

MEMORANDUM OF COOPERATION
between
the Department of Energy of the United States of America
and
the National Energy Administration of the People's Republic of China
Establishing a
U.S.-CHINA RENEWABLE ENERGY PARTNERSHIP

The Department of Energy of the United States of America and the National Energy Administration of the People's Republic of China (hereinafter referred to as the "Participants");

RECOGNIZING the important role of renewable energy in helping the United States and China address the shared challenges of energy security, climate change and environmental protection;

RECOGNIZING that through bilateral cooperation, the United States and China can accelerate the deployment of renewable energy in both countries and through their combined expertise, resources and market size, help make renewable energy more accessible and affordable around the world;

RECOGNIZING the need to modernize the electrical grid in both countries to enable wide-spread renewable energy deployment;

NOTING the *Memorandum of Understanding on Cooperation in the Development of Biofuels* between the Department of Agriculture and the Department of Energy of the United States and the National Development and Reform Commission of China signed in December 2007;

SEEKING to implement the *Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment* between the Participants signed in November 2009 (hereinafter referred to as the "MOU"), which identifies "renewable energy" and "modernization of the electrical grid" as a key areas for cooperation;

Have reached the following understandings:

I. PURPOSE

The Participants recognize that accelerating the deployment of clean, renewable energy and advanced grid solutions will enhance energy security, reduce emissions and protect the environment and create new sources of economic growth and job creation. The Participants also recognize that significant barriers exist to the wide-spread deployment of renewable energy and advanced grid technology and that bilateral cooperation can help overcome these barriers.

Accordingly, the Participants resolve to launch a “U.S.-China Renewable Energy Partnership” (hereinafter referred to as the “Partnership”), a comprehensive program of cooperation to accelerate the development and adoption of renewable energy and advanced grid solutions in both countries.

This Partnership is intended to support the objectives of the MOU, consistent with Section II, Part C of the MOU.

II. AREAS OF COOPERATION

The Participants intend to cooperate in the following areas, subject to the availability of resources. Specific projects and programs in these areas are defined through a Renewable Energy Partnership Work plan (Schedule 1).

- 1) Road-mapping: identify the renewable energy potential in both countries and barriers to wide-spread renewable deployment.
- 2) Policy and finance: share experience on how government policy and private finance can promote the deployment of renewable energy and advanced grid solutions and cooperate in the development and implementation of effective policy and financial tools.
- 3) Advanced renewable energy technologies: identify areas for collaborative research, development and demonstration of pre-commercial wind, solar (both photovoltaic and concentrating solar power), and grid technologies.
- 4) Advanced biofuels: pursue collaborative research, development and demonstration of advanced biofuels.
- 5) Renewable energy deployment solutions: develop and employ regionally-focused tools to promote the deployment of renewable energy in both countries.
- 6) Grid modernization: take steps to modernize the electrical grid in both countries to enable wide-spread renewable energy deployment.
- 7) Personnel training: training of local government officials, energy regulators, enterprise managers, and renewable energy professionals in both countries to increase energy savings in buildings and communities, industries and consumer products.
- 8) Testing and standards: seek to harmonize renewable energy technology standards and testing procedures.

III. IMPLEMENTATION

A. Renewable Energy Task Force

Cooperation under the Partnership is organized and coordinated by a Renewable Energy

Task Force chaired by the Department of Energy of the United States and the National Energy Administration of China with the participation of relevant ministries and agencies of both countries. The Task Force is expected to meet at least twice per year to assess the progress of cooperative activities described in Schedule 1 and develop additional programs and projects to implement the goals of the MOU through renewable energy and advanced grid solutions.

B. Renewable Energy Advisory Group

A Renewable Energy Advisory Group is created to support the work of the Renewable Energy Task Force, composed of representatives from local governments, industry, academia and civil society. The Advisory Group's task is to identify and recommend specific programs and projects for the Participants to pursue jointly and provide input into the Task Force's policy and financing discussions. Each Participant is to select its Advisory Group members according to its own criteria.

