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Improving China's Existing Renewable Energy Legal Framework: Lessons from the International and Domestic Experience

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Introduction

Expanding the share of renewable energy in its energy mix is one of the key pillars of China's low-carbon development strategy. At the United Nations Climate Change Conference in Copenhagen in December 2009, China pledged to reduce its carbon intensity—the amount of carbon dioxide emissions (CO_2) emitted per unit of gross domestic product (GDP)—by 40 to 45 percent by 2020 based on 2005 levels, and to raise the share of non-fossil sources of energy (i.e., renewables and nuclear) to 15 percent of its primary energy consumption by 2020, from about 9.9 percent as of the end of 2009.[1]

As China builds a further 1,000 gigawatts (GW) of power generation capacity in the next 15 years—virtually doubling the installed capacity of its current fleet of power plants—and expands its demand for energy for transportation, heating, industrial production and other uses, it is vital that it put in place a robust legal framework that can incentivize and manage the healthy and balanced expansion of its renewables resources. China has already taken important steps towards establishing this legal framework with the passage of the 2005 Renewable Energy Law (amended in December 2009) and its associated implementing regulations, which have played a major role in the rapid growth of China's renewables resources in the last few years. However, China's rapid growth in renewable energy, particularly wind, has been accompanied by some growing pains, and there is room for improving the legal framework to address these challenges.

This white paper provides an analysis of the essential features of China's current renewable energy legal framework and offers suggestions for improving this framework based on relevant experiences both internationally and domestically:

- Section I explains the key mechanisms for renewable energy development established under the 2005 *Renewable Energy Law*, including setting a national renewable energy target, the mandatory connection and purchase policy, the establishment of a national feed-in tariff system, and arrangements for cost-sharing and funding of renewable energy.
- Section II details some of the major issues that arose after the *Renewable Energy Law* went into effect, which continue to pose challenges to expanding renewable energy in China.
- Section III details the changes to the legal framework brought about by the December 2009 amendments to China's *Renewable Energy Law*, including changes to the mandatory connection and purchase policy, streamlining of the renewable energy fund, and increased central government oversight of renewables planning.
- Finally, Section IV provides recommendations for effective implementation of the amended *Renewable Energy Law,* based on Chinese and international experiences, which may be helpful as China develops future implementing regulations. These include recommendations on making the renewable power quota system more effective, formulating an effective priority dispatch policy, setting appropriate technical standards for connection of renewable resources with the grid, improving operation of the renewable energy development fund, and promoting provincial and local planning and experimentation for renewable energy.

Box 1. Key Players in China's Renewable Energy Development

The Renewable Power Generators

- There five large state-owned power generators in China (Huaneng, Datang, Huadian, Guodian and CPI, often referred to as the "Big Five") are all active in developing renewable energy projects through their subsidiaries. Together they were responsible for approximately 54 percent of the new installed wind capacity in 2009.
- Guodian's subsidiary, Longyuan, is currently the largest producer of wind in China in terms of installed capacity, with Datang, Huaneng, Huadian, and Guohua (a subsidiary of Shenhua) following in the rankings.
- Although there are other renewable power generators, such as China Wind Power, they individually represent only a small portion of overall installed capacity and power generation.

The Grid Companies

- There are two main transmission and distribution companies that provide coverage for the entire country, State Grid Corporation of China and China Southern Grid, both of which are state-owned enterprises.
- State Grid's coverage area accounts for about 80 percent of China's total electricity consumption, and it is one of the largest utilities in the world. State Grid has five wholly-owned subsidiaries with coverage areas in Northern China, Northeastern China, Eastern China, Middle China, and Northwestern China, each of which operate through their subsidiaries in the covered provinces, municipal areas and autonomous regions.
- Southern Grid operates in Guangdong, Guangxi, and Yunnan provinces through its subsidiaries.

Relevant Government Bodies

- The National Energy Administration (NEA) is situated within the National Development and Reform Commission (NDRC), China's top economic planning agency, and is responsible for development and policy planning with respect to energy. It is not a separate ministry.
- The National Energy Commission (NEC) was officially formed in 2010 and is responsible for coordinating energy planning among different government agencies and formulating a national energy strategy. The NEA is subordinate to the NEC.
- The State Electricity Regulatory Commission (SERC) is a government agency responsible for regulating China's power and electricity industry, including promulgating and ensuring compliance with relevant laws and regulations.

I. Key Mechanisms for Renewable Energy Development under the 2005 *Renewable Energy Law*

China has made impressive efforts in recent years to increase its supply of renewable energy. This effort was kick-started with the passage of the *Renewable Energy Law of the People's Republic of China* ("*Renewable Energy Law*"). On May 28, 2005, the Standing Committee of the National People's Congress ("NPC") promulgated the *Renewable Energy Law*, which became effective on January 1, 2006.[2] The *Renewable Energy Law* created a framework for regulating renewable energy and was hailed at the time as a breakthrough in the development of renewable energy in China.

The *Renewable Energy Law* created four mechanisms to promote the growth of China's renewable energy supply: (1) a national renewable energy target (2) a mandatory connection and purchase policy, (3) a feed-in tariff system and (4) a cost-sharing mechanism, including a special fund for renewable energy development. Each of these four mechanisms is explained below.

A. National Renewable Energy Target

The *Renewable Energy Law* tasked the State Council's energy department (the energy body under the National Development and Reform Commission (NDRC))[3] with devising mid- and long-term national targets for renewable energy production (Art. 7), as well as a national renewable energy development and utilization plan (Art. 8). Accordingly, in 2007 the State Council released the *Mid- and Long-Term Development Plan for Renewable Energy* ("*2007 NDRC Plan*"), which set a target of meeting 10 percent of China's primary energy consumption from renewable energy sources, including hydropower, wind, and solar by 2010 and 15 percent by 2020.[4] The following year, NDRC released the *Renewable Energy Plan for the Eleventh Five-Year Perio*d, which reiterated the target of reaching 10 percent of energy consumption from renewable sources by 2010, the final year of the Eleventh Five-Year Plan.

B. Mandatory Connection and Purchase Policy

Article 14 of the original *Renewable Energy Law* required grid companies to both connect and purchase all of the renewable power generated within their coverage area (hereinafter referred to as the "Mandatory Connection and Purchase Policy"). This was a landmark provision because it ensured there would be a market for renewable energy generated, and helped foster the clear, long-term market demand that is needed for investment in large-scale energy infrastructure projects.

When China was considering how to structure its renewable energy law, it examined a number of different international models. Ultimately, China chose to pursue a policy framework similar to that used in Germany, which also has a priority connection and purchase policy for renewable generators, as well as feed-in tariffs.[5] Given that unsubsidized renewable energy is currently more expensive than the conventional fossil fuel alternative, feed-in tariffs guarantee investors that a renewable energy project will be able to sell the electricity it generates to the grid at price above the market rate for electricity from conventional sources of energy.

After the *Renewable Energy Law* was enacted, the State Electricity Regulatory Commission (SERC), pursuant to Article 14 of the *Law*, issued the *Measures on Grid Company Full Purchase of Electricity from*

Renewable Energy ("*Full Purchase Measures*") in 2007 (See Table 1 for a list of key regulations issued pursuant to the 2005 *Renewable Energy Law*).[6] This regulation specified certain requirements for connection and purchase of renewable power. The *Full Purchase Measures*:

- Require grid companies to promptly provide connection services to the renewable generator (Art. 7).
- Establish a "priority dispatch" system, in which renewable generators are given priority in the electricity dispatching sequence to guarantee the requirements of the mandatory connection and purchase policy (Art. 8).
- Allow the dispatcher to manage the renewable power generator (e.g., curtail transmission from a generator) in cases where grid stability is threatened (Art. 8.1). If this occurs, the grid company must promptly notify the renewable generator in writing with an explanation and include an estimation of the non-purchased volume. The grid operator must also report the incident including the reasons for taking action and the corrective measures taken to SERC, which will supervise these measures (Art. 10).

The *Full Purchase Measures* also included a penalty provision in the event of grid company non-compliance with the mandatory connection and purchase policy (Art. 20). Under the penalty provision, if the grid engages in any of the activities listed below, and causes a renewable energy generator to suffer an economic loss as a result, the grid company will be held liable and must take corrective action within a time period specified by SERC. If the grid company does not take corrective action within the specified timeframe, SERC has discretion to impose a penalty up to the value of the economic loss to the renewable generator. The triggering activities for the penalty are:

- Failing to construct, or not constructing promptly, renewable energy connection facilities.
- Refusing to execute, or hindering the execution of, a power purchase agreement or a grid connection and dispatch agreement.
- Failing to provide, or not providing promptly, grid connection services.
- Failing to give renewable generators priority in dispatch.
- Any other situation in which the grid company or the dispatch body causes less than the full amount of renewable power generated to be purchased.

Despite the apparently preferential provisions in the *Full Purchase Measures* and the *Renewable Energy Law*, it became clear by 2009 that grid companies were not complying fully with their obligations to purchase all renewable power and connect it to the grid in accordance with the law and the regulations. However, there are no reported cases of SERC exercising its discretion to impose penalties for non-compliance. One of the most significant changes in the amendments to the *Renewable Energy Law* is the addition of provisions that are intended to improve implementation of the mandatory purchase and connection policy.

Table 1. Key Regulations Issued Pursuant to the 2005 Renewable Energy Law

Relevant Article of 2005 Renewable Energy Law	Name of Regulation	Issuing Authority	Year Issued
Art. 14, 29	*Measures on Grid Company Full Purchase of Electricity from Renewable Energy*	SERC	2007
Art. 20	*Interim Measures on Renewable Energy Electricity Prices and Cost Sharing Management*	NDRC	2006
Art. 20, 21, 22	*Interim Measures on Revenue Allocation from Renewable Surcharges*	NDRC, SERC	2007
Art. 24, 25	*Interim Measures on the Renewable Energy Development Special Fund*	Ministry of Finance	2006
Art. 7, 8	*Mid- and Long- Term Development Plan for Renewable Energy*	NDRC	2007

C. Feed-In Tariff System

Under Articles 19 and 20 of the *Renewable Energy Law*, the pricing administration under the NDRC is directed to set feed-in tariffs for different types of renewable energy generation. The feed-in tariffs guarantee an above-market rate that the grid company will pay to the renewable generator. Whereas the mandatory connection and purchase policy guarantees that the renewable power generated will be purchased, the feed-in tariff guarantees the price at which this power will be purchased. The additional cost of the feed-in tariff over and above the cost of conventional power is paid by a national surcharge on end-users of electricity and is discussed in more detail in the following sub-section.

