AFFORDABLE, RELIABLE AND SUSTAINABLE: A NEW ROUTE FOR CHINA'S RENEWABLE ENERGY MARKET

BY
MICHAEL ROHWER, VERMONT LAW SCHOOL
CHEN HUIZHEN, SUN YAT-SEN UNIVERSITY

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INTRODUCTION

China's economic blossoming has coincided with growing energy demand. The two indices are directly linked because affordable, reliable and sustainable energy sources provide a foundation for productivity. However, China's current energy mix is not affordable, reliable and sustainable in the long-term. Renewable energy sources are required for China to continue to enjoy economic growth.

China relies on fossil fuels for nearly 80 percent of its energy demand. Fossil fuels are not sustainable because of their contribution to the national pollution problem and global climate change. Neither are fossil fuel sources reliable for China due to the recent need to import fuel to meet demand and as evidenced by the recent agreement with Australia. Finally, fossil fuels are a finite resource with rising costs both economically, but also socially, politically and environmentally, it simply is not an affordable solution in the long term.

Renewable energy sources meet the requirements of affordability, reliability and sustainability once initial hurdles are cleared. These sources are sustainable and reliable

by definition. Affordability can be obtained once an efficient and competitive market is established to overcome the initial capital investment hurdles.

China has already identified the increased renewable energy use as a national priority and enacted legislation to that effect. To encourage the further development of renewable energy use in China, a viable and vibrant renewable energy marketplace must be established. Presently, the Chinese model for encouraging renewable energy investment relies on the Feed-In Tariff (FIT) model with high administrative involvement and significant inefficiencies built-in. As the electricity market continues to liberalize, these inefficiencies and the costs associated with an imposed price from the Feed-In tariff will drive up rates for consumers. Rate increases like this will be difficult for the consumers to bear and likely undermine China's goal of continued economic growth. The best way to develop a viable, vibrant renewable energy marketplace would be to institute a Renewable Portfolio Standard (RPS) that encourages capital investment, while providing strict enforcement mechanisms and energy price stabilization for consumers.

As the electricity market place continues to liberalize, an RPS is the superior choice as a model to increase renewable energy sources because it embraces the top-down administration, provides flexibility in design and assurances required to encourage foreign initial investment. It is not flawless, and a concerted effort in the design and enforcement processes is required for an RPS to be effective. These challenges may yet be overcome and as China's energy market liberalizes the need to ensure lowest-cost renewable energy solutions should drive an RPS to overtake the current model.

I – POPULAR SYSTEMS TO ENCOURAGE RENEWABLE ENERGY

In addressing the need to increase renewable energy sources, two different models rise to the fore-front of policy making. Some regions have chosen to pursue the Feed-In Tariff (FIT) approach, which guarantees payments to renewable energy developers on the basis of the electricity they produce. Alternatively, Renewable Portfolio Standards (RPS), mandating that electricity suppliers meet certain portions of the energy supply with renewable energy sources. Both policy tools have had successes and failures in various applications.

A. Feed-In Tariff Explained

FIT policies have been implemented in a number of various markets, most notably in Germany and Spain, and there are a number of variations on a common theme.[1] Generally speaking, FIT policies provide payment assurances to renewable energy developers for their electricity production.[2] Developers may be private citizens, corporations, local or municipal governments, or utilities.[3] Payments for renewable electricity generation may take the form of only the electricity itself, or bundled with renewable energy certificates, which represent renewable energy's "environmental attributes."[4] Such payments are made pursuant to long-term contracts, usually in the range of 15-20 years.[5] FIT policies are a production-based incentive where electricity production is rewarded via payment assurances, unlike capacity based incentives that

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[1] *See*, MARIO RAGWITZ & CLAUS HUBER, FEED-IN SYSTEMS IN GERMANY AND SPAIN AND A COMPARISON (undated) *available at* http://www.bmu.de/files/english/renewable_energy/downloads/application/pdf/langfassung_einspeisesysteme_en.pdf.

[2] Toby Couture & Karlynn Cory, *State Clean Energy Policies Analysis (SCEPA) Project: An Analysis of Renewable Energy Feed-In Tariffs in the United States*, NREL, May 2009 at 2.

[3] *Id.*

[4] *Id.*

[5] *Id.*

provide rebates for capacity installed.[6] It may be helpful to think of production-based incentives as payment per kilowatt hour, while capacity-based incentives are payments per watt.[7]

Payments under FIT policies fall into one of three different models. First, and the most common choice around the world, is methodologically based on the actual levelized cost of renewable energy generation, plus an identified rate of return.[8] This is popular because it creates a payment level that ensures profitability in renewable energy investment.[9] Secondly, payments may be based on the utility's avoided costs, which is calculated by the estimated market cost if other energy sources were used.[10] This may accomplished under locational marginal pricing, which will set different prices to the value of electricity produced at points of the network, assuming that the price influences the overall balance of supply and demand in the transmission system.[11] Alternatively, avoided costs may be measured based on the utilities projections of fossil-fuel costs. Finally, payment may be based on a fixed-price incentive.[12] Europe has employed the levelized cost model and experienced some success.[13] Conversely, the U.S. has experimented with the other two models and has seen more modest results.[14]

B. Renewable Portfolio Standard Explained

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[6] *Id.*
[7] *Id.*
[8] *Id.*
[9] *Id.*
[10] *Id.*
[11] *Locational Marginal Pricing*, ISO NEW ENGLAND, 2010, http://www.iso-ne.com/nwsiss/grid_mkts/how_mkts_wrk/lmp/.
[12] Couture, *supra* note 2, at 2.
[13] *Id.* at 3.
[14] *Id.*

Renewable Portfolio Standard policies require electricity suppliers to incorporate renewable energy as a specific portion of their electricity supply.[15] Targets for renewable energy contribution are set by the government or other authority and required of electricity suppliers. It encourages renewable developers to achieve these targets at the lowest cost through market competition.[16] These targets typically increase over time and the suppliers must demonstrate compliance on a regular basis.[17] Failure to comply with the target results in penalties levied by an administrator.[18] The RPS model establishes quantitative targets for the incorporation of renewable sources, but still permits the supplier to retain a sense of freedom in how to meet those targets.[19] Theoretically, this should provide a strong incentive for lowest-cost renewable energy.

Suppliers may choose to meet the RPS target through renewable energy facilities already owned by the supplier or through purchases of renewable electricity produced by independent generators.[20] Another alternative is to employ tradable renewable certificates to meet the targets.[21] This system works analogously to the tradable emissions permits under the Sulfur Dioxide Trading Scheme in the Clean Air Act.[22] These certificates are created when a megawatt-hour of electricity is generated from renewable sources, it may be traded separately from the underlying electricity generation,

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[15] Nancy Rader & Scott Hempling, THE RENEWABLE PORTFOLIO STANDARD: A PRACTICAL GUIDE xi (2001)
[16] *Id.* at 2.
[17] *Id.*
[18] *Id.*
[19] RYAN WISER, ET AL., EVALUATING EXPERIENCE WITH RENEWABLES PORTFOLIO STANDARDS IN THE UNITED STATES, 3 (2004) http://eetd.lbl.gov/ea/EMS/EMS_pubs.html.
[20] *Id.*
[21] Wiser, et al., *supra* note 19 at 2.
[22] Clean Air Act, 42 U.S.C. § 7651-7651o (1990).

or not.[23] It also provides revenue the renewable energy generators while giving the suppliers a means to achieve compliance with the RPS through purchase of certificates instead of directly purchasing electricity.[24] Experts believe that these certificates should exchange at a market price equal to the incremental cost, relative to standard fuel sources, of the marginal renewable generator required to meet the RPS targets.[25] Tradable renewable certificates increase flexibility for the electricity suppliers, reduce administrative burdens in tracking and enforcing compliance, and help to establish liquidity and depth in the renewable energy market.[26]

C. Benefits and Issues for Feed-In Tariffs

Europe has welcomed FIT policies with open arms and its experience has provided a solid foundation to educate future policy makers. A number of commentators have found that FIT policy has resulted in faster renewable energy project development than RPS, on average.[27] Additionally, there is evidence that when measured as cost per kilowatt hour paid for renewable energy generation, FIT is more cost effective than other models.[28]

These commentators offer two different rationales for why this is the case. For one, market competition schemes, like under RPS, place a great deal of risk on the shoulders

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[23] Wiser, et al. *supra* note 19 at 2
[24] *Id*.
[25] *See*, P. Morthorst, *The Development of a Green Certificate Market*, ENERGY POLICY ,29, 1085-1094
[26] *Id*. at 3
[27] *SEE*, D. FOUQUET, PRICES FOR RENEWABLE ENERGIES IN EUROPE 2006/2007: FEED IN TARIFF VERSUS QUOTA SYTEMS – A COMPARISON (2007),M. MENDONÇA, FEED-IN TARIFFS: ACCELERATING THE DEPLOYMENT OF RENEWABLE ENERGY (2007), KLEIN, ET AL., "EVALUATION OF DIFFERENT FEED-IN TARIFF DESIGN OPTIONS - BEST PRACTICE PAPER FOR THE INTERNATIONAL FEED-IN COOPERATION (2d ed. 2008), (noting the rate at which renewable energy project development occurs under different schemes for encouraging greater renewable energy use.)
[28] *See*, DE JAGER & RATHMANN, POLICY INSTRUMENT DESIGN TO REDUCE FINANCING COSTS IN RENEWABLE ENERGY TECHNOLOGY PROJECTS (2008), FOUQUET, *supra* note 27 (analyzing the cost-efficiency of different models for promoting greater renewable energy use).

of the developer and increase the "upward pressure on required returns."[29] FIT policies reduce these risks to the investor, and may lower capital costs through the guaranteed purchases.[30] Also, the competitive format of RPS models means that projects are frequently institutionally or corporately financed via equity, rather than debt financing.[31] Equity is more expensive than debt; therefore, there is a greater average cost of capital.[32]

There are several other advantages to FIT policies. First, there is higher investor security because the policies are designed with a built-in rate of return.[33] This also helps to lower administrative costs.[34] Second, is that it encourages public participation, which theoretically lowers social opposition to renewable energy projects.[35]

FIT policies also face issues that limit their effectiveness. First, FIT policies fail to accommodate for the high initial costs of renewable energy projects.[36] Long-term contracts are required under FIT schemes so that the large initial costs are amortized over the 15-20 year period, but the up-front costs are not addressed in any direct manner.[37] This is a major impediment for China, where investment risks are already high.

Next, in the event of expensive technology with high initial costs, FIT policies do nothing to protect consumers for skyrocketing rate increases.[38] This is related to the first problem, that FIT policies require long-term contracts and that in and of itself reduces the flexibility of the model, altogether.

