U.S.-China Clean Energy Research Center

中美清洁能源联合研究中心

Recent Achievements

最新进展

July 2014

2014年7月

U.S. President Barack Obama and Chinese President Xi Jinping endorse a strong U.S.-Sino bilateral relationship in science and technology to spur innovation and address common challenges, including clean energy and climate change

中国国家主席习近平和美国总统奥巴马支持两国科技合作深入发展，以推动创新，解决两国在清洁能源和气候变化等方面所面临的共同挑战。

"Both President Xi and myself recognize that we have a unique opportunity to take the U.S.-China relationship to a new level. I am absolutely committed to making sure that we don't miss this opportunity."

—President Obama at U.S.-China Summit, June 2013

"习主席和我都认识到我们面临着绝佳的机会，将中美关系推向一个新的台阶。我保证一定会尽力抓住此次机会。"

—奥巴马总统在中美领导人会晤时的讲话

2013年6月

Since the normalization of relations in 1979, the United States and the People's Republic of China have engaged in numerous agreements to accelerate the advancement of science and technology. In three decades of working together, scientists and engineers from both countries have built a legacy of cooperative achievement.

Today, the United States and China share common strategic and economic interests in advancing clean energy technology. As the world's largest energy producers and consumers, both face similar challenges and opportunities. Both countries depend on efficient use of energy and the innovative production of clean fuels and power. Both countries possess formidable capacities for research and innovation. History suggests that progress toward a clean energy future can be accelerated by working collaboratively and leveraging each country's strengths.

U.S. President Barack Obama and China's President Hu Jintao advanced this vision by announcing a flagship bilateral initiative—the U.S.-China Clean Energy Research Center—in November 2009. The Center's work was launched with the signing of joint work plans in January 2011. President Obama and China's President Xi Jinping affirmed that the two countries will continue to strengthen dialogue and cooperation in areas including clean energy, when they met at the Hague in Netherlands in March 2014.

自1979年中美两国关系正常化以来，两国签署了一系列加快科技发展的协议。在两国科学家和工程师的共同努力下，双方建立了牢固的合作基础，取得了丰硕成果。

中美两国在发展清洁能源技术方面有着共同的战略和经济利益。作为世界上最大的能源生产国和消费国，两国面临着相似的挑战和机遇。两国的未来取决于能源的高效使用以及清洁燃料和电力的创新生产。两国的研发和创新能力较强，若携手合作、互为借鉴、优势互补，必将加速清洁能源时代的到来。

为实现该目标，2009年11月，时任中国国家主席胡锦涛和美国总统奥巴马宣布启动中美清洁能源联合研究中心（CERC）这一旗舰项目。2011年1月，双方签署联合工作计划，中美清洁能源联合研究中心正式揭牌。2014年 3月，中国国家主席习近平和美国总统奥巴马在荷兰海牙会晤时表示，双方将继续加强在清洁能源等领域的对话与合作。

Clean energy technology development is critical for the economic future of both the United States and China.

The goal of the U.S.-China Clean Energy Research Center (CERC) is to accelerate the development and deployment of clean energy technologies for the benefit of both countries. This is done by providing a supportive platform for collaborative research, protecting intellectual property, and encouraging top scientists and engineers in both countries to join forces, learn from each other, and capitalize on unique assets and complementary strengths.

Strategic direction and governance of the Center is provided by a Steering Committee. This is headed by the Secretary of Energy in the United States and by the Minister of Science and Technology in China in conjunction with the Administrator of the National Energy Administration.

清洁能源技术的发展对未来中美两国经济的发展至关重要。

中美清洁能源联合研究中心旨在加快清洁能源技术的开发和利用，造福两国人民。实施措施包括提供支持合作研究的平台，保护知识产权，鼓励两国一流科学家和工程师携手合作、相互学习、充分利用各自资源进行优势互补。

中美清洁能源联合研究中心指导委员会为中心提供战略指导和管理。指导委员会由中国科学技术部部长、国家能源局局长与美国能源部部长共同领导。

Leadership from U.S. Secretary Ernest Moniz and Chinese Minister Wan Gang enables and encourages the formation of ambitious bilateral collaborations under CERC among researchers and participating businesses and institutional partners from both countries

中国科学技术部部长万钢和美国能源部长欧内斯特·莫尼兹对于促进两国科研人员在清洁能源联合研究中心框架下开展合作起着至关重要的领导作用。

The Center has formed three joint Consortia to carry out its operations:

- **Advanced Coal Technology Consortium (ACTC)** led by West Virginia University in the United States and Huazhong University of Science and Technology in China
- **Building Energy Efficiency Consortium (BEE)** led by Lawrence Berkeley National Laboratory in the United States and Center of Science and Technology of Construction, Ministry of Housing and Urban-Rural Development (MOHURD) in China
- **Clean Vehicles Consortium (CVC)** led by University of Michigan in the United States and Tsinghua University in China

Under these Consortia, joint research teams identify areas of mutual interest, attract industry partners, and jointly plan projects. Today, the Center's three technical tracks together include 88 projects, of which more than two-thirds are joint. The work supports 1,100 researchers and has attracted 110 partners.

