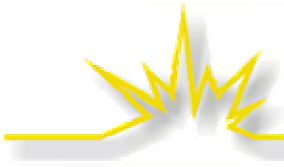

The Regulatory Assistance Project

Restructuring and the Environment: Many of the Details Matter

The Regulatory Assistance Project

Prepared For

Workshop on

Competitive Power Markets for China

(Sponsored by the State Development and Planning Commission with the assistance of the World Bank and the Energy Foundation)

Revised October 16, 2000

Restructuring an electric power system invariably affects the environment. For a nation alert to these effects, restructuring is an opportunity to improve not only economic performance but environmental quality as well. For a nation unaware of these effects or indifferent to them, restructuring may well result in unnecessary damage to the public health and to the environment.

Whether restructuring goes well or badly for the environment will be determined largely by the definition of improvement that the nation adopts. If, as is often the case, it measures improvement entirely in terms of privatization, competition, increased generation and reduced price, then the cost to the environment and to public health may undercut the economic benefits of restructuring. If on the other hand, improvement is defined to include not only privatization and competition coupled but increase in available energy and reduction in the costs of the system – *including the environmental costs* – then restructuring is more likely to improve the lives and the security of the nation. It is also more likely to be sustainable.

Important steps toward assuring a benign and sustainable restructuring could include the following:

1. An ongoing power sector restructuring working group in which the nation's environmental and public health officials have a strong voice should oversee the restructuring plan.
2. This group's charter or mandate should specifically include analysis and mitigation of environmental and public health impacts.
3. To the extent practicable, market mechanisms should be employed to achieve reductions in emissions beyond those achieved by direct prohibition.

4. Impacts that cannot be fully mitigated should be given weight in the choice among future power supply options.
5. Particular attention should be paid to assuring that resource procurement and tariff methodologies reflect the value of energy efficiency, which can be understated in methodologies based entirely upon costs and prices as conventionally calculated.

The foregoing steps are necessary because restructuring based solely on privatization, on the creation of competitive markets and on the reduction of prices will create strong pressures to run the least expensive power plants *even when those plants are least expensive because they do not meet prudent environmental standards.* A restructuring plan that ignores this fact is likely to create incentives to build and run the most environmentally harmful (but cheapest) plants even more than would be the case if restructuring had not taken place at all. Such restructuring also creates incentives to minimize the pollution control costs of new plants in order to be sure that they are the lowest cost competitors.

Creating restructuring programs through working groups that do not include environmental and public health officials may make consensus seem easier to reach, but this is a false harmony, for the environmental and public health impacts will cause continuing friction between the energy sector and those concerned with its external costs and impacts. Eventually these concerns will have to be dealt with through retrofitted solutions, but the costs will be much higher than if they had been dealt with from the beginning. And, of course, the deaths and damages will also have been much greater than necessary.

Consideration of environmental concerns as part of the restructuring process is also important because market structure and market design rules can have a profound effect on the environment. Also, proposed reforms may create or foreclose opportunities for environmental improvement.

Well documented market failures and the absence of strong and effective "polluter pays" policies demand the adoption of overarching policy options such as system benefits charges (SBC) and renewable portfolio standards (RPS). An SBC is a small charge collected from all kwhs sold. The funds are aggregated and used to support the development of renewables, energy efficiency, and research and development. The most successful models, such as those in the United States and the United Kingdom use market based auction approaches to add new renewables and energy efficiency at the lowest possible cost.

RPS approaches require all generators or distributers to use a minimum amount of new renewable sources of energy. Generators or distributers are free to obtain the new renewables in the least costly fashion. Six states in the U.S. are implementing this approach to assuring that renewables are a significant and growing part of the countries energy mix. China already plans to separate generation from transmission and distribution. Many questions and details remain on how this separation should be done. One approach to separation that also makes RPS (and Generation Performance Standards) much easier to implement is to assure that generation is separated into groups of power plant with roughly equal fuel mix and emission.

While these policy options can be grafted on to most structures, there is a long and growing list of market structure and market design decisions that will be made during the restructuring process that will have profound effects on whether the end result is environmentally sustainable. As described below many of the issues that matter most for the environment also influence whether the restructuring plan is sustainable economically and politically.