Since the *Renewable Energy Law* was enacted, China has instituted several feed-in tariff programs, a process China has generally approached by first establishing national concession programs that set a feed-in tariff on a project-by-project basis through competitive bidding. National concession programs provide the central government with valuable experience in setting an appropriate national feed-in tariff that is neither too high and thus an inefficient use of public funds, nor too low and thus insufficient to create adequate incentives for investments in renewable technologies.

In the wind sector, a comprehensive nationwide program providing feed-in tariffs for wind projects was launched in August 2009 after several rounds of concession bidding. In the concession programs, developers bid on the right to construct wind farms by putting forward a proposal that included a proposed sale price for the electricity generated.[7] The comprehensive feed-in tariff schedule for wind has eliminated the need to bid on feed-in tariffs for wind projects on a project-by-project basis.[8] The tariff schedule contains four different tiers, with the highest tariffs available for projects in regions with the least abundant wind resources. There is also a nationwide feed-in tariff for electricity generated from biomass-fired power plants. In contrast, solar does not currently have a fixed nationwide feed-in tariff (See Table 2).[9]

Table 2. China's National Feed-in Tariffs

Wind	The national feed-in tariff is divided into four tiers ranging between 0.51 to 0.61 RMB/kWh. Areas with the least abundant wind resources receive the highest tariff and areas with the most abundant resources receive the lowest tariff.
Solar	No nationwide feed-in tariff currently exists, but specific solar projects can receive a feed-in tariff through a tender process. Recent solar projects in Ningxia have received a tariff of 1.15 RMB/kWh.
Biomass	The national feed-in tariff is equal to 0.25 RMB/kWh plus the 2005 benchmark desulfurized coal price in the area where the facility is located for a period of 15 years.[10]

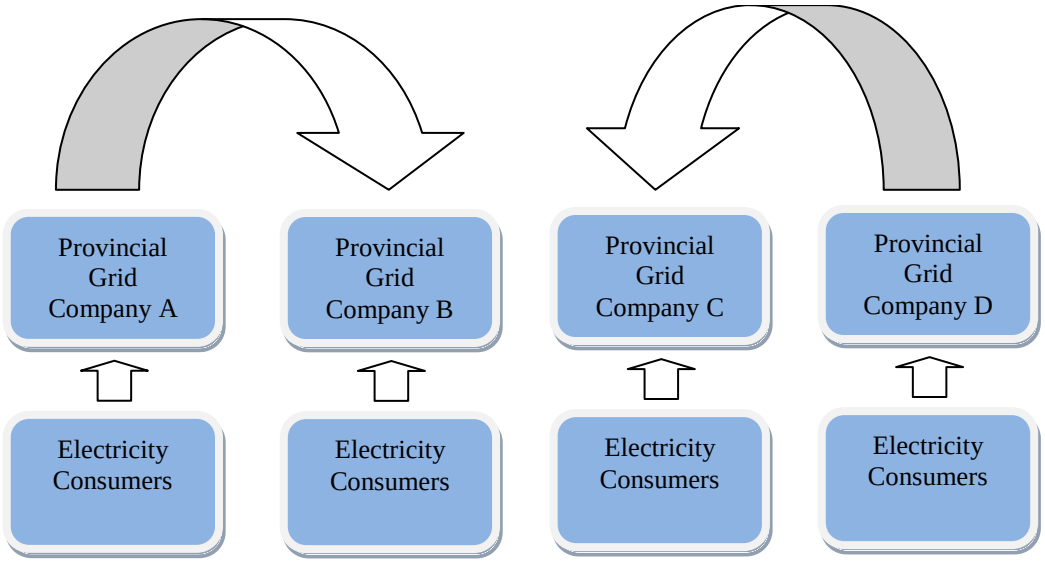
D. Cost Sharing and Renewable Energy Development Fund

China's rapid deployment of renewable energy since the enactment of the *Renewable Energy Law* has been primarily funded through a national surcharge on electricity consumption. The original *Renewable Energy Law* expressly stated that the costs associated with feed-in tariffs (Art. 20) and the reasonable costs associated with connecting renewable generators to the grid (Art. 21) are to be shared nationwide through a surcharge on end-users of electricity.

Accordingly, to compensate grid companies for the additional cost of purchasing renewable energy, in 2006 the NDRC issued the *Interim Measures on Renewable Energy Electricity Prices and Cost Sharing Management* ("*Cost Sharing Measures*"), which directs NDRC's pricing department to set a nationwide renewable surcharge levied on electricity users at a uniform rate based on the users' consumption of electricity.[11] In 2006, the surcharge was set at RMB 0.001/kWh, but it has doubled every two years for industrial users, who, as of 2009, were paying RMB 0.004/kWh (excluding Sichuan province, because of earthquake recovery efforts).[12] The amount of renewable surcharges used to fund renewable power generation totaled more than $490 million in the first half of 2009, up from $272 million in the previous six-month period.[13]

Under the *Cost Sharing Measures*, the surcharges were to be levied directly from the end-users' electricity bill by the grid company. Given the vast differences in the abundance of renewable resources across China, electricity generated from renewable sources is often consumed in a different region from which it is generated. For this reason, in 2007 NDRC and SERC issued the *Interim Measures on Revenue Allocation from Renewable Surcharges* ("*Surcharge Allocation Measures*"). These measures established an interprovincial equalization program, under which provincial grid companies are required to exchange their shortfall or surplus of surcharges with grid companies from other regions. Ultimately each grid company receives the amount to which it is entitled, on the basis of the renewable power generated in its coverage area (see Figure 1 below).[14] In the first half of 2009, the amount exchanged through this program was 1.836 billion RMB ($268.8 million).

Figure 1. Cost Sharing For Renewable Energy under the 2005 Renewable Energy Law



Step 1. Consumers pay renewable surcharge to their provincial grid company.

Step 2. If renewable energy demand is greater than supply within a particular province (such as provinces A and D), then the grid company in that province pays out the surplus renewable surcharges directly to grid companies in provinces where supply is greater than demand (such as provinces B and C), to help those grid companies to pay for their purchases of renewable energy.

According to the *Surcharge Allocation Measures*, the equalization of surcharges and payments of subsidies to renewable generators were required to occur monthly (Art. 16 and 11). In practice, however, the equalization has occurred every six to nine months. This delay is the result of the complicated, bureaucratic process of determining how much each province is entitled to and from which other provinces the funds should be collected. This delay is also the result of the tension that arises from requiring that funds be raised in one province only to be transferred to another. According to industry reports, as a result of the infrequent equalizations, a renewable generator entitled to a feed-in tariff will not receive the appropriate subsidy above the cost of coal-fired power until at least six months after the energy was actually sold to the grid company. This delay in collecting subsidies has put a strain on the cash flow for renewable power generators and their investors, ultimately hindering the scaling-up of investment needed for China to reach its renewable energy development goals.

In addition to the cost sharing mechanism, the *Renewable Energy Law* created a "Renewable Energy Development Special Fund" to be established through central government budget allocations for renewable energy. In 2006, the Ministry of Finance issued *Interim Measures on the Renewable Energy*

Development Special Fund ("*Special Fund Measures*"). This regulation explained that the fund was to be used to support the following activities:

1. Research in the science and technologies associated with developing and deploying renewable energy, setting standards and demonstration projects;
2. Renewable energy program for basic rural energy needs;
3. Establishing stand-alone electricity projects in remote areas and islands;
4. Exploration of renewable energy resources, evaluation, and relevant information system; and
5. Encouraging the localization of production for equipment used in the deployment of renewable energy.[15]

Projects seeking funding for research and development are required to apply through the national "863" and "973" High-Technology Development Research programs under the Ministry of Science and Technology, which have a long history of funding advanced scientific research in a variety of areas.[16] All other activities seeking funding are required to submit applications to the local government, but final decisions are made by the Ministry of Finance (MOF) at the central level.

It is unclear how much has been allocated to and distributed by the fund annually. However, there have been a number of renewable subsidy programs that have been established pursuant to the *Special Fund Measures*, such as the "Golden Sun" program that was instituted in July 2009.[17] Under this program, certain solar photovoltaic projects are entitled to receive a subsidy equal to 50 percent of the total cost of investment if they are grid-connected, and 70 percent of the total cost of investment if they are off-grid and in remote areas.[18]

II. Obstacles to Implementation of the 2005 *Renewable Energy Law*

While China has rapidly increased its installed capacity of renewable energy over the last five years, it has become clear that China faces many challenges in scaling up its renewable energy supply. Although the mandatory connection and purchase policy requires grid companies to connect all renewable projects and purchase all the power produced, this has not been happening in practice.

For example, although China's installed wind capacity has doubled every year for the last five years, a large proportion of the installed wind capacity encounters significant delays before being connected to the grid. According to statistics from the China Electricity Council and the China Wind Energy Association, at the end of 2009, China had 25.8 GW of installed wind capacity, but only 17.6 GW was connected to the grid, indicating that more than 30 percent of China's wind capacity was not connected to the grid as of the end of 2009.[19] China's installed wind capacity has continued to grow rapidly since then, but it is likely that a similar percentage remains unconnected.

China has recognized that renewable deployment is facing a "bottleneck" that must be addressed before the country can achieve its renewable energy potential. This bottleneck can be partly attributed to the grid companies' lack of resources and incentives to invest in the grid infrastructure necessary to keep pace with the rapid increase in renewable power facilities. Even after a renewable generator is connected to the grid, however, China may confront an additional bottleneck point as grid companies have had difficulty integrating a large amount of intermittent renewable resources into the grid network because the country's grid lacks sufficient transmission capability. Therefore,

the grid is unable to securely purchase all of the power generated without compromising the stability of the entire grid network. The original *Renewable Energy Law* did not address these connection and integration issues effectively.

In some cases, to deal with the integration issues, grid companies have required wind power producers to consent in their power purchase agreements (PPA) to a grid curtailment or "wind power management" provision. This entitles the grid company to purchase only a portion of the renewable energy generated without any compensation being paid to the generator for curtailing its production. As a practical matter, many of the provinces with large wind capacity simply do not have the energy demand to use the generated power locally, and the infrastructure does not exist to transmit that power to areas with higher demand. In such cases, the renewable power may need to be curtailed to ensure grid stability. However, as noted above, the *Full Purchase Measures* require that if the grid needs to manage or curtail the renewable power generator to avoid compromising the network's stability, the grid must follow certain rules and procedures that govern how curtailment is carried out, with potential penalties for non-compliance. Therefore, a PPA curtailment provision that is inconsistent with such procedures would appear to violate the *Full Purchase Measures*.

