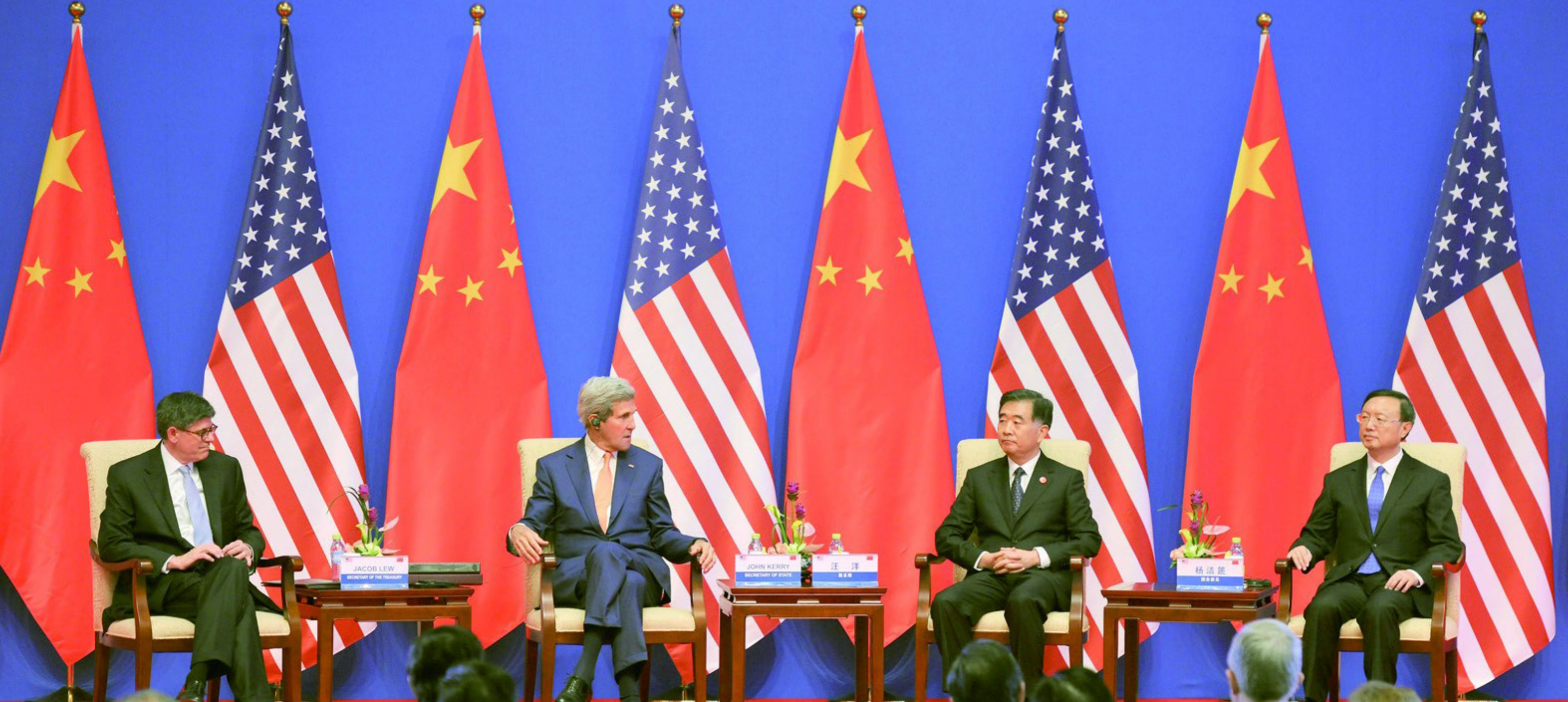
3. Promotion of efficient, clean freight

The U.S. EPA, the U.S. Department of Transportation (DOT), and the Chinese Ministry of Transport (MOT) are working together to support the expansion of China's Green Freight Initiative (CGFI) – which is similar to the U.S. EPA SmartWay Program – to improve transport efficiency and capacity and to conserve energy and reduce emissions in freight transport.

B. Smart Grids

The two sides plan to undertake four cooperative demonstration projects and set a timeline to finalize a project plan (scope, schedule, milestones, deliverables, and team members and their roles) for each project. Intended projects include a smart distribution grid project at the Philadelphia Navy Yard; a smart grid project in Qianhai, Shenzhen; a demonstration project in Irvine, California; and an integrated smart grid demonstration project at the China-Singapore Tianjin Eco-City.