中美清洁能源联合研究中心由三个产学研联盟组成：

- **清洁煤技术联盟**，由华中科技大学和西弗吉尼亚大学牵头
- **建筑节能联盟**，由住房和城乡建设部科技发展促进中心和劳伦斯伯克利国家实验室牵头
- **清洁汽车联盟**，由清华大学和密歇根大学牵头

在三个联盟框架下，联合研究团队确定双方共同感兴趣的领域，吸收产业界伙伴，共同策划项目。目前，三个联盟共设立88个项目，其中超过2/3为合作项目，共有1100名科研人员及110家合作伙伴参与。

CERC-CVC researchers at the University of Michigan explore a new battery concept that promises to contribute to the development of more efficient hybrid vehicles

中美清洁能源联合研究中心清洁汽车联盟的科研人员在密歇根大学对一组电池进行测试——该电池将有助于开发出更加高效节能的混合动力汽车。

The goal of the joint Center is to accelerate the development and deployment of clean energy technologies that will deliver strategic and economic benefits to both countries. The key premise is that by working together and leveraging each country's strengths, this can occur in a better, faster, and cheaper way.

中美清洁能源联合研究中心的宗旨是加快清洁能源技术开发利用，为两国战略和经济利益服务。通过两国携手合作、优势互补，能够以更低廉的成本、更好、更快地实现这一目标。

"Successful cooperation on climate change and other pressing concerns has an important byproduct. It helps our two countries to build trust."

—Max Baucus,
United States Ambassador to China

"在气候变化及其他棘手问题上的成功合作会带来重要的副产品——即帮助两国加强互信。"

—美国驻华大使马克斯·博卡斯

Advanced Coal Technology Consortium
清洁煤技术联盟

ENN, a CERC partner in China, demonstrates a microalgae approach for CO_2 utilization

中美清洁能源联合研究中心中方合作伙伴新奥集团展示运用微藻技术利用二氧化碳。

Because the largest sources of U.S. and Chinese greenhouse gas emissions are from coal used to generate electricity, ACTC is focused on developing technologies that will provide cleaner, more efficient, and affordable power. ACTC is spearheading the development of technologies associated with clean coal power generation and transformation, low-cost capture technologies, and geological sequestration practices. These technologies will provide energy savings and economic development opportunities to both the United States and China, as well as curtail greenhouse gas emissions. ACTC has successfully developed models that provide cost estimates for carbon capture and storage that will assist in the implementation of such projects.

Illustrative Technical Accomplishments

ACTC researchers completed an economic and technical analysis of post-combustion carbon capture using novel amine capture technology. The technology was deployed on a power plant in China, and the costs were compared to a similarly retrofitted power plant in the United States. The analysis concluded that the retrofitted technology would cost US$60–65 per metric ton of CO_2 captured. The lower end of the cost range stems from benefits related to mixed amines. In China, costs of the technology have been reported to be US$30 per metric ton of CO_2 captured. The analysis is an important contribution to power companies that are considering carbon reduction strategies, and it provides a well-documented boundary on post-combustion carbon capture.

China Collaborator: Huaneng Group Clean Energy Research Institute

U.S. Collaborators: Duke Energy, Lawrence Livermore National Laboratory (LLNL)

Chinese and American researchers collaborated to build carbon capture, transportation, and storage simulation models, which led to the first basin scale CO_2 source-sink matching analysis in the Ordos Basin in China. Such models can lead to optimization techniques for CO_2 source-sink solutions in Chinese and U.S. basins, and they can assist policy makers in the planning and analysis of carbon capture and storage projects.

鉴于电煤是中美两国最大的温室气体排放源，清洁煤技术联盟致力于开发更加清洁、高效和经济适用的发电技术。清洁煤技术联盟引领着煤清洁发电、煤清洁转化、低成本碳捕集和地质封存技术的开发。这些技术将为中美两国节约能源、推动经济发展提供机遇，同时控制温室气体排放。清洁煤技术联盟已成功开发出模型对碳捕集和封存进行成本估算，以协助这些项目的实施。

代表性技术成果

清洁煤技术联盟的研究人员采用全新的氨捕集技术对燃烧后碳捕集从经济效益和技术两方面进行了分析。中国某电厂已部署了该技术，研究人员将其发电成本与美国一家进行类似技术改造的电厂做对比，结论是美方技术改造将使每兆瓦时发电成本增加62-69美元，而采用混合氨技术将使成本增幅降低。据反馈，中国电厂采用该技术每兆瓦时发电成本增幅为30美元。这项分析为那些正在规划低碳战略的公司提供了重要的参考。

中方合作伙伴：中国华能集团清洁能源技术研究院

美方合作伙伴：杜克能源公司、劳伦斯利弗莫尔国家实验室

中美两国研究人员合作建立了碳捕集、运输和封存模型，并首次利用该模型对中国鄂尔多斯盆地进行了盆地尺度的源汇匹配分析。该模型可为中美两国盆地二氧化碳源汇解决方案提供更优的技术，帮助决策层分析和规划碳捕集和封存项目。

China Collaborators: Institute of Rock and Soil Mechanics – Chinese Academy of Sciences, China University of Mining and Technology

U.S. Collaborators: Los Alamos National Laboratory, Indiana Geologic Survey, West Virginia University

ACTC scientists demonstrated CO_2 capture and recycling using microalgae at a coal-fired power plant by using an in-house designed closed loop that was cultured using flue gas as the CO_2 source. Researchers developed a protocol for low-cost algae harvesting and dewatering and demonstrated the conversion of algal lipids to diesel-range hydrocarbons. Markets for higher-value algal biomass products, such as cosmetics and pharmaceuticals, are also being investigated. Development of these additional markets can increase the value of algal biomass, which could significantly improve the economics of CO_2 capture and recycling.