C. Advanced Grid Working Group

Given the complex nature of the electrical grid in both countries, and its centrality to wide-spread renewable energy deployment, the Partnership is to include an Advanced Grid Working Group, composed of government officials, industry representatives, academics and civil society, to develop strategies for grid modernization and make recommendations to the Task Force for areas of bilateral cooperation. Each Participant is to select its Working Group members according to its own criteria.

D. Advanced Biofuels Research and Development Advisory Group

The Partnership is to establish an Advanced Biofuels Research and Development Advisory Group to provide guidance to the "Joint Working Group" that was established under the existing *Memorandum of Understanding on Cooperation in the Development of Biofuels*. The Advisory Group should include participation from relevant government officials, industry representatives, academics and civil society and support the coordination and prioritization of advanced biofuels research and development cooperation between the two countries. Each Participant is to select its Working Group members according to its own criteria.

E. Sub-national Cooperation

The MOU emphasizes the importance of sub-national cooperation, whether region-to-region, state-to-province, city-to-city, or at the academic, business or civil society level. The Participants seek to encourage sub-national cooperation in renewable energy.

F. Funding and Staffing

Each Participant intends to identify specific personnel within that ministry or government agency to coordinate the work outlined in Schedule 1 and report progress on each program or project to the Renewable Energy Task Force on a regular basis. Funding for each program or project is to be determined on a case-by-case basis, subject to the availability of resources on both sides.

IV. GENERAL PROVISIONS

- A. Cooperation under this Memorandum of Cooperation (MOC) may commence upon signature, and may be revised at any time in writing by the Participants' mutual consent.
- B. This MOC may be discontinued at any time by the Participants' mutual consent in writing. If a Participant desires to discontinue its participation in this MOC, it should endeavor to provide at least 90 days' notice in writing to the other Participant.
- C. This MOC is not intended to, and does not, give rise to any legal rights or obligations.
- D. Each Participant should conduct the activities contemplated by this MOC in accordance with the applicable laws and regulations to which it is subject.

Signed at Beijing, in duplicate, this seventeenth day of November, 2009, in the English and Chinese languages, both texts being equally authentic.



FOR THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA:



FOR THE NATIONAL ENERGY
ADMINISTRATION OF THE
PEOPLE'S REPUBLIC OF CHINA:

SCHEDULE 1: RENEWABLE ENERGY PARTNERSHIP WORK PLAN

Cooperation under this MOC is to be implemented through the following programs and projects to accelerate the deployment of renewable energy and advanced grid solutions in both countries. This work plan is intended to be a living document, to be expanded to incorporate additional cooperative activities as they are identified and approved by the Participants.

Renewable Energy Roadmap: The Participants intend to collaborate on updating wind and solar assessments that identify market potential and deployment barriers and provide roadmaps for bilateral policy and technical cooperation. The wind and solar roadmaps are intended to include the economic, employment, environmental, and energy security benefits in both countries. The Participants intend to structure the project as follows:

1. *Resource assessment:* Evaluate the state of available wind and solar (PV & CSP) resource assessment data available for the United States and China and identify needs for additional resource assessment or refinement of existing data.
2. *Wind-solar map for the United States and China:* Building on the results of the 100-GW Wind Scenario Effort (co-sponsored by U.S. Department of Energy and the Energy Foundation) incorporate more detailed wind data from existing sources and develop an initial solar data layer.
3. *Conceptual transmission strategy:* Map connections between the key wind and solar resource areas and load centers in a conceptual way (not relying on data about existing transmission line). This step gives an initial sense of the cost of transmission between resource areas and load centers to inform transmission constraint analysis in both countries.
4. *Policy design:* Use the resource map and conceptual transmission strategy to identify key barriers to development, which could include (a) refined understanding of transmission constraints, (b) regional resource development requirements, (c) pricing and other policy requirements to enable private sector development of the desired renewable generation, (d) key data needs to improve the quality of information to support national-level renewable energy planning and implementation. Effort would draw upon both the United States' and China's utility experience in capacity expansion modeling and approaches to addressing transmission constraints for high renewable energy penetration scenarios.
5. *Policy evaluation:* Develop and apply an analysis framework for evaluating national and regional economic, employment, environmental, and energy security impacts of achieving target levels of renewable electricity development.