C. Carbon Capture, Utilization, and Storage (CCUS)



封存项目；中石化胜利油田与美国斯伦贝谢公司、肯塔基大学的燃烧后二氧化碳捕集和驱油项目。

D. 建筑和工业能效

双方初步计划从以下三个方面提高建筑和工业能效：在中国进一步发展合同能源管理；商用、民用和工业用建筑能效标准和测试；识别工业领域十佳能效技术和最佳实践。

E. 搜集和管理温室气体信息

美国将支持中国国家发改委以下部门报送系统的开发工作：发电、钢铁、水泥和玻璃、有色金属、化工、航空、陶瓷、油气、采矿和炼焦。

Four joint demonstration projects were announced, which are conducted by Huaneng Clean Energy Research Institute paired with Summit Power Group to exchange information on their coal-based integrated gasification combined cycle (IGCC) plants with CCUS and CO₂-enhanced oil recovery (CO₂-EOR); Yanchang Petroleum working with a group of U.S. research organizations and companies including Air Products and Chemicals on CCUS, West Virginia University and University of Wyoming; Shanxi International Energy Group with U.S. partners including Air Products and Chemicals on coal-fired oxy-combustion to separate CO₂ for CCUS; and Shengli Oilfield Company of Sinopec Corporation with Schlumberger Carbon Services Co. and University of Kentucky and on post-combustion CO₂ capture and CO₂-EOR.

D. Energy Efficiency in Buildings and Industry

强化政策对话

除了上述五个倡议外，双方同意通过强化政策对话，包括交流各自 2020 年后控制温室气体排放计划的有关信息，开展合作。

氢氟碳化物 (HFCs)

双方将合作支持一项在冰箱行业减排 HFCs 的示范项目。

To improve energy efficiency in the building and industry sectors, the United States and China intend to intensify cooperation on energy efficiency in three initial areas: further development of energy savings performance contracting in China; energy efficiency standards and testing for commercial, residential, and manufacturing buildings; and identifying the top ten energy efficient technologies and best practices for industry.

E. Collecting and Managing Greenhouse Gas Emissions Data

The United States is supporting NDRC efforts to develop reporting systems in the following sectors: power generation, iron & steel, cement & glass, nonferrous metals, chemicals, aviation, ceramics, oil & gas, mining, and coking.

Enhanced Policy Dialogue

In addition to making important progress on the five initiatives, the United States and China also agreed to collaborate through enhanced policy dialogue, including the sharing of information regarding their respective post-2020 plans to limit greenhouse gas emissions.

Hydrofluorocarbons (HFCs)

The two sides support a pilot project regarding reducing HFCs from refrigerators.

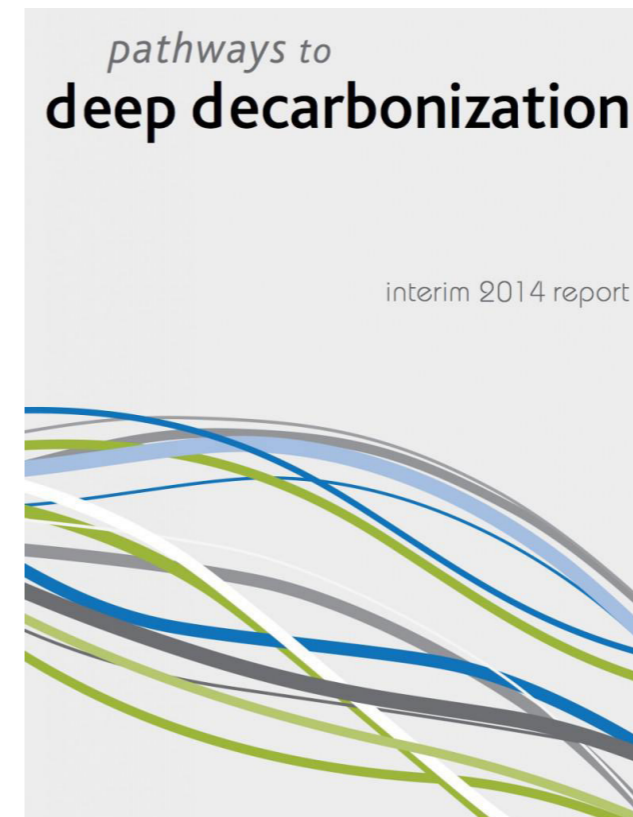
如何减碳以避免危险的气候变化 How to Cut Carbon Emissions in order to Prevent Dangerous Climate Change

联合国《深度减碳》报告介绍

An Introduction to the Deep Decarbonisation Report

本报告致力于确定通往 2050 年的实用的低碳路径，由来自 15 个国家的顶尖研究机构合作完成，也是全球在该领域的首次合作。

The report, produced cooperatively by leading research institutes in 15 countries, is the first global cooperative program to identify practical pathways to a low-carbon economy by 2050.



这份“深度脱碳之路项目”中期报告概述了来自于 15 个最大碳排放国的国家研究小组和大约 30 个合作机构的初步研究成果。该报告列出了大幅减少碳排放，力求将全球平均地表温度的上升保持在低于 2°C 的技术可行途

The Deep Decarbonization Pathway Project (DDPP) interim report summarizes early findings from national research teams and about 30 partner organizations of the 15 top carbon-emitting countries. It listed technically feasible pathways to seriously reduce such emissions in a bid to keep the global mean surface temperature to less than 2 degrees Celsius (°C).