China Collaborator: ENN

U.S. Collaborators: University of Kentucky, Duke Energy

中方合作伙伴：中国科学院岩土力学所、中国矿业大学

美方合作伙伴：洛斯阿拉莫斯国家实验室、印第安纳大学、西弗吉尼亚大学

清洁煤技术联盟的科学家们在一家燃煤发电厂验证了利用微藻实现碳捕集和循环。研究人员开发了一套低成本的藻类收获和脱水工艺，并验证了利用藻油脂制备柴油。对于具有更高价值的生物质产品，如化妆品和药品，也正在做市场调查。开发这些市场可以增加生物质的应用价值，提高二氧化碳捕集和循环的经济效益。

中方合作伙伴：新奥集团

美方合作伙伴：肯塔基大学、杜克能源公司

In a joint CERC-ACTC project, engineers from Huaneng and LLNL collaborated on a computer simulation of an innovative post-combustion capture process in use at Shidongkou, Shanghai, China (left), and then assessed its applicability to Duke Energy's Gibson Station, Indiana, U.S. (right)

在中美清洁能源联合研究中心清洁煤技术联盟的联合项目中，华能集团和劳伦斯·利弗莫尔国家实验室的工程师合作开发了新型燃烧后捕集技术的计算机模拟程序，在中国上海石洞口电厂使用，并对该技术在美国印第安纳州吉普森电厂的适用性进行了评估。左图：位于中国上海石洞口电厂燃烧后捕集项目；右图：位于美国印第安纳州吉普森电厂燃烧后捕集项目

Building Energy Efficiency Consortium
建筑节能联盟

Cool roof technology developed by CERC-BEE partners was found to have broad applicability in hot summer and warm winter climate zones in China

中美清洁能源联合研究中心建筑节能联盟合作伙伴开发的冷屋顶技术在中国夏热冬暖气候带有着广泛的应用前景。

Rapid growth in the U.S. and Chinese buildings sectors offers an enormous opportunity—with the potential to save up to US$2 billion and avoid 100 million metric tons of CO_2 emissions each year. BEE research has already made available for widespread use 23 new commercial products, technologies, and software tools; and facilitated adoption of 13 new codes and standards for more energy-efficient buildings, including one ISO standard. Activities like these have stimulated a 40% annual increase in contributions from industrial partners.

Illustrative Technical Accomplishments

U.S. and Chinese researchers are working with industrial partners to demonstrate a range of technologies developed through BEE, including lighting controls, ground-source heat pumps (GSHPs), air barriers, and liquid flashing. The teams are analyzing instrumented data to evaluate technology performance and cost-effectiveness and guide future R&D and market strategies.

China Collaborators: China Academy of Building Research, Xing Ye Solar, Rixin Solar, Kelong Insulation, Futai Construction

U.S. Collaborators: Dow Chemical, 3M, ClimateMaster, Lutron, Lawrence Berkeley National Laboratory (LBNL), Oak Ridge National Laboratory (ORNL)

Researchers have developed materials that have improved white roof coatings with superior reflectance, durability, and self-cleaning properties that are more practical in polluted urban environments. The improved cool roof could potentially avoid about 10 million metric tons of CO_2 per year by 2025.

China Collaborators: China Academy of Sciences, Chongqing University, Guangdong Provincial Academy of Building Research

U.S. Collaborators: Dow Chemical, LBNL, ORNL

A joint research team defined a method for setting suitable building energy quotas as required to implement the comprehensive building energy control initiative in China's Twelfth Five Year Plan Period. The methodology, which could support a building energy trading system, was adopted as part of the Shenzhen Public Building Energy Quota Standard and is being used by Shanghai and Shenzhen for research and practice in determining energy quotas for public buildings.

中美两国迅速增长的建筑产业为两国的节能事业提供了巨大的机遇，可为两国每年节省20亿美元，减少1亿吨二氧化碳排放。建筑节能联盟已开发了23个新的商用产品、技术和软件工具，新通过了13项规范及标准，其中包括1项ISO国际标准。在这一系列成果的鼓舞下，产业合作伙伴的投入年均增长40%。

代表性技术成果

中美研究人员和产业合作伙伴正着手示范建筑节能联盟开发的系列技术成果，包括灯光控制、地源热泵、空气阻隔和液体喷涂等，各研究团队通过分析仪表数据来评估技术性能和经济效益，为未来的研发以及市场战略提供指导。