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[29] Couture, *supra* note 2; DE JAGER & RATHMANN, *supra* note 28.
[30] Couture, *supra* note 2.
[31] *Id.* at 4
[32] *Id.*
[33] *Id.*
[34] DE JAGER & RATHMANN, *supra* note 27.
[35] Couture, *supra* note 2, at 4.
[36] *Id.*
[37] *Id.*
[38] *Id.*

Third, FIT payment schemes must be fluid and adaptable to the changes in the market.[39] The previously cited advantage of low administration costs is negated by this point. Additionally, frequent changes in the payment levels negatively impact the system and destabilize policies that require long-term contractual obligations.[40] This incubates investor uncertainty and therefore investor risk.

Fourth, a properly designed FIT policy has large up-front administrative costs.[41] The policy designers must conduct extensive research and commitment to set FIT payments on the levelized cost of renewable energy generation.[42] If this process is circumvented, and payments are not based on the levelized cost of renewable energy generation, more humble results are likely to result.

D. Renewable Portfolio Standard Advantages and Issues

There are a number of distinct advantages to the RPS as a means to encourage renewable energy. Based on specific standards, it drives a known quantity of renewable development and ensures buyers for that renewable energy.[43] It does this through market forces and market competition, which should result in lowest-cost development.[44] This is accomplished through flexibility granted to suppliers in how they deem it best to meet the targets set by the RPS.[45] This may included transferrable renewable certificates or direct purchase of electricity. Flexibility to contract is also preserved, as RPS policies function with either short-term or long-term agreements. Neutrality and fairness are inherent in the

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[39] *Id.*
[40] *Id.*
[41] *Id.*
[42] *Id.* at 5.
[43] Wiser, et al. *supra* note 19 at 4.
[44] *Id.*
[45] RYAN WISER, ET AL., RENEWABLES PORTFOLIO STANDARDS: A FACTUAL INTRODUCTION TO EXPERIENCE FROM THE UNITED STATES, 4 (2008).

system that harnesses market forces to direct lowest cost implementation and encourages technology.

Another advantage is the low cost of the RPS itself.[46] Suppliers carry the burden of demonstrating to the appropriate agency that it has met its target.[47] This alleviates the administrative costs of oversight for compliance.[48] Also, the suppliers carry the burden of deciding for themselves how to best meet the targets.[49] This means that there are not administrative costs in terms of deciding the best means to achieve targets. RPS policies also protect the consumer from sudden rate increases, due to the transferable renewable certificates that fosters lowest-cost production.[50]

RPS also maintains a great degree of flexibility. It can easily be adapted to apply in both restructured and monopoly electricity markets.[51] It supports a wide range of renewable technologies, while encouraging least-cost renewable sources. This is accomplished through "resource tiers" or "credit multipliers." Resource tiers identify the renewable source from which electricity suppliers would be required to purchase a portion of their overall supply.[52] Credit multipliers employ the transferrable renewable certificate system. High-cost technology, such as solar photovoltaics, would receive many transferrable renewable certificates for each kilowatt hour produced. This results in providing those technologies with more "credit" for the RPS than lower-cost sources.[53]

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[46] Wiser, et al., *supra* note 19 at 4
[47] Wiser et al., *supra* note 27.
[48] Rader & Hempling, *supra* note 15 at 58–59.
[49] *Id.*
[50] Wiser et al., *supra* note 19 at 4.
[51] *Id.*
[52] *Id.*
[53] *Id.*

This high level of flexibility across the board under RPS models is its greatest advantage. An RPS may be tailored to fit any situation or demand. However, there are downsides to the RPS system, too.

First, its flexibility also means that it is complex and is often difficult to design and implement properly.[54] The policy makers must invest a great deal of resources to ensure that the model is well composed and properly administered. For this reason its exact costs cannot be fully ascertained in advance.[55] Costs also vary depending on how suppliers choose to meet the targets.

Next, its flexibility also means that energy suppliers and producers/generators have a substantial influence on how the RPS performs.[56] For instance, if the participants do not reach any long-term contracts, the ability to finance projects with high initial cost is likely to be minimized. Such power in the hands of market players means that enforcement must be properly designed at the onset to mitigate abuse.

Finally, RPS policies require commitment on the part of the government. A well constructed RPS that fails to have proper support and assistance is doomed to fail as much as a poorly designed system.

II – CHINA'S CURRENT ENERGY PROFILE

The large geographic area of the nation helps to explain why China's energy sector has long been self-sufficient. Only recently has the nation had much of an impact on the global energy market, as a consumer. Rising prices, with social and environmental concerns is pushing China toward a new direction in energy sources.

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[54] Wiser et al., *supra* note 19 at 4.
[55] Wiser et al., *supra* note 19 at 4.
[56] *Id.*

A. Energy Structure

China stretches from the Pacific Ocean to the Himalayan and Kunlun Mountain ranges.[57] It embraces approximately the same land area as the United States.[58] Sheer size helps to explain the wealth of natural resources from which China is able to draw. Every one of the world's naturally occurring minerals appear in China and it globally ranks third in total mineral reserves.[59] Primary resources include coal, iron, copper, aluminum, tin, lead, zinc and mercury.[60] The most important of which, is coal.

According to the Institute of Geographic Sciences and Natural Resources Research, China's basic coal reserves reach 334.2 billion tons.[61] Located in the northern parts of the nation, China produces close to 40 percent of the world's coal.[62] However, that does not translate to high coal export rates.[63]

The reason that China produces so much coal, but exports so little is due to enormous internal demand. More than 60 percent of the nation's primary energy needs are met by coal.[64] Electricity, in particular, is almost 80 percent coal based.[65] Coal is the fuel for power stations, industry, business and households.[66] Even the popularity of

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[57] *Institute of Geographic Sciences and Natural Resource Research*, CHINA ACADEMY OF SCIENCES, http://english.igsnrr.ac.cn/web/index.aspx
[58] INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2007: CHINA AND INDIA INSIGHTS 255(2007).
[59] *Institute of Geographic Sciences and Natural Resource Research*, CHINA ACADEMY OF SCIENCES http://english.igsnrr.ac.cn/web/detail3.aspx?menuID=106&contentID=232
[60] *Id.*
[61] *Id.*
[62] BRITISH PETROLEUM. BP STATISTICAL REVIEW OF WORLD ENERGY JUNE 2007 (2007) http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2007/STAGING/local_assets/downloads/spreadsheets/statistical_review_full_report_workbook_2007.xls
[63] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: COAL RESOURCES, http://www.eia.doe.gov/oiaf/ieo/pdf/coal_tables.pdf
[64] INTERNATIONAL ENERGY AGENCY, *supra* note 58 at 262.
[65] *Id.*
[66] *Id.*

biomass in the more rural parts of the nation is declining in the face of rapidly growing coal demand.[67]

Much news has been made of China's economic grow, and those figures do not need to be replicated here. It is important to note that the world's fastest growing economy brings with it rapidly growing energy demand.[68] In some ways it is a chicken or the egg problem, because increased energy use can be seen as both a cause and a result of economic growth.[69] It seems fair to state that the two are inextricably intertwined with each other and that both can only be expected to continue their upward trajectory in the foreseeable future.

Until quite recently, China has been a predominantly self sufficient energy consumer. Biomass and coal were nearly the sole energy source in China until the 1960s.[70] Rural communities and the industrial sector simply had no other options at this time.[71] Major economic reforms in the late 1970s resulted in strong investment in energy-supply infrastructure and the electrification of close to 100 percent of Chinese homes.[72]

Growth in energy production continued into the next decades, as well. For example, total energy demand in 1980 was 604 Million tonne oil equivalent (Mtoe).[73] By 2005, demand had nearly tripled to 1742 Mtoe.[74] The rate of energy demand growth has

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[67] *Id.*
[68] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: CHINA, http://www.eia.doe.gov/cabs/China/Background.html
[69] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[70] *Id.* 265
[71] *Id.*
[72] *Id.*
[73] *Id.* at 263
[74] *Id.*

expanded even more dramatically in the years after the turn of century.[75] It also means that China's prior energy independence has waned and it now an important factor in the global energy marketplace.

Coal is the foundation for China's energy structure, and its use continues to grow. In 1990, coal provided for approximately 76 percent of all energy needs.[76] While coal demand has seen a proportional decline since then, to about 70 percent of the total energy consumption,[77] it is facing growth again recently owing to growth in electricity demand.[78] It has grown in demand at an annual rate of 12 percent since 2001.[79] The electricity sector is reliant on coal as a fuel source because 80 percent of China's electricity production is generated by coal.[80]

Oil composes 20 percent of total energy demand for China.[81] Only recently, since 1993, has China been a net importer of oil, despite being the fourth largest oil producer outside of the Middle-East.[82] Only the United States, Russia and Mexico out produce China.[83] Growth in automobile ownership is likely to stimulate more oil demand.

Great investment and interest from central authorities have led to rapid growth in hydroelectric production.[84] Hydropower has increased from only 2 percent of total

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[75] *Id.*
[76] DANIEL H. ROSEN & TREVOR HOUSER, CHINA ENERGY: A GUIDE FOR THE PERPLEXED 23 (2007)
[77] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: CHINESE COAL RESORUCES, http://www.eia.doe.gov/emeu/cabs/China/Coal.html
[78] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[79] ROSEN & HOUSER, *supra* note76, at 17.
[80] *Id.*
[81] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: CHINA http://www.eia.doe.gov/emeu/cabs/China/Background.html
[82] ROSEN & HOUSER, *supra* note76, at 20
[83] *Id.*
[84] *History*, CHINA THREE GORGES PROJECT, (2002) *available at* http://www.ctgpc.com/history/history_a.php

primary energy demand[85] to 6 percent from 2005 to 2006.[86] Since 2007, China has been the world's largest producer of hydroelectric power and will only grow with the activation of the Three Gorges Dam project, scheduled for 2011.[87]

Natural gas and nuclear remain cost prohibitive in many ways and that high cost prevents either source from contributing significantly to the energy structure.[88] Together they compose roughly 3 percent of the total primary energy demand.[89] Nuclear suffers because many of the cost-saving measures in construction commonly found in China, do not apply in the construction of Nuclear power plants due to safety concerns.[90]

Other renewable sources vary in current and projected future use. Biomass is still a popular option in many rural communities, but is declining rapidly, falling by half over the past 20 years.[91] Finally, wind sources have potential viability in the long-term, but only compose a minutia of the energy demand.[92]

Despite a current paucity of renewable sources in China's energy spectrum, it is a growing marketplace for a number of reasons. One of the reasons is the concerns over energy security. Reliance on coal, while preserving a sense of energy independence, raises questions about capacity to mine, transport, and use it cleanly and efficiently.[93] These issues require efficient industry framework and effective regulatory schemes.[94]

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[85] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 262.
[86] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: CHINA http://www.eia.doe.gov/emeu/cabs/China/Background.html
[87] US ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS: CHINA ELECTRICAL INFRASTRUCTURE http://www.eia.doe.gov/emeu/cabs/China/Electricity.html
[88] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[89] *Id.*
[90] ROSEN & HOUSER, *supra* note76, at 27.
[91] *Id.*
[92] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 262; ROSEN & HOUSER, *supra* note76, at 27.
[93] INTERNATIONAL ENERGY AGENCY, *supra* note 58
[94] *Id.*

Second, there is the over-riding issue of global climate change and local pollution problems. Fossil fuel use is a primary cause of greenhouse gas emissions, especially CO2.[95] It is a major contributor to local, regional and global air quality concerns.[96] For example, acid rain annually costs over $13.3 billion in harm to human health, farms, and forests.[97] These threats are likely to drive the cost of using fossil fuels as a power source outside of feasibility, even if only in the sense of externalities.