1. Wholesale markets

We assume that wholesale markets will consist of a number of unregulated generators and a spot energy market, or power pool. There are a number of important issues about the creation of this pool that make a difference for the environment and that also improve the efficient functioning of the market.

a. Market power

A fundamental prerequisite of a competitive wholesale generation market is the absence of vertical or horizontal market power. Structural separation of generation from transmission and distribution is vital. Control of generation must also be spread among enough owners to assure that concentration of ownership does not distort prices. The US markets have not done a good job in this area.

b. Demand response

Most power pools use supply-only bidding regimes. In the usual model of a competitive supply market, spot market prices are determined a day in advance by utilities, or in some regions by an independent system operator (ISO), power exchange, or a similar entity. A supply curve is determined using either marginal costs or bid prices to rank order the plants, beginning with the cheapest plants. The highest-cost resource called on in each hour sets the spot market price for all energy sold in that period. To the extent that there is any demand curve, it is an engineering construct based on factors such as yesterday's demand, the weather and the day of the week. It is not based on the utility customer's willingness-to-pay or on actual production costs. Consequently, even though the merit order dispatch of a utility or pool may rank supply resources according to cost, the intersection of the supply and demand curves, while reflecting historic load patterns, expected weather, and related factors, is economically meaningless because the demand curve was not itself shaped in response to the supply curve.

In the U.S., the absence of a demand response combined with market power has produced prices have been extraordinarily volatile and peak prices have been so high as to place in question the political “sustainability” of the restructuring efforts. It is vitally important that energy efficiency, load management, and other demand responses are made an integral part of power pool design.

Allowing demand response and energy efficiency to be made full partners in the wholesale market design. Experience in other countries shows that including demand response and energy efficiency significantly reduces the likelihood and severity of price spikes, lowers average wholesale energy price during all hours, and reduces pollution.

c. Generation Performance Standards (GPS)

Before Restructuring utilities invested in pollution controls equipment and regulators allowed all costs to be included in prices. The risk associated with these investments were low and investing in pollution control had no competitive effect. After reform cost recovery was based on market prices and these investments may or may not be recovered though increased prices. With reform, the new profit incentive tended to reduce spending on environment.

More important it means low-cost high-polluting plants have competitive advantage over cleaner plants. This advantage leads to increased pollution which is contrary to one of the main policy goals of reform.

Creating competitive generation markets begins with the existing stock of generation. This generation was subject to environmental regulations which were written under a particular economic and political structure which is now being changed by power sector reforms.

To prevent electric utility restructuring from resulting in a degradation of air quality, it is necessary to implement a mechanism to ensure that disparities in environmental regulation do not create a competitive advantage for more polluting resources (i.e., "leveling the environmental playing field")

Power plant emissions in the US have traditionally been regulated on the basis of pounds of emissions per unit of fuel burned (e.g., kg./MBTU). Historically, this input-based regulatory option was adopted because it could be applied to all sectors, not just power plants but industrial and commercial entities as well. This method was also consistent with the U.S. historical practice of setting different standards for power plants depending on plant age and fuel use. However, using non-uniform, fuel input-based standards has led to unintended negative consequences. It encourages the construction and operation of plants with higher emissions and lower efficiency, encourages less efficient plants to continue operating, fails to provide incentives for pollution prevention, and is not compatible with competitive markets for generation.

In contrast, output-based standards (e.g., kg/kwh) provide a mechanism for promoting greater efficiency in the generation of electric power regardless of

plant age or historic fuel use. Using uniform output-based emission standards where all producers of electricity face the same standards is important for electricity markets in the process of evolving to competitive markets since they reward facilities that are efficient in production and promote the development of new and cleaner facilities.