This example highlights the importance of setting laws and policies that are in tune with the challenges specific to the deployment of renewable energy in China. Although many of the scaling-up barriers China is facing are technical in nature, there are significant policy and legal barriers that cannot be overlooked. Instead of imposing a technically unachievable legal framework, and issuing laws and regulations that lack adequate enforcement mechanisms, China should focus its policy efforts on encouraging the development and deployment of the technology and infrastructure necessary to achieve its renewable energy potential. Concurrently, China should ensure that adequate compliance mechanisms are implemented. The amendments to the Renewable Energy Law aim to do this by: (1) setting new obligations for power generators and grid companies; (2) improving funding mechanisms; and (3) strengthening national and comprehensive planning for renewable energy deployment.

III. The 2009 Amendments to the *Renewable Energy Law*

During the NPC session in early 2009, several bills were introduced to amend the *Renewable Energy Law*, in hope of improving its implementation and further advancing renewable energy development. In response, the NPC's Standing Committee formulated and circulated draft amendments in August 2009 for public comment. On December 26, 2009 the final amendments were passed with three significant changes to the *Renewable Energy Law*: [20]

- Adding measures intended to improve implementation of the mandatory connection and purchase policy, such as a quota system, a priority dispatch system, and technical standards for interconnection to the grid;
- Streamlining the renewable energy fund that provides financial incentives for the deployment of renewable energy; and
- Increasing central government oversight of provincial and local renewable energy development planning.

Each of these changes is discussed further below.

A. Changes to the Mandatory Connection and Purchase Policy

The mandatory connection and purchase policy broadly required grid companies to connect and purchase all renewable energy generated in their coverage area. However, a gap existed between the ideals of the law and the facts on the ground.

Renewable Power Quota

Under the amended Article 14, grid companies still must adhere to the mandatory connection policy, but will now also be required to purchase a set quota of renewable power, as a proportion of their total power purchased (Art. 14, paragraph 1). Although the amendments do not themselves specify the quota percentage, they direct the NEA, SERC, and MOF to jointly set the quota amounts and instruct the NEA and SERC to enforce them annually.

The new power generation target created by the amendments to the *Renewable Energy Law* expressly creates a duty for the grid companies to purchase a fixed share of their power generation from renewable energy sources that will be enforced through penalties (Art. 29). The inclusion of a renewable energy quota in the law is groundbreaking. As noted above, the *2007 NDRC Plan* established a "Mandatory Market Share" (MMS) requirement that set the target percentage of non-hydro renewable power generation out of total power generation at 1 percent for 2010 and 3 percent for 2020. However, this requirement was not included in the *Renewable Energy Development Plan for the Eleventh Five Year Period* released in 2008 and has never been codified into the law, thereby creating an enforceable, legal obligation for the grid companies to purchase a set percentage of renewable power.[21] The significance of the renewable power quota created by the amended *Renewable Energy Law*, however, will ultimately depend on the stringency of future implementing regulations and the government's enforcement of them.

Priority Dispatch

The amended Article 14 also requires the NEA, SERC, and MOF to set priority dispatch regulations that will give priority to renewable power generators in the electricity dispatch sequence. This is the first time the concept of priority dispatch has been included in the *Renewable Energy Law*, although it was mentioned previously in regulations issued pursuant to the *Renewable Energy Law*, as well as the *Energy Conservation Law* and its accompanying regulations.

The *Full Purchase Measures* issued in 2007 stated that electricity dispatchers must give priority to renewable generators in accordance with the relevant national regulations regarding dispatch. Although national regulations regarding dispatch have not yet been issued, a trial "efficiency dispatch" policy was announced in late 2007 pursuant to the *Energy Conservation Law*.[22] Under this policy, the loading order of power- generating units was set based on the level of pollution emitted from the generating unit, with zero-emissions units being dispatched first, and the highest emission units being dispatched last. The efficiency dispatch policy is a departure from the general practice in China, in which the dispatch sequence is based on dispatching the units generating electricity at the lowest average cost (including capital costs as well as operation and maintenance costs) first.

The trial efficiency dispatch policy started with five provincial pilot projects in Jiangsu, Henan, Sichuan, Guangdong, and Guizhou. These pilot projects were relatively successful and provided provincial and central government officials with priority dispatch experience, paving the way for its inclusion in the amendments to the *Renewable Energy Law*. Nevertheless, a number of technical and

financial issues still exist. For example, one problem is that combined heat and power (CHP) coal-fired power plants are the primary source of heating used in Northern China during the winter months and are considered "must-dispatch" resources to provide heating. Thus, in practice, CHP power plants are given priority in the dispatch sequence, although wind and other renewable resources would otherwise be given that priority because of their lower emissions.
While it is unclear from the face of the amendments what the scope of the national priority dispatch regulations will be, recommendations are offered in Section IV.B below.

Technical Requirements for Grid Connection

The amendments require the renewable power generators to meet certain technical standards in order to receive the benefits of the mandatory connection and purchase policy. The original law required grid companies to purchase without condition all renewable energy available for feed-in to the grid without any condition. The amended law now limits grid companies' responsibility to only those renewable power generators that meet certain technical requirements for connection (Art. 14, paragraph 2). Although the *Full Purchase Measures* required renewable generators to satisfy the grid's technical standards, the right to grid connection was not expressly conditioned on meeting the grid's technical standards (Art. 6). Therefore, in this respect, the amendments include a limitation on the scope of the grid companies' obligations under the mandatory connection and purchase policy. However, by including technical standards for connection, the generators and the grid companies are now mutually responsible for ensuring grid stability.

At the same time the *Renewable Energy Law* was enacted in 2005, the Standardization Administration released three technical codes applicable to geothermal power, photovoltaic power, and wind power, which are either recommended or applied as guidelines, but not considered compulsory national standards under *Standardization Law*.[23] Since these technical codes were released simultaneously with the *Renewable Energy Law*, without sufficient time for detailed analysis, many of the terms are set with reference to foreign technical rules, and too ambiguous and outdated to currently be useful.

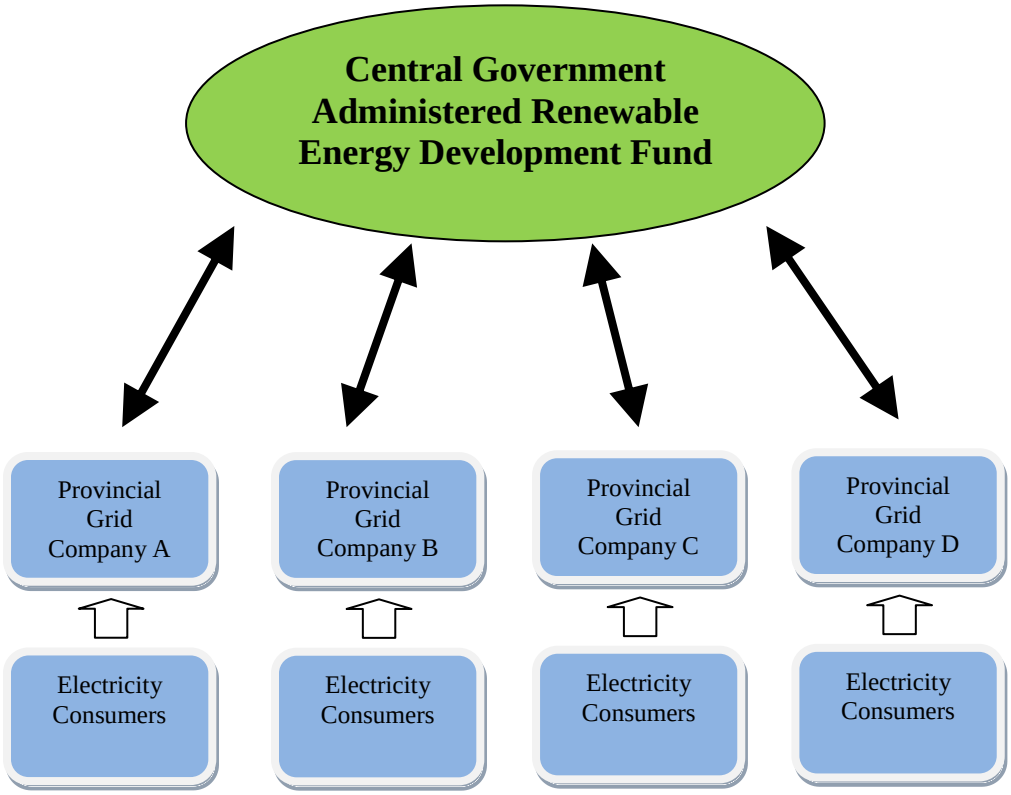
Since these technical codes are not compulsory national standards, in the interim, the State Grid Corporation has released two of its own technical standards (i.e. "enterprise standards") for connecting wind and solar power to its grid network. The amendments do not state how the new standards will be developed or what the content of the standards should include—issues further discussed in detail Section IV.C below.

B. Streamlining of the Renewable Energy Fund

The amendments also alter how grid companies will receive subsidies for purchasing renewable energy. As noted above, under the cost sharing policy established by the original *Renewable Energy Law*, renewable energy subsidies are to be paid for by surcharges levied on electricity consumers. Under the *Cost Sharing Measures*, the grid company was required to directly withhold the surcharge from end-users" regular electricity bill. Article 24 of the amended *Renewable Energy Law* alters this process. Now, instead of the grid companies' being compensated directly through the surcharges, the surcharges will be pooled together into a new Renewable Energy Development Fund, from which each grid company will seek compensation for the additional cost of purchasing the renewable power and the reasonable costs associated with grid connection. The Renewable Energy Development Fund will also be funded by central government budget allocations (See Figure 2.).

Although these changes might seem merely technical in nature, depositing surcharges into one large fund has significant advantages. First, by pooling all the surcharges into a single fund, the central government will be able to more effectively manage the sizable amount of money collected from the surcharges. The renewable energy surcharges totaled more than $689 million in 2009 and an estimated $1 billion in 2010. The funds to scale up China's renewable energy program will need to be managed more effectively than they had been under the complex, biannual equalization scheme.

Figure 2. Cost Sharing For Renewable Energy under the 2009 Amendments to the Renewable Energy Law



Step 1. Consumers pay renewable surcharge to their provincial grid company.