On the first count, china's coal and electricity sector must develop. The dramatic rise in electricity demand in 2002 demonstrated such shortcomings.[98] Production and delivery of coal could not meet the great level of demand.[99] Power outages struck the nation in the summer months of 2003 and 2004, and a staggering 105 GW of coal-fire electricity generation has sprung up to feed the demand.[100] Even though power supply has not appeared to meet demand, inadequacies still exist as a result of the reliance on coal.

There are stark regional inconsistencies in electrical production and consumption. As mentioned above, coal production primarily takes place in the north and inland provinces.[101] However, the greatest demand for coal itself, and the electricity is produces is centered along the eastern coastline.[102] The power plants are frequently constructed along waterways and adjacent to the mines themselves, rather than near the high demand

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[95] ELIZABETH C. ECONOMY, THE RIVER RUNS BLACK: THE ENVIRONMENTAL CHALLENGE TO CHINA'S FUTURE 73 (2004).
[96] *Id.*
[97] *Acid Rain Causes Annual Economic Loss of 110 Billion Yuan in China*, CHINA DAILY, Oct. 10, 2003.
[98] ROSEN & HOUSER, *supra* note76, at 23.
[99] *Id.*
[100] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 266.
[101] *Id.*
[102] *Id.*

regions.[103] Unprecedented demand for electricity, and reliance on coal as the fuel, place a strain on the infrastructure and capacity of the existing energy structure.[104]

Additionally, the environmental costs of relying on coal for 80 percent of electricity production strains the energy structure. The extraction, processing, transportation and burning of coal create obvious issues for local, regional and global air quality. For example, some estimates suggest that sulfur dioxide (SO2) directly resulted in more than $60 billion in economic damage in 2005, mainly in the form of acid rain.[105] Yet annual SO2 emissions have increased by close to 30 percent since 2000.[106] Pollution also is a detriment to the water and soil as a result of coal use and waste disposal.[107] The usual suspects are coking plants, and to a lesser extent, washeries.[108] The government has worked to address the problem, with some success, but greater efforts are needed.[109]

Carbon dioxide (CO2) emissions have been on the rise, and are growing at a faster rate than the growth in energy use, itself.[110] Even though climate change has not taken the foreground in China's environmental discussion, global pressures to ameliorate this problem will only increase with awareness of climate change's very real danger. China's first national action plan, in response to climate change was released in 2007.[111] However, it simply does not do enough, and more action is required.

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[103] *Id*.
[104] ROSEN & HOUSER, *supra* note76, at 38.
[105] *500b-Yuan Loss from Sulfur Cloud*, SOUTH CHINA MORNING POST, Aug. 4, 2006.
[106] *Id*.
[107] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 273-74.
[108] *Id*.
[109] ROSEN & HOUSER, *supra* note76, at 26–27.
[110] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 273.
[111] *China Unveils Climate Change Plan*, BBC NEWS ONLINE, June 4, 2007, http://news.bbc.co.uk/2/hi/6717671.stm

The current strategy seems to focus on decreasing energy intensity and has been successful in some degree.[112] Efficiency continues to be the spearhead of China's climate change policy.[113] Other efforts have included improved fuel quality, relocation of offending factories and encouraging diversification of energy sources.[114] Current targets for renewable energy, of only 60 GW of non-hydro renewable by 2020, seems merely *de minimis*.[115] Greater integration of renewable energy sources is required to address the global environmental crisis.

Aside from the environmental benefits, there are economic benefits to greater integration of renewable sources, as well. As mentioned above, health and welfare costs associated with pollution have direct repercussions. Other costs are more hidden, such as transportation costs of imported fuel sources. It also provides employment opportunities.[116] Most importantly, it plays right into many of China's inherent strengths. It is a labor intensive industry that embraces the enormous labor pool available in China.[117] Renewable sources stretch across the nation, from wind-farm potential in the west, tidal sources in the east and hydropower in every river.

China has a powerful role and unique opportunity to play in crafting a solution. If it chooses to lead the way, embrace the plentiful renewable resources spread across its vast geography, and truly consider the long-term situation, China may just find that renewable energy pays.

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[112] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 263.
[113] *China Strives to Contribute More to Global Fight Against Climate Change*, XINHUA NET, Dec. 15, 2009, http://news.xinhuanet.com/english/2009-12/15/content_12651624.htm
[114] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 274.
[115] *Id*.
[116] *Id*.
[117] Michael Renner, *Jobs in Renewable Energy Expanding*, WORLD WATCH INSTITUTE, July 8, 2008, http://www.worldwatch.org/node/5821

B. The Present Development Structure of Renewable Energy in China

In 2006, the investment in renewable energy is about 60 million dollars, ranking one of the largest countries in the world.[118] In 2005, China's renewable energy use accounted for about 13 percent of the total global use.[119] According the World Energy Outlook, China is already the largest producer of renewable energy in the world and renewable energy is expected to play an even larger role in the future. Additional capacity in renewable energy is mostly in large-scale hydro and wind power. By 2030, hydropower capacity reaches 300 GW and wind power 49 GW.[120]

In practice, renewable energy is becoming more and more important in China's energy consumption structure. At the end of 2006, the scale of the renewable energy used reached 2 billion tons in total, accounting for about 8 percent of total energy consumption.[121] Moreover, about 75 percent of the renewable energy is electricity, which accounts for about 150 million tons of standard coal.[122]

C. The Overview of the Renewable Power Sector

1. Background

China has the second-largest electricity market in the world, behind the United States.[123] China's policy of reform and opening-up have been in effect since 1978, using the basic role of the market in allocating resources, encouraging the entrance of entities of various ownerships into the energy field, and actively facilitating market-oriented

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[118] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[119] *Id.*
[120] *Id*.
[121] *Id.*
[122] Wang Zhongying, Li Junfeng, 2008. China renewable energy industry development report 2007. Beijing: Chemical Industry Press, pp.1-2.
[123] INTERNATIONAL ENERGY AGENCY, *supra* note 58.

reform related to energy.[124] China's energy market is at various stages of evolution, as reforms progress at different speeds. The reform priorities include establishing the market mechanism, standardizing the government regulation, and involving social parties.

a. Reform in the electricity system.

The gradual process of reform began in the mid-1980s, with the opening-up of electrical generation to investment by parties outside of the central government.[125] China has reformed the electricity system to meet the needs of economic development for several times, but still its comparatively under developed.[126] In 2002, the State Council issued The Electric System Reform Scheme.[127] It includes two primary mechanisms for reform.

First, it requires a separation of power generation from the transmission and distribution businesses. In 2002, the State Power Corporation was split into two transmission companies and five power generation groups.[128] The State Grid Corporation of China (SGCC) and the China Southern Power Grid (CSG) cover about 80 percent and 20 percent of the national market, respectively.[129] The five generation entities were each initially given around 20 GW of capacity, with the aim of ensuring that each had less than a 20 percent market share in any one region.[130] Private investment, often as joint-ventures with local or government-owned corporations, plays a growing

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[124] White paper on energy, 2007, *available at* http://www.china.org.cn/english/environment/236955.htm.
[125] ROSEN & HOUSER, *supra* note76, at 17.
[126] *Id.*
[127] Electric System Reform Scheme, promulgated by the State Council (2002).
[128] *Id.*
[129] ROSEN & HOUSER, *supra* note76, at 24.
[130] INTERNATIONAL ENERGY AGENCY, *supra* note 58.

part in the generation business.[131] This has set one of the preconditions for the introduction of wholesale and retail competition. Much work remains in detailing how the grids will be regulated, including pricing of grid services.[132]

The power generation section developed the initial stages of diversified market competition. By the end of 2008, there are 6,170 enterprises having obtained business licenses to generate electric power. Of these, there are more than 4,300 power generation enterprises with a capacity over 60 kW.[133]

The transmission sector remains a natural monopoly. Presently, there are 38 enterprises at the provincial level or above, including 31 provincial power enterprises. Apart from the Mongolia Electric Group, a limited liability company operating in the region independently, other major enterprises are monopolized by the State Grid Corporation and China Southern Power Grid.[134] The State Electricity Regulatory Commission (SERC) has declared the market to be relatively stable.[135] There were 3,172 power supply enterprises at the county and prefectural level by the end of 2008. 2,602 of these enterprises are controlled by the State Grid Corporation and China Southern Power Grid. The types and levels of these enterprises are relatively complicated and beyond the scope of interest, here.[136]

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[131] ROSEN & HOUSER, *supra* note76, at 24.
[132] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[133] THE STATE ELECTRICITY REGULATORY COMMISSION, ANNUAL REPORT FOR ELECTRICITY EXECUTION SUPERVISION IN 2008 (2008).
[134] *National Energy Grid: China*, GLOBAL ENERGY NETWORK INSTITUTE (2010) http://www.geni.org/globalenergy/library/national_energy_grid/china/index.shtml
[135] *The State Electricity Regulatory Commission*, ANNUAL REPORT FOR ELECTRICITY EXECUTION SUPERVISION IN 2008 (2008).
[136] *Id.*

Secondly, the State Council established the State Electricity Regulatory Commission (SERC) in 2002, marking an important step towards independent electricity regulation. However, the dominant influence of the NDRC on energy policies, planning and project approval may limit the independence of the SERC.

b. Reform in the electricity price system

Price system reform is the core issue of the energy market reform. There have been four main stages of pricing reform since 1978. Reforms have long been considered that would make electricity prices more responsive to demand.[137] Prices increasingly reflect true costs and subsequently, subsidies have been progressively squeezed out.[138] The price setting mechanism for power now allows some flexibility. However, the price setting remains a sensitive issue and subsidies remain large in some cases, albeit in an effort to achieve the important policy goals set forth in the 11th Five Year Plan.[139]

In 2003, the State Council issued The Scheme for Reforming Electricity Pricing System. This Scheme sets as a goal that "the generating and selling price will be formed by market competition, the transmission and distribution price will be made by the government. At the same time, a standardized and transparent price management system will be established."[140] This exemplifies the dichotomy in China's electricity markets, where market forces are slowly growing within strict regulation. The NDRC's Price Bureau sets electricity prices, with no independently established transmission tariff.[141]

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137 ROSEN & HOUSER, *supra* note76, at 25.
138 *Id.*
139 INTERNATIONAL ENERGY AGENCY, *supra* note 58.
140 Scheme for Reforming Electricity Pricing System, promulgated by the State Council (2002).
141 ROSEN & HOUSER, *supra* note76, at 25.