There are other approaches that can also eliminate the competitive advantage of dirty plants including reforms to China's existing "polluter pays"policy. Reasonable pollution fees for high polluting plants combined with rebates or payments to clean plants can also serve to level the competitive playing field.

d. Intermittent Resources

Some of the cleanest generation options such as wind and solar are intermittent. The hour-by-hour output of any individual facility will not be as predictable as it is for most fossil generation. As a result, renewables will be disadvantaged if the pool adopts rules that require all generators to state their hourly levels of generation a day or more in advance and then impose penalties if the day ahead schedules are not met. Pools that have, or are considering, penalties of this type do so to address market power concerns. A far better solution to market power issues is to fully separate generation from transmission and to be sure that generation ownership is widely dispersed.

e. Capacity costs and reliability pricing

Pools differ with respect to their treatment of capacity costs. Some pools have no capacity requirements and no capacity markets, and other pools have both. Pools also differ on how they determine operating reserve requirements. The presence and design of a capacity market and the level of required operating reserves can influence how much and what kind of new generation gets built. We prefer rules that do not discourage renewables.

Some pools allocate the costs of ancillary services, such as spinning and non-spinning reserve, to load. Other pools allocate some of these costs to generation in proportion to the level of reserves caused by different generators. Allocating the cost of generation related reserves to the generation that causes the cost to be incurred will influence the types and sizes of plants that are built.

f. Separation of Generation

The primary goal of restructuring is to create competitive markets in which the functioning of the market takes the place of regulatory oversight. Market power issues, both vertical and horizontal, must be addressed. Separating generation from transmission and distribution is an important step in this process.

But, unless the environment is considered, separating generation from T&D may have the unintended consequence of slowing pollution reduction efforts. Separating generation will give the new owner certain rights, obligations, and expectations. One expectation is that the new owners of competitive generation will not be able to pass pollution control costs on to consumers. This will make it more difficult to impose clean-up obligations on the new owner.

Our advice is to review the environmental performance of existing generation and make any clean-up requirements an explicit part of the separation process. In doing so, the market prices of the traded assets will reflect the purchasers' assessments of the rights and obligations. The US, which has accomplished some separation through sales of assets, has had some positive experience with divestiture that imposed environmental clean-up as part of the sale. Buyers, eager to win auctions for generating plants, have met the clean-up obligations at very low cost. Also, as mentioned earlier, one approach to separation that makes Generation Performance Standards and (Renewable Portfolio Standards) much easier to implement is to assure that generation is separated into groups of power plant with roughly equal fuel mix and emission.

g. Load shapes

One of the benefits of restructuring is it will send consumers better price signals. Yet, many of the markets have been structured so that no customer or retail seller has any incentive to provide a demand response to market prices. In part, this is the result of end-users not having real-time meters and paying average monthly prices. It is quite common that small, and even some large-sized, consumers end up being charged according to the load profile of the "average" customer in their customer class. The end result is that neither the customers nor their supplier has any incentive to respond to high prices or high loads with demand reductions or energy efficiency investments, since any savings that would be achieved cannot be attributed directly to the consumers who produced them. Thus, real-time metering and other policy options that allow demand-side energy efficiency to have a role in the market should be a priority.

h. Subsidies

The most contentious issue in the US restructuring process has been stranded cost. Utilities with generating or other fixed assets that cost more than they would be able to recover in a competitive environment have labeled the difference "stranded cost". Utilities have also asked, and have generally been allowed, to recover other costs which amount to ongoing subsidies to existing plants that otherwise would not be competitive. This practice creates the risk that older and more polluting plants will remain in service.

i. IRP in single-buyer models

Single-buyer systems are generally based on long-term contracts. Consumers are obligated to pay for the contracts and have no ability to choose their own sources of supply. In a spot market it is clear that a 2 cent bid is better than a 4 cent bid. In the long-term market, comparing bids is not so easy. Specific plant operating conditions, the plant's location, the allocation of risk, long-term environmental performance, and non-generating alternatives to any plant are all factors that influence which bid wins. Integrated Resource Planning (IRP) is the best way to analyze these factors and deliver the least-cost energy services.

