Public Sector Intervention in the Energy Sector

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EXECUTIVE SUMMARY

Access to modern energy is a central feature of economic and social development. Almost all developing countries need to expand and improve the efficiency of their energy infrastructure. It is difficult to imagine the conditions that would allow the eradication of poverty without adequate and reliable energy supply from electricity and fossil fuels. What role the state should play in this effort is the central concern of this paper. With an understanding of the role of the state, international institutions will be better able to create programs that can assist governments seeking to provide for adequate energy development. We focus primarily on electric power because it is at the center of the policy debate about energy today.

The relative roles of the state and the market in the energy sector have shifted in large patterns over time. Moreover, even in periods of seeming dominance by state or private parties, differences among countries have been marked. We attribute this instability and these differences in the relationship between governments and markets to the pervasive presence of both government and market failures in the energy industries.

Market failure in the energy sector is a consequence of natural monopoly, imperfect markets, externalities, and equity issues. Market failure led to an increased role for the state, especially in the 1960s and 1970s. But an important shift back toward the private sector in the 1980s and 1990s has come about as government failures have become more apparent.

The paper seeks to understand how the role of the state changes when competitive markets are introduced by looking at the regulatory innovations made by a few countries as they have sought to restructure their power industries. Tasks that seem inevitably to require government attention are coordination among the now separate parts of the industry, monitoring and blocking tendencies toward collusion, sharing of risk with private partners, and stimulating investment in expansion.

Some states are deemed unlikely to attract private investors to infrastructure projects. For these countries, there may be no alternative to state ownership, at least in the medium run. The state will, in spite of its imperfections, remain the primary player in energy production and distribution. Because many countries still manage their electric power industries through vertically integrated state-owned enterprises, we examine the bureaucratic behavior that causes many of the inefficiencies in these firms. As part of the discussion of government failure, we also consider the politics of pricing power, which plagues all different types of systems.

In all countries, regardless of the degree of market or government failure, the government must support access for rural areas and poor consumers, if they are to be adequately served.

Out of the experiences of the countries examined, one can fashion an agenda for international agencies that are trying to support development of the energy sector. The main items on this agenda are:

- Loans for infrastructure projects where the supply of private capital is hesitant or costly
- Reform of state-owned enterprises, where the best prospects still lie with state ownership
- Information on contract terms negotiated elsewhere by private investors for infrastructure projects
- Assistance in structuring the design of subsides to accomplish social goals
- Assistance in building regulatory capacity.

Public Sector Intervention in the Energy Sector

A: The Public/Private Sector Dynamic

I. Goals in the energy sector

An exploration of the role of the state in the energy sector in developing countries demands clarity about objectives to be accomplished. Fortunately, there is a good deal of consensus about objectives. Developing countries need a supply of energy that expands to meet increasing demand and rural areas need access to modern energy. These objectives need to be achieved with minimum environmental damage, at reasonable cost, and with risks allocated in an appropriate way. Unfortunately, these objectives can sometimes conflict.

There is less consensus about the appropriate role for the state and the private sector in achieving these objectives and deciding on trade-offs among them. The roles of governments and private investors in the energy sector have a long and complex history, often fraught with tension.[1] The focus here on developing countries invites a leap to the post World War II world when most of these countries became independent.

II. A shift away from state-led development

After decades of domination by the private sector, from the mid-1950s and into the early 1980s most of the energy sector in developing countries fell into the hands of state-owned monopolies. Even when energy was being produced for export and the private sector retained a major role, exporting countries created state-owned parallel institutions to deal with foreign investors. Thus, the emergence of Pertamina in Indonesia, the National Nigerian Petroleum Company, and similar state-owned oil companies.

Especially for the domestic energy sector, the absence of market pressure to control costs and the presence of political forces to provide jobs, high wages, and other favors eventually took their toll on the costs and efficiency of state-owned firms. Often, labor costs in state enterprises grew to the point that they were out of line with market norms. The firms employed more people than necessary and management deteriorated as political intrusion eroded skills and morale.

On the revenue side, governments often hesitated to allow increases in energy prices to match inflation and the high cost of operating the state-owned enterprises. And, low prices added further to demand since they discouraged conservation. Political considerations and management indifference also often meant that these companies failed at collecting their bills, whatever the tariff structure. Caught in the trap of providing large volumes of energy while receiving low revenues, state-owned firms were not able to expand capacity and to invest in up-to-date technology. Thus, despite large government subsidies, energy infrastructure was

[1] See Vernon (1992) and Klein and Rogers (1998).

inadequate and service, poor for the industries and businesses that are essential for economic development. Modern, low cost energy supply did not reach poor individuals in society who often had to turn to higher cost substitutes.

Some of these problems were, of course, not unique to the energy sector, but affected public sector enterprises across the board. Concern about poor performance began to swell in the early 1980s, coinciding with the debt crisis that hit many of these countries. The inability of countries to service existing debt led commercial banks to hesitate to make further loans to the state for state-owned enterprises. Subsidies to state-owned enterprises were challenged as government budgets were squeezed. Calls for reform of state-owned enterprises and for privatization spread as reformers looked to the incentive structure of private ownership to improve efficiency and generate the funds to relieve government budgets and to ease the constraints on capital investment. A sector that was once largely privately owned would, in a number of countries, again become private. But the shift from state ownership to private was very uneven across countries. And some transformations were it appears, very successful, while others could be described as failures.

III. Looking ahead

After a decade and a half of promoting private sector engagement in energy industries, reformers can point to important accomplishments. Overall, the role of the market has expanded and the role of government has declined. A number of countries in Latin America have made impressive strides in privatizing and introducing competition in the sector. In the most successful countries, reform efforts have succeeded, with the result that costs have declined and the quality of service has improved.

Many countries, however, have been left behind altogether. Most private sector capital has flowed to the energy sectors of only a small number of countries. None of these countries is in Africa. Moreover, even where private investment has been forthcoming, rural areas have not benefited as much as desired. In a number of the countries where the private sector has become involved, tensions between investors and the state have grown to the point that they remind one of the old conflicts of the 1960s and 1970s. The cancellation or renegotiation of a few high profile investments, in India, Pakistan, and Indonesia, for example, of the 1990s caught many enthusiasts off guard and highlighted the difficulty of "getting it right" with the private sector.

Today, the vast majority of developing countries still operate all or parts of their energy industries as state-owned monopolies.[2] The slow progress and occasional failures need not suggest a retreat from the reform efforts of the past twenty years. Rather they suggest the need to calibrate our understanding of the complex relationship in the energy sector between the state and private investors and to identify the factors that influence this relationship. Only then can international agencies position themselves to promote appropriate policies.

The reasons for the historical shifts in emphasis between public and private control that are described above include changes in the availability of funds, changes in technology, and changes in ideology. But, underlying the choice of public versus private ownership has always been a dilemma: the energy sector, and in particular the electric power industry, is especially subject to market failures. At the same time, government failure has also characterized attempts

[2] For a survey of the energy reforms undertaken by developing countries in the past decade, see Bacon (1999).

by governments to intervene to counter market failures. The result has been that every solution is inevitably something of a compromise; and, compromises have a tendency to be unstable.

In spite of the strong ideological tilt today toward private ownership in the industry, the many countries have that have resisted turning the sector over to private hands suggests the extent of problems. The choices that governments face and the consequences of those choices can best be understood in the context of market and government failures that characterize the industry and the systematic variation in these failures across countries. We will argue that there is no single right answer for all countries. The appropriate approach for some countries may fall short of full private ownership, something we will explore toward the end of this paper. Moreover, even in the countries that have moved farthest toward private ownership, a number of problems remain unsolved, and the role of the state remains very important. Not only will different countries find different solutions appropriate at a particular time, within a country, the mix of public and private is likely to shift and be subject to continual experiments and learning.

The following two sections explore first the market failures and then the government failures that characterize the industry and create the underlying dilemma that confront countries. The next examines the variables that shape the choices that governments have in attempting to develop their energy sectors. The paper ends with some proposed activities for international agencies to support energy development.

B: Market Failures

If markets worked perfectly, there would be no need for the state to intervene in the energy sector, except possibly to affect income distribution or to accomplish other objectives not captured in market models.[3] But in fact, there are market failures that, under some conditions, call for state involvement. The following sections consider the traditional categories of market failure relevant to the energy sector today.

I. Natural Monopolies

Important parts of the energy industries were long considered natural monopolies.[4] The economies for energy production and the networked delivery systems meant that competition was not technologically efficient in many segments of these industries. One firm could operate at substantially lower average and marginal cost than could several firms sharing the same market. Moreover, as a monopoly was natural in some stages of the industries, other stages became vertically integrated with the steps characterized by market monopoly. This evolved as a way for firms to avoid dealing with a monopoly or monopsonist. Vertical integration was also a mechanism for capturing the efficiencies of technical coordination of investment and operations across the stages of production. Arranging the delivery of a non-tradable product into distribution systems with fluctuation demand was, it seemed, more easily arranged within a single firm than across firm boundaries.

[3] For a classic presentation of the theory of market failure see Bator (1958).
[4] For a summary of the literature on natural monopoly see Sharkey (1982).

In recent years, technical change and institutional developments have reduced the monopolistic tendencies of some parts of the energy industries and made possible the separation of stages of the production/processing/transportation/marketing chain and the introduction of competition. For most of the energy industries, however, the transportation or transmission stages remain natural monopolies. Moreover, in all developing countries, the state owns the rights to the conventional sources of energy—coal, hydrocarbons, geothermal, and water. However, even where technological advance has not changed what used to be natural monopolies, new contracting arrangements have encouraged experiments with competitive bidding for operating rights. The new arrangements offer the possibilities of more efficient management and lower costs by having private parties bid for management rights.

In the power industry, innovation on the generation side has allowed smaller, less expensive generating facilities to be competitive. The new combined cycle generation plants for electricity generation, for example, require smaller investments and can be operated efficiently over a broader range of hours, making distributed generation technically and economically attractive to independent private operators. As a result, generation, once a market monopoly, can be made competitive, in certain cases. The expansion of distribution systems and power grids overtime has brought more customers to a single network, increasing the possibilities of competition in generation. On the other hand, provision of transmission and the wire side of local distribution remain natural monopolies and are not easily privatized.

In the export petroleum industry, production, refining, shipping, and marketing have long been primarily private, although not especially competitive until the 1960s. But many producing countries chose to keep some aspects of the national oil industry in the hands of a state-owned enterprise, both to increase learning by nationals and to concentrate expertise needed for dealing with private investors.

On the fuel side, monopolies remain common. A number of producing and most non-producing countries have held oil refining and distribution in state hands until recently, perhaps largely for political, not economic reasons. Pipeline transportation, to take oil or gas from production sites to generators, remains a natural monopoly.

In the coal industry, the potential for natural monopoly exists in the transportation segment if coal is transported by rail with no competition from truck or sea shipment. The state in developing countries has regularly intervened to own railroads or to regulate them when they dominated the transportation of important commodities, such as for coal sector in China.

As a direct energy source, the transmission of natural gas, like power, constitutes a natural monopoly. Because pipelines often connect private energy developers with private marketing organizations for the output, state regulation rather than ownership has been the favored type of public sector intervention.

Although the physical and market characteristics of the various energy industries are different, state ownership of the rights to energy resources and the combination of potentially competitive segments in production and natural monopoly segments in transport or transmission are common elements. With the introduction of competition into some industry segments, the regulatory environment changes; vertically integrated state ownership or the regulation of a monopoly shifts to separate regulation of the components. The following sections look at the

efforts to introduce competition into the power industry to illustrate the issues of state involvement in these situations.

