世界资源研究所中国办公室
China Office, World Resources Institute

# RELEASE: China releases the first guidelines on carbon capture, use and storage

The *Guidelines for Carbon Dioxide Capture, Utilization, and Storage* (CCUS) *in China*, prepared under a cooperative project of the Tsinghua BP Center and the World Resources Institute, is released in Beijing today.

The Guidelines are the first detailed examination of CCUS regulations in China. It provides a complete set of recommendations for how to regulate CCUS in its technical, environmental and social dimensions.

Prof. Li Zheng, Dean of the Tsinghua Department of Thermal Engineering and Director of the Tsinghua BP Clean Energy Research and Education Center, stated, "This is an important development in developing CCUS in China. These are the first such guidelines written by Chinese, specifically for the Chinese context."

He emphasized that the authors do not make a recommendation as to whether China should adopt CCUS, but rather, he said, "These guidelines provide decision makers, both in the government and at the company level, with the information needed to make that decision and if they decide to move forward, with how to do so safely, economically and effectively."

The Guidelines are organized into six main chapters. After introducing climate change, greenhouse gas emissions, and the potential role of CCUS around the globe, the text works methodically through each of the three stages in a CCS project – capture, transport, and storage. These chapters are structured to present first the underlying scientific and engineering principles governing the technology at each stage. The scientific overview is followed by a detailed discussion of the implementation processes for each stage. Further information unique to each stage is also presented.

Given the importance that China places on the utilization of CO2 in the near term, the fifth chapter provides a looks at numerous means of utilization. The sixth chapter then ties each stage together by presenting the project-level perspective, analyzing how each stage (capture, transport, utilization, and storage) evolves over the seven-phases of an actual CCUS demonstration project, separating a project into seven phases across its lifetime. The final chapters include a review of the key recommendations of the Guidelines and more in-depth and detailed descriptions of CCUS technology in the appendixes.

These Guidelines also show, however, that there are technical and procedural measures that can be taken to limit most of the inherent risks and consequences. For example, on the matter of economics alone, taking advantage of China's energy sector, CCUS projects could be implemented by sources with high-purity CO2 emissions and lower costs near to oil reservoirs suitable for EOR. Such projects could potentially have net positive economic benefits in addition to their contribution to limiting greenhouse gas emissions.

The Guidelines are the product of a two-year cooperative program between Tsinghua University and the World Resources Institute, supported by the U.S. Department of State under the Asia-Pacific Partnership (APP) and the U.K. Foreign and Commonwealth Office. The Tsinghua work began by studying Guidelines that WRI had prepared for a US audience, adapting appropriate portions and developing its own approach based on the Chinese regulatory and energy developing context. WRI and Tsinghua together assembled a group of international and Chinese experts to advice the part, and this team has been integral to shaping the project and ensuring the drafting team was fully aware of both international best practice and the specific Chinese context.

Key facts about CCUS in the Chinese Context:

- China has some of the world's largest coal-to-chemicals, cement, steel, and thermal power industries that are key targets for CO2 capture. Specifically, the abundance of high-purity and lower cost capture options at coal-to-chemical plants make them a primary target for near-term CCUS project development.
- China has a large and growing oil import dependence. The prospect of EOR offers the three-fold advantage of CO2 emissions reduction, CCUS technology development, and greater energy security.
- China has high demand and numerous options for the utilization of CO2. While CCUS costs are still high, it is worth looking at as the starting place for CCS development.
- Old wells in China are of lower quality and are more poorly recorded than in other countries, thus making them even greater risks for CO2 leakage.
- The Energy penalty for CO2 capture runs counter to the national goal of improved efficiency and energy resource conservation.
- China has a higher and most likely long-lasting dependency on coal for social and economic development.
- China is trying to balance limiting CO2 emissions with the continued social and economic development goals.
- China's geology is less well known and understood, leaving a large knowledge gap with respect to the real prospects of potential CO2 storage

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# 新闻稿：中国第一个关于碳捕集和封存技术与实施指南正式出版

由世界资源研究所（WRI）和清华大学合作编写的《二氧化碳捕集和封存技术与实施》今天在北京正式发布。这是中国第一个关于碳捕集、利用及地质封存（CCUS）监管的详细指南，在技术、环境和社会层面上就如何监管碳捕集、利用和地质封存给予了详细的参考意见。