The report indicates that limiting the increase in global mean temperature to less than 2°C imposes a tough constraint on cumulative GHG emissions, including CO₂ emissions, which are the largest single source (76%) of GHG emissions. To have a likely chance (>66-100%) of staying within this limit, the level of cumulative CO₂ emissions from land use, fossil fuels, and industry must be in the range of 550-1300 billion tons (Gigatons or Gt) by mid-century.

If one excludes a significant contribution from net negative emissions, the CO₂ budget to 2050 is 825 Gt. Staying within this CO₂ budget requires very near-term peaking and a sharp reduction in CO₂ emissions thereafter, especially in energy-related CO₂ emissions.

The scenarios reviewed by the IPCC that give a likely chance of staying within the 2°C limit project CO₂ emissions from the burning of fossil fuels and industrial processes (“CO₂-energy emissions”) close to 11 Gt in 2050 on average (down from 34 Gt in 2011).

The IEA Energy Technology Perspective (ETP) 2°C

径。

该报告表明，要将全球平均温度的上升限制在低于 2°C 的水平，必须在累积温室气体排放上强加一个严格的限制，包括温室气体最大的单一排放源二氧化碳排放（76%）。为有可能（概率：>66-100%）实现 2°C 温控目标，来自土地利用、化石燃料和工业的累积二氧化碳排放水平在本世纪中叶必须处于 5500—13000 亿吨范围内。

如果将来自于净负排放的重大贡献排除在外，到 2050 年的二氧化碳排放预算是 8250 亿吨。要保持在这一二氧化碳预算内，需要二氧化碳排在非常短的时期内达到峰值，并且之后二氧化碳排放大幅减少，尤其是与能源有关的二氧化碳排放。

政府间气候变化专门委员会（IPCC）认为，为有可能实现 2°C 温控目标，来自燃烧化石燃料和工业流程的二氧化碳排放（与能源相关的二氧化碳排放）在 2050 年的平均值约为 110 亿吨（2011 年为 340 亿吨）。

国际能源署（IEA）《能源技术展望》的情景研究表明，实现 2°C 温控目标（50% 机会），2050 年能源相关的二氧化碳排放需要控制在 150 亿吨。

假设世界人口到 2050 年达到 95 亿——这与联合国人口司的生育预测中值一致——这意味着世界各国能源相关的二氧化碳排放必须在 2050 年达到接近人均 1.5 吨的全球平均水平，与目前全球人均 5.2 吨的平均水平相比，下降幅度巨大。对于那些目前人均排放远高于全球平均排放的发达国家来说，尤其如此。

该报告还指出，虽然实现 2°C 温控目标极具挑战性，但是可行的。虽然各个国家由于国情不同，策略各异，但是所有的国家共享国家能源系统深度脱碳的三个共同支柱：

1) 能源效率与能源节约：在所有的能源终端利用部门大幅提高能源效率，包括通过改进的车辆技术、智能城市设计，和优化的价值链，提高客货运输的能源效率；通过改进的终端利用设备、建筑设计、建筑实践和建筑材料，提高住宅和商业建筑物的能源效率；通过改进的设备、生产流程和余热再利用，提高工业的能源效率。

scenario (2DS), which gives only a 50% chance of staying within the 2°C limit, reaches 15 Gt CO₂-energy in 2050.

Assuming a world population of 9.5 billion people by 2050—in line with the medium fertility forecast of the UN Population Division—this means that countries would need to converge close to a global average of CO₂-energy emissions per capita of 1.6 tons in 2050, which is a sharp decrease compared to today's global average of 5.2 tons, especially for developed countries with current emissions per capita much higher than today's global average.

The report also indicates that keeping below the 2°C limit is challenging but feasible. While individual countries might have a wide variety of different approaches based on national circumstances, all countries share three common pillars of deep decarbonization of national energy systems:

1) **Energy efficiency and conservation:** Greatly improved energy efficiency in all energy end-use sectors including passenger and goods transportation, through improved vehicle technologies, smart urban design, and optimized value chains; residential and commercial buildings, through improved end-use equipment, architectural design, building practices, and construction materials; and industry, through improved equipment, production processes, material efficiency, and re-use of waste heat.

2) **Low-carbon electricity:** Decarbonization of electricity generation through the replacement of existing fossil-fuel-based generation with renewable energy (e.g. hydro, wind, solar, and geothermal), nuclear power, and/or fossil fuels (coal, gas) with carbon capture and storage (CCS).

3) **Fuel Switching:** Switching end-use energy supplies from highly carbon-intensive fossil fuels in transportation, buildings, and industry to lower carbon fuels, including low-carbon electricity, other low-carbon energy carriers synthesized from electricity generation or sustainable biomass, or lower-carbon fossil fuels.