That means that one body, the NDRC sets the price at which the grid companies buy power from the generators and how much the grid companies may charge consumers.

c. Reform in the investment system

The Chinese power industry was initiallly monopolized by the central vertical monopoly administration system.[142] In 1985, China began to implement a number of policies and measures to encourage investment it the power construction sector.[143] The power investment system reform has attracted a lot of the investors. The result has been the gradual formation of a number of independent power suppliers, changing the monopoly power market by investment subject pluralism.[144]

2. The Current Situation of Renewable Power

The Renewable Energy Law and encouraged the installed capacity and power generation of renewable energy to increase year-by-year. By the end of 2007, the installed capacity of renewable energy was about 15,494 million kW, accounting for 21.6 percent of the national installed capacity in China.[145] Renewable power generation reached 4825 terawatt hour, accounting for 14.8 percent of the national electricity generation.[146]

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[142] *Id.*
[143] *Id.*
[144] SHI DAN, THE RESEARCH REPORT ABOUT CHINA'S ENERGY INDUSTRIAL MARKETIZATION REFORM 24 Beijing: Economy& Management Publishing House (2004).
[145] *Renewable Energy Potential in China*, GLOBAL ENERGY NETWORK INSTITUTE (2010) http://www.geni.org/globalenergy/research/renewable-energy-potential-in-china/Renewable percent20Energy percent20Potential percent20in percent20China.pdf
[146] THE STATE ELECTRICITY REGULATORY COMMISSION, THE REPORT ABOUT THE IMPLEMENTATION AND SUPERVISION OF THE RENEWABLE POWER PURCHASE PRICE POLICY (2008).

Overall, the share of renewable energy in power generation rises steadily, to reach 24 percent of total electricity generation in 2030.[147] China is expected to have 311 GW of hydropower in place by 2020, meeting the government target, and 380 GW in 2030.[148] The target for wind power is expected to be exceeded, with wind power reaching 42 GW in 2020 and 79 GW in 2030.[149] Similarly, the target for photovoltaics (PV) is also expected to be surpassed. China is in the process of developing world-class manufacturing industries for wind turbines and solar PV modules, and this is likely to have a strong impact on the domestic electricity market.[150]

3. China's Administration System for the Renewable Energy

To regulate and promote the development of the renewable energy, the State Council and relevant departments constitute the administration system for the renewable energy. Like the structure of China's government as a whole, the energy administration is a top-down model. The very top of the pyramid is the State Council, which is China's highest governing body. It includes three levels of departments to address renewable energy: Comprehensive Administration Department, Specialized Administration Department, and the independent regulator.[151] Policy and initiatives are promulgated from the central authority then local authorities carry out these policies. Renewable energy policy implicates many different departments and the risk of conflict and coordination between these departments must be addressed for any renewable energy policy to be effective.

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147 *Renewable Energy Potential in China*, *supra* note 145.
148 *Id.*
149 *Id.*
150 INTERNATIONAL ENERGY AGENCY, *supra* note 58.
151 JIANFU CHEN, CHINESE LAW: CONTEXT AND TRANSFORMATION (2007).

a. Comprehensive Administration Department

Two major Commissions under the auspices of the State Council oversee the broader field of energy policy. These are the State Energy Resources Commission and the National Development and Reform Commission. Even though these two Commissions share some degree of responsibility on energy issues, they address in different ways.

i. State Energy Resources Commission

Because energy issues involve many fields and many departments, the State Council established a high level deliberation and coordination agency, the State Energy Resources Commission in 2008. The National Energy Leading Group of the State Council was replaced after operating for only 3 years. The purpose of the Commission is to strengthen energy strategic decision and coordination. The State Energy Resources Commission is responsible for researching and drafting the state energy development strategy, reviewing the major issues of the energy development.[152] The State Energy Resources Commission is constituted by 22 departments, including National Development and Reform Committee (NDRC), Ministry of Finance, Ministry of Science and Technology, among others. At the same time, the National Energy Administration is responsible for its specialized work.

ii. National Energy Administration

Policy making on energy issues stems from the National Development and Reform Commission It oversees economic management though policy, administrative and regulatory means. On July 30, 2008, the NDRC established the National Energy

[152] *Power to the SERC*, China Daily, April 6, 2007 *available at* http://www.china.org.cn/english/GS-e/206277.htm

Administration (NEA) as the administrative department of energy of the State Council, changing from a department bureau class unit to deputy unit.[153]

NEA is responsible for formulating and implementing energy development plans and industrial policies, promoting institutional reform in the energy sector, administering energy sectors including coal, oil, natural gas, nuclear power, and new and renewable energy. It also participates in the formulation of economic and social policies related to energy such as resources, finance and taxation, environment protection, and addressing climate change. The NEA effectuates these responsibilities though making recommendations on energy price adjustment, imports and exports aggregate, and undertaking the daily work of the National Energy Commission.[154]

b. Specialized administration department

Many other agencies have more specific responsibilities related to energy policy. Fossil-fuel resources and reserves are under the watch of the Ministry of Land and Resources.[155] Current hydropower resources fall to the Ministry of Water Resources. Interestingly, the Ministry of Agriculture is the main agency leading renewable energy policy because it has domain over the rural energy structure.[156] The Ministry of Finance and the State Bureau of Taxation shoulder the responsibility for taxes and fees, as well as financial incentives.[157] The State Environmental Protection Administration oversees environmental standards and has also grown in its influence over energy projects. This is

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[153] Erica S. Downs, *China's "New" Energy Administration*, CHINA BUSINESS REVIEW, Nov.-Dec. 2008.
[154] *Main Functions of the Development and Reform Commission*, NATIONAL DEVELOPMENT AND REFORM COMMISSION (2010) http://en.ndrc.gov.cn/mfod/t20081218_252224.htm.
[155] *Responsibilities of the Ministry of Land and Resoruces*, MINISTRY OF LAND AND RESOURCES http://www.mlr.gov.cn/mlrenglish/
[156] *Oration of the Minister of Agriculture*, MINISTRY OF AGRICULTURE, http://english.agri.gov.cn/
[157] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 270.

not an exhaustive list, but designed to present a picture of the various ways different government units cooperate to formulate energy policy.

c. The independent regulator

SERC is empowered by the State Council to perform administrative and regulatory duties for the national electric power sector in accordance with laws and regulations.[158] It is responsible for the overall regulation of the national power sector. This includes establishment of a coherent system for regulatory organization, exercising direct leadership over its regional branches, monitoring electricity market operations to ensure orderly and fair competition in the market, regulating transmission and distribution, and noncompetitive generation businesses among other tasks.[159]

The policies established by these different departments must then be carried out through the provincial and municipal equivalents of these agencies. Clearly, energy policy reform would cross the province of many different agencies orchestrating new directives require cooperation and coordination between the agencies. Oversight and accountability are critical to policy success and the agencies must be sure to work together to develop cohesive and effective reform

4. Renewable Energy Legislation and Implementation in China

a. The legal framework for renewable energy development in China

In order to encourage the development of renewable energy, China introduced the Law of the People's Republic of China on Regenerable Energies (the Renewable Energy Law) which was adopted by Standing Committee of the National People's Congress in

[158] *State Electricity Regulation Commission*, US-CHINA BUSINESS COUNCIL, http://www.uschina.org/public/china/govstructure/govstructure_part6/serc.html
[159] *Body Functions*, STATE ELECTRICITY REGULATION COMMISSION, http://www.serc.gov.cn/.

2005, and came into effect on January 1, 2006. The Law provides for the compulsory grid connection for plants producing electricity from renewable sources. It stipulates that all energy generated from renewable sources, must be purchased and that utilities must provide grid connection services and related technical support. [160]

Generally speaking, the Renewable Energy Law with regulation and a series of supporting policies constitute the preliminary legal framework promoting renewable energy development in China. The framework includes some important systems, such as the Renewable Energy Target Policy, Feed-in Law, price classification, cost allocation, and special fund.

b. Introduction to some primary systems

i. The Renewable Energy Target Policy

The Renewable Energy Target Policy allows the government to fix renewable energy's share of the market by the law. It is the core of the Renewable Energy Law. There are two ways to articulate the target, one is the quantitative objective, the other is the proportion target[161]. Quantitative targets would set a specific number of kW that must be generated. Proportion targets identify a share of total supply that must be met through renewable sources.

Legislation and policy has focused on the Renewable Energy Target Policy in principle or specially. This policy, as mentioned above, is developed at a the national level and implemented at the provincial and municipal level.

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[160] INTERNATIONAL ENERGY AGENCY, *supra* note 58.

[161] THE READING ABOUT LAW OF THE PEOPLE'S REPUBLIC OF CHINA ON REGENERABLE ENERGIES, 17 (Li Junfeng & Wang Zhongying, ed, 2005)

On a broad scale, renewable energy development stems from the 11th Five Year Program Planning on National Economy and Social Development. It calls for the implementation of "preferential benefit the finance and taxation, the investment policy and the compulsory market share policy, in order to encourages the production and consumption of the renewable energy source, and to enhances its proportion in energy consumption structure."[162] This plan is heavy on ideology and substantive suggestion, but leaves the details to other authorities.

A second, more detailed enactment on renewable energy implementation is the Law of the People's Republic of China on Regenerable Energies.[163] The major components include procedures for establishing a national target for the proportion of renewable energy use, and specific procedures for planning development.

Under Article 7, the Administrative Department of Energy of the State Council formulates the national medium and long-term gross target according to the national energy need and the renewable energy resources available. This gross target provides predictability in amount of renewable energy integrated into supply. The Department must then formulate a plan for exploitation of renewable energy sources. The target and plan are then to be carried out locally, and announced with the State Council's approval.

Based on the gross target mentioned in the preceding clause and the economic development and actual situation of the renewable energy resources in the provinces, the Administrative Department of Energy establishes and announces the regional medium and long-term targets about the exploitation of the renewable energy source, jointly with

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[162] *The 11th Five Year Plan*, http://www.gov.cn/english/special/115y_index.htm

[163] Renewable Energy Law, promulgated at the 12th Meeting of the Standing Committee of the 11th National People's Congress of the People's Republic of China on December 26, 2009

the provincial people's governments.[164] The task of actually enforcing the target and implementing the plan falls to more local authorities.

Article 8 details the procedures for this implementation. According to the national medium and long-term gross target, the Administrative Department of Energy's plan under Article 7, will be implemented jointly with relevant departments of the State Council.[165]

Furthermore, the Departments of Energy Management in the provinces, autonomous regions, and municipalities directly under the central government, formulate regional exploitation plans.[166] This is done jointly with relevant departments of the People's governments at the corresponding levels in their respective administrative. Then the plans will be summated to the people's governments at the corresponding level for approval before implementation.