Step 2. Provincial grid companies pay the collected renewable surcharges into the central government administered Renewable Energy Development Fund, which is also funded by central government budget allocations.

Step 3. The Renewable Energy Development Fund redistributes funds to provincial grid companies based on their purchases of renewable energy.

Also, the new funds-flow process is more likely to ensure that subsidies are actually being used for renewable power generation. According to some industry reports, some grid companies have initially used the renewable energy surcharges for other purposes—such as boosting their own working capital—rather than their intended purpose—to purchase renewable power. This is a result of some grid companies finding the collected surcharges to be insufficient to compensate for the higher price of purchasing renewable generation. Thirdly, the new funds-flow process will allow the surcharges collected in China's wealthier eastern provinces to be allocated more quickly to China's less developed western provinces, where some of China's richest renewable energy resources are located, streamlining the process of nationwide renewable energy planning (Art. 21). The regional imbalance among provinces in terms of their financial and renewable energy resources poses a challenge that must be addressed in China's future national renewable energy planning.

There is also a tax benefit to the new funds-flow process. Under the previous system, the surcharges collected by the grid companies were subject to income and value added taxes (VAT). One criticism of the old system was that after taxes were subtracted from the surcharges, the remaining tariff was not enough to compensate the grid company for purchasing renewable power. Because the subsidies received will be disbursed directly from the government fund, they will no longer be considered *capital* and are therefore exempt from income tax and subject to a lower VAT rate.[24] The result of this tax benefit is that a greater percentage of the surcharges will now be spent directly towards renewable energy.

C. Increased Central Government Oversight

A significant change is that the amendments strengthen central government oversight over provincial-level planning for development of renewable energy within the province, municipality, or autonomous region. Under the amendments, provincial-level governments are required to file their renewable energy development plans with NDRC and SERC before they may be implemented. In contrast, the original *Renewable Energy Law* simply delegated to the energy department at the relevant level the discretion to formulate the planning for its own jurisdiction without any direction or oversight at the national level. This lack of unified planning has created coordination problems between the development of the grid and development of renewable energy projects.

In addition, the amendments require that provincial-level renewable energy development plans must be formulated on the basis of the *National Plan for Renewable Energy Development and Deployment*. Previously, the law only required that the mid- and long-term renewable energy targets for that region be taken into account when such provincial plans were formulated. The filing system created by the amendments will presumably enable the central government to access and oversee the details of provincial-level planning. The official explanation provided in conjunction with an earlier draft of the amendments states:[25]

> Although the renewable energy industry in our country has developed quickly in recent years, a number of issues have gradually been revealed, such as…. national and local-level planning have lacked coordination. The result has been that the development plan for renewable power generation has fallen out of step with the development plan for the electrical grid, and this lack of coordination is impacting the targets of the plan more and more every day…Therefore, we need to increase overall coordination of [renewable energy] planning through law and regulations…

and make clear that local governments must determine their implementing plans in accordance with the national plan.

The amendments demonstrate that China intends to enhance central government oversight over local governments' planning and implementation of renewable energy policy. In addition, by mandating that local planning takes into account national renewable energy planning, provincial plans across China are likely to be formulated in a more unified way, both in terms of pace and scale.

IV. Recommendations for Strengthening Implementation of the Amended Renewable Energy Law

The amendments to the *Renewable Energy Law* leave many of the details to be defined by subsequent implementing regulations. For this reason, the amendments themselves will not necessarily bring about any improvements to the overall system unless effective, detailed regulations are issued. In the section below, we offer recommendations for how these regulations should be drafted in light of international experience with similar policies and China's own experience with its renewable energy legal framework over the last four years.[26]

A. Renewable Power Quota System

As noted above, in accordance with the amendments to Article 14 of the *Renewable Energy Law*, SERC, MOF, and NDRC will now be required to set renewable power generation targets for the grid companies. Setting targets defined in terms of power generation rather than installed capacity is a positive step. Although capacity-based targets are easier to monitor, they do not create an effective incentive for renewable power generators to install the most efficient generation facilities, nor do they create an incentive for grid companies to promptly connect and purchase the power generated.

This type of generation target is similar to the Renewable Portfolio Standards (RPS) that have been implemented in various states in the United States. On the basis of the experience in the United States with RPS-setting, there are a variety of factors Chinese policy-makers should consider when determining how the quota regulations should be implemented to increase their effectiveness and avoid potential pitfalls.

The quota amount should increase gradually and predictably every few years and be set high enough to encourage additional investment in renewable energy

The target should continually and predictably increase annually or biannually in order to drive the development of additional renewable power generation. For example, in the State of Nevada, the RPS increases by 3 percent every two years until the goal of 20 percent is reached in 2020.[27] In the past, China has tended to prefer five-year time horizons for target setting, which can be easier to administer than an annual target. However, a quota requirement with a five-year time horizon would make it difficult to implement a renewable energy credit trading scheme.

In order to create an additional incentive beyond existing policies, renewable- power generation targets should be set realistically higher than current projections for that particular year. The 2007 MMS policy (discussed in Section III.A above) sets a nationwide target of 3 percent of power generation from non-hydro renewable sources by 2020. This is a low target if it is intended to spur additional investment in renewable energy deployment. The Energy Research Institute, (ERI) an

energy think-tank affiliated with the NDRC, has conducted an analysis of three hypothetical policy scenarios based on various assumptions regarding energy demand and supply for the year 2020 (See Table 3). Under these three scenarios, the percentage of wind and solar generation, as a percentage of total power generation, ranges from 3.85 percent in the less aggressive *energy efficiency* scenario to 9.53 percent in the most aggressive *enhanced low carbon* scenario. This analysis suggests that a national target for non-hydro renewable power generation of 3 percent for 2020 is not likely to be a driver for substantial additional investment in renewable energy, whereas a target of 9 percent is likely to be high enough to serve as a catalyst for additional investment, assuming there are sufficient incentives and penalties to encourage compliance.[28]

Table 3. ERI 2050 Study: Wind and Solar Generation in 2020 as a Percentage of Total Power Generation under Three Scenarios[29]

Power Generation (TWh)	Energy Efficiency Scenario	Low Carbon Scenario	Enhanced Low Carbon Scenario
Wind Power Generation	200	353	423
Solar Power Generation	39	94	99
Total Power Generation	6211	5653	5479
RE percentage of total	3.85%	7.91%	9.53%

The quota should differentiate between different types of renewable energy technologies

According to recent reports, China is considering implementing two renewable energy quotas: one that applies to all forms of renewable energy, including hydropower, and one that excludes hydropower. Given that hydropower is a mature renewable technology in comparison to other renewable technologies, it would be wise for China to use these two-track targets.

Since renewable energy technologies vary widely in their cost, with wind and biomass being less expensive than solar and other less mature technologies, the quota should also include additional provisions to encourage a diverse renewable energy portfolio. In the United States, those states that did not create special provisions for solar energy have seen less expensive forms of renewable energy, such as wind used to meet the target, leaving solar without any accompanying benefit. There are several advantages to having a diverse renewable energy portfolio, such as providing greater market certainty for the next generation of renewable technologies, as well as utilizing intermittent renewable resources in a coordinated way to meet energy demand trends.

There are various mechanisms to accomplish this goal, such as: (1) setting different percentages within the overall target for different technologies, (2) setting minimum or maximum contributions from certain technologies, or (3) assigning a multiplier for certain technologies so that credits generated in a renewable credit trading scheme are assigned a higher value. While these policy mechanisms clearly benefit a diverse renewable portfolio, they increase the administrative complexity in enforcing the targets. Nevertheless, in the United States more than 12 states have created a solar set-aside that requires that a portion of the RPS specifically come from solar resources.[30]

For example, Nevada has set a minimum contribution of 5 percent from solar in its overall renewable portfolio standard and also uses a multiplier to incentivize solar PV, in which a generator will receive renewable energy credits equal to the number of kilowatt hours produced, multiplied by 2.4. The experience in Nevada, however, has shown that setting a specific solar target has been more effective than a multiplier mechanism in encouraging investment in solar PV. New Jersey, on the other hand, has taken a different approach by setting a renewable portfolio standard that includes different percentages for different renewable technologies in the overall target. In total, New Jersey is required to have 22.5 percent of its energy come from renewable sources by 2021. This is broken down further for three categories of renewable technologies (See Table 4).

Table 4. New Jersey's Renewable Portfolio Standard for 2021

Type of Renewable Technology	**Percentage**
Solar	2.12 percent
"Class I" Renewables such as wind, geothermal technologies, wave and tidal action, methane gas from landfills, and other biomass resources (provided that the biomass is cultivated and harvested in a sustainable manner).	17.88 percent
"Class II" Renewables such as hydropower facilities of 30 MW or less and electricity from resource-recovery facilities that meet certain conditions.	2.5 percent
	Total 22.5 percent

Verification of compliance with the quota should initially use a pure "tracking method" and the potential for adding a trading system should be explored

There are two general methods for verifying that renewable energy portfolio targets are being met: a pure *tracking method* in which the government verifies compliance with the relevant target, and a *tracking and trading method*, in which utilities are permitted to trade Renewable Energy Certificates (RECs, also known as renewable energy credits) created when a certain unit, such as one megawatt hour, of renewable electricity is generated.[31] Given the current state of China's legal and regulatory system, a pure tracking method, in which grid companies would submit documents to a central government agency regarding their purchase of renewable power, would be the most effective option.

Grid companies should be required to submit to SERC copies of each of their power purchase agreements with renewable power generators and an annual report detailing the generation source and amount for all power purchased during the previous year. These filings should be checked against data reported by the power generators, including any data reported via real-time communications equipment installed at the power generator, such as supervisory control and data acquisition (SCADA) equipment that generators may become required pursuant to the technical standards for interconnection to the grid (SCADA is discussed in more detail in Section C below). To ensure timely and accurate filing, the annual report should be made public and subject to substantial penalties for false or misleading information.

One question is whether it would be possible to implement a trading system in China in which grid companies and power generators could trade renewable energy credits for the excess or shortfall in meeting their targets. A trading mechanism has the potential to increase economic efficiency in meeting renewable generation targets by reducing administrative costs and increasing flexibility.