2) 低碳电力：通过以可再生能源（如水力、风能、太阳能和地热能）、核能、和 / 或配备碳捕集与封存的化石燃料（煤炭、天然气）发电取代现有的基于化石燃料的发电，来实现发电的脱碳。

3) 燃料转换：将交通、建筑和工业等终端能源利用部门的高碳化石燃料转换成低碳燃料，包括低碳电力、或其它化石能源与较低碳能源协同利用所生产的低碳能源产品。

该报告列出了对所有国家深度脱碳至关重要的一些关键技术，这些技术目前尚未成熟，或者还比较昂贵，包括：

The report indicates some key technologies, which are critical for deep decarbonization in all countries, are not yet technically mature or economically affordable. They include:

- 先进的能源存储、灵活的负载管理和用于平衡大规模采用不稳定可再生能源（如风能和太阳能）的电力系统的整体设计
- 极高性能的电气设备、控制系统和建筑材料
- 具有足够续航里程的零排放车辆，尤其是电动车或轻型燃料电池车
- 用于空运和海运的可持续生物燃料或合成燃料
- Advanced energy storage, flexible load management, and integrated portfolio design for balancing power systems with high penetrations of variable renewable energy (e.g. wind and solar)
- Very high performance appliances, controls, and materials for buildings
- Zero emissions vehicles with adequate range, notably battery electric or fuel cell light-duty vehicles
- Sustainable biofuels or synthesized fuels for air and marine transport

一些新兴的低碳技术对一些特定国家是关键的。这些包括：Some emerging low-carbon technologies are key in a some specific countries. These include:

- 新型可再生能源技术（如先进的地热能、深海风能和潮汐能）
- 碳捕集与封存（用于化石燃料电厂和工业部门）
- 保持公众信心和支持的先进核能技术
- New types of renewable energy technologies (e.g. advanced geothermal, deep offshore wind, and tidal energy)
- Carbon-capture and sequestration (on fossil-fueled power plants and industries)
- Advanced nuclear power technology that sustains public confidence and support

奥巴马绕过国会推动发电厂碳减排 Obama Bypasses Congress to Cut Power Plant Emissions

《清洁电力计划》介绍

An Introduction to the Clean Power Plan



今年6月份，美国环保署提出《清洁电力计划》，这被认为是美国政府在应对气候变化方面所迈出的最强有力的一步。自从2010年共和党控制众议院以来，国会对几乎所有白宫提出的政策都采取了对抗态度，这次奥巴马绕过国会提出该计划。如果该计划顺利实施，美国现有的燃煤电厂——温室气体最大的单一排放源——将必须在2030年较2005年减碳30%。

In June, the U.S. EPA proposed the Clean Power Plan (CPP), the strongest action ever taken by the U.S. government to fight climate change. The CPP bypasses Congress, which has been

antagonistic to nearly all White House policies since Republicans controlled the U.S. House of Representatives in 2010. If implemented as proposed, the CPP will force existing coal-fired power plants, the single largest source of greenhouse gas emission in the country, to slash their carbon pollution to 30% below 2005 levels by 2030.

电厂是美国最大的二氧化碳排放来源，占美国国内所有温室气体排放的大约三分之一。作为奥巴马《气候行动计划》的一部分，美国环保署于2014年6月提出了一个基于已有实践的电力部门碳减排计划，被《纽约时报》称赞为美国政府为对抗气候变化所采取的最强有力的行动之一。

目前美国环保署已经为该计划的顺利实施召开了4次听证会。待联邦公报发布该提议后，还有120天的向公众征集意见时间。美国国会和州议会也将对该计划进行严格审查。根据《清洁电力计划》提出的时间表，各州的减排计划将最晚在2016年提交环保署评审，各州独自实行计划的最晚时间是2017年，各州加入集体履约的时间是2018年。考虑到新规则所要经历的复杂过程，以及法律上的争吵可能会导致该计划实施日期的延误。

Power plants are the largest source of CO2 emissions in the United States, making up roughly one-third of all domestic greenhouse gas emissions. In June 2014, the Environmental Protection Agency (EPA) proposed a common-sense plan to cut carbon pollution from power plants as part of the President's Climate Action Plan and is credited by the New York Times as one of the strongest actions that the U.S. government has ever taken to fight climate change.

By far the EPA has held public hearings in four locations for the proposed Clean Power Plan and it will hold the public comment period open for 120 days after the proposal is published in the Federal Register. It is anticipated that the rule will undergo great scrutiny in the halls of Congress and in many state capitols around the country. According to the timeline proposed in the Clean Power Plan, initial state plans will be due to EPA for review in 2016, with final plans due for states acting alone in 2017 and for states participating in multi-state compliance groups in 2018. Given the complex process of developing new rules and programs, legal squabbling might cause delay.

目标

- 在全国范围内，该《清洁电力计划》在2030年将有助于把来自电力部门的碳污染在2005年的水平上削减30%。
- 在2030年该提议还将削减25%以上的煤烟污染。

该计划涉及的电厂数量

- 在美国，该法规涉及拥有3000个机组的1000个化石燃料电厂。
- 公共设施规划人员已经开始为长期服役的发电机组制定减排计划。这些燃煤机组的平均服役年限是42年。燃油机组的平均服役年限是36年。天然气联合循环机组的平均使用年限是14年。