The implement of the target policy needs the participation of different levels of governments and market participants. The Law of the People's Republic of China on Regenerable Energies has stipulated the Renewable Energy Target Policy, the corresponding safeguard measures, and the government's responsibility.[167]

In order to ensure effective implementation, some supporting policy has stipulated the concrete target. The Medium and Long Term Renewable Energy Development Plan does just that**,** it requires that renewable energy will account for the total energy

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164 *Id.*
165 *Id.* art. 8.
166 *Id.*
167 *Id.*

consumption by 10 percent in 2010 and by 15 percent in 2020.[168] It stipulates the compulsory market share goal of renewable source electricity generation. To 2010 and 2020, the renewable energy source electricity generation, which is covered by the large-scale grid, achieves above 1 percent and 3 percent in the electrical network total output of electrical energy proportion respectively.[169]

More recently, the 11th Five-Year Plan on the Development of Renewable Energy was implemented by the State Council. This plan states that to 2010, the renewable energy source achieves 10 percent in energy consumption proportion. The national renewable energy source annual consumption amount achieves 300,000,000 tons coal equivalent. In other words, the "keys to expanding energy supply are identified".[170] Once the Renewable Energy Target is identified in the legal framework, its importance and implementation become clearer and easier.

ii. Feed-in law system

China has tried to implement the feed-in law since 1994. There is some legislation, regulation and policy designed to craft a productive Feed-in tariff. The current law grew over time and often was the result of other legislation.

In 1994, the Electricity Department issued the Administrative Provisions About the Wind Power Field's Operation of Grid Connected**.** According to these provisions, the

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[168] The Medium and Long Term Development Plan for Renewable Energy, English Translation, *available at:* http://www.chinaenvironmentallaw.com/wp-content/uploads/2008/04/medium-and-long-term-development-plan-for-renewable-energy.pdf

[169] *Id.*

[170] INTERNATIONAL ENERGY AGENCY, *supra* note 58, at 271.

electrical network Control section should allow the wind electric field nearby to access the grid, and purchases the on-grid energy completely.[171]

Based on the electricity market reform, the General Office of the State Council issued the Notice of the Reform Scheme About the Electricity Price, in 2003. It declares that: "Wind power does not participate in market competition, the power grid will preempt the electricity according to the government fixed price or the tender price."[172]

Law of the People's Republic of China on Regenerable Energies stipulates that all electricity generated from renewable sources must be purchased. Specifically, Article 13 states that the country encourages and supports the renewable energy source to be combined to the grid. constructs the renewable energy source incorporation electricity generation project, must defer to legal and State Council's stipulation obtains the politics to permit or sending sets up a file.[173] The construction about the renewable energy source incorporation electricity generation project, must obtain the administrative permission. When there are multiple parties applying for the same project permission, the government must determine the licensee legally through bidding processes. Article 14 then requires that the power grid enterprise must sign the grid-connected agreement with the renewable energy power plants, which have obtained the administrative permit. This agreement requires the grid enterprise to purchase the on-grid power in its electrical network coverage area entirely, providing on-grid service for the renewable energy source electricity generation.[174]

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[171] Administrative Provisions About the Wind Power Field's Operation of Grid Connected, promulgated by the Electricity Department (1994).
[172] Notice of the Reform Scheme About the Electricity Price, promulgated by the State Council (2003).
[173] Renewable Energy Law, *supra* note 163, art. 13.
[174] *Id.* art. 14.

In March 2005, the State Development and Reform Commission formulated the Interim Provisions for the Administration of Grid Power Price. It includes some important provisions. Article 2 defines the "on-grid price" as one that refers to the price at which an electricity generation enterprise and a power purchaser settle the grid electric energy.[175] Article 23 states that the energy enterprise does not participate in the market competition temporarily.[176] The power grid will preempt the electricity according to the government fixed price or the tender price. The government will stipulate the proportion of the renewable energy in the electricity sales amount of the power supply enterprises at the right moment, and establishes the special competitiveness market of the new and renewable sources of energy.[177] In 2006, the State Development and Reform Commission formulated the regulation about the renewable energy generation. Under Article 11, it suggests that the grid enterprises should design and transform the grid, ensuring the electricity generated by the renewable energy connected to the grid entirely.[178]

One year later, the State Electricity Regulatory Commission issued the Supervising Methods for the Grid Enterprise's Full Purchase the Renewable Energy Electricity. It reiterated that renewable electricity must be purchased and integrated into the electricity grid.[179] In detail, Article 8 states that the Power Switching Agency should not restrict the generated output from the renewable energy, except for the force majeure or the situation

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[175] Interim Provisions for the Administration of Grid Power Price, art. 2, promulgated by the State Development and Reform Commission (2003)
[176] *Id.* art. 23
[177] *Id.*
[178] *Id.* art 11.
[179] Supervising Methods for the Grid Enterprise's Full Purchase the Renewable Energy Electricity, promulgated by the State Electrical Regulation Commission (2007).

endangering the safety and stability of power grid. Also, the power grid enterprise becomes subject to administrative penalty. These penalties apply if they are found to have refused or hindered to the agreement with the renewable energy power generation or fail to purchase the electricity generated by the renewable energy entirely.[180] The National Development and Reform Commission concurrently drafted the Interim Measures About the Allocation of Renewable Electricity Additional Revenue. This measure calls for "the power grid in provincial level should purchase the on-grid electricity generated by the renewable energy within their service area entirely."[181]

In sum, the renewable energy still has noncompetitive capacity in the existing technology and economy accounting system, so the feed-in law system is the necessary mechanism to promote its development.[182]

iii. Price classification

China classifies the electricity prices according to the types, regions and periods. Because of the differences among all sorts of renewable power cost, price classification can promote the renewable energy development more reasonably.

Law of the People's Republic of China on Regenerable Energies, issued in 2006 also stipulated that "in order to promotes the renewable energy development, the price administrative department of the State Council will determine the on-grid price of the renewable energy source electricity generation project, basis on characteristic of different type renewable energy source electricity generation and different area's situation. The

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[180] *Id.* art 20.
[181] Interim Measures About the Allocation of Renewable Electricity Additional Revenue, promulgated by the National Development and Reform Commission (2007).
[182] *See* THE READING ABOUT LAW OF THE PEOPLE'S REPUBLIC OF CHINA ON REGENERABLE ENERGIES *supra* note 161, at 26 (describing the role of the feed-in law in broader scheme of Chinese energy regulation).

price administrative department of the State Council will adjusts the price at the right moment according to the technical development of renewable energy source exploitation. The on-grid price must be announced."[183] In 2006, the National Development and Reform Commission promulgated the Tentative Management Measures for Allocation of Prices and Expenses for Generating Electricity by Renewable Energy. Article 5 states that the price of renewable energy will be the government guided price as determined by the tender price in the bid-inviting process.[184] As far as the perspective of implementation of classification system, the main purpose is educe project examination and approval procedures, make clear the investment returns, lower the development costs of project and to restrict unfair competition. [185]

iv. Cost allocation system

The distribution of renewable energy resources is uneven geographically. The higher power cost and the great positive externality to the society is shared by society as a whole. The Law of the People's Republic of China on Regenerable Energies has stipulated that the reasonable expenses and other reasonable costs paid by the grid enterprises for acquisitions renewable energy power, can be included in the cost of transmission of electricity and recovered from the sale price. This reflects the idea of passing the additional costs on to the consumer. It protects business interests, but leaves consumers vulnerable to dramatic or sudden price increases. This idea is reinforced under Article 20. If the grid enterprises purchase the renewable energy at the price in accordance with the

[183] Renewable Energy Law, *supra* note 163.
[184] The Tentative Management Measures for Allocation of Prices and Expenses for Generating Electricity by Renewable Energy, promulgated by the National Development and Reform Commission (2006).
[185] *Id.*, at 29.

provisions of article 19, which is higher than the average price of conventional energy power, the differential section between the avoided cost occurred in the sale price of electricity can be added into the sales price and shared.[186] The concrete measures shall be formulated by the appropriate of the State Council, most likely the Pricing Department.

The Tentative Management Measures for Allocation of Prices and Expenses for Generating Electricity by Renewable Energy states that the premium of the renewable energy electrovalency is ascertained by the Pricing Department of the State Council, and collected by the quantity of electricity which the consumer actually used.[187] The standards will be unified nationally. Additionally, Articles 17, 18 and 19 state that the premium of the renewable energy electrovalency to be included into the sales price and collected by the grid enterprises. The premium will also be adjusted according to the practical situation, the adjustment cycle of which is less than a year.[188] Finally, the balance between the provincial grid enterprise's actual payment of the subsidy power fare, the grid-connecting expense, and the premium of the renewable energy electrovalency they share, will be unified allocation of resources nationwide. The State Electricity Regulatory Department will formulate specific administrative measures and submit these measures to the Pricing Department t for examination and approval.

In 2007, the National Development and Reform Commission formulated the Interim Measures About the Allocation of Renewable Electricity Additional Revenue. It states that additional charges of the renewable energy electrovalency is the mark-up standard,

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[186] Renewable Energy Law, *supra* note 163, art. 20.
[187] Tentative Management Measures, *supra* note 184.
[188] Renewable Energy Law, *supra* note 163 art. 17 – 20.

which is shared equally among the national sales quantity, in order to support the development of the renewable energy.[189] Any additional charges of the renewable energy electrovalency will be determined based on the income of the provincial grid enterprises.[190] Collected charges will be first used to pay their own provinces, autonomous regions, and municipalities renewable energy price subsidies. The remaining balance will be distributed through a rationing transaction.[191] If the amount of the additional charges of the renewable energy electrovalency collected by the Provincial grid enterprises, is less than the due amount of the subsidies for the renewable energy price, the balance will be the quota of the additional charges of the renewable energy electrovalency for sale.[192] If the amount of the additional charges of the renewable energy electrovalency collected by the Provincial grid enterprises, is more than the due amount of the subsidies for the renewable energy price, the remaining balance can be used to buy the quota of the additional charges of the renewable energy electrovalency.[193]

The Interim Measures About the Allocation of Renewable Electricity Additional Revenue also requires the State council price department to record statistics and review each provincial grid enterprises' surplus and deficiency of additional charges of the renewable energy electrovalency in the last month.[194] If the additional charges of the renewable energy electrovalency collected by the provincial grid enterprises is not enough to pay the renewable energy price subsidies, the State council price department

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[189] Interim Measures About the Allocation of Renewable Electricity Additional Revenue, art. 2, promulgated by the State Council (2007).
[190] *Id.*
[191] *Id.* art. 8
[192] *Id.*
[193] *Id.* art.13
[194] *Id.*

would issue the certificates of quota of additional charges of the renewable energy electrovalency to the provincial grid enterprises basis on the same amount of funds shortage, formulate and issue a transaction scheme about the certificates of quota. For the convenience of each transaction, the State council price department can issue several certificates of quota to the grid enterprises within the full amount of funds.[195]

c. The legal framework and systems

The legal system supporting renewable energy can be summarized as a national renewable energy development target, embodied and implemented by the national and provincial renewable energy development planning. The renewable energy is priced by the government. Grid enterprises must purchase the renewable energy and provide grid-connection services and related technical support, but the burden of the price difference is shared by the end users of the national power grid.