中方合作伙伴：中国建筑科学研究院、兴业太阳能、日新太阳能、科隆建筑节能和阜泰建设集团。

美方合作伙伴：陶氏化学、明尼苏达矿务及制造业公司、柯马特、路创、劳伦斯伯克利国家实验室和橡树岭国家实验室。

研究人员研制出了能够改进白色屋顶涂料的材料，这些材料为涂料赋予了卓越的反射率、耐久性和自洁性，在受污染的城市环境中更加实用。到2025年，改进型冷屋顶每年有望减少约1000万吨的二氧化碳排放。

中方合作伙伴：中国科学院、重庆大学和广东省建筑科学研究院

美方合作伙伴：陶氏化学、劳伦斯伯克利国家实验室和橡树岭国家实验室

为实现建筑节能的总体目标，中国政府提出在“十二五”期间，鼓励采用模式结合的方法，将建筑节能考核方式逐步由技术措施控制转向用能总量的控制，采用科学的方式确定能耗定额可以有效的实现用能总量控制目标。中美两国研究团队通过合作研究和对国际经验的共同分析，对适用于中国的建筑能耗定额方法进行了探讨，相关成果已被应用于深圳市公共建筑能耗定额标准以及上海和深圳等地的公共建筑定额研究和实践工作，同时为今后实现建筑能耗总量控制，形成建筑能效交易打下基础。

中方合作伙伴：住房和城乡建设部科技发展促进中心、深圳市建筑科学研究院

China Collaborators: Center of Science and Technology of Construction – MOHURD, Shenzhen Institute of Building Research

U.S. Collaborators: ICF International, LBNL

Engineers developed and demonstrated advanced, distributed GSHPs that require 21%–36% less drilling depth and use 30% less system energy than conventional GSHPs. As a result of their work, U.S. collaborators received an R&D 100 Award in 2013.

China Collaborators: Chongqing University, Tainjin University, Tongji University

U.S. Collaborators: ClimateMaster, ORNL

Researchers assessed the potential of solar thermal technology in 11 Chinese cities to optimize component selection, integration, and operation in diverse climates. This work gave investors, businesses and researchers valuable insight into the potential for technology penetration in commercial buildings, and commercial licensing of the optimizing software is under negotiation in China and the United States.

China Collaborators: Tongji University, XingYe

U.S. Collaborators: C3 Energy, LBNL

美方合作伙伴：ICF国际、劳伦斯伯克利国家实验室

工程师已经研制出替代性地源热泵换热器，此类换热器所需钻孔深度减少了21%到36%，同时又能达到与传统换热器相同的性能水平。相关研究使系统能耗减少了30%以上。凭借中美清洁能源联合研究中心在研发方面的努力，美方合作伙伴赢得了2013年全球百大科技研发奖（2013 R&D 100 award）。

中方合作伙伴：重庆大学、天津大学、同济大学

美方合作伙伴：柯马特公司、橡树岭国家实验室

研究人员对中国11个气候各异的城市的太阳热能技术发展潜力进行了评估，并对可再生能源技术的选择、集成及实时操作进行了优化。此类市场评估很有价值，为投资者、企业和研究人员深入了解高度多样化的商业建筑领域中潜在的技术拓展空间提供了帮助。中美两国都在就优化软件的商业许可进行协商。

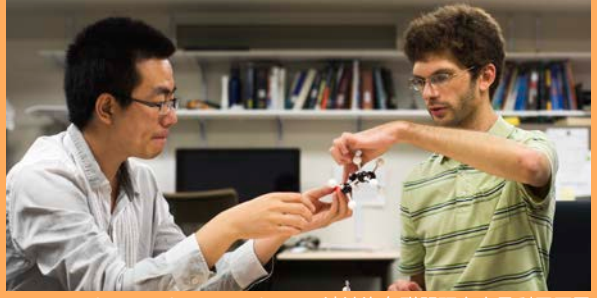
中方合作伙伴：同济大学、兴业太阳能

美方合作伙伴：C3能源公司、劳伦斯伯克利国家实验室

Design rendering of the Xingye Building in Zhuhai, China, one of the five CERC-BEE demo buildings under development in each of China's climate zones

兴业在珠海的示范项目效果图，建筑节能联盟在中国不同气候区的5个示 范建筑之一。

Clean Vehicles Consortium
清洁汽车联盟



CVC researchers simulating Li-air battery components with atomistic models 清洁汽车联盟研究人员利用原子模型模拟锂空气电池组件

As the world's largest automobile markets and oil consumers, the United States and China can benefit from substantial energy savings from improvements in vehicle technology. The scope of CVC's pioneering research includes advanced battery technologies; biofuels; vehicle electrification; advanced lightweight materials and structures; vehicle-grid integration; and energy systems analysis, technology roadmaps, and policy.

Illustrative Technical Accomplishments

Researchers demonstrated a new cathode design that slows battery degradation and maintains capacity—a significant step towards making high energy density lithium-sulfur batteries a reality and thus improving battery performance.

China Collaborators: Beijing Institute of Technology, Tsinghua University

U.S. Collaborators: Massachusetts Institute of Technology, University of Michigan

Engineers developed techniques for the modeling, analysis, design, and control of power-split hybrid powertrains. An optimal design method was developed that is approximately 12,000 times faster than other exhaustive optimization methods such as dynamic programming. The optimal design method has been used to analyze powertrain configurations with varying constraints on the number of planetary gears and clutches.