Private investors in power generation

As the possibility for competition in power generation grew, some governments opened this stage of the industry to independent producers and a few countries have succeeded in attracting private investors. But the transition has demanded rather special arrangements to respond to the fact that governments in most of these countries have maintained transmission as state-owned or state regulated monopolies and, in many cases, have retained ownership of the distribution networks. A result of state ownership of transmission and distribution is that independent power producers are tied commercially to the public sector. This is the model in most of Asia and in Colombia, for example. In such cases, independent producers sell to a state-owned or state-regulated entity—a monopsonist. Investors, fearing that a single buyer will take advantage of its monopsony position to drive the price to a financially untenable level, sought and often obtained government guaranteed assurances that the state-owned or state-regulated entity would buy specific quantities of electricity at prices determined by a contractually agreed formula. These contracts conflict with the competitive model that usually lay behind the introduction of independent private generators.

The concern of the investor faced with a single buyer is multiplied by the fact that generation involves high fixed costs and relatively low marginal costs. Competition for the single buyer can, in the medium term, drive prices down to marginal costs, leaving the investor without adequate return. The solutions have been either take-or-pay at contract prices, capacity payments, or regulated power pool selling arrangements.

Indeed, to be credible, the guarantees against risks with respect to price and quantity may have to come from the national government. The issues associated with state guarantees are discussed in more detail below. Here, it is important to point out that guarantees for long-term purchase of power may preclude, or at least make much more difficult, moving to a further stage of reform where monopoly transmission serves only as a fee-collecting entity between independent suppliers and customers for whom suppliers compete.

The transition solution can make moving to a fully competitive market even more difficult. Hungary, for example, adopted a single buyer model when it restructured its power industry in the mid-1990s.[5] The single buyer and seller on the wholesale market, the state-owned company, MVM, signed power purchase agreements with private generators. In order to conform to the standards of the European Union, however, Hungary will have to liberalize its wholesale market so that large consumers and eventually all customers can purchase power directly from generators. MVM could find itself without customers for the power it committed itself to purchase under the agreements unless it was willing to incur losses. Similarly, in the Philippines, the government guarantees for long-term contracts pose a potential roadblock for the privatization of the public utility because any new owner might have to honor these contracts in the future.

Competition for large industrial users and distributors

[5] See World Bank (1999), pp. 14-16.

In order to avoid the contractual guarantees described above, a few developing countries have tried to create competition among generators for large industrial users. In contrast to many other industries, government regulators must play a pivotal role in organizing the newly competitive markets because these markets did not exist under the model of the integrated monopolistic power company.

In these new systems competing generators are given access to the transmission system for a fee of some sort. Different methods for managing the sharing of the transmission facility, such as having an independent system operator, have been devised. Government regulators have to assist the industry in setting up this system and regulate its operation to make sure that fair and open access to the transmission system is given to all market participants. The rules governing the management of these systems has become more sophisticated as the regulatory institutions have advanced and experience has grown.

A few countries in Latin America have sought to franchise the operation of distribution systems. The privately operated distribution companies then become customers for the competitively generated power. In the United States, local governments in California and Massachusetts have gone farther; they are attempting to open access to local distribution systems to enable producers to compete directly for small industrial users and households. The extension of competition to this level has yet to be tried in developing countries.

Coordinating in the absence of vertical integration

As noted above, vertical separation of the different stages of the electricity industry allows for the possibility of competition in those segments where it is technically possible. The expectation is that competition will lower prices, improve service, and prompt technical innovation.

On the other hand, separation of the stages in the electric power industry leads to its own problems. One reason for capturing more than one stage in the same enterprise is that the special advantages of "hierarchies" are lost when one stage is separated from others.[6] The first problem with separation—the possibility of creating monopsony and monopoly relationships—was discussed in an earlier section. A second problem is the loss of coordination that accompanies separation.[7] In the electricity industry, technical coordination of investment and operations is a significant advantage of hierarchy because generation and transmission must be coordinated to keep the system stable. Central control of the dispatch of generating plants and, if necessary, the shedding of electricity loads is essential. With separation, this coordination must be organized across firms, through markets. Managing the interdependencies of generation and transmission is often done by a central system operator. Because transmission is a natural monopoly, the state will participate in devising and implementing the rules for the independent system operator. Coordinating the location and timing of new investments in generation and transmission capacity is another task that needs to be addressed in a restructured industry.

[6] Williamson (1975).

[7] For a discussion of the cost efficiency of vertical integration in the electric power industry see Vickers and Yarrow (1985).

Countries have often sought to address the problems of coordination that arise in restructured infrastructure industries through contracts between the different firms. The negotiation of these arrangements can be complex and time consuming, especially since contracts must cover so many contingencies. The new arrangements are made more complicated by the fact that one or more parties attempting to negotiate coordination will be subject to regulation. To avoid these complications, a few countries have tried to use price signals to accomplish coordination in their separated electricity industries. The case of Argentina shows some of the advantages of price signals as well as some of the shortcomings.

USING PRICE SIGNALS FOR TECHNICAL COORDINATION
THE CASE OF ARGENTINA

The vertical unbundling of an electricity system to create opportunities for competition raises problems of coordination of operations and investment between the monopoly transmission system in the middle and wholesale generators and customers on the ends. The two most common approaches to such coordination in infrastructure project have been negotiated agreements and pricing signals. Argentina, one of the early pioneers in restructuring and privatizing its electricity industry, was innovative in its use of price signals to deal with coordination problems. Its successes and failures are instructive for countries that are attempting to introduce competition today.

Argentina's began restructuring in 1992. By 1998, more than thirty five private generation companies were providing electricity on the wholesale market. The major buyers were 25 distribution companies that retail power retail and more than 1000 industrial users that buy on the wholesale market. A not-for-profit company, CAMMESA, acted as the independent system operator (ISO). There were seven transmission companies connected to the national grid, one that operated the national grid, five that operated regional transmission trunks, and one that connected the Yacyreta dam to the Buenos Aires area. A government agency, ENRE, set the tariffs for transmission and administered a system of penalties and bonuses designed to control quality. Performance improved dramatically with restructuring and privatization and wholesale prices fell by about one-half in spite of an increase in demand.

Because the cheapest sources of power in the country (Comahue in the south and the Northeast region) were far away from the areas of highest consumption (Buenos Aires), the system faced potentially serious constraints on transmission. To deal with these, Argentina adopted a nodal system for pricing—a wholesale market in which prices depends on where power is put in and withdrawn.* The variations in prices within the system reflected the fact that there were congestion issues and power losses in transmission. Nodal prices varied by as much as 20%, with prices higher at the importing nodes and lower ones at the exporting nodes. The system has forced generators and consumers to consider transmission losses and traffic constraints when locating new facilities.

The unsolved problem lay in how to expand transmission capacity. Creating a system that gave the right signals or incentives for expanding transmission capacity proved elusive. By the mid-1990s, new generating capacity in the Comahue and the Northeast regions absorbed excess transmission capacity. Small expansions of transmission capacity (those costing less than $2 million) or expansions that served only one customer are dealt with by rather simple rules. For larger projects with multiple users, the government established a system of voting in which a group of beneficiaries (generators, distributors, and customers) could propose a transmission project. All the identified beneficiaries would then vote. If the project were approved, ENRE would conduct a competition for the concession. The concessionaire would recover construction costs through an annual tariff schedule that was the same as that of Transener, the transmission company operating the national grid. The concession would be awarded to the bidder offering the lowest annual construction fee. The users of the line would pay the annual fee in proportion to their benefit.

A proposal for a new line to connect Comahue and Buenos Aires was the first test case. It failed to win approval, despite the fact that without it, wholesale prices were highly likely to increase. Regulators and project promoters found other mechanisms to increase transmission capacity. The experience, however, exposed flaws in the voting system. Partially to blame was a faulty methodology for determining how much various participants contributed to power flow between the two points. It has been problematic to identify correctly all beneficiaries and to assign weights to their votes according to their degree of interest. The use of power flows to determine financial interests did not accurately identify the incentives of the various parties in the construction of any particular line and

to allocate correctly. The use of an open competition to award the contract for construction and maintenance of new lines would ensure reasonable costs. It did not, however, address the issue of where new lines should be built and who should pay for them. To date, Argentina has not devised a pricing scheme to identify transmission needs and to apportion costs; this remains the task of regulators.

Source: The summary is based on Jose A. Gomez-Ibanez, "Regulating Coordination: the Promise and Problems of Vertically Unbundling Private Infrastructure," Discussion paper, Center for State and Local Government, J.F. K. School of Government, Harvard University, 1999.

*The nodal pricing system used that created by the Chileans as a model

Other problems that emerge with vertical separation are the need for rate rebalancing and the exposure of stranded assets. With separation and privatization, subsidies that were part of the rate structure of vertically integrated monopolies have to be adjusted otherwise some assets may be "stranded" in unprofitable activities. These may be short-term problems but they are thorny issues for governments to tackle.

Creating competition for a natural monopoly

For those parts of an energy system where natural monopolies preclude competition (transmission of power, operation of a dam, retail distribution, etc.), some governments have introduced competition for the market through competitive award of a franchise to operate the facility. Concession agreements typically spell out prices, the investment program, and reliability standards of the franchise. The state retains a role in monitoring to ensure that performance obligations are met.

The large number of uncertainties in the power industry such as fuel prices, exchange rates and pollution control standards, raises difficulties in constructing these contracts, particularly if the contract is a long-term one.[8] Contracts that attempt to specify all contingencies become incredibly complex and are almost impossible to administer. On the other hand, the absence of specificity requires more administration by a government agency. These issues are dealt with later in the discussion of regulation by contract and regulation by commission. Whatever the mechanism, because of its monopoly position, the government will have to regulate the rate of return and the access rules.

Periodic competitive rebidding of the franchise is one mechanism for adjusting to changing conditions and ensuring quality of service and thus reducing the day-to-day regulatory role of the state. There is some danger that the incumbent firm has a substantial advantage over possible rivals, thus deterring potential competitors from bidding. On the other hand, a concessionaire could be deterred from making capital investment at an appropriate level if there was a chance of losing the franchise.

These bidding systems work most effectively if the concessionaire is engaged to operate and maintain an existing facility. Investors who face large capital costs of building a dam or substantially expanding a transmission or distribution network will require a relatively long concession period to recoup their investments; they are unlikely to be enthused about having to rebid the concession after a few years. The periodic rebidding of operating contracts is simply

[8] See Williamson (1976).

not consistent with the private financing of capital expenditures that have economic lives that stretch beyond the length of the concession.

Sustaining competition

The electric power industry has other special characteristics beyond natural monopoly that can require government intervention. Even in large markets, the size of an efficient generating plant may be large compared to the demand on a particular grid. As a result, in most markets, the number of firms competing is likely to remain small and the danger of price fixing real. In England, for example, certain features of the power pool regime and the small number of generators have led to gaming and collusion.[9] Government regulators must therefore monitor electricity markets to ensure that generators are not exercising excessive market power. Antitrust regulations are also needed to enforce competitive markets.

Planning and financing expansions

Restructuring segments of the energy industries to introduce competition is driven by the desire to make these activities more efficient, more transparent, more service oriented, and to lower costs. Such restructuring may benefit many developing countries that are facing bottlenecks in existing facilities. It is doubtful, however, that introducing private ownership and competition alone deal with the chronic shortages of financing needed to expand energy infrastructure.

Given the problems inherent in having contract managers finance the expansion and extension of transmission facilities, other proposals have emerged. Some schemes charge the costs of expansion to the users who will benefit from the expansion are on the table. The Argentina case cited earlier describes one such attempt. Tradable transmission congestion contracts[10], a method using price signals related to ration the available transmission capacity. Due to the nature of electricity, however, these price signals are not appropriate for the locational specification of investments in transmission capacity. To date, no satisfactory mechanism has been devised to allocate the costs among the beneficiaries. As a result, most states retain responsibility for building and financing new transmission capacity, even when transmission is privately operated.

II. Incomplete markets

Another category of market failure is the presence of incomplete markets. For the energy sector, it is the market for risk that is incomplete. While there are well-developed markets for conventional categories of political risk--expropriation, civil unrest, and currency inconvertibility--insurance markets are not sufficiently developed to cover some of the major risks that affect investments in energy projects. Efficient management of risks for many projects in the energy sector therefore requires public sector participation.

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[9] Sioshansi and Morgan (1999).
[10] See Hogan (1999).