巨大的公共健康与气候福利

- 在2030年，该计划拥有的公共健康与气候福利估计价值为每年550亿美元至930亿美元，远超过73亿美元至88亿美元的成本。

各州的政策统计

- 各州、各市和各企业已经设定了能源效率目标、提高了其可再生能源的使用、以及形成了减少碳污染的共识。以下是各州根据该计划采取的碳减排措施。
- 47个州开展需求侧能源效率项目
 - 38个州拥有可再生能源标准或目标
 - 10个州拥有基于市场的温室气体减排项目
 - 27个州拥有能源效率标准或目标

以排放率为基础的方法确定各州的减排目标

各州的目标通过使用一个公式来确定——用排放的二氧化碳量除以产生这些二氧化碳所生产的兆瓦时电力（1磅/兆瓦时）。

具体来说，环保署以每个州2012年的二氧化碳排放率（1磅/兆瓦时）为基准，然后着眼于被广泛用于能源部门的四个战略：

1. 提高现有燃煤电厂的效率：燃煤电厂可以变得更高效，这将减少各州二氧化碳排放总量，降低各州的排放率。
2. 提高现有天然气电厂的使用率：由于天然气电厂较燃煤电厂的碳排放低，各州可以更经常使用其天然气电厂。这降低了各州二氧化碳排放总量并且提高了清洁发电，进一步降低各州的排放率。
3. 扩大风能、太阳能或其他低排放或零排放替代选择的使用：各州可以增加可再生能源，如风能和太阳能，并且保持其核能发电。这些零排放和低碳排放源降低了二氧化碳排放，而且增加了清洁发电，更进一步降低各州的排放率。
4. 提高家庭与企业的能源效率：各州可以扩展能源效率项目，这样一个州的居民和企业可以少用电力。在该公式中，这视为清洁发电的增加，将本州的排放率降低到一个最终的数字。
5. 这个最终数字就是本州的目标。

削减二氧化碳排放的灵活措施

各州可以灵活采用的一些减排措施包括，但不限于：

- 需求侧的能源效率项目
- 可再生能源标准
- 提高电厂效率
- 共燃或转换到天然气
- 建设新的天然气联合循环电厂
- 提高输电效率
- 能源储存技术
- 退役
- 扩大可再生能源的使用，如风能和太阳能
- 扩大核能的使用
- 以市场为基础的交易计划
- 能源节约计划

The targets

- Nationwide, the Clean Power Plan will help cut carbon pollution from the power sector by 30% from 2005 levels in 2030.
- The proposal will also cut pollution that leads to soot and smog by over 25% in 2030.

The number of power plants covered by the Plan

- In the U.S., there are 1,000 fossil fuel fired power plants with 3,000 units covered by this rule.
- Utility planners are already making plans to address an aging fleet. The average age of coal units is 42 years. The average age of oil units is 36 years. The average age of natural gas combined cycle units is 14 years.

The big public health and climate benefits

- The Clean Power Plan has public health and climate benefits worth an estimated \$55 billion to \$93 billion per year in 2030, far outweighing the costs of \$7.3 billion to \$8.8 billion.

The State policy statistics

States, cities and businesses have set energy efficiency targets, increased their use of renewable energy, and made agreements to cut carbon pollution. These are the kinds of programs that states will be able to use to cut carbon pollution under this proposal.

- 47 states with utilities that run demand-side energy efficiency programs
- 38 states with renewable portfolio standards or goals
- 10 states with market-based greenhouse gas emissions programs
- 27 states with energy efficiency standards or goals

The rate-based approach to determining the state goals

The state goals are determined by using a formula that takes the amount of CO2 emitted and divides it by the megawatt-hours of electricity generated (lbs/MWh).

Specifically, EPA started with each state's 2012 CO2 emissions rate (lbs/MWh) and then looked at four strategies that are in widespread use in the energy sector:

1.Improving efficiency at existing coal-fired power plants: coal power fleets can become more efficient, which will reduce total state CO2 emissions, dropping the state's emission rate.

2.Increasing utilization of existing natural gas fired power plants: states can use their natural gas power plants more often because those plants don't emit as much carbon pollution. This lowers total state CO2 emissions and increases clean generation, reducing the state's emission rate further.

3.Expanding the use of wind, solar, or other low- or zero-emitting alternatives: states can increase renewable energy sources such as wind and solar and sustain their nuclear power generation. These zero- and low-carbon emitting sources lower CO2 emissions and increase clean generation, dropping the state's emission rate even further.

4.Increasing energy efficiency in homes and businesses: states can expand energy efficiency programs so a state's residents and businesses use less electricity. In the formula this counts as an increase in clean generation, dropping the state's emission rate to a final number.

5.This final number is the state goal.