Policy and Financing Best-Practices: Policy incentives and financing strategies for renewable energy are still being developed in both the United States and China, and there is significant scope for sharing best practices as the two countries scale up deployment. Through the Partnership, the Participants intend to facilitate policy and finance-oriented

study tours and conferences for legislators, energy officials, national regulators, academics, financiers, and industry representatives.

Tasks in this area may include the following.

1. *Symposium of renewable energy policy and finance*: This workshop would initiate a richer and more focused dialogue between the United States and China on renewable energy policy and finance by bringing together policy analysts, policy makers, finance providers, and renewable industry representatives for a comprehensive survey of United States, Chinese, and international experience and best practices in these areas. Topics to be covered include: cost-effective policies to induce private investment, allocation of risk between public and private sectors, and mechanisms to turn critical research into viable renewable energy projects.
2. *Study tour 1: Federal Policy*: This study tour would be oriented toward decision makers at the national level in the United States and China and provide a more focused look at the history of energy policy, and renewable energy policy in particular, in the United States and worldwide. It would provide decision makers with a summary of that experience and a distillation of lessons learned and best practices.
3. *Study tour 2: Finance*: This workshop focuses on state-of-the-art techniques and best practices for financing clean energy projects, including both renewable energy and energy efficiency technologies through both private capital markets and through 3rd party approaches used in the United States and in China. It includes special topics such as the development of energy service companies and utility regulatory policy.
4. *Study tour 3: State and local policy*: This activity would focus on regional and local initiatives that may be replicated in the United States or China. Regional and local policies to promote renewable energy systems are often critical to the success of renewable energy project development. This tour would delve into policy initiatives in both The United States and China to comprehend the impact and share best practices to enable future development.

Regional Renewable Deployment Solutions: The Partnership is intended to support the sharing of best practices from wind deployment experiences in China and the U.S. including the Wind Powering America outreach programs to accelerate wind and solar investment in both countries. Activities may include state-to-state or region-to-region partnerships to cooperate in utilizing relevant deployment tools. The analytic framework for a national wind-solar-transmission plan described above can also support provincial-level planning using similar techniques at a finer geographic scale. Task areas in this part of the work may include the following.

1. *Adapt methods to regional level*: This task comprises primarily discussions with national, provincial, and local stakeholders in order to understand the range of implementation issues that must be covered in order to support provincial level planning and implementation responsibilities.
2. *Pilot provincial technical support effort*: In this task, a team of U.S. and

Chinese technical consultants work with local and provincial officials and other local stakeholders to develop a provincial implementation plan for meeting specified renewable electric targets.

3. *Assessment and reporting:* The U.S.-China technical team assesses the experience of the pilot effort, catalogs key lessons learned, and develops two sets of guidelines: One guidelines document informs provincial and local parties about the renewable electric planning and implementation process. The second set of guidelines comprises resources for Chinese technical consultants in supporting the development of provincial clean energy plans.

Grid Modernization: Reliably integrating renewable energy into the electrical grid is perhaps the single largest barrier to deployment at scale. Through the Partnership, and the Advanced Grid Working Group, the Participants intend to advance high-voltage transmission, grid-connected storage, and smart grid technology solutions that enable broader renewable energy penetration. Both The United States and China can benefit significantly by sharing information and expertise in this area.