Risks for energy investors

As noted above, there are special risks associated with having a monopsony buyer even with contracts where the variables are known that control the quantity to be sold and its price. Since the state is involved, firms consider the usually commercial risks of volume or price to be political risks. The same is true if the supplier of fuel for generation is a monopolistic state-owned or regulated entity. But, there is no insurance market for these types of risk.

With respect to foreign exchange, investors in energy for the domestic market face an unusually large risk when prices of the energy being sold are in local currency and demand is price sensitive, and when foreign borrowings are a large share of total costs. Also, fuel prices are often effectively set by world prices regardless of whether the fuel used in generation is imported or bought locally. As a result, investors are extremely vulnerable to exchange rate movements. Although investors can hedge against short-term exposure in foreign exchange markets, there is no good market for long-term foreign exchange risk.

Beyond the risks arising from state-owned or regulated monopsony buyers, monopoly sellers, and foreign exchange exposure, investors face an uncertain regulatory environment. The regulation of energy utilities in most countries is in flux. Devising regulatory regimes and pricing structures that balance the goals of investors and consumers has proved difficult everywhere. At the same time, environmental and health concerns have introduced new problems for energy regulators to factor into their efforts.

Most developing countries facing these changes have limited administrative and institutional capacities and a have only modest level of technical skill in the electricity industries. They often have the engineering skills needed to operate a public utility, but not the legal, economic, and financial expertise required by some of the new regulatory mechanisms. This problem is exacerbated in small countries. On the other hand, countries with experienced state-owned oil companies may have some advantages in this regard. Perhaps the largest uncertainty arises from the frequent intrusion of politics into the regulatory decision making in most developing countries, a subject taken up below under the discussion of government failures.

Investors, probably with good reason, have little confidence in the stability of the regulatory environment. To the extent that the regulation is by commission as opposed to contract—a subject also taken up later in this paper, these risks are heightened. This is especially true for foreign investors.

The importance of foreign investment

Foreign investors have played a dominant role in the recent wave of privatizations in the energy sector in all regions of the developing world.[11] Given the scale and the location of technology for large energy infrastructure projects, this dominance is likely to persist for many years. Yet, foreign ownership can generate special risks for the investor.

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[11] Between 1990 and 1998, foreign investors participated in 90% of the private investment power projects in developing countries. The foreign share of overall investment in these projects was over 85%. See Sader (1999), p. 9.

The risks facing foreign investors in developing countries were a topic of great concern in the 1970s. As efforts to regulate and even exclude foreign investors gave way in the late 1980s to efforts to promote inward investment, interest in this subject waned. In the past several years, foreign investment in large-scale infrastructure projects has prompted a renewed interest in this subject.[12]

The conceptual underpinning for much of this work has been the notion of the "obsolescing bargaining."[13] In short, countries favor local over foreign ownership, especially in important sectors of the economy. On the other hand, they may be willing to accept foreign ownership at the beginning of a project when foreign investors are seen as the only, or a far better way, to attract needed capital, technology, or access to markets. But over the life of the project, perceptions typically change. Once the investment is in place, the need for the foreigner is not always so obvious if the original contributions have been made (if capital), or mastered by local employees (if technology), or not continuing. With changed perceptions, costs of foreign involvement seem large. Should someone want to make an issue of the project, the original deal begins to obsolesce and the foreign investor is an attractive target. The case of the Dabhol power project in India demonstrates how quickly an agreement can inflame political debate. This case also illustrates the shifting of risk to host governments that is discussed below.

POWER POLITICS
THE DABHOL PROJECT IN INDIA

In December 1993 the Maharashtra State Electricity Board (MSEB) in India signed a power purchase agreement with the Dabhol Power Company (DPC), owned by Enron Development Corporation and its joint venture partners, General Electric and Bechtel, to build, own and operate a 2015 megawatt power project. The project, one of the largest natural gas-fired plants in the world, was planned in two stages. The first of these was a 695 megawatt facility that would initially be fueled by distillates purchased locally. Once Enron secured from the Qatari government LNG supply contracts, an additional 1,320 megawatts of generating capacity, a LNG regassification plant, and storage and harbor facilities would be developed. This second stage was to proceed at MSEB's option.

Increasing power capacity was a central component of India's development strategy in the 1990s. Faced with a power sector that fell far short of meeting increasing demand for electricity, the government initiated a series of legal, administrative, and financial reforms to stimulate investment. As part of this reform, private sector companies were invited to build and operate power stations and 100% foreign ownership was allowed. Negotiations between Enron and MSEB began in June 1992. The project was put on a "fast-track", which circumvented many of the usual procedures for approving such projects. Dabhol was the first successfully negotiated foreign investment in India's power sector.

The power purchase agreement required MSEB to purchase power from DPC once the power station began commercial production on a take-or-pay basis. The tariff was structured in two parts. The first part was a capacity payment determined by baseload and peak capacities; the second part was based on actual output of power. MESB had to make capacity payments regardless of whether or not it actually purchased the power. Energy payments were based on the variable costs for actually producing power. MSEB was required to bear the exchange rate risk of the dollar payments. The agreement dealt with inflation risk by increasing fixed operating and maintenance charges and energy payments at the U.S. inflation rate for dollar denominated charges and at the rate of Indian inflation for the rupee charges. The dollar component for capital recovery costs increased at 4% per year.

The governments of India and Maharashtra guaranteed the payments in the event of default by MSEB. Both parties had the right to terminate the agreement for breach of contract. In case of termination by DPC for

[12] See Wells and Gleason (1995).
[13] This concept was first articulated by Raymond Vernon, in Vernon (1971), Chapter 2.

cause, DPC was entitled to the higher of the present value of expected revenues under the power purchase agreement or the depreciated value of the plant. In the case of termination by MSEB for cause, MSEB was entitled to the lower of the present value of expected returns under the power purchase agreement or the depreciated replacement value of the plant.

The estimated power tariff at the proposed start of operation in 1996 was 7.05 cents per kilowatt hour. The agreement captured a return on equity of 25.22% for DPC.

This agreement ran into trouble before one might have even anticipated an "obsolescing bargain." As soon as the power purchase agreement was signed, journalists and industry specialists attacked the process and the terms. The lack of transparency during the negotiations bred suspicion of corruption. The absence of a bidding process for the project and the lack of bidding requirements for the suppliers to the project provoked a storm of criticism. MBES's obligation to buy 90% of the plant's output was deemed inappropriate.

State elections in 1995 brought to power a new coalition that had more nationalist tendencies than the Congress Party politicians who had been in power when the project was negotiated. Criticism of Dabhol featured prominently in the campaign speeches of some members of the coalition. Once in power, the new state government initiated a review of the agreement. In August 1995 the review committee repudiated the first phase of the project, valued at $300 million and cancelled the second phase. In addition to the lack of transparency and the lack of competitive bidding, the committee cited the government's relaxation of regulations that had enabled this project to be fast-tracked. The committee challenged the reasonableness of the capital costs especially in comparison to similar projects elsewhere, the tariff rate and the escalation formulae, and the take-or-pay aspect of the contract.

The state government and Enron exchanged acrimonious charges and both sides sought legal remedy, Enron initiated arbitration proceedings in London and the Maharashtra government filed suit in the Bombay High Court. Eventually, the agreement was renegotiated with some reduction in tariff for the second phase of the project and lower capital costs. The state government's ownership, originally 10% was increased to 30%. The take-or-pay arrangement was left in place and the government committed itself to stage two of the project. In February 1996, an amended agreement was signed. Government ownership increased. Began commercial operations in May 1999.

The issued reared its head again in the fall of 1999, during the state election campaign. This time the representative of the Congress Party pledged, if elected, to halt construction of the plant and renegotiate the price India was paying for the first phase power. Local Congress politicians alleged that Enron was still charging too much, threatening to drive industries away for the state and bankrupt the MSEB. Meanwhile the breakaway Nationalist Congress Party said that it would review the project's terms if it wins the state election.

Souce: This summary is based on Harvard Business School, "Enron Development Corporation: The Dabhol Power Project in Maharashtra, India," Cases A (9-797-085), B (9-797-085), and C (N9-797-087), February, 1997; and Jonathan Karp, "Enron Facility Again Becomes Political Target in India," *Wall Street Journal*, September 8, 1999.

Energy infrastructure projects are particularly vulnerable to this kind of instability.[14] First, these projects require large capital investment in immobile, client-specific assets, investments that are usually made at the beginning of the relationship, with little continuing input from the foreign investor. Pricing and access of the outputs are visible and politically sensitive. Market conditions in the energy sector can change greatly over time in unpredictable ways. Investments that deal with the public, such as distribution of electricity are especially sensitive. In addition, energy infrastructure projects almost always require the granting of some type of an exclusive concession at the outset. Thus controversy over a projects can be exacerbated by the allegation or belief that corruption was involved in the original deal. Finally, the long investment periods that are needed to recover investment allow lots of time for changes that can cause contractual disputes to arise. For example, environmental regulations might change and a

[14] See Gomez-Ibanez (1999).

dispute might arise as to how much of the additional costs caused by this regulation should be borne by the consumers versus the foreign investors.

This problem is made more serious by the fact that electricity systems need to be constantly expanded and upgraded. If the private concession is for a fixed period of time, the private operator will be less and less likely to want to make further investments as the period over which they will be rewarded is reduced. As the private sector slows investment, the political tension will rise as more and more of the growing demand for service is not being met by forthcoming supply.

Shifting the risks

The insurance available for political risks from international institutions, national agencies, and private sources does not cover the gradual deterioration in a commercial position caused, for example, by incremental regulatory requirements, or the inability of the contracting enterprise (a state-owned firm, for example) to meet its obligations. The World Bank's Multilateral Investment Guarantee Agency (MIGA) is trying to offer insurance on contract terms. It is difficult, however, to be optimistic about the success of this effort since the insurance is against events that are difficult to identify precisely and that impose costs that are difficult to measure. In the absence of insurance against these political risks, investors have made efforts to shift these risks to the government.

The "take-or-pay" agreements that are typical for the new power generation projects demand that the local party take or pay for a specified quantity of output, regardless of whether or not it is needed. These contracts shift demand risk to the local party, first to the contracting party. Most investors will seek full government backing in the form of guarantees to enforce these agreements. In an effort to commit the government further, investors may seek international agencies, such as the IFC, as partners. Such moves make efforts to renegotiate a contract more costly to the government. Alternatively, if renegotiation is necessary, the presence of an international multilateral organization may help maintain an orderly set of negotiations.

Investors in generation projects have also sought to shift the foreign exchange risk to the state or a state-owned company by indexing most costs and prices to dollars. Linking domestic prices to dollars in turn increases the risk on the demand side, since movements in the real exchange rate will cause changes in the real price of electricity.

The assumption of these risks creates contingent liabilities for governments. While the potential cost of these obligations may not loom large at the time of negotiations, if governments are ultimately required to make payments under the guarantees they represent real liabilities. Thus, for example, in Indonesia private companies are seeking to collect from the government payments that PLN, the state-owned power company, is unable to make.

Finally, when investors are unable to manage risk through the traditional methods or shift it to the government, they seek compensation through high rates of return. When paid to foreigners this high rate of return becomes an economic cost to the country. In view of the visible nature of these projects, high rates of return can be a source of instability themselves. Not only does the foreign aspect of the project come under attack, but allegations of corruption on the part of local officials are also likely to surface in the face of high profit rates earned by concessionaires.

When private sector ownership becomes too costly

Investors may be willing to take on risky projects at very high rates of return—publicly reported rates of 25-30% are not atypical. In such instances, a government may be better off giving up the operating efficiency that a foreign investor offers in exchange for a lower cost of capital. In other words, at some cost of capital, the benefits of greater efficiency from private sector investment may be offset by the higher economic costs of foreign capital.

