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Legal and Policy Frameworks for Renewable Energy to Mitigate Climate Change

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Introduction

Renewable energy plays an important role in mitigating climate change by reducing carbon dioxide emissions, advancing energy security by diversifying an energy mix and reducing the impact of fossil fuel price uncertainty, and stimulating economic development by generating jobs, increasing incomes, and reducing poverty. The key to successful renewable energy development is the implementation of a sound legal, policy, and regulatory framework that will attract large-scale investment in renewable energy.

Renewable Energy — Global Status & World Bank Efforts

Renewable energy is making a difference in the way the world meets its power needs. In 2005, worldwide renewable power capacity expanded to 182 gigawatts ("GW"), excluding large hydropower, which is about four percent of global power sector capacity. Developing countries have 44 percent of this capacity. The top six countries were China (42 GW), Germany (23 GW), the United States (23 GW), Spain (twelve GW), India (seven GW), and Japan (six GW). Counting traditional biomass and large hydropower, renewable energy supplies seventeen percent of the world's primary energy. Investment in new renewable energy reached U.S. $38 billion in 2005. Forty-nine countries have renewable energy targets and promotion policies in place, including fifteen developing countries, and the list is growing.[1]

Counting traditional biomass and large hydropower, renewable energy supplies seventeen percent of the world's primary energy.

At the 2004 International Conference on Renewable Energies in Bonn, Germany, the World Bank Group ("WBG") committed to increasing lending for renewable energy ("RE") and energy efficiency projects by an average of at least twenty percent per year for the next five years. For the second year in a row, the WBG has outperformed its Bonn target. In fiscal year 2006, the WBG's financial support for renewable energy and energy efficiency was U.S. $860 million. Commitments for new renewable energy[2] and energy efficiency were U.S. $668 million, more than double the Bonn twenty percent target. This represents a 45 percent increase over the amount of commitments made by the WBG to new renewable energy and energy efficiency in fiscal year 2005.[3]

Legal and Policy Frameworks for Grid-Connected Renewable Energy

Twenty-five years of experience with successful renewable energy programs demonstrates that the implementation of an enabling environment of legal, policy, and regulatory frameworks that will attract large-scale capital investments is instrumental. Key success factors for RE policies require a legal and regulatory framework that ensures fair and open grid access and stable tariffs for Independent Power Producers ("IPPs"). Long-term price predictability through long-term power purchase agreements ("PPAs") with transparent and adequate pricing is the most important factor to attract investors.

Experience from industrialized countries shows that deregulating the power sector has the potential to expand service, attract private investment, and attract IPPs to the market, which appears to be essential for renewable energy development. However, the privatization of the power sector is inherently biased against capital-intensive investment in RE.[4] Privatized utilities are more reluctant to purchase intermittent renewable energy resources. However, an effective legal framework can establish policies to promote renewable energy.

It is essential that RE be considered early in the design of power sector reforms, not after the reforms are complete. Power sector structures influence the approach to RE market penetration. Vertically integrated utilities provide economies of scale, but the amount of RE capacity is determined by a monopoly that may be resistant to change, and there is little risk sensitivity. In an unbundled system, competition exists, and the market rules allow more flexibility. In addition, increased opportunities exist for private generators to compete though they may need special treatment, and each actor manages his/her own risk. In such cases, long-term contracts are important.[5]

To date, three major mandated market policy options to promote RE operate in the marketplace: (1) price-based feed-in laws, which require mandatory purchase of renewable energy at a fixed price (*i.e.*, used in Germany, Spain, and France); (2)

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quantity-based renewable energy portfolio standards ("RPS"), which require a minimum share of power or a minimum level of installed capacity in a given region is met by renewable energy (*i.e.*, used in Australia, Denmark, Italy, the Netherlands, some states within the United States); and (3) tendering mechanisms, which involves government-sponsored competitive bidding processes for the acquisition of renewable electricity whereby long-term contracts are awarded to lowest priced projects (*i.e.*, used in the British Non-Fossil Fuel Obligation, Ireland, and California). All these three mandated market policies ensure the right for the RE power suppliers to recover incremental costs between RE and conventional energy from consumers and to connect to the grid. Each approach has its own advantages and disadvantages.