该指南的主要撰写专家、清华大学热能工程系主任、清华 BP 清洁能源研究与教育中心主任李政教授指出，“本书的出版对中国发展 CCUS 具有重要的价值，这是用中文编著的最早的针对中国发展 CCUS 的参考意见。”

他强调本书写作的目的并不在于支持或者反对中国发展 CCUS，而是为中国的决策者——既包括政府部门的，也包括企业的——提供他们制定 CCUS 发展决策所需要的关键信息，以及如果决定发展 CCUS，应当如何具体实施，以保证项目能够安全、经济和有效的进行。

《二氧化碳捕集、利用与封存的技术及实施》一书共分为 7 章。第 1 章简要介绍了气候变化、温室气体排放以及 CCUS 在全球减碳事业中的作用。正文第 2~4 章主要针对 CCS 项目的 3 个主要环节——二氧化碳捕集、管道运输和封存——展开细致论述。这些章节通常首先介绍各个环节所涉及的科学知识和技术原理，随后详细讨论各个环节的具体实施步骤，以及各个环节各自所涉及的一些特殊问题。

考虑到中国在近期对于二氧化碳利用所表现出的浓厚兴趣，本书的第 5 章专门讨论各种可能的二氧化碳利用途径。第 6 章从完整项目的角度出发，将一个 CCUS 项目的全部实施过程划分为了 7 个阶段。第 7 章则根据前面各章的详细叙述内容，针对不同类型读者归纳了针对 CCUS 项目在中国安全、经济、有效地实施的参考意见。另外，限于正文部分的篇幅，CCUS 项目各环节所涉及到的一些技术细节的知识和信息被放在了本书的附录部分。

在本指南的撰写过程中，专家团队发现现有已经成熟的技术手段基本上已经能够有效地防止 CCUS 项目实施过程中绝大多数风险的发生，或是即便发生，也能够将发生的后果控制在可接受范围内。例如，从经济角度来看，目前中国可以选择二氧化碳排放浓度高的排放源点进行捕碳，并将二氧化碳用于附近合适油田的强化采油作业（EOR），这样的项目甚至能够在有效减少人为碳排放的同时产生较显著的经济效益，非常值得重视。

该书的研究和出版工作得到美国国务院在“亚太伙伴计划”项目下以及英国外交和联邦事务部的联合资助，由清华大学与世界资源研究所通过开展了为期两年的合作共同完成的。

在整个项目过程中，清华大学研究团队系统研究和消化了世界资源研究所 2008 年出版的针对美国读者的 CCS 指导准则（Guidelines for Carbon Capture and Storage），本着“引进，消化，吸收，再创新”的精神，从中国能源行业以及法规制度体系现状出发，独立形成了一整套针对我国 CCUS 技术发展和项目实施需求的参考意见。世界资源研究所和清华大学分别邀请了美国和中国 CCUS 相关研究和工业领域的专家学者组成了专家指导委员会，对本书的研究和撰写工作提供了宝贵

的方向性指导、信息和具体建议，保证研究成果充分反映了国际和国内 CCUS 最新发展动态和最佳实践。

关于在中国实施 CCUS 的一些关键信息

- 中国拥有世界最大的煤化工产业、水泥产业、钢铁产业以及燃煤发电产业，这些也是碳捕集的关键潜在对象。其中，碳排放浓度高、捕集成本低的大量煤化工厂将是近期内中国实施 CCUS 的首要选项。
- 中国的石油进口依存度已经很高，而且还在迅速升高。利用二氧化碳进行强化采油（EOR）的可能性将给中国带来三方面好处：实现有效的减碳、帮助发展 CCUS 相关技术、以及提高中国的国家石油安全。
- 中国对利用二氧化碳有巨大的需求和大量的可选利用方案。尽管 CCUS 的实施成本仍较高，但将其作为中国发展 CCS 的初始选项还是十分值得的。
- 中国的很多年代较早的油气井的施工质量相对较低，而且相关地质数据记录与发达国家相比要差一些，因此如果被用于二氧化碳地质封存的话，这些井发生泄漏的风险较高。
- 实施二氧化碳捕集所导致的能量损失与中国政府所大力推行的“节能减排”基本国策有矛盾。
- 未来很长一段时间中，中国的经济社会发展都很有可能将继续高度依赖煤。
- 中国正试图在减少二氧化碳排放与实现经济社会可持续发展目标之间取得平衡。
- 中国的地质信息调研不如发达国家充分，因此未来要确定适合二氧化碳封存的地质储层，中国有更多的地质调查和评估工作要做。

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