With negotiations explicitly around rates of return, considerations of risk and return have been described quite clearly with respect to negotiations in China.[15] China has relied on a cost-of-service approach to negotiation, with caps on return negotiated at the outset. With the generating project, Shajiao B, Hopewell Holdings was allowed a return of at least 18%. But the Chinese government eventually decided that this kind of return made private foreign capital too expensive, and attempted to lower the rate to 10 to 12 %. As a result of the return demanded by investors for the risks they perceived in China, no more agreements with private firms had been negotiated up through the late 1990s.

III. Externalities

The negative externalities created by the production and consumption of energy have been widely documented. The literature on environmental and health impacts of various kinds of energy use is vast.[16] That these negative externalities justify a regulatory role for the state in protecting the environment and promoting public health is widely accepted.

Many efforts to protect the environment involve policies toward energy users: pollution standards for cars, provision of rapid transit systems, and so on. This discussion is limited to environmental and health externalities only to the extent that they involve regulation of the industries that produce and distribute energy.

The design of measures to minimize or eliminate negative environmental externalities is not a trivial issue; these measures can affect the operation and commercial viability of industries in the sector.[17] In most cases, trade-offs must be made and choices can require understanding of technical matters, behavioral responses, and possible unintended consequences. The following sections look at the role of the state in efforts to reduce emission of carbon dioxide and dangerous substances and to limit damage from the construction and operation of energy projects. These are followed by a discussion of some of the interrelationships between energy production and energy use.

Limiting harmful emissions

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[15] China's experience negotiating with foreign firms is described by Murray, Reinhardt, and Vietor (1998), Chapter 19.

[16] For extensive references on the subject see Stern (1977). For a discussion of health effects see Wilson and Spengler (1996).

[17] In 1993, U.S. state and local governments and industry spent approximately $140 billion to comply with national environmental laws. The U.S. Environmental Protection Agency estimates that the annual cost of such compliance will rise to $160 billion by 2000. See Environmental Protection Agency (1990).

The most common types of regulation to limit emissions are establishing a system of tradable permits, imposing absolute emission standards, specifying the use of a particular technology, and managing relative prices of fuels for generating end use.[18] The choice among these affects the role that the state will play and, perhaps, the design of the electricity market itself.

In a system of tradable permits, energy producers compare switching fuel, installing equipment or new processes to reduce emissions, or buying permits to pollute. Tradable permits, in principle, encourage investment to be made first in solutions with the highest return. In order for such a system to work, however, the permits must be allocated at the outset and a market for them must develop. The state must determine the total amount of pollution to be allowed by a sector or even across sectors; in making this determination, it must make a trade-off between pollution and uncertain costs.

Auctions, which are often suggested as a means for allocation, assume that there are competing bidders and that capital markets are adequate to finance reasonable prices. This is unlikely to happen if there is not an adequate legal and regulatory system in place. Moreover, policing of pollution generated under permits assumes the existence of a measurement and enforcement mechanism to determine emissions by each energy producer. This must be provided by the state or a state-appointed entity. Measuring emissions is not always an easy job, and once emissions (or the lack thereof) have monetary value, the temptations for corruption can rise sharply.

By imposing absolute standards or specifying technology, a government establishes the behavior required of all firms. A regime of standards allows energy producers to decide how to meet the standard; they, for example, might choose to switch fuels or to install equipment to reduce emissions. In a system of standards, the government is relieved of having to allocate permits and assure a market for them. The monitoring requirements, however, are similar to those required for tradable permits. And, common standards mean that investments are not necessarily made first in the plants with the highest payoff.

The complexity of monitoring by the state can be reduced by specifying equipment that an energy producer must use. But, this approach discourages the development of new technologies and is unlikely to lead to the most efficient allocation of resources.

Price controls and the management of relative prices provide another tool for influencing the choice of fuels. Governments can set relative prices of different fuels such that users have an incentive to shift from energy sources whose use causes environmental damage. These price measures can be directed at power generators, commercial users, and households.

Perhaps the most important environmental issue for developing countries is the use of traditional fuels by households. Burning of firewood throws carbon dioxide into the air; the accompanying deforestation reduces the available carbon sinks for the absorption of carbon from the atmosphere; and deforestation can lead to land erosion, to local climate change, and to loss of biodiversity. Moreover, the particulates released locally are a serious health hazard.

[18] For a summary of policy options to reduce emissions see Intergovernmental Panel on Climate Change (1995).

In response, some governments have kept the price of kerosene or other energy sources low in order to discourage cutting of wood. Such policies have to be designed carefully, however, so as not to encourage other types of environmentally destructive behavior. In Indonesia, for example, the price of kerosene was so low that mixing it with diesel fuel for busses and trucks—an especially polluting combination-- became common.

Not only does the type of regulatory regime affect the role that the state will play, but it may also have consequences for the design of the electricity market. The design of the electricity market, in turn has consequences for the role of the state. Operating within an absolute standard of pollution control, for example, a producer could be driven to the use of a more expensive fuel for generation such as natural gas or the construction of a hydroelectric dam. Operating within a tradable permits system, on the other hand, a producer may find it less expensive to burn coal and pollute while another producer makes a different choice.

Construction and maintenance of energy projects

The decision to construct new facilities to produce energy almost invariably engages the government in a decision about the trade-off between increasing the availability of energy and minimizing environmental damage. Moreover, choosing the type of facility and its technology involves a trade-off between costs and the environment. Building a hydropower facility, for example, provides a clean source of energy but almost always raises serious local environmental issues, and may even cause climatic changes.[19] Similarly, pipeline projects often cross through delicate environmental areas and therefore require careful scrutiny and regular monitoring. Large strip mines can also damage local environments and cause surface and ground water pollution. Only the government can make these kinds of trade-offs when the projects are very large and the impacts are varied. Inevitably, the government will require, and have to judge, an environmental impact assessment for new energy projects.

Once a project is operational, the government may need to monitor certain aspects of operations to assure proper maintenance and safety standards. Oil and gas leaks due to poorly maintained pipeline systems can cause severe environmental damage. One of the dilemmas with environmental protection measures is that the state-owned enterprises are often much less responsive than the private sector to the threat of penalties and sanctions for the violation of environmental laws. The Niger Delta in Nigeria, for example, stands as a warning of the need for vigilant attention to pipeline maintenance. The Nigerian experience also suggests failure on the part of a state-owned enterprise to manage codes imposed by foreign partners. In some other instances, state-owned enterprises also do not have access to the funds necessary to make the investments in environmental control equipment that is required.

Energy investments and global environmental externalities

Substantial volumes of natural gas produced as a by-product of oil production are flared and vented. This practice appears to represent a significant waste of fuel. On the other hand, the cost of pipelines or LNG facilities to make use of the gas may be uneconomic for private sector

[19] The proposal to build megadam on the Yangtze River in China, the Three Gorges Dam, is larger than most hydro projects. However, the environmental issues that have arisen in the forty years of controversy that this project has generated are the same as those faced by most hydo projects in developing countries—resettlement, damage to agricultural lands, and ecological changes. See Luk and Whitney (1993).

investors. But flaring is posing environmental costs as well. The costs of these externalities may be great enough that the state or an international body should subsidize uses that a private investor will not undertake alone.

This also applies to a number of potential cogeneration opportunities. When the economic cost of the externalities arising from the creation of additional carbon dioxide emissions are factored into the benefits, a number of cogeneration projects that are now financially unattractive become economically viable. To bring the private decision making into line with the maximizing of economic net benefits, some public sector intervention will be needed. The Jindal Tractebel Power Project in India, which uses waste heat from a steel plant to generate electricity, is a case in point. In this project, the estimated NPV to owners was less than half of the economic value of the externalities of reduced CO_2.[20]

IV: Equity Considerations

The failure of the market to address equity concerns leads to public intervention. The case for intervention is not on the basis of efficiency; even if markets do generate economically efficient outcomes, the distribution effects may not meet socially accepted standards. The desire to reduce extremes in wealth and poverty can be invoked to justify a role for the public sector. Introducing consideration of equity or fairness is to introduce an element of judgment and therefore of values. The link between access to modern sources of energy and economic and reduction of poverty provides a strong argument for government intervention to support energy service for remote customers and to subsidize poor consumers.[21]

The countries and the regions within countries that lack access to modern energy are among the poorest in the world. For households, the use of modern energy creates a more healthful environment and frees time otherwise spent in the collection of fuel. Moreover, the extension of the power grid to small cities and towns makes possible some industrial development. The resulting creation of demand for labor outside of the urban areas can reduce migration to overcrowded cities, with the accompanying social costs.

Electricity also makes it possible for telephone networks to spread throughout the countryside. This not only reduces the cost of communication for those living in the countryside, but also generates an external benefit through lower costs to those living in urban areas and wish to communicate with the countryside. The greater the intensity of telephones in a country, the greater is the value of this social externality that arises from the telecommunications sector. In addition to the benefits arising from direct use, the placement of a telephone in a household creates a benefit associated with the insurance service it provides. Its existence has a value even if not used because in times of emergency it is available for use.

Despite the centrality of modern energy for economic and social development, about forty percent of the world's population relies on traditional fuels for cooking and heating. In most developing countries, the percentage is substantially higher; in most African countries, only a small percentage of the total population has access to modern energy services. It is particularly in the rural areas that people lack modern energy. Although reached by the distribution system, poor households in some urban and peri-urban areas are often unable to pay the cost of modern

[20] See Jenkins and Dhakal (1999).
[21] See, for example, Eberhard and van Horen (1995).

energy services. Financing the geographic expansion of energy infrastructure and making energy affordable to the poor are perhaps the greatest energy challenges facing governments in developing countries today.

Energy for rural areas

The extension of electricity distribution to rural areas entails high fixed costs per user. Major expansion of a national grid over long distances requires large, lumpy investments. And, consumers are unlikely to be able to bear the cost of installation, either in the form of one-time payments or higher energy prices. In the absence of an expectation of reasonable returns, private investors have shunned such projects.

Developing small-scale projects based on renewable energy sources such as solar, wind, thermal, and hydro, is often cited as an alternative to extending standard commercial service to remote areas. As yet, the economic feasibility of such alternatives remains unproved. Going down the path of serving rural users by decentralized systems that use renewable resources will requires substantial investment in technological innovations that lower the costs of these types of projects. This is unlikely to be undertaken by the private sector, at least without substantial subsidies. If renewable energy sources are going to offer a serious alternative to conventional sources, international institutions will have to play a leading role in mobilizing the financing while governments will have to help identify suitable opportunities.[22]

The ability to pay

Even when modern energy is accessible, low-income people may not be able to afford it. As part of policies to meet income distribution goals, governments may choose to help supply these services to low income households by setting prices in ways that will benefit poor consumers. Producers must offset these by charging more to other customers or through government subsidies. Either approach raises difficult questions for policy makers: 1) Do low energy prices create disincentives for conservation? 2) Can subsidies or offsetting prices coexist with systems of market competition; without further distortions? and, 3) How can service be improved or expanded if prices are kept low ?

Governments can, of course, employ other mechanisms for helping poor households such as direct cash transfers supported by general government revenues. Designing a subsidy mechanism that achieves a country's particular goals and administering the system are not simple matters. A study on how different subsidy mechanisms worked in Central Europe and the former Soviet Union during their economic transitions during the 1990s shows that different approaches achieve different goals.[23]

C. Government Failure

[22] The paper in this volume, "Asia Alternative Energy Program" describes an effort by the World Bank to promote alternative energy projects.
[23] Laszlo, Can we cite this paper yet? World Bank (2000).

While market failures provide the reason for most state intervention, how well the state can and does intervene to correct failures of the market is debatable. Along with the acceptance of the core theory of market failure into mainstream economics, the notion that the state will act wisely and well in the national interest is also generally rejected today. Skepticism about the ability of the state to craft and implement policies that will optimize social outcomes has been formalized into the concept of "government failure." With the government facing its own failures when it tries to correct the failures of the market, the appropriate role for private and public partners in certain activities is difficult to determine a priori. The best choices depend on the nature of the market failure and the capacity of government to overcome government failures. The next section presents three types of government failure that are often raised in regard to public intervention in the energy sector. This is followed by a discussion of mechanisms that can be used to try to minimize some types of government failures.