Feed-in laws produce high penetration rates in a short period, create local manufacturing opportunities, provide strong incentives for private investments, and can be cost effective if the tariff is periodically and wisely adjusted. To date, feed-in laws demonstrate the highest installation rates for RE and are considered most desirable by investors given their price certainty. RPS mechanisms are good at reducing cost and price with competitive bidding, yet tend to favor least-cost technologies and established industry players unless separate technology targets or tenders are put in place. They are also more complex to design and administer than feed-in laws. Tendering policies are effective at reducing cost, but ensuring that signed contracts are realized is a key challenge.[6]

The types of instruments selected should be based on objectives, country conditions, and power sector structure. There is no single solution. The effectiveness of a particular policy will rely on how well it is designed and enforced. A case study of China Renewable Energy Law, described later in this article, provides insights and lessons on how these policy instruments are selected, designed, and applied. A comparison of these three policy options is summarized in the table below.

Each policy option must consider who will pay for the incremental costs between renewable energy and conventional energy sources, whenever appropriate. Passing costs onto customers by way of systems benefits charge, a carbon tax on fossil fuel, or a dedicated fund financed by the government or with donor support are the most frequently used approaches for covering this incremental costs and funding the various policy measures.

Furthermore, a range of financial incentive policies can level the playing field between conventional energy and RE investments. These policies can decrease upfront capital costs through subsidies, reduce capital and operating costs through tax credits, improve revenue streams with carbon credits, and provide financial support via loans and guarantees. Experience demonstrates that output-based incentives are generally preferable to investment-based incentives for grid-connected RE. The investment-based mechanisms do not necessarily provide incentives to generate electricity or maintain the performance of the RE plants once they are installed, while the output-based incentives promote the desired outcome — generation of electricity from RE.[8]

Finally, various models of public-private partnership for financing renewable energy exist. In general, public sector funds must be highly targeted to catalyze, not displace, private capital. Public funds can be used to support infrastructure development through methods such as loans and equity investment in companies and projects, business development, marketing campaigns, technical assistance, research and development, standards development, and public awareness.

Renewable Energy Policy Options Comparison[7]

	Quantity Of RE Development	**Cost/ Price Reduction**	**Resource Diversity**	**Market Sustainability**	**Local Industry Development**	**Investor Certainty**	**Simplicity**
Feed-In Laws	Large amounts RE in short time	Cost efficient if the tariff is periodically and wisely adjusted	Excellent	Technically & economically sustainable	Excellent	Can reduce investor risk with price guarantee & PPA	Most simple to design, administer, enforce, & contract
RPS	If enforced, can meet realistic targets	RPS and tendering best at reducing cost & price with competitive bidding	Favor least-cost technologies	Technically & economically sustainable	Favor least-cost technologies & established industry players	Lack of price certainty difficult for investors/PPA can reduce risk	More complex to design & administer & complex for generators
Tendering	Related only to quantity RE established by process	Good at reducing cost	Favor least-cost technologies sustainable if planning supported, stable funding	Tied to resource planning process	Favor least-cost technologies & established industry players	Can provide certainty if well designed (more risk than feed-in)	More complex than feed-in, simpler than RPS

Legal and Policy Frameworks for Off-Grid Renewable Energy

In many sparsely populated and remote areas, off-grid RE can provide least-cost solutions to rural electrification compared to grid extension or fossil fuel based options, such as diesel and kerosene. These renewable energy resources are fueled by indigenous resources and are environmentally benign. In addition, off-grid RE, particularly RE mini-grids, can also contribute to productive uses and social services, as well as generate heat, motive power, and other non-electric energy. Compared to fossil fuel based options, however, off-grid RE has unique characteristics with high upfront investment requirements but low energy costs.

It is essential that the rural electrification planning and policy frameworks clearly define the roles and criteria for grid expansion and off-grid options and ensure a level playing field between grid and off-grid alternatives. Grid extension and off-grid options should complement each other rather than compete. In locations where off-grid RE systems are the most economically viable option, governments should explicitly consider and encourage diffusion of these options in lieu of grid extension. In dispersed markets where often multiple service providers exist, the government should encourage business expansion and competition through the establishment of a conducive institutional and regulatory environment.

Grid extension and off-grid options should complement each other rather than compete.