Also, it would allow grid companies in areas with few renewable resources, such as Beijing and Shanghai, to meet their target obligations by purchasing RECs from areas with rich renewable resources, such as Inner Mongolia and Gansu. However, an adequate legal and regulatory infrastructure must be in place and reliable generation data must be available for such a trading scheme to be successful and to prevent gaming of the system. While it may be premature to institute a nationwide REC trading scheme in the near-term, a pilot trading scheme could be developed to help lay the groundwork for implementing a national trading system in the mid to long-term. Trading of renewable energy credits is particularly helpful in encouraging distributed solar PV generation. As noted above, the State of New Jersey has implemented a renewable portfolio standard with an aggressive solar set-aside. To implement this policy, electricity suppliers that do not meet their solar target may choose to either pay an alternative compliance fee or they can meet their target by purchasing Solar Renewable Energy Credits (SRECs). Registered solar projects, which include small-scale, residential solar installations, can earn one SREC credit for every 1,000 kWh generated.[32] Earned credits are banked in an account, which can then be used to sell the credits to a purchaser using a tracking system. Since its inception, the SREC program has created an incentive for more than 6,000 small-scale solar installations, making New Jersey one of the fastest growing solar photovoltaic markets in the United States.[33] If China were to implement a similar system to encourage small-scale solar installation and building-integrated solar PV projects, the key would be ensuring that legitimate projects are registered, and that detailed and reliable records are kept with respect to the power generated by each registered project.

A target responsibility and evaluation system should be established to verify grid companies' performance in meeting quotas

According to recent reports, China is considering implementing a target responsibility and evaluation system to assess grid companies' compliance with their quota targets.[34] Performance evaluations of government officials—which determine whether officials are rewarded or penalized based on their performance in meeting economic, social, and environmental targets—have proven to be one of the most effective tools for implementing China's centrally determined targets at the provincial and local level. This governance tool has been used not only in evaluating government officials, but also to motivating the behavior of China's state-owned enterprises. Both State Grid and Southern Grid are state-owned enterprises, as are the Big 5 power producers, and therefore, most of the key players in the energy sector are influenced to some extent by non-market factors and must balance the firm's profit motive against centrally determined policy objectives.

Target responsibility and evaluation systems have proven to be an effective non-market tool for promoting achievement of energy and environmental goals, particularly during the Eleventh Five-Year period. For example, the State Council announced a program in 2007 for implementing national energy intensity and pollution reduction targets.[35] The implementation program included an annual evaluation system to assess the performance of the top 1,000 most energy-consuming enterprises (the so-called "Top 1,000 Program"), as well as the relevant provincial and local officials with supervisory responsibilities, in meeting the energy-saving targets set for the enterprises and regions. Under the program, leaders of the regions and enterprises that do not meet their assigned energy saving targets will not be given annual rewards or honorary titles; leaders in state-owned enterprises will not receive annual evaluation awards, and officials will not be promoted.[36]

The Top 1000 program has already achieved significant progress, indicating that the evaluation system has been effective at influencing the behavior of the top 1000 enterprises. By the end of

2008, the program had already met its five-year goal of reducing the combined energy consumption of the participating enterprises by 100 million tons of coal within the first three years of the program.[37] If a similar target responsibility and evaluation system could be devised to ensure grid company compliance with the quota system, it could serve as a strong compliance mechanism suited to China's unique system of governance.

Penalty provisions should be clearly defined and sufficiently stringent

As noted above, the amendments contain a penalty provision for non-compliance with the quota system. Whereas the original law stated that penalties would be imposed on grid companies that did not purchase the full amount of renewable power generated, the amendments have modified this provision so that penalties will now be imposed on grid companies not complying with the regulations regarding purchasing renewable power (i.e. the quota system). The amendments do not specify the details of the penalties for non-compliance; instead authority is granted to NEA, SERC, and MOF to set penalty regulations.

As noted above, the 2007 *Full Purchase Measures* include a similar penalty provision. Even though violations have been known to occur, there are no reported cases in which penalties have actually been imposed. There is no simple answer as to why this is the case, but the 2007 *Full Purchase Measures* contained numerous weaknesses that could be improved upon when drafting the new penalty regulations for the quota system:

1. **Define a Short Reconciliation Period**. The penalty regulations should set the length of time for the reconciliation period, during which any shortfalls could be remedied to ensure consistency and predictability. The *Full Purchase Measures*, in contrast, left the period for corrective action up to SERC's discretion to be decided on a case-by-case basis. The reconciliation period should be short—not exceeding three months—to ensure prompt compliance with the quota. This would compel grid companies to promptly rectify any failure to purchase the quota amount and serve as a stronger deterrent for non-compliance.

2. **Penalties Should be Automatically Triggered**. Once the reconciliation period has ended, if grid companies have not fulfilled their quota, non-compliance penalties should be imposed automatically without discretion. This would create a stronger deterrent for non-compliance and ensure that the target is being uniformly enforced. Currently, the *Full Purchase Measures* state that SERC *can* impose a penalty, but is not required to do so. Therefore, the regulations should state that SERC *shall* impose the penalty when a triggering event occurs. Automatic penalties will not only serve as a stronger deterrent, but also relieve SERC of the administrative burden of deciding on a case-by-case basis whether to impose a penalty.

3. **Setting the Penalty Amount High Enough to Discourage Non-Compliance.** Article 29 of the amended *Renewable Energy Law* provides that a non-compliance penalty fee with the renewable energy quota should be set "up to the value of the economic loss of the power generator." [38] It appears, though, that the implementing regulations will not be able to establish a non-compliance penalty above the value of the economic loss to the generator unless the penalty regulations are issued pursuant to a different provision or authority. However, setting the value of the penalty in terms of economic loss to the generator is unlikely to deter non-compliance. Only if the penalties are set significantly higher than the

price of purchasing the renewable energy can the penalties serve as an effective compliance mechanism.

4. **Rolling Over Shortfalls in Meeting the Quota**. In addition to paying the penalty, any shortfall should be rolled over to the following year or period to alleviate any incentive for grid companies to pay the penalty rather than purchase their quota. Since the quotas will be set as a percentage of overall power purchased, the shortfall should be rolled over as a percentage amount instead of an absolute amount. For example, if there is a 1 percent shortfall of renewable power purchased in one year, then the grid company should be required to purchase an additional 1 percent of renewable power the following year even though overall power consumption will likely have increased.

B. Formulating a Priority Dispatch Policy

As noted above, Article 14 now requires the NEA to formulate priority dispatch rules. The rules should address at least three issues: (1) financial and operational issues that arise in implementing priority dispatch, (2) procedures during grid disturbances, and (3) contractual arrangements regarding dispatch.

Financial and Operational Issues Raised by Priority Dispatch

Under a priority dispatch policy, the power dispatch sequence would be determined on the basis of each power plant's level of emissions or fossil fuel consumption per unit of power output. Because renewable technologies typically use very little or no fossil fuels and produce near-zero emissions, renewable resources would be the first to enter the dispatch supply curve, and would push technologies that use more fossil fuels and produce more emissions further down the dispatch schedule. To the extent that the supply of renewable energy increases while total electricity demand remains constant, or increases at a slower rate, there will be some excess supply of conventional power. As a result, fossil fuels that otherwise would have been burned to create electricity will now be saved.

As discussed above in Section III.A, since 2007 China has experimented with priority dispatch in five provinces. In Guizhou, a total of 1.35 million tons of standard coal equivalent were saved from January 2008 to September 2008 as a result of the trial dispatch policy.[39] However, a number of financial and technical issues have arisen during the pilot projects, which should be addressed in future priority dispatch regulations:

1. **Financial Mechanisms.** Altering the dispatch policy will create economic winners and losers. Since inefficient conventional power plants will produce less power as a result of the dispatch policy, they will experience a loss in revenue. In addition, the grid company's energy purchase costs will rise under the priority dispatch policy if it is meeting a larger portion of its energy demand from more expensive energy sources. A drastic and sudden reallocation of resources has the potential to undermine overall compliance with the priority dispatch system. Therefore, it is necessary that financial mechanisms are implemented to balance the financial loss experienced by conventional power plants and grid companies, with the environmental goals of the priority dispatch policy to ease the transition to a new dispatch policy.

2. **Operational Issues.** The implementation of priority dispatch can be technically difficult because of the general non-storability of electricity and the intermittent nature of renewable energy resources. Since electricity generated by a wind farm typically cannot be stored for future use, it must be dispatched entirely at the moment it is produced, even if this occurs during a period of low demand. The dispatcher must meet energy demand with a sufficient amount of energy supply even as demand fluctuates throughout a single day. If, for example, a wind farm is the first power generator in the dispatch sequence, the dispatcher will need to know the exact amount of wind power being produced as soon as possible in order to successfully match power supply and demand; otherwise, priority dispatch could lead to power outages and compromise the stability of the entire grid network.

   For this reason, it is necessary for renewable generators to provide real-time information to the dispatcher. In Spain, for example, wind power facilities must transmit the following information every 12 seconds to a coordinating body: (1) active power, (2) reactive power, (3) connected status, (4) voltage level, (5) wind speed and direction, if available, and (6) ambient temperature, if available.[40] On the basis of this information, the coordinating body is able to estimate the maximum output of the wind farm every 12 seconds. The technology that makes real-time information possible has become a required standard for wind interconnection to the grid and will be discussed below in section IV.C, *Technical Standards for Interconnection*.

Managing Grid Disturbances

Germany's priority dispatch experience could be useful for China in considering how to set its own policy. Under the 2008 amendments to the *German Renewable Energy Source Act*, grid system operators must "immediately and as a priority purchase, transmit and distribute the entire available quantity of electricity from renewable energy sources."[41] However, as a result of these amendments, the priority connection and purchase system was changed from an *unconditional* system to a *conditional* one, in which there are exceptions in certain defined circumstances by which the grid is permitted "to take technical control over installations connected to the grid."[42] As a result of these changes, grid companies are now permitted to force the curtailment of power generated from renewable facilities with a capacity of over 100 kilowatts (kW) if all of the following conditions are met:

1. The grid would otherwise be overloaded if curtailment were not to take place;

2. The grid has ensured that the largest possible quantity of electricity from renewable sources and combined heat and power is already being purchased; and

3. The grid has reported the current situation to the relevant region of the grid system.

If a qualifying situation occurs and power generation is curtailed, the grid company is required to immediately publish a notice of the event on its website to ensure complete transparency. Notably, the German law includes a "hardship clause" which states that *even if* the grid is permitted to curtail generation in situations that meet the above three requirements, the grid is still required to compensate the renewable generator for the curtailment, on the basis of either a negotiated price or, ,in the event an agreement cannot be reached, the feed-in tariff price minus the expenses saved by the generator as a result of the curtailment.[43] One transmission grid operator in Germany has

negotiated an agreement with the industry and agreed to pay 90 percent of the lost revenue in such situations.[44]

When drafting its regulations, China should consider specifying similar conditions that make clear when it is permissible for grid companies to deviate from the mandatory connection and purchase policy. As required in the German model, the burden should be on the grid company to show at least the following factors: (1) the necessity of the deviation from the mandatory purchase policy, (2) steps taken to prevent the deviation and to mitigate its severity and (3) immediate and full disclosure of the deviation.