The flexible approach to cut CO2 emissions

Some of the measures states can choose to rely on in their plans include, but are not limited to:

- demand-side energy efficiency programs
- renewable energy standards
- efficiency improvements at plants
- co-firing or switching to natural gas
- construction of new Natural Gas Combined-Cycle plants
- transmission efficiency improvements
- energy storage technology
- retirements
- expanding renewables like wind and solar
- expanding nuclear
- market-based trading programs
- energy conservation programs

气候变化带来商业风险 Climate Change is Risky for Business

美国版斯特恩报告《风险下的商业》报告介绍 An Introduction to the Risky Business Report

前纽约市长迈克尔·布隆伯格（独立派人士）、前美国财政部长亨利·保尔森（共和党人士），以及亿万富翁汤姆·斯泰尔（民主党人士）在政治议题上鲜有一致。但这三人对气候变化的经济影响却有着相同的忧虑。去年秋天，他们合作启动了一个称为风险下的商业的研究项目，该项目致力于研究气候变化对美国商业可能的经济影响。

Former New York City Mayor Mike Bloomberg (an independent), former U.S. Treasury Secretary Henry Paulson (a Republican) and billionaire Tom Steyer (a Democrat) don't typically agree on political issues. But all three men share a concern for the economic impact of climate change on U.S. business. Last fall, they embarked on what they're calling the Risky Business initiative, a project that will culminate in a report that will spell out the likely economic impact of climate change on U.S. business.

这份最近发布的跨两党报告是受前纽约市长迈克尔·布隆伯格、亿万富翁、可再生能源支持者汤姆·斯泰尔以及小布什总统时代的前财政部长亨利·保尔森的委托完成的。该报告类似于美国版的《斯特恩报告》，但更加关注美国。该报告对各地区和各部门提出了严厉警告。

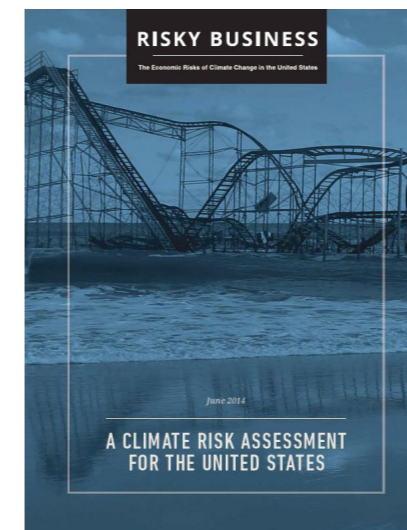
该报告重点关注那些最明确、与经济最相关的气候风险：上升的海平面和越来越多的风暴潮对沿海财产和基础设施的破坏、由于气候变化导致的农业生产和能源需求的变化、以及高温对劳动生产率和公共健康的影响。

该报告得出结论：“美国经济面临气候变化的多种重大风险。与经济结构一样，美

The bi-partisan Report released recently was commissioned by former New York Mayor Michael Bloomberg, billionaire renewable energy advocate Tom Steyer, and George W. Bush's former Secretary of the Treasury Henry Paulson. The Report is similar to the Stern Review on the Economics of Climate Change, but this has more focus on the US. Its conclusions provide stark warnings for various regions and sectors.

The Report focused on the clearest and most economically significant of these risks: Damage to coastal property and infrastructure from rising sea levels and increased storm surge, climate-driven changes in agricultural production and energy demand, and the impact of higher temperatures on labor productivity and public health.

The Report concluded: "The



国各地的气候条件相差非常大。这些不同会使得我国的经济对气候变化更具韧性。但是每个地区具有不同的风险状况和不同的风险控制能力。总的来说，不可能单用一个数字来形容气候变化对美国全国的经济成本：我们必须从区域的角度来理解我们面临的气候风险。”

为使美国商业面临的气候风险最小化，该报告呼吁采取三个方面的行动：

American economy faces multiple and significant risks from climate change. Climate conditions vary dramatically across the U.S., as does the mix of economic activity. Those variations will benefit our economic resilience to future climatic changes. But each region of the country has a different risk profile and a different ability to manage that risk. There is no single top-line number that represents the cost of climate change to the American economy as a whole: We must take a regional approach to fully understand our climate risk.”

The Report called for the three general areas of action that can help to minimize the risks U.S. businesses currently face from climate change:

商业适应

“改变商业惯例，以变得更具韧性。”

该报告指出，在全国范围内，一些气候影响正在被感受到；甚至一些气候影响已经确定是我们的未来经济不能改变的一部分。理性的商业从业者必须适应。

BUSINESS ADAPTATION

“Changing everyday business practices to become more resilient.”

The Report stated that some of the climate impacts are already being felt across the nation; indeed, some are already an unalterable part of our economic future. Rational business actors must adapt.

投资者适应

“将风险评估纳入资本支出和资产负债表中。”

该报告提到，当前的商业投资必须对到本世纪中叶时特定地区面临的实际气候风险进行评估。认识到这一现实，2010年，美国证券交易委员会发布了有关气候信息披露的解释说明，为公司提供了一些如何考虑其面临的“实质性”气候风险的思路。

INVESTOR ADAPTATION

“Incorporating risk assessment into capital expenditures and balance sheets.”

The Report mentioned that today's business investments must be evaluated in terms of the actual climate risk specific regions face as we approach the middle of this century. In 2010, recognizing this reality, the

公共部门响应

“制定减缓和适应气候变化的政策。”

该报告表示，我们应更好地理解气候变化的潜在风险并界定如何应对这些风险——尤其是那些由我们数十年前作出的决策导致的、深潜于我们经济中的风险。

PUBLIC SECTOR RESPONSE

“Instituting policies to mitigate and adapt to climate change.”