2. **Transmission**

Competitive generation markets require that generation be separated from transmission. The transmission entity is responsible for providing open and efficiently priced transmission services to all generators. How this general responsibility is met can influence the environmental performance of the restructured market. The key transmission issues appear below.

a. Transmission pricing for intermittent resources

There is no single established system for pricing transmission services. Some pricing options will bias new construction against intermittent sources such as wind. For example, if transmission prices are based on the generating capacity connected to the grid, a 100 MW farm with a 35% capacity factor (or perhaps 35% coincidence factor) would pay the same transmission fee as a 100 MW fossil generator with a 90% capacity factor. Pricing based on distance may also discourage the development renewables resources located the western parts of China.

b. PBR

The transmission entity (or entities) will be a monopoly and its prices and revenues will be regulated in some fashion. It is important that the transmission firm be regulated in a way that provides incentives for efficient trade off between new investment in transmission and investment in transmission alternatives including energy efficiency, load management, and efficiently located new sources of generation.

3. Distribution companies

At the outset distribution companies will distribute and sell electricity. Later, if retail competition is implemented, the role of distribution companies will be more limited. The following are a few of the more important distribution company issues that bear on the environment.

a. Form of regulation

The distribution entities will also be monopolies and their prices and revenues will be regulated in some fashion. Because of the nature of distribution utility costs, both traditional and price-cap regulatory approaches tend to reward increased sales and discourage energy efficiency. Under price cap approaches the distribution company's revenue grow in proportion to sales growth. Because distribution company costs do not grow in proportion to sales, the company's profits go up as sales go up. This produces very strong disincentives to invest in, and encourage others to invest in, energy efficiency.

A better approach is to use revenue cap approaches to regulation. Revenue caps specify the total revenues or the revenues per customer that the distribution company may collect. Revenue caps better match cost trends and eliminate disincentives for end-use energy efficiency.

b. Rate design

How the distribution company charges customers for its services will influence the incentives consumers see to invest in energy efficiency. Fixed monthly charges, unlike usage-based charges, tend to discourage customer investment in energy efficiency. Also, when consumers, especially large industrial consumers, see the real-time costs of the electricity they consume, they have an incentive to save energy at certain times of the day and will invest in energy efficiency technologies

c. Distributed resources

Distributed resources include several rapidly developing technologies including a new class of small (less than 100kW) clean mirco-turbines and fuel cells. These new technologies can provide electricity and thermal energy on site and in some applications they can substitute for expensive distribution system expansion. New pricing systems are being developed now under which distribution companies can send efficient signals telling customers and developers where these systems make most economic sense.

By delivering electricity locally fewer, in any, transmission and distribution lines will be needed. These new technologies offer to do to the electric industry what wireless cellular telephones are doing for the telephone industry. Restructuring the electric sector should not create or perpetuate barriers to the development of these technologies.

4. Role of Regulation

The need for a well qualified independent regulatory body to oversee all aspects of power sector reform is widely recognized. The role of such a body is multifaceted. It's most basic duty is to protect public interest from the possible abuses of monopoly service providers and competitive providers that engage in abusive market power activities. Regulators also oversee price, service quality, and safety related issues.

As it industry becomes more competitive a key responsibility is to create, monitor, amend, and enforce market rules to assure the efficient operation of markets for the benefit of the public.

The meaning of having the regulators be "independent" is one of the more difficult concepts to understand tp explain. In summary form it means

Another lesson learned about regulation is the strong need to coordinate efforts between regulators at different levels of government as well as coordinating the efforts of to utility and environmental regulators. Many regulatory actions that appear on the surface to involve purely economic issues have profound environmental implications. For example, one economic treatment for SO2 scrubbers, another for the payment of pollution fees, and another for the operating cost of using cleaner fuels and yet another for decisions to retire dirty plants and replace them with cleaner options. Coordinating with environmental regulators and policy makers will assure that the best solutions are selected

A well-qualified and independent regulatory body is an integral part of power sector reform. This has become increasingly apparent in other parts of the world. Experience shows that flaws and weaknesses in power market rules are quickly identified and exploited. Competitive businesses seek and find opportunities to profit in ways that were not originally anticipated or desired. Some of these actions may be contrary to the public interest. A competent regulatory body must be able to identify and detect behavior that is contrary to the public interest and take corrective action.

Market participants may have input to the development of these rules but the interest of market participants is often different than the public or national interest. For example, generators have an interest in high prices, existing generators may have an interest in keeping new entrants out of the market, and transmission owners in one province may have an interest in discouraging alternatives to transmission or interconnections with other transmission companies.