Generally speaking, the legal system of renewable energy development is composed of the Feed-in law system, preemptive purchase, classification price, and cost allocation, is similar as the Feed-in tariff. Moreover, the present legal system has played a positive role at the initial stage of renewable energy development in China. For example, Feed-in law system can reduce renewable energy project transaction costs, shorten the project access time, improve the credibility of project financing, promote renewable energy industry to develop rapidly. [196]

III- ISSUES AND CHALLENGES

[195] *Id.* art. 15

[196] ON THE CHINA ENERGY LEGAL SYSTEM 240 (Ye Rongsi, Wu Zhonghu, ed, 2006).

Chinese policy makers take the challenge of an affordable, reliable and sustainable energy supply very seriously and have formulated a range of policies to respond to them. Chief among these are interventions aimed at diversifying the country's energy sources, improving energy efficiency and restructuring the economy away from highly energy intensive activities.[197] In order to promote the development of renewable energy sources, China has established the primary legal systems of renewable energy, and they have played an important role. However, there are still some issues and challenges in the development of the renewable energy.

A. The Renewable Power Market Development

1. State is still the major investor in the investing system

First, the renewable energy development needs large scale investment. The cumulative investment needed to underpin the projected growth in energy supply in China is $3.7 trillion over the period 2006-2030.[198] Moreover, China's total investment in the electricity sector will account for a quarter of the world's total.[199] Cumulative investments in generation, transmission and distribution over the period to 2030 will amount to $2.8 trillion.[200] Transmission investments have been significant in recent years, accounting for about 40 percent of total investment in the power sector in 2006.[201] Power generation investment in China has historically been made primarily by state-owned or provincially-owned entities, backed by public funds. The large investment requirements associated with this level of generation would put considerable pressure on

[197] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[198] *Id.*
[199] *Id.*
[200] *Id.*
[201] *Id.*

government budgets. This, in turn, will increase the pressure to accelerate the pace of market reform, moving towards more efficient market structures, better able to attract private-sector investment.[202]

Therefore, financing these huge investment requirements in the power sector is going to demand funding from both public and private sources. Though transmission and distribution remain the responsibility of the central government, private finance is expected to play an increasing role in generation investment. Foreign investment could help China achieve its objectives for the sector, but experience to date suggests some significant hurdles remain before the sector can be considered attractive to foreign investors.[203]

Secondly, the energy industry's concentration is high, the state-owned enterprises take up the major parts. The state maintains extensive direct control over the energy sector, though some energy companies are also highly influential with the government, it is not easy for the private enterprise to enter in the market. In line with the ownership and economic regulatory reforms since the 1980s, the central government has relinquished ownership of smaller enterprises to local governments and allowed non-state enterprises to enter certain segments of the energy industry. However, state-owned enterprises are still dominant in the electric power industry, from the power generation to the transmission and supply. For example, the state-owned and state holding enterprises accounted for about 90 percent of the generating enterprises. The installed capacity of the five big power group accounts for 44.9 percent of the total installed capacity, while the

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[202] *Id*.
[203] INTERNATIONAL ENERGY AGENCY, *supra* note 58.

installed capacity of the private and foreign power enterprises occupies only 5.1 percent.[204]

Third, the condition for the foreign and domestic investment is not equal. In financing, Chinese domestic wind power developers can borrow up to 80 percent of the project costs, while there is a 66 percent limit on borrowing by foreign investors. This tends to lower the return on equity of foreign investor-owned projects. Furthermore, to qualify for clean development mechanism (CDM) credits, projects are required to be at least 51 percent Chinese-owned, which forces international investors to hand over control of the project to a Chinese partner.[205] Currently, the rate of return to foreign investors on wind projects is around 2 percent to 4 percent, which explains their lack of enthusiasm. Domestic investors earn much higher returns, of at least 8 percent, depending on the particulars of the project.[206]

In normal market conditions, when the power demand exceeds supply, the focus of competition among power producers is to expand production scale of resources and seizes the market share. Though the power marketization began in 2002, the energy supply still greatly exceeds demand in China. "The key to promote the enterprise competition and energy development,is opening market access and diversification of investmen,rather than splitting the enterprises."[207]

2. Administrative Over-involvement and Weak Market Mechanisms

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[204] Annual Report, *supra* note 133.
[205] Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. (1998).
[206] INTERNATIONAL ENERGY AGENCY, *supra* note 58.
[207] SHI DAN *supra* note 133, at 36.

The major systems mentioned above are almost all based on the price and dominated by the Government Administration, ignoring the benefit and development of the market subject. The government still holds some important rights, such as the pricing and the project approval power, which should be the decision right of the market and enterprises. Because of the integration of policy making and regulation, government agencies are involved in the complexity of the coordination and arbitration work rather than important strategy research and decisions making.[208]

Currently, the development and utilization of renewable energy is mainly driven by administrative measures, rather than an economic and price method. Some policies' dynamics are inadequate, some policies is relatively lag. [209] Moreover, the sustainability of renewable energy development is uncertain if it depends heavily on government policy rather than the market mechanism, because the policy is unstable and changes frequently.[210]

3. The rights and obligations are not clear

Though China has tried to reform the power market for a long time, the competitive market is still developing. Especially in the power market, the relevant subjects include traditional power enterprise, renewable power generation enterprise, grid enterprises, and power supply enterprises. Issues within renewable energy development mainly lay in the renewable power production, connection to the grid and sales. The relationship among

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[208] *Id*, at 38.
[209] LU WEI, ON CHINA'S RENEWABLE ENERGY DEVELOPMENT SITUATION AND POLICY ORIENTATION. Vol.01 (2007).
[210] SONG LIPENG, STUDY ON RENEWABLE PORTFOLIO STANDARD (RPS) IN CHINA (2008).

the renewable power generation enterprises, the traditional power generation enterprise, and the grid enterprises, may become important issues.

The relationship between the grid enterprises and the renewable energy power generation enterprises is the most important one. Under China's current legal framework, the grid enterprises must purchase the renewable power fully to promote the renewable energy development. However, allocating excessive obligations or losses to grid enterprises with insufficient corresponding economic compensation is a violation of the Law of Market Economy.[211] At the same time, the grid enterprises will likely try to set up a barrier and refuse to carry out the obligations, in pursuit of greater profit.

Second, the relationship between the renewable power generation enterprises and the traditional power generation enterprise is important. Most of the traditional power generation enterprise are state-owned enterprises with abundant funds and tremendous technologies. They likely will seize the renewable power market in the process of the project approval or tender. For example, the wind power installed capacity of the five major generation group has occupied 76.72 percent of the national capacity. [212]

Finally, cutthroat competition may arise among the renewable energy enterprises. For example, some wind power investment enterprises occupy the wind power market by low-price bidding, resulting in the low on-grid price of the wind power.

4. The administration system of the renewable energy

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[211] Decisions of the State Council on Rectifying and Standardizing the Order in the Market Economy (promulgated by the State Council, April 27, 2001, effective April 27, 2001) LAWINFOCHINA (last visited May 12, 2010) (P.R.C.).

[212] THE STATE ELECTRICITY REGULATORY COMMISSION, RELEVANT DATA OF LARGE POWER ENTERPRISE SURVEYS AND STATISTICS (2009).

As the mentioned above, the government oversight of renewable energy development suffers from poor supervision, divergent functions, and low efficiency. The development of the renewable energy is administrated by a multitude of different departments. None of them have the mandate to unify the administration of renewable energy.

The establishment of the State Energy Resources Commission and NEA, has strengthened the comprehensive administration to a certain degree. However, the State Energy Resources Commission is just a coordination agency and the NEA is just a department of NDRC.

Department of Decentralized Management and Unified Coordination Mechanism has been a great problem. To promote the renewable energy development, China should establish a central government department to take charge of the overall coordination of energy and relevant policies.

5. On the related legal mechanism

a. The Renewable Energy Target Policy lack of specificity and flexibility

Although the Renewable Energy Target Policy articulates a degree of policy and regulation, legal responsibility and specific objectives are not clearly specified. Moreover, the policy and regulation differ in terms of the legal responsibility. For example, according to The Medium and Long Term Renewable Energy Development Plan, the grid and the generating investors have the obligation to reach the target. Conversely, according to The Administrative Provisions About Power Generation from Renewable Energy Resources (2006), the generating enterprise should be responsible for the target. According to the Interim Provisions for the Administration of Grid Power Price (2005),

the power supply enterprises are the subject of legal responsibility. How to determine which entity bears the burden to ensuring compliance with the Renewable Energy Target Policy depends on who you ask. This is not an acceptable way to approach developing greater renewable energy supply.

b. About the feed-in law system

Firstly, the compulsive and administrative intervention is too much. Markets are not permitted to function in a recognizable way. While it certainly stimulates investment in a renewable energy market, it does so in an artificial manner.

Secondly, because the relationship of interest and cooperation between the enterprises is unclear, the feasibility of purchase index for the grid enterprises and effective administrative control over grid enterprises is lacking. Additionally, requiring full purchase for renewable energy is hard to implement in practice.[213]

Questions of definition within the law exist, too. For example, what does “full purchase” means? Even the grid enterprise purchase all the electricity, does it not necessarily equate to realization of the target. Moreover, because many generating enterprises are still controlled by the grid enterprise, the grid enterprise can make the generating enterprises produce non-renewable power rather than renewable power, in order to evade the obligation.

Generally speaking, the mandatory purchase might solve the problem in sales and safeguard power generation enterprise's interest in the supply chain. For example, the wind power sector has a glut of production, but effective and efficient grid-connectivity is

[213] The draft Amendments to the Renewable Energy Terms and Draft Specifications, *available at* http://www.npc.gov.cn.

limited.[214] But, the issue is still how to promote and expand the renewable energy supply in a way that does not threaten to destabilize the market is still an important and fundamental challenge in the renewable energy development.

c. About the on-grid pricing

Firstly, because of the on-grid price is mainly fixed by the government, it is hard for the enterprises to guarantee the lowest cost of development, and react to the renewable energy cost reduction quickly. If the on-grid price is adjusted frequently, the management cost will increase and the price uncertainty will endanger the project financing. In addition, once the price is fixed, from the political point of view, it would be difficult to reduce price level.[215]

Generally speaking, the electricity price mechanism includes five levels: price forming, operating, restricting, regulation and control mechanism.[216] However, power markets in China are not yet structured to provide well-developed market-based price signals.[217] Greater market liberalization will be required to do so.

d. About the allocation of cost system

According to the Renewable Energy Law and related regulations, the additional charges of the renewable energy electrovalency is allocated through the settlement among the grid enterprises. There are still some problems.

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[214] Wan Zhihong, *Offshore Wind Power Sets Sail*, CHINA DAILY, April 24, 2010 http://www.chinadaily.com.cn/business/2010-04/24/content_9770604.htm

[215] HE JIANKUN, ET AL., RENEWABLE ENERGY LEGISLATION RESEARCH AND DEMONSTRATION REPORT (2004) available at: http://www.energylaw.org.cn/html/news/2008/6/20/2008620115571887.html.