The Report said that we need to better understand the potential risks of climate change and decide how to respond to those risks—especially those that are already embedded in our economy because of decisions we made decades ago.



美国《清洁电力计划》前途未卜 U.S. Clean Power Plan Faces an Uncertain Future

碳减排目标的地区差异大 Big Regional Differences

虽然很多报道说美国 EPA 制定的《清洁电力计划》试图让美国电力系统的碳排放总量在 2030 年比 2005 年降低 30%，但实际上此计划中直接制定的目标是针对碳排放率的，也就是生产每千瓦时电的碳排放量。而总碳排放量比 2005 年降低 30% 则是根据 EPA 的分析预测。

在此计划中，州与州之间的碳排放率的减低目标差异非常大。例如，与 2012 年相比，到 2030 年亚利桑那州的碳排放率降低 52%，德克萨斯州降低 39%，加利福尼亚州降低 23%，而北达科他州只降低 11%。主要原因是这个计划的设计中考虑了各个地区现有电力系统的差异性，比如现有煤电和天然气发电的能力，可再生能源发电的潜力，以及能效提高的潜力。

Although EPA's Clean Power Plan (the Plan) is often reported as intending to cut overall carbon dioxide emissions by 30 percent below 2005 levels by 2030, the Plan actually specified state-level emission rate reductions, that is, the amount of carbon dioxide emitted per megawatt hour electricity produced. EPA estimates that on a national average level, the Plan will lead to a reduction of US power system carbon dioxide emissions of up to by 30% as compared with the 2005 level. State-by-state emission rate reductions vary considerably. For example, as compared to the emission rate in 2012, Arizona's rate goal is 52% lower by 2030, Texas' is 39% lower, California's is 23% lower, and North Dakota's is only 11% lower. The main reason for the differences is that the design of the plan considers regional differences in the existing power systems, such as the existing capacity of coal-fired power plants and natural gas power plants, and EPA's views of renewable potential and energy efficiency potential.

《清洁电力计划》“真相” The Truths of the Plan

在 EPA 公布该计划的同时也发布了其对该计划可能造成的影响的分析。分析表明，这个计划的实施会导致更多的煤电提前退休。大概有 30 吉瓦到 50 吉瓦的煤电会在 2020 年前因为这个计划而退休，这

As EPA announced its proposed rule, it also published its Regulatory Impact Analysis using the Integrated Planning Model (IPM). EPA's analysis shows the implementation of the Plan will lead to 30 GW to 50 GW of additional coal plant retirements by 2020 (in addition to about 50 GW



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大概在现有煤电的 10% 到 15%（这不包括在没有这个计划的情况下就会有 50 吉瓦退休的煤电）。但是，EPA 的分析预测这个计划会导致到 2030 年对新的天然气发电的投资减少 30 吉瓦。原因是 EPA 的预测中能效的提高使总的用电需求降低。根据 EPA 的分析，能效提高会使用电总量在 2030 年减少 11%。另外，在计算碳排放率时只是已有电厂在计算之内，而新的天然气发电厂并不能使各州降低其碳排放强度，这就导致新的天然气电厂不如已有的天然气电厂有价值。最后，可再生能源的发电能力略有增加，到 2030 年低于 10GW。总体来说，美国整体装机能力在 2030 年不到 1000 吉瓦，低于 2012 年的 1063 吉瓦。

从一次能源的使用来看，电力系统对煤炭的需求到 2020 年降低 25% 左右，由原来的 844 百万吨降低为 616 到 636 百万吨左右。而对天然气的需求增长大概 10%-14% 左右，由原来的 8.35 万亿立方英尺增长到 9.2 到 9.54 万亿立方英尺之间。值得注意的是，到 2030 年天然气的电力需求是降低的。这同样也是由于用电需求的降低以及对新的电厂投资的减少。对煤炭需求的降低会导致煤炭价格的降低，有 2030 年的每百万英热 2 美元到 1.7 美元。而天然气的价格到 2020 年上升大概 10%，从每百万英热 5 美元上升 50 美分左右，但是到 2030 年天然气价格几乎没有变化，在每百万英热大概 6 美元左右。

EPA 的分析表明在 2020 年电力生产的成本上升 54 到 74 亿美元左右，而 2030 年上升 73 到 88 亿美元。这里的成本包括因为要达到碳排放标准所导致的增加投资新的电厂以及已有电厂的改造，燃油费用以及电厂运行的费用。这些成本的增长低于 EPA 所估计的因为排放降低对环境和人的健康状况的改善所带来的利益，使得该计划具有合理性。对于用户来说，EPA 的分析预测该计划导致零售电价在 2020 年全国平均上涨 6% 左右，到 2030 年上涨 3% 左右。但有些地区电价会出现下降。到 2030 年用户用于电费的总支出却下降 8%，同样是因为用电需求的减少。