I. Common forms of government failure in the energy sector

Recognition that government intervention may not overcome market failures and can create costs is not new. But systematic efforts to understand the causes and implications of the failure of government intervention in economic affairs have proliferated over the past two decades.[24] As yet, however, there is no consensus around a theory of government failure that explains why government interventions designed to correct market failures are so often faulty. Certain categories of problems, however, are raised by most analysts.

A failure of bureaucracy

Two characteristics of bureaucracies are often cited to explain why governments fail to make and implement policies that are in the national interest. First, bureaucrats may be driven by internal organizational goals such as maximizing the size of their budgets and expanding their span of control as opposed to optimizing performance in terms of national economic goals. This results in over regulation, excessive red tape, and waste of resources. Such behavior can also lead to inter-agency struggles, deadlocks over policy decisions, and compromises that are not ideal.

Second, government bureaucracies may lack the competence to make and implement appropriate policies. Civil service pay scales often do not attract talented people while, at the same time, civil service rules can make it difficult to fire those who underperform. Promotions based primarily on seniority discourage motivated employees who leave for challenging positions elsewhere. Moreover, even capable civil servants may be seriously impeded by a lack of technical information needed to make proper decisions. Asymmetries in information between government decision-makers and the subjects of these decisions are a common problem. The firms being regulated, for example, know the engineering details much better than the regulators, who are normally distant from the day-to-day operations.

The absence of competition and of clear performance measures helps explain why self-serving bureaucratic behavior and limited capacity are common in government tasks. Private organizations face some of the same problems, of course. But, private organizations usually do have clear performance standards (profits) and usually face competition. The firms that do not resolve problems of bureaucratic behavior fall by the wayside in competitive markets.

[24] For a review of this literature see Wallis and Dollery (1999).

Some of the failures of the government or state-owned firms may not be inherent in state ownership per se. When state-owned enterprises operate in a competitive environment, they can succeed. Witness Singapore Airlines, which is consistently ranked among the world's best airlines and which does not receive subsidies through high priced domestic routes or as direct payments. But, in infrastructure industries the environment is generally not competitive; state-owned enterprises can thus succumb to bureaucratic behavior.

On the other hand, one could argue that bureaucratic failure should be easier to control in state-owned power companies than it is in other government activities. Although profit might not be measured, other elements of performance are quite easy to calculate. Output of electricity, for example, is homogeneous and easily quantified. Prices of fuels can be compared to world market prices and standard conversion indexes are generally available. Norms for operating costs are widely available, as are data on distribution losses, collection rates, and continuity of service. As a result, one could, in theory at least, hold management of state-owned power enterprises accountable for performance against some agreed standards, and thereby reduce room for bureaucratic failure.

A failure of politics

Regardless of the seeming ease for creating performance standards for state-owned power companies, failure is extremely common. The principal reasons, we believe, are found in the politics that are inevitably associated with electric power.

The core of the problem lies on the revenue side. Both the pricing of electricity and the related issue of collecting receivables are major political issues in most countries. They involve distributional issues—across regions, sectors, and income levels. If the political process were perfect, the pressures would lead governments and their enterprises to optimal behavior. In fact, the political process reflects different degrees of influence by various affected parties and different "discount rates."

The distortions can be many: the elite don't pay their bills, certain customers hook up service without being charged, rural voters have undue influence and end up with low rates, industrial policy creates subsidies for favored sectors, and so on. The result, commonly, is that the cash flow of state-owned enterprises falls short of what is required for operations, maintenance, and replacement.

Mexico is a good case in point.[25] The oil boom of the 1970s permitted the national electricity utility, Comission Federal de Electricidad (CFE), to make investment to meet growing demand and keep prices low. With the decline in oil prices in the following decade, however, investment faltered and the reliability of the overall system was at risk. A look at the average electricity tariffs for different types of customers demonstrates why cash flow was insufficient to support maintenance of the system. In 1988, the ratio of tariffs to the long-run marginal cost was 33% for residential customers, 64% for industrial customers, 81% for commercial customers, and 14% for rural customers. In order to raise money for deferred investment in the distribution system, CFE devised a "project" in the amount of US$ 1.93 billion (in 1990 prices) and sought project funding.

[25] For an account of the Mexico case see Jenkins and Lim (1998).

Pricing and collection problems are not unique to state-owned power enterprises. One of the main concerns of the government in a regulated system is pricing. If prices are driven very low in regulated systems, the private operators are likely to neglect maintenance and will certainly be unable to expand service. This, of course, is the opposite of another version of political failure, "regulatory capture" by the producing enterprises, believed to be common in the industrialized countries and, perhaps, a risk when the private sector becomes important in the developing countries.

The tension between investors and customers over price is exacerbated when project financing is present. Most such investments in energy have economic lives of twenty to thirty years. However, commercial financing is generally for a much shorter period of time. Hence, investors would like to have tariffs front end-loaded in order to repay the debt. Once the debt is repaid, such high real rates will end up creating an excessively high rate of profit.

Beyond the issue of revenue, there can be many other manifestations of political failure. Labor unions may, for example, have more input in the political process than consumers, where interests are diffuse. Thus, overstaffing state-owned enterprises to appease powerful public unions, for example, may cause higher costs for electricity. Similarly, a politically connected contractor may be hired regardless of qualifications.

Maximizing personal profit

Government intervention in the energy sector often generates a transfer of wealth. It may be that something of value like a concession or a license or a subsidy is granted to a private party. It is also possible that a fuel supplier is awarded a lucrative contract. Or, something away can be taken away in the form of a tax or a penalty, for example. The power to make such transfers of resources from one party to another creates and opportunities for corruption. This is further exacerbated by the existence of government guarantees to either purchase inputs or buy outputs. Although these guarantees have a great value to the private investor, their cost to the private sector is seldom, if ever, accounted for at the time they are given.[26]

Both bureaucrats and politicians can be corrupt. They may take payment to do something that they are supposed to do, like repairing power lines to a house. These practices can lead to problems for privatized firms as new management attempts to cut off this source of income from low level personnel. Bureaucrats or politicians may also take payments to do something that they are not supposed to do, like granting a concession to a high-cost firm. The latter is a more serious government failure. The award of power contracts in Indonesia during the 1990s shows how serious this type of failure can be.

PRIVATE POWER CONTRACTS IN INDONESIA

Indonesia's experience with power contracts during the 1990s provides a compelling example of the dangers of awarding contracts on the basis of private negotiations instead of open, competitive bidding. The publicly reported story of Paiton 1, the first and largest private power venture in Indonesia, illustrates the high costs that can occur when politicians are unchecked and contracts are awarded without transparency.

[26] Baldwin, Lessard, and Mason ( ).

At the beginning of the 1990s, rapid growth of the Indonesian economy was leading to increasing demand for electricity. During this decade, PLN, the state-owned power company, signed agreements for twenty six new private power projects. Only one of these projects was competitively bid. The average contracted price for power in Indonesia was 30% higher than the rest of the world.

The Paiton 1 project for a 1,230 megawatt coal-fired plant in Java, was won by a consortium of Edison Mission Energy, GE, and Mitsui & Co. in 1991. The group's Indonesian partners were connected to the Suharto family. The Indonesian partners were given a 15% stake in the project without their investing any cash. Partners in the consortium lent these Indonesian $49.6 million to pay for this share with repayment to be made out of project dividends. Experts disagree whether such "carried interest arrangements" violate the U.S. Foreign Corrupt Practices Act, but they are certainly no more than a delayed gift.

One of the early conditions for award of the contract was that the consortium purchase boilers from ABB Combustion Engineering. B.J. Habibie, then Minister for Research and Technology, was chairman of Combustion's state-owned Indonesian affiliate and one of Suharto's sons was the company's commercial representative in Jakarta. ABB's boilers cost $20 million more that those originally proposed by the consortium.

Further adding to the project's cost was an arrangement for the supply of coal from a company that was owned by the consortium's Indonesian partner and others with strong political connections. The contract cost for coal was 30% to 40% higher than at other PLN plants.

The contract price for electricity from Paiton 1 makes the power some of the most expensive in the world. After extensive negotiation in which the consortium began by asking for 10.3 cents per kilowatt hour when the original government bid was 5.2 cents, Suharto reportedly intervened to settle the price at 8.6 cents. A former head of research at PLN, Nengah Sudja stated "It was a presidential decision." Other private power agreements followed suit in requiring very high tariffs. By way of comparison, the only competitively bid project in Indonesia provided electricity for 5.8 cents.

This was not a case of foreign partners taking advantage of unwitting local partners. Throughout the negotiations, PLN and other advisors to members of the government raised concerns about the project. Early in the process, analysts argued that the project was inappropriate for PLN and made alternative proposals. At many stages, cost estimates were challenged. Djiteng Marsudi, PLN's president from 1995 until mid-1998 when he was fired for speaking out about the corruption, is quoted as saying the companies dictated terms "because they had the first family behind them."

A government audit issued in late 1999 found that the project's cost had been highly inflated. It cites some $22 million in unspecified development costs and says that estimates for fuel, construction, engineering, and transportation were inflated as much as $600 million. As a benchmark, the report turned to the costs of one of PLN's own 1,200 megawatt plant.

Members of the consortium contend that there was no impropriety in their efforts to win this contract and that the cost reflected the project's value and the investors' costs.

PLN defaulted on its payments to Paiton 1 in 1999 and sued the group to annul the contract on the basis of corruption. The new president, Wahid, instructed that the court drop the case. The director of PLN resigned over this directive. As of early 2000, the issue remained unsettled.

Source: This summary is based on reporting by Peter Waldman and Jay Solomon in the *Wall Street Journal*, "U.S. Power Deals in Indonesia Draw Flak," December 24, 1998; and Jay Solomon, "Foreign Firms Accused of Bribery in Indonesia," January 5, 2000. See also http://www.softwar.net/paiton2.html for information on this project.

In the power industry, the award of large concessions for constructing new generating plants and transmission facilities, for example, offers the opportunity for large-scale corruption. The operation of distribution facilities, on the other hand, usually allows small-scale kick-backs

for activities like repairing a connection or purchasing supplies. This disparity in the prospects of payoffs for high level politicians may explain the preference for large projects and the neglect of the maintenance of substations that is typical in many developing countries.

II. Government failure under different types of intervention

Despite the possibility of government failure and the evidence that policies have often not achieved their goals, some form of state intervention in energy industries is unavoidable. As discussed earlier, competition can be introduced into some segments of these industries, but some sectors remain natural monopolies, where government regulation, government ownership, or government supervision of management contracts is almost inevitable. Moreover, in sectors where competition is possible, government is likely to remain involved even if private firms are encouraged to compete. Licenses have to be awarded. The government must assure that competition is not eroded by mergers or collusion. The government will have to deal with externalities and, perhaps, equity issues. And, there is accumulating evidence that competition may not deal with capacity problems without an accompanying price instability in the electric power industry, where fixed costs are so large.

Recognition that governments will continue to play a major role in infrastructure has elevated questions of how to assist in the improvement of government performance to the top of the development agenda today. Helping states build the capacity to make and enforce sensible policies is proving to be a complicated and long-term process. In the meantime, however, developing countries desperately need new investments in energy infrastructure and must consider how best to provide it, regardless of the fact that government performance is not perfect. This section looks at measures to mitigate failures typically found in the different kinds of intervention.

Government providing services

Most governments that have decided to provide services themselves in energy industries have done so through state-owned enterprises. The creation of state-owned enterprises itself was an effort to overcome some forms of government failure that were apparent when activities were within ministers. The poor performance of many of these firms in the energy sector over the past few decades, however, shows how difficult it is to escape government failure. It has not proved easy to keep politicians out of the running of these firms. Performance generally remains hard to measure, since state-owned firms are often assigned multiple goals and since they frequently operate in non-competitive sectors. Probably as a result of the complex goals, many still receive subsidies, freeing them from "market discipline," even when competition is possible. And, even where measures are clear enough governments have often hesitated to enforce performance standards in state-owned enterprises for many of the reasons of government failure discussed earlier.