In addition, the regulations should set forth clear requirements for compensation. According to recent reports, China's draft regulations may require grid companies to compensate the power generators if the deviation is "not justified." While this would be an improvement over the current situation, it does not provide the same level of certainty to the generators as is provided under the German model, which requires the grid to compensate the power generator even in those circumstances where the deviation is justified. The purpose of the German provision is to hold the grid operators responsible for grid overload situations, thereby encouraging the grid to invest in upgrading their infrastructure as well as ensuring a greater degree of predictability for renewable power generators.

Although defining the necessary conditions for grid curtailment has certain benefits, the disadvantage of permitting exceptions to the mandatory purchase system is that it will add to the administrative cost of implementing and enforcing the mandatory purchase policy. To ease the administrative burden, the requirements should be set stringently enough such that curtailment is not permitted under normal conditions.

Contractual Arrangements Regarding Dispatch

As noted above, some grid companies and renewable power generators have agreed in their PPAs to grid curtailment under certain circumstances, despite the *Renewable Energy Law's* requirement that all power must be purchased and the *Full Purchase Measures's* limited exception for curtailment during a grid disturbance. This raises the question of whether there are certain circumstances under which the parties to a PPA should be granted the contractual right to curtail power generation in certain circumstances even if it would otherwise be a violation of the *Renewable Energy Law* and the implementing regulations.

In Germany, under the 2008 amendments to *the Renewable Energy Sources Act*, transmission operators and power generators now have the right to enter into a contract that deviates from the priority purchase system.[45] These contracts typically allow wind companies to interconnect a new wind project if they agree to follow curtailment orders without demanding any compensation during the curtailment. One of the advantages of allowing the parties to contract around the priority purchase system is that it can lead to the connection of certain renewable generating facilities that otherwise would not have been connected to the grid if an adequate grid network has not yet been built in that area. One German transmission operator estimates that these contractual arrangements have allowed for more than 1 GW of additional wind capacity to be constructed in its service area over a three-year period.[46] Therefore, by allowing parties to agree to grid curtailment under specified conditions by contract it has allowed for more renewable energy to be connected to the grid.

Although permitting renewable power generators and grid companies to contractually agree to grid curtailment might have a similar benefit in China, the potential for misuse of this deviation from the law by contract is high and weighs against the potential benefits. Power purchase agreements in China are generally not negotiated and the terms are generally dictated to the renewable generator by the grid company based on a formal agreement. In China's single-buyer utility system, grid companies have significantly greater bargaining power than their power generating customers, and this dynamic leaves renewable generators with very few legal options in the event that the grid company is not complying with its obligations under the law or under their contractual arrangements.[47] In light of this imbalance in bargaining power, the parties' freedom of contract should be restricted to the extent the contractual provisions are inconsistent with laws and regulations, in order to protect the interests of the renewable power generator and the public.

If, however, the regulations do permit the parties to contractually agree to a dispatch arrangement that is otherwise inconsistent with the dispatch regulations, the regulations should still define certain rules for such provisions. For example, the grid company should still be required to compensate the renewable generator in those instances under a so-called "take or pay" provision that requires that the generator be compensated for its available capacity even if the power was not actually dispatched. Furthermore, there should be a cap on the amount of generation that can be curtailed, such that the instances of grid curtailment do not exceed a certain level during a particular period. Without effective rules regarding contractual curtailment provisions, renewable power generators will continue to face a grid bottleneck when it comes to selling all of the power they generate.

C. Setting Technical Standards for Interconnection

Setting compulsory national standards for interconnection can be a positive force for improving grid stability as well as promoting the development of renewable technologies. For example, the development of national grid codes in the United States has helped to advance wind turbine technologies that ultimately make it easier to integrate wind projects into the grid.[48] Although grid codes around the world vary in many respects, there are certain common features of successful grid codes for wind power in the United States and Europe.

Technical Requirements

Many grid codes around the world require that wind turbines have certain technical capabilities to maximize grid stability, including (1) low-voltage ride through (LVRT) capabilities, (2) the capability to maintain a particular power factor and (3) remote supervisory control and data acquisition capability.

In many countries in Europe and the United States, wind turbines are required to demonstrate LVRT capability in order to be connected to the grid. LVRT helps ensure that wind turbines and large wind arrays can remain online when system voltage drops instead of tripping offline, which improves the overall reliability and stability of the grid network. The technology can be expensive, and thus, discussion of an LVRT requirement has already aroused some debate among China's wind industry.[49] One concern is that LVRT technology may need to be licensed from foreign firms that own the relevant patents, but several Chinese wind turbine manufacturers such as Goldwind and Sinovel have already begun producing turbines with this technology. As wind penetration levels continue to increase rapidly over the next decade, it will become increasingly important that wind

turbines have this capability and, therefore, the potential costs of LVRT are outweighed by the necessity of its installation for grid stability. In addition, there are two issues that must be addressed: (1) whether those wind turbines already in operation that do not posses LVRT technology will need to be retrofitted with the necessary capabilities, and (2) if so, who will pay for the upgrade. With regard to the first question, wind turbines without LVRT could be "grandfathered" and not required to be retrofitted, or alternatively retrofitting could be required when a wind turbine requires a major refurbishment for other reasons. Another option would be to require that all wind turbines above a certain capacity be retrofitted with LVRT. With regard to the second question, cost could either be borne by the wind turbine owners directly or spread nationwide on all wind energy consumers.

In addition, grid codes around the world typically include power factor requirements to support power system voltage. The lower the power factor of the system, the more reactive power that is required to meet the load. Therefore, grid codes attempt to maximize the system power factor to reduce generation requirements on the system. In the United States for example, wind generators are required to have the capability to control their reactive power within the 0.95 leading to 0.95 lagging range.[50] However, given the significant costs associated with providing this capability, a wind generator may be exempted from this requirement if the required interconnection study concludes that it is unnecessary.[51] In cases where it is necessary to maintain system stability, developers are required to install equipment that provides reactive power to enhance the system power factor. An interconnection study will also be undertaken to determine whether switched capacitors will be sufficient to meet this requirement or whether power electronics are needed. These facilities, however, can add significantly to the cost of a wind project, and thus, China must design a standard that effectively balances the costs to the renewable generator and/or the grid company with the environmental benefits of wind energy and added stability for the grid.

The wind interconnection standard in the United States also requires remote supervisory control and data acquisition (SCADA) capability, which enables real-time communications and data exchange between the power generator and the grid. Requiring SCADA capability would also improve the effectiveness of the priority dispatch policy because it would allow real-time communications to take place between the generator and the dispatchers. An additional benefit of requiring SCADA technology is that it also allows the generator to optimize the performance of the wind farm through performance monitoring using the SCADA data.

Importantly, small-scale renewable generators should be exempted from such costly equipment requirements and should comply with a separate, interconnection standard designed that is appropriate for small generators. In general, the loss of a single small generator because of system disturbance will not significantly compromise system reliability. The standard for wind interconnection in the United States only applies to wind plants with an installed capacity over 20 MW. It is also important to allow for small-scale, residential renewable installations to be permitted to connect to the grid without having to meet the same standards as utility-scale projects, and instead require them to meet more appropriate technical requirements for their scale.

The Standard-Setting Process

The amendments to the *Renewable Energy Law* do not specify who will set the standards and how they will be monitored. Although non-mandatory technical guidelines for wind, solar and geothermal were issued in China in 2005, compulsory national standards do not currently exist. As noted above, the State Grid Company currently uses its own "enterprise" standards for interconnection to its grid

network, but these standards were developed by the grid company alone and without public input. Draft wind power technical standards, developed for the NEA, are currently under review.[52]

National standards should be developed through an inclusive, transparent process involving all of the relevant stakeholders. For example, in the United States the grid code for interconnecting wind farms to the grid was issued after nearly two years of stakeholder input from power generators, trade associations, transmission providers and regulators. A similar committee of all the relevant stakeholders should be established in China to participate in the development of the standards. As noted above, technical standards will now be a condition for connection to the grid. Therefore, setting technical standards for interconnection in a way that is fair and inclusive is important to prevent this exception to the mandatory connection and purchase policy from becoming so broad as to undermine the purpose of the policy by preventing the interconnection of what would otherwise be qualifying projects.

D. Improvements to the Renewable Energy Development Fund

The amendments regarding the Renewable Energy Development Fund are a promising development, but their effectiveness will ultimately depend on the requirements set forth in the implementing regulations. We provide the following recommendations for improving the effectiveness of the fund.

Subsidies should be distributed from the fund as frequently as possible and on a regular basis.

As noted above, subsidies paid to provincial grid companies for purchasing renewable energy are equalized on a 6-month basis under the current practice. Despite the *Surcharge Allocation Measures* requirement that grid companies pay the renewable generator each month for the power purchased, in practice renewable generators are being paid the subsidies by the grid companies on a 6-month basis, putting a strain on the generators' cash flow, increasing the risk for investors and thus increasing the overall cost of a project. Therefore, to improve the compensation process, subsidies should be distributed on a monthly basis from the fund to compensate grid companies more effectively, which in turn should lead to a more effective allocation of the subsidies to renewable generators.

Allocating subsidies on a biannual basis is also problematic for attracting international financing because interest payments paid under an international financing facility will generally be collected on a monthly basis. Since the subsidies are received on a 6-month basis, the timing of the revenues paid in will not match up with the interest payments due out.

There are two main reasons why attracting international financing is important for the sustainable growth of China's renewable energy industry. First, although currently credit is widely available from Chinese banks at preferential rates, this dynamic could change if there are significant changes in China's macroeconomic situation. For this reason, encouraging a diversity of funding sources is important to ensure that credit for renewable projects is available even if China's macroeconomic conditions fluctuate. Second, many renewable equipment makers, particularly in the wind industry, are looking to expand their markets outside of China. However, one problem they face is that international banks are hesitant to extend credit to projects that install Chinese wind turbines because they are "untested" and present unknown risks on return. Therefore, it is to the benefit of

China's renewable energy industry to encourage international financing of projects in China to help the industry to overcome the initial hurdle of being unfamiliar to international banks.