当然，这些都是 EPA 的分析。这样的分析结果将来可能会受到挑战。比如有些人可能会质疑 EPA 在分析的过程当中对于各州的可再生能源的目标的假设，有些人可能会质疑能

of coal retirements in the Base Case without the Plan), which is about 10-15% of the existing coal-fired power plants. However, EPA projects that the Plan will also result in a reduction of 30 GW for new gas power plant investment by 2030 relative to the Base Case without the Plan. The reason is that EPA assumed energy efficiency will lead to dramatic reductions in demand for electricity, and hence less need for new capacity addition. Based on EPA's analysis, energy efficiency could lead to 11% of reduction in total energy in 2030 as compared to the Base Case without the Plan. Another reason for less investment in new gas plants is that in EPA's formula for calculating emission rate, only existing but not new gas power plants reduce the emission rate, which means that new gas power plants are not as valuable as existing power plants. Lastly, renewable energy generating capacity increased slightly, less than 10GW by 2030. Overall, the U.S. installed capacity in 2030 is below 1000 GW, lower than the total installed capacity in 2012 of 1,063 GW.

From the point of view of primary energy consumption, electric demand for coal is forecasted to be reduced by about 25 percent in 2020, from 844 million tons to about 616-636 million tons. The growth in demand for natural gas is around 10%-14% in 2020, increasing from 8.35 tcf to 9.2-9.54 tcf. It is worth noting that gas demand for electricity in 2030 is below Base Case demand, consistent with lower electricity demand and reduced investment in new gas power plants. Reduced demand for coal will lead to lower coal prices from \$2/MMBtu to \$1.7/MMBtu in 2030. The price of natural gas in 2020 rises about 10 percent, or about 50 cents/MMBtu from \$5/MMBtu, but in 2030 natural gas price stays at about \$6/MMBtu, with little change in natural gas prices from the Base Case.

EPA projects that the total electricity production costs in 2020 will rise about 5.4-7.4 billion dollars and 7.3-8.8 billion dollars in 2030 due to the implementation of the Plan. The production costs include costs for investing new capacity and upgrading existing fleet, fuel costs, and the costs of running and maintaining the plant. However, the benefits brought by the reduction of emission for climate and human health outweigh the cost increase, justifying the Plan. For consumers, EPA's analysis forecasts that the retail price rise about 6% in 2020 and 3% by 2030 on national average while in some regions the price may even decline. By 2030 the total electricity bills (total expenditures for electricity) declines by about 8% because of reduced demand for electricity.

Of course, these are all based on the EPA's regulatory impact analysis, which may face many challenges in the future. For example, some may question if the renewable target assumptions in this analysis

效提高的假设。

are reasonable, and others may challenge EPA's assumption for energy efficiency.



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未来仍十分不确定 The Uncertainties of the Plan

EPA 的这个计划是美国第一个针对现有电力系统的碳排放出台的政策。EPA 声称这个政策是很灵活的：不仅仅局限于化石能源，还包括其他的清洁能源手段，如可再生能源以及能效提高的手段。同时，各州可以在本州的范围内来实行也可以跨州进行区域间的合作。这些灵活性有助于降低实行这一计划的成本。但是在另一方面，面临碳排放减排目标较高的州会认为这不平等。另外，大多数核电厂和水电厂并不在计算公式之内，这些电厂的拥有者会认为他们对碳减排的价值没有被公平的对待。最后，有些人质疑可能会针对 EPA 出台的这个计划是否在《清洁空气

The EPA's Plan is the first national regulation in the US to regulate carbon emissions from existing power plants. EPA claims that the policy is flexible since it is not limited to fossil fuels plants, but allows other means to be qualified as the compliance measures, such as energy efficiency and renewable. Meanwhile, a state can implement the Plan by itself, or choose to collaborate with other states on a regional level. These flexibilities may help to reduce the compliance cost. In addition, the design of the state's emission reduction targets considers regional differences. On the other hand, states which face with more stringent carbon emissions reduction targets may think the Plan is unfair. In addition, most existing nuclear power plants and hydro plants are not accounted for in the calculation of the emission rate. Nuclear and

法案》给它的权利范围之内。比如有些人指出，《清洁空气法案》只是给予 EPA 权利去设定针对电厂的减排目标，并不是针对一个州。

按照现在的计划，EPA 会在 2015 年 6 月正式出台这一计划。在此之后，各州开始要制定州计划为 2020 年达标做好准备。然而与此同时，EPA 也很有可能面临来自州和电力企业的各种诉讼。总而言之，奥巴马政府这一具有非常重要意义的政策前途还很不确定。

the hydro plants owners may argue that their value in reducing carbon emissions is not fairly credited. Finally, there is still a question whether the "Clean Air Act" gives EPA the authority to do what it lays out in the Plan. Some have argued that the "Clean Air Act" only gives EPA the authority to set emission reduction targets at the power plant level, but not at the state level.

According to the current timeline, EPA will finalize this rule in June 2015, after which states will be required to set up state implementation plan to comply starting in 2020. However, it is also likely that EPA will be sued by multiple parties including state governments and power companies. So the fate of this important climate policy set by the Obama Administration is very uncertain.

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