Tasks in this area may include the following:

1. *Day-ahead forecasting:* Assess state-of-the-art methods for forecasting wind and solar production in advance of the operating day, and for updating production schedules in advance of the operating hour.
2. *Geospatial diversity:* Measure the degree to which wind production varies over 10-minute and one-hour periods, and the degree to which the net variance diminishes when multiple wind facilities are co-scheduled.
3. *Co-scheduling wind and solar resources* with flexible dispatchable resources. Using the results of the forecasting and geospatial diversity studies, assess the feasibility of co-scheduling intermittent wind and PV resources with dispatchable hydro, CSP and natural gas generation so that the combination provides a constant level of production over a 24-hour period that can be used to replace coal for an equivalent amount of baseload generation.
4. *DC transmission paths:* Using the results of the Renewable Energy Roadmap, identify the best opportunities for ultra-high voltage DC transmission paths.
5. *Demand response:* Assess the ability of the industrial sector and other large consumers to provide ancillary services. Establish a methodology for assessing demand response potential on a given transmission corridor, and for including the value of potential demand response in planning where transmission, generation, and industrial development should occur.
6. *Electric vehicle integration:* Identify options and technical requirements for using fleets of electric-powered buses, cars and scooters to enhance grid reliability.

Advanced Renewable Energy Technologies: The Participants intend to identify areas for the conduct of joint research and development of advanced solar, wind, and grid technologies and cooperate in pre-commercial renewable energy demonstration projects. Through the Partnership, the Participants also intend to cooperate in testing, standards,

and certification for PV panels, large scale CSP plants, wind turbines, and advanced grid technology to enhance reliability and expand bilateral trade in low-carbon goods and services.

Potential activities in this topic include:

1. Technical and informational exchanges focusing on improving and harmonizing technology standards, codes, and certification protocols;
2. Workshops on R&D best practices including approaches to basic science and pre-commercial research in the renewable energy sector to identify and promote potential collaboration on areas of mutual interest;
3. Technical exchanges on technology deployment and commercialization protocols to enhance United States and Chinese programs for partnering with private entities on commercially viable innovations from national laboratories and universities;
4. Development of specific R&D collaborations that provide mutual benefit to Chinese and United States and establishment of partnerships between Chinese and United States renewable energy testing authorities and laboratories.

Advanced Biofuels: The Participants intend to identify areas for collaboration in the research and development of advanced biofuels with a focus on 1) reliable and economic supply of feedstocks (including logistics), 2) cellulosic ethanol and sweet sorghum conversion, 3) thermochemical conversion (techno-economic analysis and catalyst characterization and modeling), 4) algae biodiesel, and 5) green diesel. The Participants should seek to prioritize cooperative activities and coordinate with stakeholders in both countries engaged in advanced biofuels research and through a Joint Biofuels R&D Advisory Group established by the Partnership, facilitate coordination with the Joint Working Group established under the above-referenced U.S. -China Biofuels MOU.

Potential activities include:

1. Proposed “International Advanced Biofuels Conference” by the National Energy Administration to be held in 2010. The conference would invite international experts for exchange of ideas and highlight US-China biofuels cooperation results. It would be complemented with a study tour to US research institutes and operating plants.
2. Cooperation to develop improved capacities in both nations to analyze, plan and reduce costs of feedstock supplies and logistics.
3. Integrated support of advanced cellulosic ethanol conversion demonstration projects in China providing cellulosic conversion R&D and feedstock analysis support for proposed joint US-China projects involving US and Chinese corporate partners.

4. Support for advanced thermochemical conversion joint projects (biomass to ethanol et al biofuels) involving US and China corporate partners, similar in scope to item 3 above.
5. Algae biodiesel and green diesel R&D, techno-economic analysis, and LCA project support.
6. Facilitate participation in international initiatives to assess biofuel sustainability.

Renewable Energy Forum: The Participants intend to establish the *U.S.-China Renewable Energy Forum*, modeled after the U.S.-China Oil and Gas Industry Forum and U.S.-China Electric Vehicles Forum, to be held once a year alternating between the United States and China. The Renewable Energy Forum is to serve as a platform for policy-makers in both countries to share experience and best practices in promoting renewable energy technology, testing and standards and for the various advisory and working groups established under the Partnership to meet and share their recommendations with the Task Force. As a public-private partnership, the Renewable Energy Forum is to bring together industry representatives from both countries to unlock commercial opportunities in renewable energy while meeting energy security, climate change and environmental goals.