As large as the problems with state ownership are, the survival of natural monopolies, the absence of private investors interested in energy projects in some especially poor countries, the high cost of foreign investment in others, and the political costs of foreign ownership mean that state-ownership is likely to persist for the foreseeable future in a number of countries. One then faces the question of how the performance of state-owned firms can be improved. Better

approaches to governance and the use of contractors to improve the efficiency of state-owned enterprises are two areas where some success has been attained.[27]

Organization and governance--Creating organizational structures that isolate a state-owned enterprise from interference to satisfy short-term political considerations is perhaps the most difficult task of all. Who sits on the board, how appointments are made, what decisions the board can take, the conditions under which it can intervene, the nature of reporting relationships, and so on are central features in determining the degree an organization's independence.

Financial arrangements also matter. Being able to generate and retain cash frees an enterprise from having to ask a ministry for financial support, and thus reduces opportunities for political pressure. State-owned enterprises that are not burdened by heavy debt obligations and which are allowed reasonable tariffs are particularly likely to be independent. Financially separating out a state-owned enterprise from the rest of the government can also help deal with the usual absence of performance measures. Having standards about plant and operating costs, for example, from state-owned enterprises operating in other states in the same country or even from other countries can provide some performance benchmarks.

Even if politicians agree to ideal organizational and financial structures at the outset, however, maintaining the commitment to cede control in the face of changing economic and political conditions can be very difficult. Germany's experience with a state-owned enterprise charged with privatizing East German companies in the 1990s shows just how difficult it is to sustain commitment to non-intervention, even over a relatively short time period and in an industrialized country. Given the long-term nature of infrastructure projects, it is inevitable that " something will change" and that the politicians will at some point want to use the organization to satisfy other goals. Given that no single solution is likely to last, countries need to revisit the problems of organizational and financial structures from time to time.

DEALING WITH GOVERNMENT FAILURE
PRIVATIZATION IN GERMANY

In 1989 after the fall of the Berlin wall, Germany faced the task of reorganizing more than 12,000 eastern firms that were inefficient and ill-prepared to face global competition. In creating an organization to carry out this job, the Government leaders wanted to demonstrate their commitment to rapid privatization. They attempted to design a system that would protect the privatization process from political opponents, who would focus on unpopular closures. They also wanted to attract talented managers to the effort.

They set up Treuhand, an independent legal entity to privatize East German assets, whose profits would go to the Ministry of Finance and the Ministry would cover losses. The Ministry played a role on the board and was responsible for overall supervision, but did not play a strong role in day-to-day operations. A report by the government accounting office described the Ministry's supervision as indirect and reports that Treuhand systematically ignored suggestions from the Ministry and other government agencies.

Treuhand was given a short life (five years) in order to discourage bureaucratic empire building. Since it was not subject to civil service rules on hiring and compensation, Treuhand offered salaries competitive with the private sector and paid very high performances bonuses. These bonuses were calculated to support the organization's goals of rapid privatization, reducing the organization's financial obligations, the number of jobs guaranteed, and the

[27] For an empirical study of the success of different measures to improve the performance of state-owned enterprises see World Bank (1995).

amount of investment to be made by the new owners. As a result, the agency attracted bankers and managers from private industry.

During its first eighteen month, Treuhand privatized thousands of firms, closed plants, and laid off workers. It successfully resisted political demands to change. As time went on, however, the quality of the firms in the agency's portfolio declined and the number of workers facing layoffs grew. So did political pressure. Labor groups organized protests and strikes. The Government responded by modifying the original arrangements. More money was provided to support restructuring, Treuhand's discretion was circumscribed, and political groups gained more influence in supervisory bodies.

Despite a shift in Treuhand's policies, which slowed down the privatization process and placed greater emphasis on the employment effects, political protest escalated, with violent demonstrations and riots resulting in deaths. In this charged atmosphere, organized labor proposed that unprivatized companies be grouped into regional holding companies that would be owned and subsidized by the state. To block this move,
the Government decided to establish another type of organization, called a Management KG. A number of KGs were planned, each of which would be responsible for eight to ten firms. Eventually five KGs were established; these became private limited partnerships wholly owned by Treuhand.

The KGs entered into three- to five-year management contracts with private firms to take over responsibility for managing, restructuring, and selling a group of Treuhand firms. These contracts were legally binding agreements that restricted Treuhand's governance rights to those found in private firms. Treuhand was prohibited from intervening in a wide set of managerial decisions, ranging from day-to-day operations to certain asset sales and shut-down decisions. Treuhand would still own the firms and be responsible for financial liabilities.

The negotiation of these contracts proved extremely difficult. The Ministry of Finance was concerned about allowing the KGs so much automony yet being itself responsible for the bills. KG managers worried that the Government would renege on its commitments. The resulting contracts were highly detailed, complex, and rigid. They delegated extensive decision rights to the KGs and had generous plans for management bonuses. These detailed contracts were needed to attract skilled managers were time consuming to negotiate, difficult to interpret, and costly to administer.

Experience with the first two KGs led the government to change the terms in the three subsequent agreements. The newer agreements required approval for many more management decisions, including decisions involving layoffs of more than 100 people. The KGs also assumed responsibility unrestricted liability for the firms. The new agreements did increase management salaries.

Source: This summary is based on I.A.J Dyck, I.A.J., and K.H. Wruck., "Organizational Structure, Contract Design and Government Ownership: A Clinical Analysis of German Privatization," *Journal of Corporate Finance*, 4 (1998) pp. 265-299.

* The contracts for the five KGs were somewhat different in detail. The description here is of one of the early KGs, Planschna.

This lack of sustained government commitment to a path has also plagued efforts to improve the performance of managers and staff of the state-owned enterprise through the use of performance contracts, which explicitly spell out the obligations of government and the managers of state-owned enterprises. Despite the popularity of these contracts during the 1990, their record in improving the economic performance of state-owned enterprises is decidedly mixed.[28] Some of the failures can be partially attributable to flawed designs. Many performance contracts, for example, offer rewards for good performance but do not penalize poor performance. Others define performance in vague terms. These issues can be addressed. However, in instances where the performance of the state-owned enterprise is dependent on

[28] Ibid., Chapter 3.

some government action, such as raising electricity tariffs, managers cannot control government actions (or lack thereof) that undermine the arrangements. The failure of many performance contracts to improve profitability and productivity are a consequence of governments themselves failing to live up to the contract terms.

Contract out to private sector— Another approach is to retain the state-owned enterprise, but to bring in private sector contractors to perform specific tasks. The question becomes which activities of state-owned enterprises in the power sector lend themselves to private contracting.

At one extreme, a state-owned enterprise can contract out its management to a private firm for a fee. Although such use of management contracts in developing countries has been fairly limited, there is some evidence that these contracts show a promise.[29] Indeed, there are many successful stories of state-owned hotels operated under management contracts by international chains. Moreover, power projects, where the output is homogenous and the technology is relatively stable, are especially good candidates for management contracting. Open bidding, relating the contractor's fee to performance, and allowing the contractor autonomy in personnel matters are important factors in the success of management contracts.

Many state-owned enterprises have successfully used private contractors for narrowly defined tasks, particularly in construction. In the transport sector, for example, private construction companies have the necessary skills to build roads and are protected from the constraints of public unions that often plague the departments of public works. Build-Operate-Transfer (BOT) contracts are, of course, a common use of private contractors in the power sector. Where the length of the contract is relatively short, say five years, BOT can be seen largely as a construction contract. On the other hand, when BOTs are awarded for ten to twenty or thirty years, the distinction between a state-owned enterprise using contractors and straightforward foreign direct investment or a management contract blurs.

As in any government contracting, competitive and open bidding is needed to eliminate the prospect of corruption in award of construction contracts. In the power sector, the problem may be ensuring that there are a sufficient number of bidders and in the construction of the bidding process so that bids are comparable.

Another area where private contracting may help eliminate certain aspects of government failure in the power industry is on the distribution side. Privatizing substations or contracting out their management can introduce performance standards and may help overcome the poor performance due to high level neglect. A comparison of the performance of private and public substations in Nepal shows the dramatic gains from private operation of a substation. The reliability of the electricity service can be dramatically improved through this simple institutional innovation. This is an aspect of electricity privatization that requires little or no regulatory or public sector supervision. Yet, to date, this aspect of electricity privatization has frequently been overlooked.

POWER SUBSTATIONS IN NEPAL

Himal Iron & Steel Ltd. (Himal) and Jyoti Spinning Mills Ltd. (JSM) are two private firms located in the central southern part of Nepal a few kilometers away from one another.

[29] Ibid.

Himal receives power from a substation operated by the government utility, Nepal Electricity Authority (NEA). Himal receives power at the primary distribution voltage of 11kV. NEA brings electricity distribution board through a metering device. This meter measures Himal's power consumption at 11 kV and Himal pays for the power at the applicable tariff. At its factory, Himal steps down the voltage to the secondary distribution voltage of 380 volts, using its own transformer.

In contrast, JSM has its own privately-owned substation. This firm taps power directly from the high voltage transmission line connected to the national grid. The tower from which JSM draws its power is only one transmission tower away from the substation supplying power to Himal, a distance of less than one kilometer. JSM taps power from the grid at 66 kV and passes it through a metering device to a step-down transformer at JSM's captive substation. JSM pays for the electricity at a lower tariff applicable to 66kV supply. After reduction of the voltage to 11 kV at the substation, the electricity is transmitted to JSM's factory through JSM's overhead cables and poles. At the factory it is again stepped down to 380 volts.

Both companies kept meticulous records of power outages for a period of five years in the middle 1990s. An analysis of these data shows that power outages are much more frequent when an enterprise obtains power supply from the government-owned station than when the substation iw owned by the ultimate consumer. During the five years of record keeping, Himal experienced a total of 2001 power failures for total outage duration of 1,517 hours 25 minutes. At JSM, 430 power failures took place for a total of 631 hours 53 minutes.

There were some lengthy outages common to both enterprises, which can be attributed to a breakdown in the whole grid. The failures unique to Himal can be attributed to substation failure, i,e. a breakdown or an open circuit at the substation level. Poor maintenance of the government-owned substation and of the distribution system caused most of the failures. Other problems included: connections to the consumers exceeding the rated capacity of the substation equipment; tampering with the protection devices in the distribution system; and, unauthorized or illegal power connections and consumption. Connections were made for customers with political influence or who paid bribes. Hence, the rated capacity of the government substation was frequently exceeded.

A financial and economic analysis has shown that it is exceedingly profitable and economically worthwhile to have private consumers own and operate their own substations.

Source: This summary is based on Roop Jyoti, *Investment Appraisal of Management Strategies for Addressing Uncertainties in Power Supply in the Context of Nepalese Manufacturing Enterprises*, Doctoral Thesis, Harvard University, December 1998.

Regulating monopoly

Once a government has decided to award a monopoly to a private firm instead of providing service directly through a state-owned enterprise, a different set of issues arises. Regulation, through contract or through a regulatory agency, becomes essential.[30]

Contract regulation--In regulation by contract, the private investor and the public entity enter into a detailed agreement about rights, obligations, conditions, and, most important, rates. Because such contracts must inevitably deal with many contingencies, they become long and complex. Those for power generation often run upwards of 300 pages. This agreement is what regulates the subsequent behavior of the company. Regulation by contract is often seen as an attractive alternative for developing countries because there is no need to establish a comprehensive regulatory organization immediately. Countries that are short on skills can hire the expertise to negotiate contracts, a one time, up-front activity. For investors, risks associated with regulatory discretion are reduced.

[30] For a discussion of regulation by contract and by commission see Shugart (1998).

The disadvantage, however, is that it is devilishly difficult to construct contracts that provide for all possible changes in circumstance. Some events are not expected; covering large numbers of contingencies creates extremely complex agreements. These can be time consuming to negotiate, difficult to interpret, and costly to administer. Again, the experience of Germany's privatization effort is instructive. Moreover, in some cases, parties do not want to admit to the possibility of unattractive events or face up to the terms that might be implied. Given the long-term nature of most contracts in the energy sector, the inability to cover all contingencies in contracts means that renegotiation is a risk, if not a certainty.