China Collaborators: Shanghai Jiao Tong University, Tsinghua University

U.S. Collaborator: University of Michigan

作为世界最大的两个汽车市场与石油消费国，中美两国可以通过汽车技术的改进获得显著的节能效益。清洁汽车联盟的开创性研究涉及先进电池技术、生物燃料、汽车电气化、先进轻型材料与结构、电动汽车-电网集成以及能源系统分析、技术路线图与政策。

代表性技术成果

研究人员验证了一种全新的阴极设计方法，可减缓电池老化，保持电池容量，在制造高能量密度锂硫电池、改善电池性能方面迈出了重要的一步。

中方合作伙伴：北京理工大学、清华大学

美方合作伙伴：麻省理工学院、密歇根大学

工程师开发了功率分流式混合动力系统的建模、分析、设计及控制技术。新开发的优化设计方法比动态规划等穷举优化方法快12000倍左右。这种方法已用于分析具有多变量约束的行星齿轮与离合器的动力系统配置。

中方合作伙伴：上海交通大学、清华大学

美方合作伙伴：密歇根大学

Researchers developed models to simulate the performance of lightweight vehicles in crash safety tests, optimize vehicle aerodynamics, and study the effects of battery layouts on crashworthiness. These models enable the rapid exploration of thousands of variations in structural and geometrical parameters, allowing an engineer to optimize lightweight body structure for a clean vehicle in terms of safety, cost, manufacturability, and aerodynamics.

China Collaborators: Tongji University, Tsinghua University

U.S. Collaborator: University of Michigan

研究人员开发了一系列模型来模拟碰撞安全测试中轻型汽车的性能，优化汽车空气动力学性能，研究电池布局对耐撞性的影响。此类模型能帮助工程师快速研究千变万化的结构和几何参数，让他们能够从安全、成本、制造及空气动力学性能等方面对清洁汽车的轻型车身结构进行优化。