Funding criteria and application process should be transparent.

In order for the fund to be effective in funding renewable energy projects, a transparent application process should be established. The application process should include, at minimum, detailed eligibility criteria for deciding which projects will be awarded funding as well as performance requirements for projects in order to ensure that the fund is applying its capital efficiently towards the most qualified projects.

E. Provincial and Local Renewable Energy Planning

As noted above, the amendments now require the provincial government to file their renewable energy development plans with NDRC and SERC before they may be implemented, thereby creating greater central government oversight over provincial-level renewable energy planning nationwide. The recommendations are provided to improve the effectiveness of provincial renewable energy development.

Provincial plans should be made public.

After filing the provincial plans with NDRC and SERC, the provincial plans should be made publicly available. Public disclosure of provincial-level renewable energy plans serves a number of significant functions. First, by allowing the public to access the local renewable energy plan for their province it will raise public awareness about the role of renewable energy in their province, which is ultimately essential for maintaining public support and funding for renewable energy projects. In addition, public disclosure of renewable energy planning will help encourage additional investment in renewable energy by providing investors with confidence and predictability regarding the expected development of renewable energy in a particular region.

National plans should not discourage voluntary provincial initiatives.

A number of provinces have been early leaders in renewable energy because of the economic benefits in addition to the environmental benefits that renewable energy projects and production can bring to their province. One concern is that certain provinces that have their own aggressive renewable energy policies may end up being constrained should the central government choose to reign in the growth of renewable energy in that province.

For example, a number of more developed provinces (such as Jiangsu and Guangdong) have instituted additional, province-wide feed-in tariffs or other incentive programs to encourage the deployment of renewable energy within their province. As a result of the changes to the funds-flow process in the amendments, the surcharges collected in these provinces will now be paid directly into the Renewable Energy Development Fund and the province will not be permitted to retain any surplus collected to pay for its additional feed-in tariff. It is unclear what will happen to those existing projects that have already been granted a provincial feed-in tariff and whether this program will continue going forward. Therefore, these provinces may need to devise alternative mechanisms for raising capital if they wish to maintain their own incentive programs. This could be achieved by levying a province-wide renewable energy surcharge in addition to the national surcharge or through

surcharges on fossil fuel power generation. The central government should not prevent a province from taking such proactive measures should it choose to pursue a more aggressive renewable energy policy. Instead, the central government should consult with the province on how it can continue to fund a provincial feed-in tariff through its own efforts.

V. Conclusion

The amendments to the *Renewable Energy Law* demonstrate that China is pushing ahead with its vows to clean up its energy supply and is working on overcoming some of the barriers that have stood in the way of achieving this goal. However, there are a number of questions raised by the amendments, and their significance will ultimately depend on the strength of the implementing regulations as well as the central government's commitment to enforcing them. The key recommendations for improving China's renewable energy legal framework fall under the following categories:

- **Establishing and Implementing an Effective Renewable Power Quota System**. In setting a renewable power quota, the quota amount should increase gradually and predictably every few years and set high enough to encourage additional investment in renewable energy. In addition, the quota should differentiate between different types of renewable energy technologies to encourage the development of a diverse renewable portfolio. To ensure compliance with the quota, the penalty provisions should be set high enough to discourage non-compliance and should include automatic penalties when the period for reconciliation has ended. Besides financial penalties, a target responsibility and evaluation system, similar to the system used for China's energy intensity, SO_2 and Chemical Oxygen Demand (COD) reduction targets, should be created to verify grid companies' compliance with the quota system. In the mid- to long-term, the possibility of establishing a trading system for renewable energy credits that could lower compliance costs should be explored.

- **Devising an Effective Priority Dispatch Policy**. The enactment of a nationwide priority dispatch policy would represent a significant step forward for China's electricity system. However, to ensure that the transition to a new dispatch system is smooth and effective, there are financial and operational issues that need to be addressed. These concerns must be balanced against the environmental goals of the policy to ensure that these goals are not undermined by the policy's implementation. In addition, the regulations should create a detailed protocol for dispatch during grid disturbances that addresses (1) the necessity of the deviation from the mandatory purchase and priority dispatch policies, (2) the steps taken to prevent the deviation and to mitigate its severity and (3) immediate and full disclosure of the situation. Furthermore, once dispatch regulations are put in place, the parties to a power purchase agreement should not be permitted to agree to any provisions that would the power purchased from a renewable power generator or conflict with priority dispatch rules.

- **Setting Appropriate Technical Standards for Interconnection**. National standards for the interconnection of different renewable technologies to the grid should be developed through an inclusive and transparent process. The technical standards for interconnection for wind farms above a certain capacity level should include requirements regarding low-voltage ride through capabilities, supervisory control and data acquisition capabilities, as well as power factor requirements. Importantly, small-scale projects should be exempted from

these interconnection standards and separate standards should be created that encourage distributed generation without sacrificing grid stability.

- **Improving the Functioning of the Renewable Energy Development Fund**. The amendments to the Renewable Energy Development Fund contemplate a compensation mechanism that is more efficient than the equalization mechanism that currently exists. However, for the fund to be a more effective mechanism, subsidies should be distributed from the fund as frequently as possible and on a regular basis in order to ensure prompt compensation to the grid companies and the renewable generators. In addition, the regulations should clearly define the criteria used for determining which projects are eligible to receive funding and the application process should be made more transparent to ensure effective use of the funds.

- **Increased Central Oversight over Provincial Planning**. With greater central government oversight over provincial-level renewable energy planning, it is likely that the development of renewable energy in China will now progress with greater coordination among the central and local governments. Provincial plans should be made public to increase transparency and predictability, making it possible to gain the necessary support of investors and the public. In addition, national plans should not discourage voluntary provincial initiatives that can be funded through province-wide funding mechanisms.

While China has made significant progress in increasing its renewable energy capacity in recent years, much more needs to be done for China to achieve a diverse, large-scale renewable portfolio capable of keeping pace with its rapidly increasing energy demand. The amendments to the *Renewable Energy Law* demonstrate that China's central government is committed to overcoming some of the barriers that have stood in the way of achieving this goal. However, ultimately, the success of China's renewable energy program will depend on the details of the regulations and programs that have yet to be formulated, as well as the government's commitment to implementation and enforcement of these regulations and programs at each level throughout the country.

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ENDNOTES

[1] Although non-fossil fuel energy accounted for 9.9 percent of China's primary energy consumption in 2009, the majority of this is supplied by hydropower, which accounted for over 15 percent of China's total electricity generation as of the end of 2009. In comparison, wind energy accounted for less than 1 percent of total electricity generation during the same period, and the shares of solar, biomass, and geothermal energy were so small that they do not appear as separate items in official national statistics. *See* China Electricity Council, "2009 Electricity Industry Statistics Annual Report, Basic Data Summary" (2009年全国电力行业统计年报基本数据一览表), available at: tj.cec.org.cn/news/showc.asp?id=130958 and Xinhua, "Levying carbon tax, promoting low-carbon education proposed," March 10, 2010, available at: www.china.org.cn/china/NPC_CPPCC_2010/2010-03/10/content_19572382.htm.

[2] *The Renewable Energy Law of the People's Republic of China* (original 2005 version) is available online in Chinese at: news.xinhuanet.com/energy/2008-06/18/content_8392646.htm and in English at www.npc.gov.cn/englishnpc/Special/CombatingClimateChange/2009-08/25/content_1515301.htm.

[3] The energy body under the NDRC was previously the NDRC Energy Bureau. The National Energy Administration was formed in March 2008 and replaced the NDRC Energy Bureau. See Erica S. Downs, "China's 'New' Energy Administration," *China Business Review*, November-December 2008, available at: www.brookings.edu/%7E/media/Files/rc/articles/2008/11_china_energy_downs/11_china_energy_downs.pdf.

[4] *2007 Mid- and Long-Term Development Plan for Renewable Energy* (可再生能源中长期发展规划), available at: www.sdpc.gov.cn/zcfb/zcfbtz/2007tongzhi/W020070904607346044110.pdf . The *2007 Mid- and Long-Term Development Plan for Renewable Energy*'s target of having 15 percent of primary energy consumption be supplied through renewable energy was expanded in 2009 to include non-fossil energy sources other than renewables, i.e., nuclear.

[5] *See* Jan Hamrin, *China's new Renewable Energy Law: the California connection*, 36 Golden Gate U. L. Rev., 413-430 (2006). *See also* 2008 Renewable Energy Sources Act (Germany), available at: www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eeg_2009_en.pdf.

[6] *Measures on Grid Company Full Purchase of Electricity from Renewable Energy* (电网企业全额收购可再生能源电量监管办法), SERC No. 25 [2007], available at: www.gov.cn/flfg/2007-08/01/content_702636.htm.

[7] *See, e.g.*, *Notice Regarding Requirements for Construction and Management of Wind Farms*, NDRC Energy Bureau No. 204 [2005], available at: www.ndrc.gov.cn/nyjt/nyzywx/t20050810_41378.htm. For an in-depth analysis of China's concession programs and wind power pricing see Baker & McKenzie et al, *Report on China's Renewable Energy Laws* (May 2009) 61-63, available online at: advancedbiofuelsusa.info/wp-content/uploads/2009/05/china_renewableenergylaw_article_may09-bakermckenzie.pdf

[8] *Notice on Perfecting Wind Power Feed-In Pricing Policies*, 《完善风力发电上网电价政策的通知》NDRC Pricing Bureau, No. 1906 [2009], available at: www.ndrc.gov.cn/zcfb/zcfbtz/2009tz/t20090727_292827.htm.

[9] Although a second round of concession projects for solar PV, totaling 280 MW, was announced in mid-2010, there has been no clear indication of when the central government might set a feed-in tariff for solar PV, which would likely depend on policymakers' assessment of the state of current solar PV technologies and costs, and the value of setting a feed-in tariff at this time versus continuing with concession projects.

[10] Art. 7, *Interim Measures on Renewable Energy Electricity Prices and Cost Sharing Management* (可再生能源发电价格和费用分摊管理试行办法), NDRC Pricing Bureau, No. 7 [2006], available at: www.gov.cn/ztzl/2006-01/20/content_165910.htm.

[11] *Id.,* Art. 14.