As noted earlier, contracts that award monopoly rights in the energy sectors are often of great value and their award presents enormous opportunities for corruption. The same safeguards of open and competitive bidding are critical to minimizing opportunities for this type of government failure.

Commission regulation--In regulation by commission, a regulatory body manages the behavior of the private investor, especially prices.[31] The regulator can specify rates, service, and so on; these can be changed with changing circumstances. The advantage for the parties in regulation by commission is the flexibility to adjust to unforeseen developments, including changes in technology and market conditions.

An investor is likely to commit funds in an industry regulated by commission only if he is confident that he will "fairly" compensated. Consumers will be well served only if the commission is not captured by the investor. Establishing an "independent" commission that is not unduly influenced either by politics or vulnerable to capture is a hard sell for many politicians. Some of the safeguards described above for reducing the risk of political interference in the operations of state-owned enterprises from politics are germane here: clarity of goals, professional criteria for appointment, exemption from civil service salary rules, and an independent source of funding.

The disadvantages of such regulation are that competent technical skills are difficult to assemble and political influence on decision-making may be great. It has not proved easy to set up competent, independent regulatory bodies in many countries, and it has been even more difficult to convince foreign investors that they will be treated fairly.

In reality, the difference between regulation by contract and regulation by commission is not as stark as it might appear. All contracts require some regulatory framework for monitoring and enforcement. Efforts to deal with uncertainty in contracts by including adjustment rules require specialized expertise on the part of negotiators. As the number of contracts of the same type increases, a uniform approach makes sense, which implies some degree of organization. For both approaches to work, a country needs government officials with a wide range of technical skills.

Whatever choices a government makes in the restructuring of energy industries, the regulatory function requires technical expertise and some degree of organization. Building regulatory capacity requires time and political commitment. The countries that to date have most successfully restructured their power sectors have sophisticated and technically skilled regulatory

[31] Smith (1997).

systems. Many developing countries are likely to be overwhelmed by the organization and technical demands of administering complex regulatory schemes; they may be better off relying on contracts, as unstable as thy seem to be or even improving the performance of state-owned enterprises.

Regulating competition

In situations where competition is possible, government has to assure that, once created, competition survives. As we saw earlier, the number of firm engaged in electricity in any one market is likely to be small. For most markets, the economies of scale associated with the production of electricity mean that it is inefficient to have really large numbers of producers. With a small number of competitors, businesses often seek to avoid price instability through explicit or implicit cartels or acquisition of competitors. There is evidence of this happening in Germany, where there is no power regulation, as large firms have tried to drive small producers out of business by lowering prices.[32] Further, the large firms have tried to control access to the grid through the "*Verbandevereinbarung*", an accord reached between the big utilities who set terms for grid access.

Cartelization or monopolization threatens the gains that government sought from a competitive market. To maintain competitiveness, governments must have an effective anti-trust policy. This is not simply a matter of passing a law; the nature of regulation moves beyond the setting prices and rates of return to include the identification and prevention of the exercise of market power by electricity suppliers and consumer groups.

D: Country Variations

In every country, the relationship between the state and the private sector is linked to history, circumstances, values, and institutions. And the energy sector is complex: characteristics specific to oil, gas, electricity, coal, and the so-called renewables affect how investors, public and private, interact. Moreover, for each part of the energy sector, additional country-specific variables—geological and geographic factors, and market structure, for example--will affect the public/private dynamic. This chapter attempts to identify the most important factors that lead to different roles for the state in the energy sectors of different countries. First, we look at the extreme cases of very weak states and very strong states to get some understanding of the most important factors influencing a country's choices. We follow this with a consideration of other important variables that determine a country's policy choices.

I. The extreme cases

Whether a country can or will opt for a system based on private investors as opposed to a state-led system is determined in the first instance by whether private investors are interested in power projects in the country. Their interest is largely a matter of the risk that a county poses. Secondly, even if a country can attract investors, the government must have the capacity to regulate a private, competitive model. If the government's capacity does not meet the demands

[32] See Economist (1999), pp. 65-66.

of the regulatory framework, the market-based system will be subject to political attack. The fact that investors are likely to be foreign will make such attacks more likely.

It is useful to think about states at the extremes, that is countries that investors consider very risky and that have low regulatory capability on the one end; and, on the other, states considered as low risk and that have well-developed regulatory capacity. For convenience, we call the former weak states and the latter, strong states.

Being perceived as high risk, weak states have a difficult time attracting private investors to power projects. In theory, high returns might tempt investors to take the risks, but in fact, investors are likely simply to ignore the risky countries. Further, their governments are likely to find allowing comparatively high returns to be politically unacceptable. As noted earlier, investors might also attempt to shift the risk to the government through contracts but the contingent liabilities in such arrangements can be unacceptably high to the government, if it is aware of their true economic costs.

We have already seen how skewed the private infrastructure investments of the 1990s are, with Africa and South Asia lagging far behind Latin America and Southeast Asia. In some countries perceived as high risk, governments have been able to sell existing generating facilities to private investors, but at throw away prices, as in Kazakhstan,[33] for example. When the private sector is not a viable source of investment capital, at least in the short run, international lending agencies may have to step into this role.

Weak states also have a difficult time managing the participation of private companies in power projects. The skills required of government officials to bring on stream a greenfield investment in power are well beyond the engineering expertise that these countries have typically acquired running a public utility. The project financing, which supports these investments, involves complex financial and legal arrangements. Moreover, the negotiation of large power projects requires coordination across ministries to ensure that all the approval and clearances will be forthcoming. The successful ongoing operation of a project requires a reasonable stable and predictable regulatory environment. The construction of such an environment has proved to be a difficult task even for countries with a substantial degree of administrative capacity.

Privatization of existing infrastructure facilities, another route to competition, also requires substantial administrative and legal capability. Privatizating is more complicated than attracting and negotiating new investment at the front end because it requires a political commitment to change, which in turn requires overcoming vested interests in the continuation of a state-owned facility. On the other hand, when privatization is part of overall sector reform, once accomplished, subsequent regulation may be easier because the rules of the game have been established for the sector and not simply based on project-by-project negotiations.

In summary, weak states may not have the option of creating a market-based system because they cannot attract private investors. At the same time, their capacity to manage large private sector projects—in negotiation and operation—may make these investments subject to ongoing controversy. As we have seen, however, public ownership raises serious issues of government failures, many of which are likely to be more pronounced for weak states than for strong ones.

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[33] See World Bank (1999), pp. 112.

Given how unlikely private investment is in the very weak states, efforts may be better devoted to improving the management of state-owned enterprises. The previous section dealt with organization and sub-contracting as possibilities. There are additional options for very weak states. One of these is to create "mini" systems in which private generators are linked directly to industrial customers or to industrial plants while the state-owned system provides service for commercial and residential customers. There are different variations on this theme. Large industrial operations may generate their own electricity. Or, industrial parks that serve a number of firms may have their own generating facility. These isolated systems, however, are very costly if a reasonable level of reliability of service is to be achieved. Own-generation by industrial consumers creates real problems for the state-owned enterprise that may rely on cross subsidies between classes of users to maintain financial feasibility but at least large industrial users get energy.

Where improvement of state-owned enterprises is unlikely, some observers will argue that a private monopoly is a viable option. It is important, however, to recognize from the start, the likely instability of this arrangement.

At the other end of the spectrum are strong states that are able to attract private investment and have the administrative capacity and technical skills to regulate a market-based system. As we have seen above, regulating in an environment where segments of the system are private and may be competitive and others are natural monopolies requires a high level of technical skill and a well-developed regulatory system. The deregulation of electricity requires high level participation and promotion by regulators at the outset and the continued regulation of the residual monopoly in transmission and distribution. Moreover, the countries that have made the most progress in introducing competition—Chile and Argentina in Latin America, the U.K and Norway in Europe, and New Zealand in Asia—have undergone sector reform to create the systems that they have today. As a result, these countries can privatize, manage negotiations, regulate, and solve problems as they arise. But, their governments invariably remain deeply involved in creating the regulatory environment in spite of the major role given to the private sector.

REGULATION OF ELECTRICITY GENERATION IN CHILE

Chile, a pioneer in restructuring and privatizing its electricity industry, has gone further than most countries in introducing competition and private ownership. The experience is largely judged a success in efficiency and welfare terms. The success of Chilean experience is attributed to the effectiveness of the regulatory framework in providing enterprises with adequate incentives. Meanwhile, regulation seems also to have protected consumers.

Chile's regulatory agency, the National Commission of Energy (CNE), plays a central role in devising and enforcing the regulatory framework. CNE's board is comprised of ministerial-level members and is supported by a small, highly qualified staff. Its regulations deal with entry, pricing, coordination, access, and dispatch. The major features of the framework are summarized below.

- The regulations clearly specify the rules of entry:
- Enterprises compete for the approval of CNE to establish new projects. Selection is made on the basis of least-cost investment program.
- CNE designs and enforces the rules under which the Economic Load Dispatch Center (ELDC) decides to operate certain plants. The daily operation of ELDC is left to a commission whose members are representatives of the generating enterprises. CNE's rules are intended to ensure equal access to the system, fair competition, and safety and reliability.

- Enterprises decide to conclude supply contracts with clients, up to the limit of their capacity. ELDC sets norms for capacity.
- The regulations clearly specify the rules of pricing:
- Prices for the sale of electricity to distribution enterprises are regulated. These prices are set on the basis of short- and long-run marginal costs. A computer model is used to calculate long-run marginal costs.
- Tariffs are revised twice a year.
- Spot prices for exchange among generation enterprises are set by ELDC on the basis of short-run marginal costs at the substation of origin. To ensure price stability, spot prices are calculated into the future taking into account parameters acceptable to all parties including reservoir levels, prices of coal and of oil, demand, etc.
- To ensure adequate competition, any producer can gain access to any customer through "wheeling" charges, based on short-run marginal costs.
- There are clear procedures for settling disputes.

Details of regulatory rules are contained in law, which are difficult to change in Chile and enforced by an independent judiciary. Perhaps equally important to the success of this experience, the country undertook significant reforms of its financial sector before privatization.

Source: The summare is based on Chapters 8, 9, 10, and 12 in Ahmed Galal, Leroy Jones, Pankaj Tandon, and Ingo Vogelsang, *Welfare Consequences of Selling Public Enterprises: An Empirical Analysis*, (New York: Oxford University Press, 1994).

The problems that these countries face in sustaining market based systems are the possibility of regulatory capture, the need to create the proper incentives to get expansion of service, and the dominating role of foreign investors which can cause political concerns over time. The combination of inadequate systems and foreign participation has been a dangerous cocktail in the past. Many of the privately owned infrastructure projects of the early 1900s were nationalized when companies refused to expand to meet growing demand, when they perceived the political risks might prevent them from recovering their investment.

II. Additional country variables

Other country variables affect the options that a government has in designing a regulatory framework for the energy sector. These are in some instances related to risk and regulatory capacity, but deserve attention on their own as well.

Macro economic instability

Macroeconomic instability generally means that the state has to play a larger than usual role in assuming risks if a country wants to encourage private investment in the energy sector. Macro economic instability can come in various forms. Most common perhaps have been high (and generally fluctuating) rates of inflation and volatile real exchange rates. Government efforts to manage the macro economy can result in "stop and go" economic growth. Any of these kinds of instability can make regulation more difficult and the resulting uncertainty can make investments look risky to potential private investors. In some areas, the state is called on to give, and eventually to honor explicit or implicit guarantees given to investors. Instability can also increase the required rates of return required by investors to the point that some kind of state action may be demanded. Unfortunately the shortages of supply in such a situation are usually

so great that the economic rates of return justify paying large financial rates of return to compensate for the risks.