中方合作伙伴：同济大学、清华大学

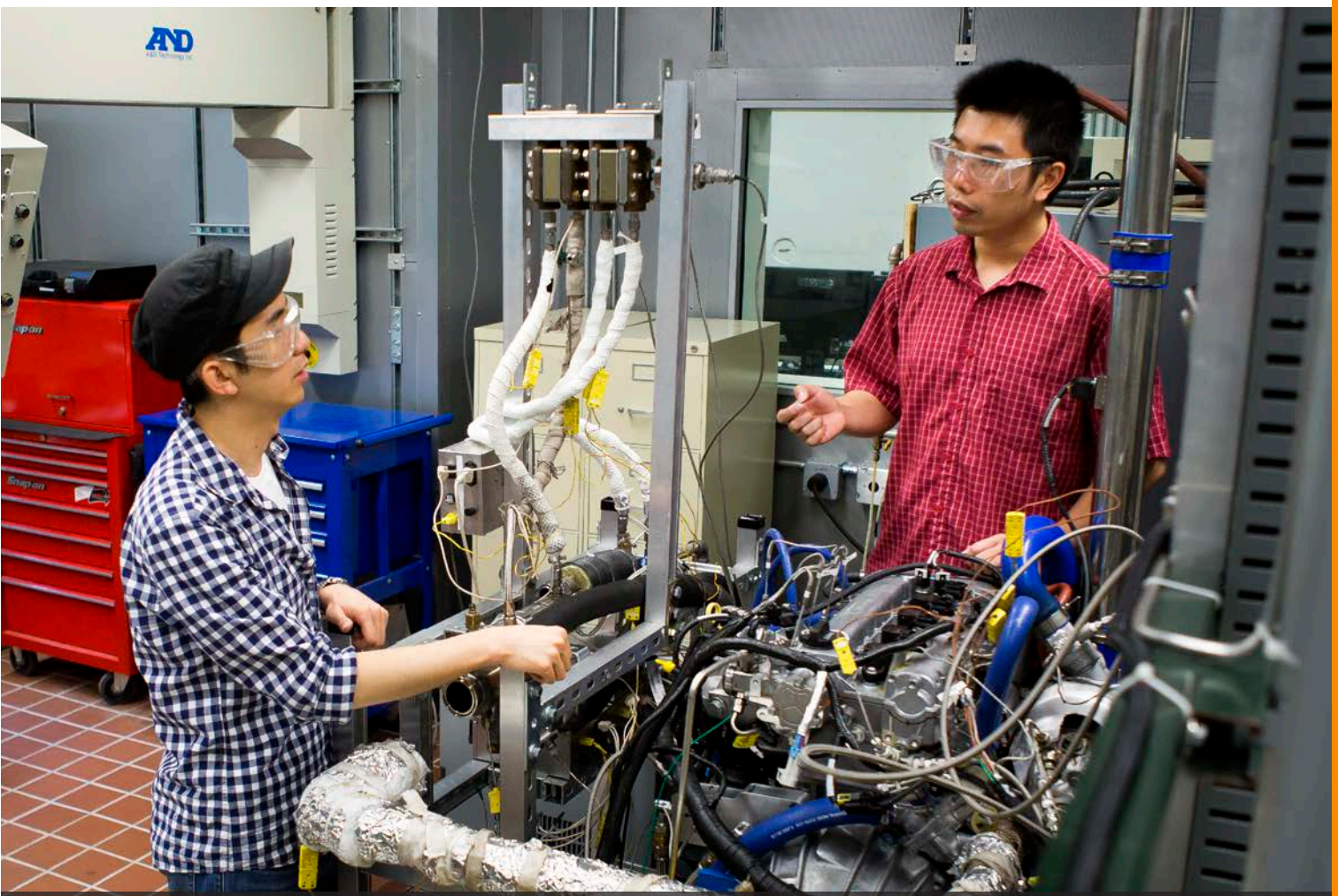
美方合作伙伴：密歇根大学

"The battery work being conducted by CERC-CVC researchers provides us with additional insights into advanced battery technology, materials, diagnostics, and modeling. We industrial partners appreciate the CERC-CVC focus on pathways for implementation."

—Ted Miller, Senior Manager, Ford Motor Company

"清洁汽车联盟研究人员开展的电池研发工作让我们进一步了解了先进的电池技术、材料、诊断及模型。清洁汽车联盟专注于实践途径，作为产业合作伙伴，我们对此深表赞赏。"

——福特汽车公司高级经理Ted Miller



CERC-CVC researchers at the University of Michigan work on a hybrid powertrain simulation

清洁汽车联盟研究人员在密歇根大学开展混合动力系统模拟

Intellectual Property

Protecting intellectual property (IP) is essential for truly collaborative efforts between the United States and China. CERC's pioneering IP framework facilitates joint research and innovation, allowing teams to conduct research in an open and trusting manner with the confidence that IP will be protected. This IP protection enables a robust research agenda.

The central components of the CERC IP framework—the Protocol, Annex, and Technology Management Plans—provide for a number of features that both strengthen IP protection and encourage IP exploitation. They do all of the following:

- Provide both countries a guaranteed right to use IP in the other country's territory,
- Provide for mutual recognition and protection of background IP,

知识产权

保护知识产权（IP）对于中美两国的实质性合作十分重要。中美清洁能源联合研究中心研究制定的开创性的知识产权框架推动了联合研究与创新，让研究团队对知识产权的保护充满信心，从而以一种开放和信任的态度投入研究，确保了研究计划的稳健推进。

中美清洁能源联合研究中心知识产权框架的核心组成部分包括议定书、附件及技术管理计划（TMP），其中许多内容既强化知识产权保护，又鼓励知识产权利用。它们的作用包括：

- 保障两国在对方国家使用知识产权的权利;
- 提供背景知识产权的声明与保护；

LP Amina, a CERC-ACTC partner, tests a calcium carbide furnace. The process uses coal to produce fuels, chemicals, heat, and power at high efficiencies and low CO_2 emissions. Interest in its adoption in China is facilitated by joint development of an innovative IP framework under CERC

中美清洁能源联合研究中心清洁煤技术联盟的合作伙伴美国阿米那能源环保公司（LP Amina）测试一座电石炉。该技术高效利用煤制造燃料、化学品、热量和电力，而二氧化碳排量很低。中美清洁能源联合研究中心的知识产权框架有利于该技术在中国的利用。

- Establish a framework for "a priori" procedures for allocating and protecting rights to new inventions,
- Provide for non-exclusive licensing of IP under favorable terms,
- Encourage sub-agreements for specific IP and related terms and conditions,
- Support fair resolution of disputes under international standards,
- Establish a role for government monitoring and oversight,
- Encourage compliance with existing agreements, and
- Are officially endorsed by both governments.

CERC IP education and training workshops have played a central role in building a greater understanding of patent laws in the two countries by highlighting commonalities and differences. They have also facilitated the development of how-to guides for researchers.

- 为新发明的相关权利分配和保护规定"先验"程序；
- 以优惠条件获得知识产权非独占许可；
- 鼓励就特定的知识产权及相关条款订立附属协议；
- 支持遵照国际标准公正解决纠纷；
- 确立政府的监管角色；
- 鼓励遵守现有协议；
- 经两国政府正式批准。

中美清洁能源联合研究中心知识产权研讨会重点探讨中美专利法的差异，对于增进两国专利法的认识发挥了重要作用。研讨会还为研究人员提供了应用指导。

"CERC-BEE research has delivered substantial benefit to Dow's innovation pipeline and commercialization efforts for U.S. and Chinese markets. Through the research collaborations developed under CERC, and access to unique expertise at U.S. national laboratories, Dow is accelerating commercialization of new cool roof materials and sprayable liquid flashing products."