[12] Residential and rural users continue to pay .001/kWh as of the end of 2009. *See*, *e.g., Notice on Adjustment of Electricity Price for the Eastern China Grid*, NDRC Pricing Bureau, No. 2924 [2009], available at: www.sdpc.gov.cn/zcfb/zcfbtz/2009tz/t20091120_314524.htm. The regulations do not differentiate between residential

and commercial users, but news articles have indicated that this rate increase may only apply initially to non-residential users.

[13] The amount of subsidies paid through the interprovincial exchange program during the first half of 2009 is available online at: www.sdpc.gov.cn/zcfb/zcfbtz/2009tz/W020091225564375714237.pdf. The amount of subsidies paid through the interprovincial exchange program during the second half of 2008 is available online at: www.sdpc.gov.cn/zfdj/jggg/dian/W020090701355271410435.pdf.

[14] Art. 8, *Interim Measures on Revenue Allocation from Renewable Surcharge* (可再生能源电价附加收入调配暂行办法), NDRC Pricing Bureau, No. 44 [2007], available at: www.lawstar.cn/cacnew/200703/30004775.htm.

[15] *Interim Measures on the Renewable Energy Development Special Fund*, Ministry of Finance, Finance and Construction Department (可再生能源发展专项资金管理暂行办法), No. 237 [2006], available at: www.cicpa.org.cn/Column/Information_regulations/Finance/200804/t20080429_9592.htm.

[16] *See generally*, Evan Osnos, "Green Giant: Beijing's crash program for clean energy," *New Yorker*, December 21, 2009, available at: www.newyorker.com/reporting/2009/12/21/091221fa_fact_osnos.

[17] In addition to the Golden Sun program, other subsidy programs pursuant to this regulation include: *Interim Measures on the Wind Power Equipment Production Special Fund* (风力发电设备产业化专项资金管理暂行办法), Ministry of Finance, Finance and Construction Department, No. 476 [2008], available at: www.investzj.gov.cn/wjc/212.doc and the *Interim Measures on the Straw Biomass Utilization Subsidies Fund* (秸秆能源化利用补助资金管理暂行办法), Ministry of Finance, Finance and Construction Bureau, No. 735 [2008], available at: jx.mof.gov.cn/lanmudaohang/zhengcefagui/200904/t20090413_131995.html

[18] *See Interim Measures on Golden Sun Demonstration Project Financial Subsidies Fund* (金太阳示范工程财政补助资金管理暂行办法), Ministry of Finance, Finance and Construction Bureau, No. 397 [2009], available at: jjs.mof.gov.cn/zhengwuxinxi/zhengcefagui/200907/t20090721_185102.html

[19] China Electricity Council, "2009 Electricity Industry Statistics Annual Report, Basic Data Summary" (2009年全国电力行业统计年报基本数据一览表), available at: tj.cec.org.cn/news/showc.asp?id=130958; China Wind Energy Association, 2009 China Wind Installed Capacity Statistics (2009年中国风电装机容量统计), available at: www.cwea.org.cn/upload/201006102.pdf.

[20] *The 2009 Amendments to the Renewable Energy Law of the People's Republic of China* are available online in Chinese at: www.npc.gov.cn/huiyi/cwh/1112/2009-12/26/content_1533217.htm.

[21] See NDRC, *Renewable Energy Development Plan for the Eleventh Five Year Period* (可再生能源发展"十一五"规划), available at: www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/W020080318381136685896.pdf

[22] *Measures on Energy Saving Electricity Dispatch (Trial)* (节能发电调度办法（试行）), State Council Office, No. 53 [2007], available at: www.sdpc.gov.cn/zcfb/zcfbqt/2007qita/t20070828_156042.htm.

[23] The standards include grid connection standards for wind (GB/Z 19963-2005), solar photovoltaic (B/Z 19964-2005) and geothermal (GB/T 19962-2005). *See Announcement of Newly Approved National Standards of the People's Republic of China*, 2005 No.13 (Total No.87), available in English at www.sac.gov.cn/templet/english/countryBulletinByNoEnglish.do?countryBulletinNo=20051387 and in Chinese at www.sac.gov.cn/templet/default/countryBulletinByNo.do?countryBulletinNo=20051387.

[24] *See* "Pu Haiqing: Renewable Energy Law Amendments Reflect Five Major Advancements" (Chinese), December 23, 2009, available at: npc.people.com.cn/BIG5/14997/53063/10640181.html. Pu Haiqing is the Deputy Chair of the Environment and Natural Resources Committee of the National People's Congress.

[25] The draft amendments were released in August 2009 and included an explanation for the proposed draft amendments. The final amendments passed in December 2009, however, do not include an official explanation. The draft version and final amendments differ in a number of respects, but the draft Art. 8 related to provincial planning is exactly the same as the final version. The draft amendments are available online at: www.china.com.cn/policy/txt/2009-08/28/content_18422927_2.htm.

[26] *See also* Center for Resource Solutions, *Designing a Renewable Portfolio Standard: Principles, Design Options and Implications for China* (2000), available at: http://www.resource-solutions.org/pub_pdfs/IntPolicy-Final_RPS_Options.pdf.

[27] See Anne-Marie Cuneo, "Renewable Portfolio Standards: the Nevada Experience," available at: www.cleanenergystates.org/JointProjects/RPS/RPS_Presentation_Cuneo_July_2008.pdf.

[28] Energy Research Institute, *China's Low Carbon Development Pathways by 2050: Scenario Analysis of Energy Demand and Carbon Emissions*, pp. 73-74 (Sept. 2009). This study estimates power generation under three different scenarios: Energy

Efficiency Scenario, Low Carbon Scenario and Enhanced Low Carbon Scenario. To be clear, none of these scenarios are projections about expected power generation in 2020, but are modeled scenarios based on different assumptions.
[29] Each of the scenarios embodies various assumptions with respect to a multitude factors that are not limited to investment in renewable energy, including the success of China's energy efficiency measures and overall structural adjustments to the Chinese economy.
[30]Rusty Haynes, "50 States, 30 Directions: Making sense of state solar policy," June 23, 2009, Database of State Incentives for Renewables and Efficiency, available at: www.dsireusa.org/documents/PolicyPublications/IREC_webinar.ppt#345.
[31] For more information on state REC tracking systems, see K.S. Cory and B.G. Swezey, "Renewable Portfolio Standards in the States: Balancing Goals and Implementation Strategies," National Renewable Energy Laboratory, December 2007, available at: www.nrel.gov/docs/fy08osti/41409.pdf. *See also* Center for Resource Solutions, *Designing a Renewable Portfolio Standard: Principles, Design Options and Implications for China*.
[32] *See* New Jersey's Clean Energy Program website: www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/new-jersey-solar-renewable-energy.
[33]*Id.*
[34] Liu Qi, "[NEA] Deputy Director Liu Qi's Speech on the Renewable Energy Law Amendments at the Conference of Implementation" (刘琦副局长在《可再生能源法》（修订）实施座谈会上的讲话), March 16, 2010, available at: nyj.ndrc.gov.cn./nygz/t20100427_343167.htm.
[35] *State Council Approves for Distribution the Notice on Implementation Scheme and Methods for Statistics, Monitoring and Evaluation of Energy Intensity and Pollution Reduction Work* (国务院批转节能减排统计监测及考核实施方案和办法的通知), State Council, No. 36 [2007], available at: www.gov.cn/zwgk/2007-11/23/content_813617.htm.
[36] NDRC, *Energy Consumption Per Unit GDP Assessment Implementation Program* (单位GDP能耗考核体系实施方案) (2007), Section 4, available at: www.china.com.cn/news/txt/2007-11/23/content_9282997.htm. *See also* Lynn Price, et al., "The Challenge of Reducing Energy Consumption of the Top-1000 Largest Industrial Enterprises in China," Energy Policy (August 2010).
[37] NDRC Notice No. 18 (2009) (regarding evaluation of Top 1,000 program, in Chinese), available at: www.ndrc.gov.cn/zcfb/zcfbgg/2009gg/t20091124_315017.htm.
[38] The language of the amendments in Chinese is: "处以可再生能源发电企业经济损失额一倍以下 的罚款." There is some ambiguity as to whether the appropriate translation of this phrase is "up to the value of the economic loss" or "up to twice the value of the economic loss." In this white paper, we assume the appropriate translation is "up to the value of the economic loss" because the official translation of the original law is "up to the value of the economic loss" and the Chinese language version of this section is unchanged under the amendments. Currently, there is no official English translation of the amendments.
[39]"The First National Efficiency Dispatch Program Searches for Success" (国内首家节能发电调度 探索成功), International Energy Network, November 5, 2008, available at: www.ce.cn/cysc/ny/dl/200811/05/t20081105_17290086.shtml.
[40] National Renewable Energy Laboratory, *Wind Energy Curtailment Case Studies: May 2008-May 2009 (NREL Curtailment Case Studies)*, October 2009, p.34, available at: www.nrel.gov/docs/fy10osti/46716.pdf.
[41] 2008 Renewable Energy Sources Act (Germany), Section 8.1.
[42] *Id.* at Section 11.1
[43] *Id.* at Section 12.
[44] *NREL Curtailment Case Studies* at 40.
[45] 2008 Renewable Energy Sources Act (Germany), Section 8.1.
[46] *NREL Curtailment Case Studies* at 39.
[47] For this reason, there are no known cases of renewable generators initiating litigation for a breach of contract or other violation of the law, regardless of the seriousness of the violation.
[48] *See* Federal Energy Regulatory Commission, Orders 661 and 661A, available at: www.ferc.gov/industries/electric/indus-act/gi/wind.asp.
[49] For a discussion of the debate surrounding the necessity of LVRT in China, see Liu Weixun, "Debate Over Regulations Establishing Wind Power Standards," Economic Observer, April 8, 2010, available in English at www.eeo.com.cn/ens/Industry/2010/04/08/166945.shtml and in Chinese at www.eeo.com.cn/eeo/jjgcb/2010/03/29/166224.shtml.

[50] In some cases, grid companies in China will retain the right in their PPA with a wind power facility to charge the generator 0.01 RMB per kVArh of reactive power if the facility's power factor is less than 1.
[51] Robert Zavadil, et al., *Queuing Up: Interconnecting Wind Generation into the Power System*, IEEE Power and Energy Magazine, November/December 2007, pp. 47-58, available at: www.awea.org/utility/pdf/04383123Queuing.pdf.
[52] Liu Weixun, "Debate Over Regulations Establishing Wind Power Standards."