The regulation of mini-grids, whether from RE or conventional sources, must be performed in different ways relative to the same regulatory tasks for grid extension. Mini-grid electrification uses different business models and often requires the need to coordinate tariffs with subsidies. Utilities and major private sector players with large financial resources generally invest in grid extensions. Mini-grids, on the other hand, are usually developed by local entrepreneurs or community-based organizations. Currently, most mini-grid service providers are often not regulated or are over-regulated. The regulatory frameworks for mini-grids should allow "light-handed" procedures and processes, and the regulator should delegate regulatory tasks to the rural electrification agency or rural electrification fund that inevitably is the *de facto* regulator. The regulatory framework should also permit private sector entities to enter the market, and ensure fair competition for all service providers.[9]

Tariffs allowing the RE providers to recover their costs are probably the single most important factor determining the long term commercial viability of mini-grid and other rural electrification projects. However, it is usually unrealistic to expect a full cost-recovery tariff, given the low ability to pay in rural areas. It is important to keep a balance between ensuring commercial viability of the service providers and meeting rural consumers' ability to pay.[10] Rural household surveys in many developing countries demonstrate that rural consumers can afford to pay up to five percent of household income on electricity and up to ten percent on all energy use, such as candles, kerosene, and dry cell and car batteries in un-electrification areas, ranging from three to twenty U.S. dollars per month.[11] When designing tariff structures for rural electrification projects, including mini-grids, a principle should be born in mind that the tariff should at least recover operation, maintenance, and management ("O&M&M") costs, and preferably partial capital investment costs.[12]

An adequate tariff structure for RE mini-grids should:[13]

- Recover at least O&M&M costs;
- Reflect cost structure — a high fixed charge (higher than typical tariff structures applied in large grid systems) to reflect fixed O&M&M costs, a variable charge to reflect fuel costs, and a levelized capital cost charge partially reflect capital investment costs; and
- Remain below consumers' ability to pay.

Following this principle, a fixed monthly fee may be a more appropriate tariff scheme for RE mini-grids since it is more directly related to the cost structure of a RE system, and it provides the operator with a clearer financial forecast. Other pricing schemes such as pre-payment and binary real time pricing as well as new solutions for intelligent metering, such as energy dispensers and behavior-based charge controllers, have been applied in a few pilot RE mini-grid projects. Such tariffs can be differentiated by customer segments with different consumption patterns in order to be more proportionate to the customer's ability to pay.[14] In addition, community involvement is critical for RE mini-grids. Communities sometimes can pay up to ten to twenty percent of the capital investment of RE mini-grids up front in the form of labor, material, and cash.

Worldwide, almost all rural electrification programs involve some form of subsidy. In principle, subsidies should be applied to access costs (connections), not to operating costs (ongoing consumption).[15] Following the principle that tariffs should recover O&M&M costs, while subsidies should buy down initial investment costs, RE mini-grids can become more attractive than diesel genset, because they require lower tariffs compared to diesel generators and are less exposed to fuel price volatility. Sometimes, in a remote area where the price of diesel is quite high, the O&M&M costs for diesel generators can be higher than the local consumers' ability to pay.

A Case Study — China Renewable Energy Law

China has the largest renewable energy capacity in the world, with an installed capacity of 42 GW in 2005, mostly small hydroelectric power. At the Beijing International Renewable Energy Conference in 2005, the Chinese government announced an ambitious target to achieve sixteen percent of energy consumption from renewable energy by 2020, which is equivalent to an installed capacity of 75 GW of small hydro, 30 GW of wind, and 30 GW of biomass.

China passed Renewable Energy Promotion Law in February 2005, which took effect on January 1, 2006, making it one of the first countries in the developing world to adopt mandated market policies for renewable energy. The World Bank China Renewable Energy Scaling-Up Program provided U.S. $213 million in International Bank for Reconstruction and Development loans and Global Environment Facility grants to assist China in implementing the Renewable Energy Law and investing in wind farms, biomass power generation, and small hydro plants.

The development of the Chinese Renewable Energy Law offers valuable insights and lessons on how RE policy instruments are designed and applied in the real world. After carefully examining the three options of the mandated market policies through study tours and workshops, the Chinese government decided to adopt the feed-in tariff approach in the Renewable Energy Law that was passed in 2005.

While the Renewable Energy Law in 2005 provided critical principles and frameworks, it did not include detailed operational guidelines for implementation and enforcement, which were left to be developed in the Implementation Regulations. While feed-in laws have produced the highest RE penetration rates and are relatively easy to administer, it is tricky to set up the feed-in tariff level at the beginning, particularly when there are no reliable cost benchmark data available on large-scale commercial wind farms and biomass power plants from real world experience in China. If the feed-in tariff is set too low, it will not provide sufficient incentives to the investors, thereby defeating the purpose. If the feed-in tariff is too high, it will create high rent and not be cost-effective. In addition, considerations in regional equity added another layer of complexity. Given the wide variations in renewable energy resources, coal resources, economic development status, and electricity tariff levels among different regions, a question of whether the feed-in tariff should be set at the national level with regional differences or at provincial level also generated a major debate. Drafts of the Implementation Regulation, circulated for public comments in November 2005, had clearly stated that the wind power tariffs would be set at baseline coal-fired power prices in each province, plus a subsidy of RMB 0.23/kWh (U.S. $0.028 US/kWh).