— Jai Venkatesan, Global R&D Director, Dow Building & Construction

"中美清洁能源联合研究中心建筑节能联盟所开展的研究有利于陶氏创新渠道的发展，也为中美市场的商业化活动带来了巨大收益。通过中美清洁能源联合研究中心框架下的研发合作以及美国国家实验室的专业知识，陶氏正加紧对新型冷屋顶材料和喷雾液体闪蒸产品进行市场化。"

——陶氏建筑全球研发总监Jai Venkatesan

Sprayable liquid flashing technology, developed by ORNL and Dow Chemical, reduces installation costs and improves sealing. The technology is being demonstrated and evaluated at the new headquarters of the Chinese Academy of Building Research, Beijing

橡树岭国家实验室和陶氏化学开发的喷雾液体闪蒸技术能减少安装成本，提高密封性。该项技术在中国建筑科学研究院的新大楼进行示范和评估。

Business Engagement

The Center actively engages a range of business, industrial, and non-governmental entities that contribute meaningful resources and guide R&D planning. These partners help sharpen the focus of research, introduce additional intellectual capacity, and provide paths to commercialization. The Center encourages each Consortium to accept new partners that meet published criteria.

Partners collaborating under the auspices of the Center's Consortia are seeing results and accruing benefits, including the following:

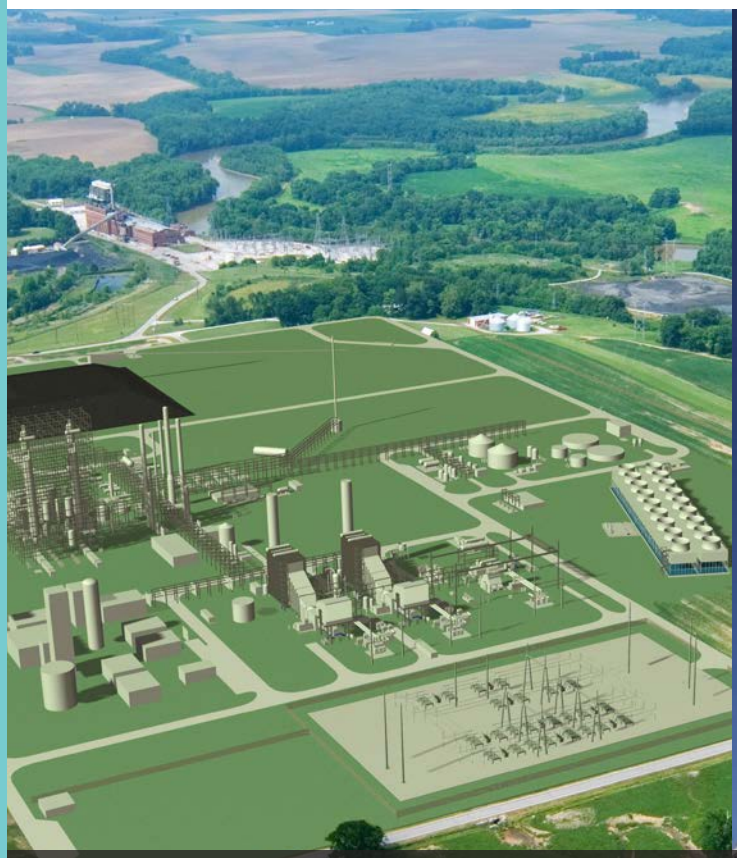
- Knowledge and technology performance data important to future business planning,
- Opportunities to demonstrate and compare technologies across a variety of operating environments and run experiments on new or unique laboratory facilities,

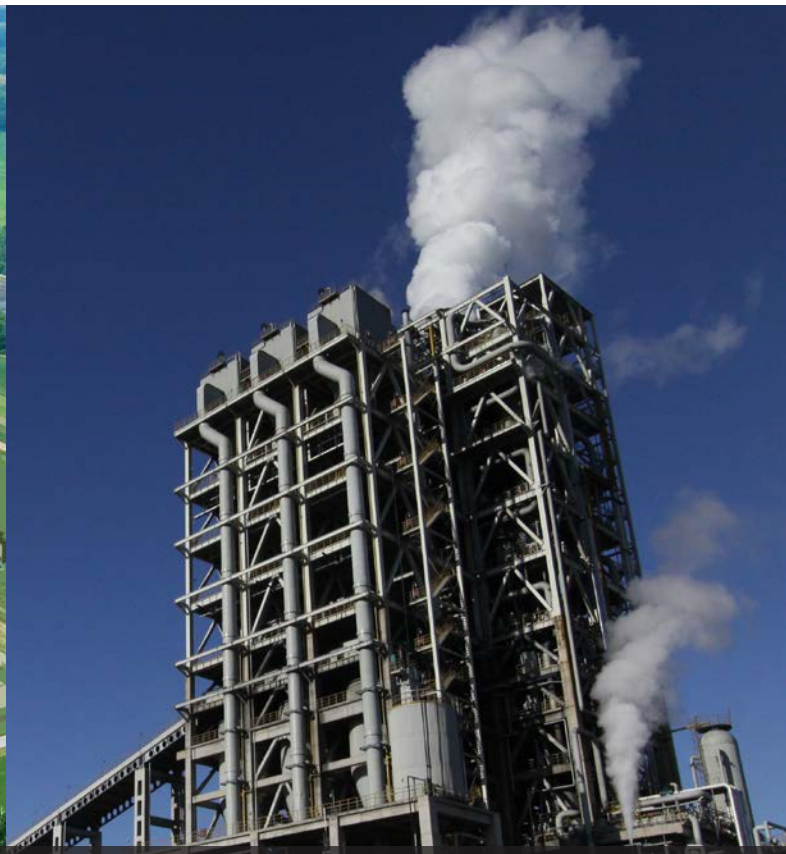
企业参与

中美清洁能源联合研究中心积极吸引企业、产业界及其他非政府机构的参与，为合作提供重要资源，引导研发规划，突出研发重点，带来知识和智力资源，为成果产业化提供渠道。中美清洁能源联合研究中心鼓励各联盟与产业界合作，按照公布的标准接受新合作伙伴加入。