[216] DONG LITONG, RESEARCH ON THE MECHANISM OF RPS EXECUTED IN CHINA. NORTH CHINA ELECTRIC POWER UNIVERSITY (2006).

[217] INTERNATIONAL ENERGY AGENCY, *supra* note 58.

Firstly, as the additional charges of the renewable energy electrovalency is balanced in the grid enterprises' sales revenue, the taxes associated therewith may account for one third of the total additional funds. Thus, the compensation for the grid enterprises is insufficient and ineffective. Secondly, the cycle of capital allocation is long and the subsidies cannot be in place timely. This will increase the electric power enterprise's financial pressure.[218] Thirdly, the allocation and transation is made by the grid enterprises and dominated by the government, the market mechanism is lacking.

The issues and challenges of the renewable energy development mainly lie in the unclear and unspecific target, uncertain subject of legal responsibility, weak market mechanism, disordered administration system, and imperfect legal system. The key to promote the development of renewable energy is to foster cooperation between the government, enterprises and public respectively. Moreover, they must play their roles properly to establish the competitive renewable energy market and promote the healthy development of renewable energy industry.[219]

e. Conclusion

Considering the issues and challenges of current legal systems, China's energy market must continue along the path of liberalization. As that occurs, the hidden costs of these inefficiencies will unleash themselves upon the rate payers. This was observed in Germany as the increase in renewable electricity generation led to dramatic rate

[218] Draft Amendment, *supra* note 213.
[219] see *supra* note 215.

increases.[220] Similar rate increases in China could be expected as market liberalization continues, bringing about added costs to the industry-led demand growth. This could threaten broader economic growth. Another model for supporting renewable electricity generation must be adopted to prevent a dramatic rate increase that threatens to destabilize GDP growth.

V – EXAMPLES OF RPS EXPERIENCE

Previous experience with RPS has been both positive and negative. It is important to observe systems that fail to meet expectations as well as systems that succeed. In the U.S., Texas has seen dramatic growth in its renewable energy market, while keeping consumer prices within market bounds.[221] Massachusetts' RPS was fraught with financing issues from the onset, and failed to realize any real growth for a number of reasons.[222] The U.K. also implemented an RPS-like system that managed to encourage investment in the renewable energy market and protect consumers from rate increases.[223] All of these experiences provide a guide for crafting an RPS for China.

A number of nations have applied some sort of RPS at a national level, including Australia, Belgium, Italy, Sweden and the United Kingdom.[224] The U.S. has also considered implementing some form of RPS at the federal level, but at this time it

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[220] *See*, Electricity from Renewable Energy Sources: What Does it Cost? (Michael van Mark & Wolfhart Durrschmidt eds. undated) http://www.bmu.de/files/pdfs/allgemein/application/pdf/brochure_electricity_costs.pdf; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) Public Relations Division, WHAT ELECTRICITY FROM RENEWABLE SOURCES COSTS (2008).

[221] Wiser, et al., *supra* note 19 at 7.

[222] *Id*.

[223] *Renewables Obligation*, DEPARTMENT OF ENERGY & CLIMATE CHANGE http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/renew_obs/renew_obs.aspx

[224] Wiser, et al., *supra* note 19, at 5.

remains a state-dominated policy.[225] A total of 28 states and the District of Columbia have an RPS.[226] Estimates suggest that RPS programs encompass close to 50 percent of the total electricity sales in the U.S.[227] Renewable energy targets for 2025 will then compose 4.7 percent of total electricity sales in the US, which marks a 15 percent growth in demand since 2007.[228] Texas is regarded as one of the most successful RPS policies in the U.S. and provides many important lessons for crafting a policy applicable to China.

A. Texas

Texas was one of the early states to implement an RPS program in the U.S.[229] In 1999 the Texas legislature passed a bill that required a target of 2000 MW of renewable electricity be added to the then current supply within 10 years.[230] This addition represented close of 2.5 percent of the total state load.[231] The model included transferrable renewable certificate trading, use of existing sources to meet renewable purchase targets, and clear penalties for noncompliance.[232]

It was an exceptionally successful program that met the 2000 MW target four years ahead of schedule.[233] The transferrable renewable certificates have received much of the credit for the success of Texas' RPS.[234] It successfully permitted suppliers to comb the state for the lowest cost renewable source generation without being constrained by the

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[225] *Id*.
[226] Gulen, et al, RPS in Texas: Lessons learned and the Way forward, Center for Energy Economics, University of Texas, 2009
[227] *Id*.
[228] *Renewable Portfolio Standards in the United States: A Status Report with Data Through 2007*, LBNL, April 2008.
[229] Gulen et al., *supra* note 225, at 5.
[230] *Id*.
[231] Wiser, et al. *supra* note 19, at 7.
[232] *Id*.
[233] Gulen, *supra* note 225, at 5-6.
[234] *Id*.

need to accept physical delivery.[235] Therefore, the most efficient renewable generators could produce high volumes of electricity that is used locally, but purchased where there is a lack of efficient generation.

The Texas model also has a proper supply-demand balance. This refers to the availability of eligible renewable sources. For example, an overly expansive eligibility requirement that includes fossil-fuel cogeneration reduces the incentive to construct new renewable sources to a point where it is no longer economically feasible.[236] Texas implemented strict eligibility restraints, limiting hydro to production under 2 MW and eliminating any fossil fuel eligibility.[237] Any facilities that existed prior to passage of the legislation in 1999 were excluded from the transferrable renewable certificates, but were granted some offsets.[238] The rationale was to limit, but not eliminate, the use of these preexisting renewable sources, so as to encourage construction of new facilities.[239] It is also important to note that many of these sources are large hydropower facilities, which have other detrimental ecological impacts.[240]

The targets under the legislation were firm and stable, while compliance opportunities for suppliers remained flexible. A mandate of 2000 MW and a long target date of 10 years encourage long-term contracts.[241] These level and targets were clear, and unwavering, which gives a sense of confidence to investors and incentives to work

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235 *Id*.
236 *See*, Wiser, et al. *supra* note 19, at19 (highlighting the poor result of Maine's RPS due to the overly expansive resource eligibility rules).
237 25 Tex. Admin. Code § 25.173 (2009).
238 *Id*.
239 Gulen, *supra* note 225, at 8.
240 *Id.*
241 *Texas Renewable Portfolio Standard*, STATE ENERGY CONSERVATION OFFICE, http://www.seco.cpa.state.tx.us/re_rps-portfolio.htm.

toward projects even with significant initial cost. Secondly, because the transferrable renewable certificates allowed suppliers to purchase electricity without physical delivery, there were few geographic restraints.[242]

Finally, the Texas RPS model contained strong enforcement provisions that worked to keep all participants involved in a fair and efficient manner. The Electricity Reliability Council of Texas oversees the transferrable renewable certificates.[243] They manage a user-friendly online system to track meter data and the Council supports the online system with in-person monitoring.[244] Additionally, the transferrable renewable certificates may only be retired, so are easily tracked, due to their one-time use.[245] The penalty for a certificate not retired for compliance was set at $50, which is presently ten times the trading price.[246] This substantial fee has helped keep compliance high, and preserve the system, as a whole.

The Texas system has resulted in enormous increases in renewable energy source growth, mainly in wind power.[247] This is due to the tremendous wind power capacity in western Texas, assisted by the transferrable renewable certificates that negated the burden of physical delivery in order to meet compliance.[248] Without a base resource and strong, top-down policy making, from the legislature to the public utility, this system would not thrive.

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[242] Gulen, *supra* note 225, at 5-6.
[243] *Id.*
[244] *Id*.
[245] *Id*.
[246] *Id.*
[247] *Texas Renewable Portfolio Standard*, *supra* note 241.
[248] *Id.* at 10

Important parallels may be drawn from the strengths of this RPS to the potential for China. First, fostering competition fueled by stable market situations should pose no problem for a nation now famous for encouraging investment. Next, China has a number of potential renewable resources, from hydropower along its many rivers to the high wind capacity areas in the west. Finally, China's top-down administration is similar to that in Texas. The lessons that competition works, and that stability in the rules with flexibility in compliance options make for a successful program will translate well to China's needs.

B. Massachusetts

Lessons also may be drawn from less successful RPS models. A good example of this comes from Massachusetts. The program there emphasized new and incremental increases in renewable energy generation.[249] However, its design made long-term contracting difficult and has shown modest results, with rate increases among the highest in the U.S.

The Massachusetts Division of Energy Resources installed a RPS model that began with a minimal target of 1 percent mandatory renewable incorporation into the total energy supply in 2003.[250] This expands to 4 percent by 2009, with increases of one percent again annually until the Division of Energy Resources suspends the increase.[251] The eligible resources include unique options such as ocean thermal and fuel cells.[252] Like the Texas model, it incorporated transferrable renewable certificates.[253] In

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[249] Wiser, et al., *supra* note 19, at 7.
[250] *Id.*
[251] *Massachusetts RPS*, PEW CENTER ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/node/4667
[252] *Id.*
[253] Union of Concerned Scientists, *Massachusetts Renewable Portfolio Standard Summary*, April 2008 http://www.ucsusa.org/assets/documents/clean_energy/massachusetts.pdf

Massachusetts, though, those certificates were tradable across the region, not just the state. It also contained an "alternative compliance mechanism" that caps the incremental cost of RPS at around 5 cents per kilowatt-hour.[254]

This has succeeded in increase the use of renewable energy sources in the region, but at a cost to consumers. The cause of this issue is primarily the lack of long-term contracts and the alternative compliance mechanism. Here, contracting standards for the less efficient providers has made the market very short-term oriented.[255] There is also uncertainty as to whether certain resources will be held as eligible over a longer period. Just recently, all biomass projects have been suspended from consideration by the Division of Energy Resources. [256] The alternative compliance mechanism has restrained the need for suppliers to look for long-term commitments because if a short-term contract expires and a more viable need does not appear, the alternative is to pay a fee, which may just be pushed on to consumers.[257] Without long-term contracts, as seen in Texas, some of the incentive to invest in projects with high initial costs is lost.

A lesson to be gathered from this experience is that while flexibility in compliance is important to foster integration, an open escape hatch may reduce incentives to work toward long-term contracts. Also, it is important to keep in mind that stability in the rules reduces risk to investors. The Massachusetts RPS did not meet that requirement. Contracting standards are needed to encourage long-term agreements. As a result, Massachusetts faces high compliance costs and renewable energy developers cannot find

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254 *Id.*
255 Wiser, et al., *supra* note 19, at 17.
256 *Notification of Removal of Biomass Fired Generation from Eligible Sources*, DIVISION OF ENERGY RESOURCES, http://www.mass.gov/Eoeea/docs//doer/rps/Mass percent20Biomass percent20Energy percent20Stakeholders.pdf
257 Wiser, et al., *supra* note 19.

financing for new projects. This leads to shortfalls and again, higher costs. Avoiding such pitfalls is critical to the success of an RPS.