Contrary to expectations, the Implementation Regulation announced on January 1, 2006 did not apply the feed-in tariff to wind power, only to biomass. Biomass power tariffs are set at province-specific average coal prices plus a premium of RMB 0.25/kWh Chinese Renminbi, which is equal to three U.S. cents per kilo-watt-hour ("cents/kWh"). Wind power tariffs, however, are established through the ongoing concession process.[16]

The Chinese government introduced competitive bidding for wind farm development in 2003, to steadily ramp up new wind power capacity at the lowest possible costs. After years of high wind electricity tariffs, the government hoped that such a concession approach would drive down and reveal the cost of wind farms in China. Under the Wind Power Concession program, the National Development and Reform Commission invited international and domestic investors to develop 100 megawatt ("MW") wind farms on a potential wind site. Winning bidders are granted approval to develop the selected project site, a PPA for the first 30,000 hours of the project operation, guaranteed grid interconnection, financial support for grid extension and access roads, and preferential tax and loan conditions by the central government. This backing of the central government creates a comparatively lower-risk investment environment for wind farm developers in China.[17]

The first round of bidding took place in October 2003, with two projects awarded 200 MW. While the winning bid prices were significantly lower than any previous wind farm price in China, they were below the long-run marginal costs. The selected developers experienced difficulties in obtaining financing, and project construction was delayed. The subsequent rounds of bidding from 2004 to 2006 awarded an additional 2000 MW capacity.[18] The winning bid price for the wind concession projects to date ranged from 4.6 to 6.2 U.S. cent/kWh, while current average cost of wind power in China is estimated to be between 6.3 and 8 U.S. cent/kWh.[19]

To date, the concession caused a major concern to the wind industry in China because the bidding process resulted in prices that are too low to be financially viable. As a result, there are reduced incentives for developers to invest in this nascent industry. In addition, the number of companies attempting to bid for the concession projects actually fell from the first round of concessions to the second round, contrary to expectations that the number of participants would increase with the program's increased visibility and the "success" of the first two concessions. Furthermore, better wind resource measurement is needed to decide the selection of concession sites and the bid prices.

Conclusion

Renewable energy is an effective approach to mitigate climate change. Worldwide, renewable energy technologies are growing rapidly and have become a mainstream industry. Developing countries have done more than expected to promote renewable energy development, and China is a world leader on renewable energy capacity.

The key to success for renewable energy development is the implementation of a sound legal, policy, and regulatory framework that will attract large-scale investment in renewable energy. Successful renewable energy policies must be long-term and consistent; have a secure and predictable payment mechanism; provide fair and open grid access; possess strong governance conditions, clear administration procedures; and low transaction costs; have strong public acceptance; and enforcement is key. Countries should start simple in the design of energy policies, and always remember that "the devil is in the details."

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ENDNOTES: LEGAL AND POLICY FRAMEWORKS

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[1] REN21, *Renewables: Global Status Report 2006 Update*, *available at* http://www.ren21.net/globalstatusreport/download/RE_GSR_2006_Update.pdf (last visited Feb. 10, 2007).

[2] New RE includes solar, wind, biomass, geothermal, and small hydropower less than 10 MW. The World Bank Group's commitments for new renewable energy alone were $221 million in fiscal year 2006.

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[14] Toolkit, *supra* note 8.

[15] Toolkit, *supra* note 8.

[16] Renewable Energy Law (promulgated by the Standing Comm Nat'l People's Cong., Feb. 28, 2005, effective Jan. 1, 2006), ch 5, *available at* www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc (last visited Feb. 11, 2007).

[17] Toolkit, *supra* note 8.

[18] Jean Ku et al.,*Wind: The Future is Now*. RENEWABLE ENERGY WORLD, July–Aug. 2005, *available at* http://www.nrel.gov/international/china/pdfs/2005_renewable_energy_world.pdf (last visited Feb. 11, 2006).

[19] Ku et al., *id.*