在联盟支持下，合作伙伴取得了丰硕成果并积累了收益，包括：

- 对未来商业规划具有重要意义的知识和技术性能数据；
- 在多种运行环境下示范和比较各种技术以及使用新的或独特的设备进行实验的机会；





Major demonstration platforms in the United States and in China afford unique opportunities for comparative analyses of technical approaches and operational experiences by CERC researchers. Pictured (at left) is the Integrated Gasification Combined Cycle (IGCC) Project of Duke Energy in Edwardsport, Indiana, U.S., and (at right) the IGCC GreenGen Project of the China Huaneng Group in Tianjin, China

中美两国的主要示范平台为清洁能源联合研究中心的研究人员对技术方法及运行经验进行比较分析提供了绝佳的条件。左图：中美清洁能源联合研究中心在美国印第安纳州爱德华兹波特的整体煤气化联合循环（IGCC）项目；右图：中美清洁能源联合研究中心在中国天津的 “绿色煤电” IGCC项目

- Relationships with leading institutions and technology innovators,
- Access to clean energy markets in the United States and China,
- Protection of existing intellectual property in both countries (through use of the Center's innovative IP Framework and Technology Management Plans),
- Access to new IP arising from joint work,
- Accelerated development by avoiding research redundancies and building on successes, and
- Increased understanding of potential new markets for clean energy technologies.

- 与一流机构和技术创新人才建立联系；
- 拓展中美两国清洁能源市场机会；
- 保护两国现有知识产权（借助中美清洁能源联合研究中心知识产权框架和技术管理计划）；
- 利用合作产生的新的知识产权；
- 避免重复研究、借鉴成功案例以加快发展；
- 增进对清洁能源技术潜在市场的了解。

U.S. and Chinese CERC-BEE researchers and industrial partners tour the demonstration of advanced building technologies at the China Academy of Building Research (CABR) in Beijing

中美两国建筑节能联盟的研究人员和产业界合作伙伴考查中国建筑科学研究院北京先进建筑节能技术示范项目现场

"Participation in the Consortium will help us drive the growing market for large-scale energy efficiency and sustainability projects forward, and give all members the opportunity to learn firsthand about the energy efficiency needs of the Chinese market."

— Stefan Babirad,
Technical Director, 3M

"大规模节能及可持续发展项目市场正在快速增长，加入联盟可以帮助我们拓展这一市场，并且直接了解中国节能市场的需求。"

——3M公司技术主管 Stefan Babirad

How to Join CERC

Members of CERC, including businesses, governments, and non-governmental entities, can benefit from CERC's collaborative research model to accelerate the development of clean energy technologies. CERC welcomes new member participation within its Consortia. New members must meet the following criteria:

- Support the mission of CERC and the vision and goals of the respective CERC Consortium,
- Add value to CERC's capacities and work program,
- Support projects that meet CERC criteria,
- Agree to be bound by the same obligations of an existing Consortium's members, and
- Agree to adhere to the provisions of the Protocol and the Technology Management Plans.

如何加入中美清洁能源联合研究中心

中美清洁能源联合研究中心的成员包括企业、政府以及非政府实体。成员可从中美清洁能源联合研究中心的合作研究模式中获益，加快清洁能源技术的开发。中美清洁能源联合研究中心欢迎新成员加入其下属的联盟。新成员必须符合以下条件：

- 为达成中美清洁能源联合研究中心的使命以及中心下属各联盟的愿景和目标提供支持；
- 为中美清洁能源联合研究中心的研发能力和工作计划创造价值；
- 支持开展符合中美清洁能源联合研究中心标准的项目;
- 同意履行与联盟现有成员相同的义务；
- 同意遵守协议及技术管理计划的规定。

For more details on how to become a member, contact:

Advanced Coal Technology Consortium	
James Wood, Director, West Virginia University jfwood@mail.wvu.edu	Dr. Zheng Chugang, Director, Huazhong University of Science and Technology cgzheng@hust.edu.cn

Building Energy Efficiency Consortium	
Dr. Nan Zhou, Director, Lawrence Berkeley National Laboratory nzhou@lbl.gov	Dr. Liang Junqiang, Director, Center of Science and Technology of Construction, Ministry of Housing and Urban-Rural Development gjc.liang@chinaeeb.gov.cn

Clean Vehicles Consortium	
Dr. Huei Peng, Director, University of Michigan hpeng@umich.edu	Dr. Ouyang Minggao, Director, Tsinghua University ouymg@tsinghua.edu.cn

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建筑节能联盟	
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