Inflation poses difficulties for the state in its role as regulator or as owner. Investors either will try to have a contract that indexes prices to inflation, or will look to the regulatory agency to deal with erosion in real prices.[34] On the other hand, because energy prices are an important element in inflation indexes, the government may be reluctant to try to pass on inflation through tariff adjustments. As a result, inflation increases uncertainty for investors. Uncertainty, in turn, raises the expected returns demanded by investors.

Sharp movements in a country's real exchange rates cause a different set of problems. A steep decline in the value of the domestic currency relative to foreign currencies—as experienced by several countries in the Asian currency crisis--may make it impossible for governments or state-owned enterprises to make good on contracts. With power purchase contracts that effectively index obligations to dollars, the state-owned enterprise may have to raise prices higher than the domestic rate of inflation to obtain the revenue needed to meet contractual obligations. On the other hand, no government is likely to find it politically acceptable to allow rates to rise faster than inflation. Under these conditions, state-owned enterprises may be forced to default on their obligations (as happened recently with power agreements in Indonesia). In instances where governments have implicitly or explicitly guaranteed obligations, the state may be called on to make up the short-fall with some level of subsidy.

Erratic rates of growth make it hard to plan capacity and are likely to lead to intermittent surpluses and shortages. Surpluses mean low returns to investors. Shortages often lead to conflicts between investors and the state. In fact, many of the nationalizations of infrastructure investments in the past were precipitated by the belief that investors were hesitant to add capacity in the basic infrastructure industries.

Natural resource endowment

To some extent, the regulatory role of the state depends on whether a country is primarily an importer or a producer of fuel for generating electricity or of direct energy sources.

Countries that import fuel for generating can generally leave purchases to market forces. In most cases, there is sufficient competition that users can turn to well-developed markets for fuels. Presumably, they will buy from the lowest cost sources that meet reliability standards. There may, however, be some exceptions that require government intervention. A generator might, for example, contract with an affiliate abroad for fuels at above-market prices, with the results 1) that costs for regulatory purposes are misleading and 2) that understated profits for tax purposes result in lost revenues. In both cases, intervention may be called for. In the case of transfer prices, the administrative task is not special to infrastructure. Rather, tax authorities have to monitor transfer prices whenever there are affiliate transactions across borders.

When a country has domestic energy sources, what these are, and how they are distributed geographically will affect the role of the state. In all developing countries, the state

[34] Inflation affects most publicly provided or regulated services in the same way. The financial crisis experience by the New York City subway system occurred because of the wild inflation following World War I. See Hood (1994).

owns the rights to oil and gas, coal, geothermal, and water. The primary public policy issue concerns who captures the "resource rents" that are associated with attractive sources. When the state exploits the resources, it potentially captures the rent. The issue then is whether the rent is passed on to the consumer as a subsidy, used by the state-owned entity for some other purpose, or collected by the state in the form of royalties, taxes, or dividends. When a private party exploits the resources, some division of rents must be made, usually through some kind of "concession" contract. Although having potential investors bid for the source provides an attractive solution in theory, in practice, it often fails. There may be fewer bidders, they may collude, or if lump sum payments are sought, capital markets may be inadequate to fund the "right price." Tender arrangements often turn into individual negotiating sessions between investor and the state.

Legal framework

A well functioning legal system that is free from political influence and able to enforce contracts is essential for attracting investors to large-scale energy infrastructure projects and for making competition work. To the extent that such a system does not exist, a country will have difficulty restructuring its energy industries.

A fully developed legal system will have a series of laws that deal with business transactions: company law, contracts law, bankruptcy law, and anti-trust law. The coverage and details of these pieces of legislation can be quite different from country to country, but the law in some way provides a set of rules to govern common business transactions. Moreover, laws must be backed by an effective court and administrative system. The system must assure investors for example, that they can collect bills from parties, even from politically connected customers. In regulation by commission, investors expect to have legal recourse against decisions that appear to be arbitrary. Yet, the system must discourage frivolous claims. And, bankruptcy and anti-trust laws must be implemented by technically competent agencies and courts.

When legal systems are inadequate, countries often turn to very detailed contracts with investors; the contracts may be backed with commitments to submit disputes to international arbitration. Although, such arrangements can substitute for an adequate domestic legal system in some cases, the substitution is far from complete. While international arbitration might cover problems between the investor and the government, it is unlikely to solve problems faced by the investor who does business with local private parties, for example.

Where international arbitration is the only reliable protection, the investor may stay away from extensive transactions with parties other than the government or state-owned enterprise. Thus, the absence of a competent domestic legal system limits privatization to sectors such as generation, where most transactions can be with state-owned distributors. Private investors are especially likely to stay away from investments in distribution, where bills must be collected from many private parties. And, they will probably steer clear of joint ventures, especially minority positions with public partners. Therefore, countries with weak legal systems will have a difficult time turning over major sectors of the energy industries to private hands.

Corruption can undermine any set of laws, even though the legal system might look good on paper. If the legal system is captured by payments, the outcome of regulation becomes unpredictable. Business transactions become hazardous. Moreover, if they make illegal payments, foreign investors risk violating laws in their own countries and invalidating their risk

insurance from bilateral and international institutions.[35] They will also suffer from having costs that cannot be put in their cost basis for determining prices or in their costs for tax purposes.

Location of regulatory responsibility

In some countries, state or municipal entities control local distribution of energy. With reform, contract negotiation and regulation is likely to fall into their control. The involvement of sub-national groups can add substantial complexity for investors.

If the project spans more than one jurisdiction, oversight can become complicated. If prices are cost-based, for example, disputes can arise over allocations between jurisdictions. Different jurisdictions could operate under different kinds of contractual arrangements. Reforms might be timed differently.

From the country's point of view, the need to staff local regulatory agencies may strain a country's already limited pool of expertise. It has been argued that regulation by contract may be especially attractive to a local government so as to avoid the need for establishing a regulatory commission at the local level. Entering into contracts with a local governmental unit may, however, add risk for the investor. In the event of a contract dispute, the local government may be less constrained in taking actions against the investor than would a national government because the local government is less likely to be concerned with potential consequences for the national "investment climate."

On the plus side for the country, regional jurisdiction can offer opportunities if the subdivisions are large enough. In this case, they might be used to experiment with innovative schemes without having a wholesale national commitment to an untested regulatory effort, for example.

Market size and structure

In some countries, the market for electricity may be too small to support enough generating facilities for competition to be feasible. In other instances, country-wide demand may be large enough but the market may in fact be segregated. For example, urban centers may be too far apart to be serviced by a single grid is and each market alone is too small to justify competitive generation. Similarly, a country make up of a number of islands, like Indonesia, may have many small markets that do not warrant competitive power production.

The model of inducing competition among generators requires a number of customers. The countries that have succeeded so far had a large number of industrial customers. In this way, the market, and often the payment, risk can be reduced through direct contracts between private parties.

[35] Under an OECD agreement member countries have agreed to adopt legislation similar to the U.S. Foreign Corrupt Practices Act.

E. A Role for International Agencies

It is clear that governments have primary responsibility for improving energy infrastructure and expanding access to it in their countries. It is highly unlikely that significant inroads can be made in privatization, job creation, and poverty reduction unless supplies of electricity and fossil fuels are available. There are many changes that only governments themselves can make. At the same time, not all governments have the necessary financial and human resources and information to accomplish these goals effectively. International agencies can support their efforts. Recognizing that different countries will make different choices in the mix between public and private participation, we suggest a number of supporting activities for international agencies.

I. Providing investment capital

Chronic shortages of investment capital doom many developing countries to struggle along with inadequate energy infrastructure. In some of these countries, privatization is an attractive option in theory only. When private domestic investors with sufficient financial resources are unavailable and foreign investors are unwilling to assume the risks or ask too high a price, international agencies need to step in.

Financing from international agencies can play several roles. In some cases, we know that private foreign investors are hard to attract. When private capital is simply not forthcoming, international lending agencies can make up for the shortfalls. Second, in some cases, private investment may be forthcoming if fears of risk can be assuaged. Private investors may be comforted if their capital is complemented by funds from international agencies. Finally, having the option of undertaking a project on its own with international financing may increase a government's bargaining power of governments vis a vis private investors.

In the past decade, institutions have been reluctant to provide finance for state-owned firm. We believe that there are cases where such financing is appropriate.

II. Promoting reform of state-owned enterprises

Improving governance and building capacity in developing countries are top priorities for the international development community today. To the extent that these efforts mitigate the kinds of government failures that we discussed earlier, governments will better manage their energy sectors. For governments wishing to retain ownership of energy facilities, or having little choice, state-owned enterprises can be made more efficient. At the same time, stronger governments are more able to manage the administrative and institutional frameworks that are needed to oversee regulated competition.

The World Bank is engaged in trying to understand what changes are effective in improving the governance of state-owned enterprises. Programs specific to improving performance in the energy sector could focus on the use of contracting by state-owned power enterprises. Research on the use of management contracts with a focus on infrastructure would illuminate the potential for improving the performance of public companies in the power sector.

Similarly, attention to the importance of the efficient operation and maintenance of power substations might direct some policy efforts to this often overlooked part of power systems.

III. Collecting information on private power contracts

We have seen that some of the private power contracts of the 1990s, particularly those in countries that have relied on regulation by contract, attracted tremendous criticism and created bitter disputes between investors and host governments. Often governments negotiate bad deals out of ignorance. In other instances, tension arises when newspapers report on seemingly better contract terms prevailing elsewhere. This reporting is almost always partial and does not permit full comparison of agreements. Some of this tension might have been avoided if government negotiators, and their public audiences, had reliable information on the terms of similar contracts elsewhere, at the time of negotiation and later. International agencies could play a helpful role in collecting and making such information available.

IV. Accounting for contingent liabilities

Some countries have provided investors with government guarantees on price and volume to attract foreign investors to power projects. These guarantees look free of cost at the outset, but they can turn into substantial commitments particularly in times of economic downturn. Increasingly, advice to governments is that they should not agree to guarantees to private investors. Analysts prefer that contracts with state-owned enterprises or local authorities should stand or fall on the credit worthiness of the contracting entity. But, if governments decide to undertake such obligations, their potential costs should be calculated and accounted for in government budgets.

When these guarantees support contracts that are in the form of take-or-pay agreements, an additional set of issues arises. In such instances, governments assume potential liabilities that look very much like debt.[36] That is, constant payments are due regardless of demand conditions or exchange rates. If countries decide to accept these instruments, it would be helpful to have these obligations accurately accounted for as "debt-like" so that government officials, potential investors, and international financial institutions have a clear idea of a country's true debt situation. The International Monetary Fund has been increasingly involved in setting standards on data reporting, and could usefully include reporting on contingent liabilities. Moreover, if government guarantees back these obligations, they should be considered as government liabilities.

V. Structuring subsidy arrangements

Schemes to subsidize remote or poor consumers are likely to be part of the energy policy package of all developing countries. It is important to have a clear idea about how different types of subsidy mechanisms achieve the goals that governments have for them and what other repercussions they have. International agencies should conduct more empirical research to ascertain just how different kinds of subsidies function in different environments, how costly they are in terms of their eventual impacts, and what kinds of administrative support are needed

[36] The debt-like nature of these arrangements is elaborated by (forthcoming).

to make them function properly. It is apparent that trade-offs are involved in satisfying the various objectives of subsidy systems. But, too little is known about the nature of these trade-offs.

VI. Assisting in building regulatory skills

There are a number of success stories in the electric power industry, countries that have developed sophisticated regulatory mechanisms to deal with the problems of coordination, access, pricing, and so on. And, we can expect that these countries will continue to experiment and to improve their systems. All of this experience makes it easier for those who follow.

While the new regulatory mechanisms have been described in some detail, not much is understood about how a country can make the transition from one to another. We know, for example that certain steps begin to foreclose some options, or at least make them more difficult. Conventional take-or-pay power purchase agreements, for example, can make the introduction of competition among generators more difficult in the future. Similarly, certain steps make other steps more likely, whether or not that is part of the original plan. There are undoubtedly a number of related factors that need to be spelled out before we have a clear road map of how to move toward a regulatory system for competitive markets. Learning about transitions is a useful task for international agencies.

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