C. United Kingdom

These state-based programs can teach lessons on a small scale, but the situation in China is more national in scale. This is a result of China's governmental and legal framework, which is organized in an efficient top-down model.[258] Therefore it is prudent to explore how nations have adopted this model on a national level. The United Kingdom's Renewables Obligation has resulted in increasing foreign investment in renewable energy development in the U.K., while succeeding in driving down electricity rates.

The Renewables Obligation Order came into effect in April 2002.[259] Like RPS policies it mandates that energy suppliers to include a specific portion of their total supply from renewable sources.[260] Central to its operation is the equivalent of transferrable renewable certificates, called Renewables Obligation Certificate.[261] It is issued to generators that use eligible sources, and then transferred to the supplier per megawatt hour purchased.[262] These certificates are then presented to the administrator to verify compliance with the target portion of renewable energy.[263] Target has increased in annual increments to 6.5 percent in 2007–2008.[264] If a supplier does not meet the target,

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[258] Chen, *supra* note 151.
[259] *Renewables Obligation*, OFFICE OF GAS AND ELECTRICITY MARKETS, http://www.ofgem.gov.uk/sustainability/environment/renewablobl/Pages/RenewablObl.aspx
[260] *Id*.
[261] *Id*.
[262] *Id*.
[263] *Id*.
[264] *Id*.

that supplier must pay the equivalent of the market value of the disparity to a fund. The proceeds of that fund then are paid back to the compliant suppliers on a pro-rata basis.[265]

The results have been positive. In 2009, the target for the Renewables Obligation has risen to 9.1 percent of the total electricity purchased by customers will be from renewable sources. Rates have remained stable while renewable electricity is growing at close to 18 percent over the last year.[266]

Many of the same policies that were successful in Texas have been successful in the U.K. Stability in the rules, contract standards and strong enforcement have helped to stimulate growth. The transferrable certificates have helped to keep liquidity and depth in the market and protect consumers from sudden rate increases.

VI – A MODEL RPS AND ADVICE FOR CHINA

China's current FIT model to encourage renewable energy investment has effectively encouraged greater renewable energy production.[267] However, China has also demonstrated a commitment to market liberalization in the electricity sector.[268] Together these goals are likely to result in steep rate increase for consumer. This is because the mandatory purchase obligation at a price above the market price drives up costs for suppliers and transmitters, who will pass those costs along to consumers in a more open market. To protect the interests of consumers, China needs to explore new policy options.

Promoting renewable energy development is a form of legal system engineering. Considering the issues and challenges above, China should deepen the energy system

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[265] *Id*.
[266] *About Us*, OFFICE OF GAS AND ELECTRICITY MARKETS, http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/Annual percent20report percent202007-08_Version percent204.pdf
[267] *Offshore Wind*, *supra* note 152.
[268] White paper on energy, *supra* note 124.

reform, including accelerating market system construction, diversifying the financing and investment system, deepening reform of management system, advancing price mechanism reform. At the same time, China should establish the Ministry of Energy to optimize administrative power and improve the management efficiency. Furthermore, it's important to establish the renewable energy market through RPS.

As stated above, a primary competitive market has been established in generating sector, the two grid enterprises are still the monopoly in the transmission, distribution and sales sector, but governed extensively through the NDRC.[269] Considering the current situation of the power market, the strategy to establish the renewable energy market consists of two steps.[270]

In the short-term, the feed-in law system should be continued and the grid enterprises should purchase the renewable power fully at a designated price. This will encourage maximum renewable energy penetration in the market. At the long-term stage, thought, with the power market reform and the development of renewable energy resources, the development pattern should be the RPS model.

One of the primary strengths of an RPS model is its flexibility in approaching the goals set by the model. Here, the goals are to encourage greater renewable contribution over time, while protecting consumers from the risks of rate increase. Secondarily, the model must also encourage foreign investment at the initial cost stage. Finally, the model must provide some protection for current industries. These can be best accomplished by

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[269] *Supra*, at 20.

[270] FU SHANLU, STUDY ON COMPLEMENTARY PATTERN OF RENEWABLE PORTFOLIO STANDARD (RPS) AND FEED-IN LAW (FIL) IN CHINA. Zhejiang University of Technology. (2008)

embracing some of the successful strategies from the Texas system and avoiding the pitfalls that plague more modestly successful programs.

The first question that must be addressed in developing an RPS program is which resources are eligible. Protection of existing renewable sources is important, and ought to be included. This will ensure the viability of current projects and help to keep costs and rates low at the onset. The risk of flooding the market is low because renewable sources compose such a small part of China current energy system. However, because hydropower has developed so rapidly without this model and the Three Gorges Dam project is already prepared to introduce 22.5 GW, current hydropower projects ought to be excluded.[271] Hydropower eligibility should match the common strategy of permitting small projects under 2 MW.

Other sources should include tidal technology, wind and ocean thermal. Of these sources, wind is likely the most readily applicable. It is already the second greatest renewable energy contributor after hydro, and the NDRC plans to increase capacity by 10 GW by 2010.[272] Much like the Texas system, it is likely that wind power will lead the way due to its availability.[273]

While biomass meets the definition of renewable, it poses many of the problems identified above, and most importantly it is a source of air pollution, CO2 emissions and particulates. These are the reasons that Massachusetts was forced to suspend its

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[271] *Country Briefs: China - Electricity*, US ENERGY INFORMATION ADMINISTRATION, July 2009, http://www.eia.doe.gov/emeu/cabs/China/Electricity.html

[272] *Id*.

[273] *Renewable Energy Potential in China*, *supra* note 154

consideration.[274] But, if the biomass fuel can be harnessed in a way that minimizes these problems, there is no reason to exclude it.

In a general sense, the list of eligible resources ought to be inclusive. The basic purpose is to replace fossil fuel reliance and so long as the replacement source fits into a definition of renewable, the presumption should be inclusive.

Next, a decision should be made as to the mechanisms to effectuate the target. The primary lesson learned from previous RPS experience is that transferrable renewable certificates have been the most efficient and effective method, and should be employed here. These certificates should be issued on a regular time-frame and based on the producer's kilowatt hour production, rather than capacity. Capacity based models provide for easier tracking, but may encourage generators to develop inefficient technology that do not actually produce electricity at the full, expected capacity.[275] The certificates would be issues on this production basis regularly and consistently. Electricity suppliers purchase these certificates from a marketplace like the Texas model. This makes both monitoring and enforcement easier and most cost-effective. Certificate prices will necessarily be determined by the market demand and while they may fluctuate slightly in price, they will always be representative of the market. Suppliers then present their total number of certificates to the administrator to demonstrate compliance. In the event of non-compliance, penalties would automatically apply.

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[274] *Technical Guidance*, DEPARTMENT OF ENERGY RESOURCES, *available at* http://www.mass.gov /?pageID=eoeeaagencylanding&L=5&L0=Home&L1=Grants+ percent26+Technical+Assistance &L2=Guidance+ percent26+Technical+Assistance&L3=Agencies+and+Divisions&L4=Department+of +Energy+Resources+(DOER)&sid=Eoeea

[275] Couture, *supra* note 2.

Enforcement and penalty provisions are a challenge for this system, but are necessary to produce positive results. A model provision for enforcement would have two separate sections, one for a highly competitive market and one for a less competitive environment. In the event of a crowded, competitive market, the threat of operating license revocation may be necessary to ensure compliance. In a less fierce environment, 1/10 of 1 percent revenue or a set figure fine for non-compliance would be collected.[276] A penalty based on revenue ensures that noncompliance is kept to minimum to avoid harsher and harsher fines. Models like Massachusetts' that lack strict enforcement or only levy fines minimally above the market price fail to produce long-term contracts, which are necessary to the success of an RPS.[277] The fines from noncompliance will be placed in a fund that is then distributed on a pro-rata basis to compliant participants, just like the Renewables Obligation system in the U.K.[278] Collection and distribution in this manner rewards compliance and punishes failure in a way that protects consumers, because a noncompliant supplier loses any competitive advantage and will be replaced by the less-cost compliant alternative.

Enforcement ought to be conducted by a government agency with direct accountability up the chain of command. However, this agency should have limited discretion, in order to increase transparency to foreign investors. Strict enforcement will demonstrate a specific and real renewable energy demand. Demand will fuel investment. If agency enforcement appears overly discretionary and there is no stability in it, foreign investors will shy away. Penalties should be mandatory, clear and specific. The only

[276] *See*, 30 V.S.A. §30 (penalizing noncompliance with electricity regulation through a portion of profits)
[277] *Supra* at 50.
[278] *Supra* at 51.

exception should be a *force majeure* provision that grants a reprieve in the event of a natural disaster, or unforeseeable circumstances.

Finally, the RPS should not be overly concerned about emerging technologies at its early stages, but may later work to encourage greater diversity through a credit multiplier system. In this system, specified resources or technologies receive additional transferrable renewable certificates per kilowatt hour of production. It provides direct incentives to invest and develop otherwise uncompetitive and cost-prohibitive sources. However, it appears that this mechanism drives up administrative costs, because the multiplier must be closely observed and it raises the total price for energy with little downward pressure, which results in high consumer rates.

Inclusive resource eligibility with restrictions on hydropower expands the resource base without risking flooding the market. These resources are easily traded, tracked and verified through the transferrable renewable certificates. Enforcement must be mandatory, effective and simple for the administrator. Finally, targets should be set low for initial years with incremental, predictable nonexcessive increases. These factors will help China encourage investment in an energy market that is affordable, reliant and sustainable.

CONCLUSION

China's current renewable energy programs have successfully driven investment into the marketplace. However, it has done so through an artificial market. As liberalization of the electricity sector progresses, the hidden costs inherent in that artificial market will visit themselves upon consumers. Industry-led growth in electricity

demand will slow as costs increase, and so too may industry growth itself. This places economic growth as a whole in jeopardy.

An RPS model that focuses on proper resource eligibility, ease of transferrable renewable certificate use, strong enforcement and clear, predicable rules is likely to be a success. Investor protection through incentives, while ensuring demand is more than merely likely to encourage investment. The question that remains is whether or not collecting renewable resources is truly sustainable. Sources, such as biomass, have the potential of still being a significant source of CO2 emissions. Only after ensuring sustainability of a resource should it be included.

A properly designed RPS would achieve result in lowest-cost generation and transmission to consumers, and a strict, predictable enforcement mechanism will encourage compliance. This provides for increased renewable energy production while protecting the interests of generators, who must adhere to traditional business and market theories, by requiring the lowest cost generators to reap the guaranteed market. It protects the interest of generators by providing a clear and consistent goal that makes planning and participation in the market relatively easy. Finally, the consumers' interests are protected by forcing the generators and suppliers to adhere to fundamental concepts of competition to secure investment. If done properly, there is no reason that an affordable, reliable, sustainable energy market for the long-term will not emerge.