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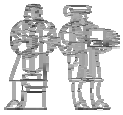
Reform and Regulation of the Electricity Sectors in Developing Countries

Tooraj Jamasb



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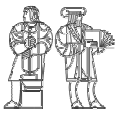

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REFORM AND REGULATION OF THE ELECTRICITY SECTORS IN DEVELOPING COUNTRIES

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Abstract

The 1990s witnessed a worldwide trend toward electricity sector reforms in developed and developing economies. These reforms have generally been based on private participation, regulatory reform, and competition in the sector. This paper reviews and draws lessons from the reform experience in developing countries. Developing countries have had to reform technically and financially less efficient electricity systems with less developed private sectors, weak economic and political institutions, shortage of skilled human resources, and lack of regulatory experience. The paper argues that competition and regulatory reform are equally important to the success of reforms. Also, the sector's systemic characteristics and the country's institutional endowment should weight equally in the design of reforms. In addition, distributional and access to service aspects of reforms call for a redefined state involvement rather than a complete withdrawal from the sector.

Keywords: Electricity, Reform, Regulation.
JEL Classification: L52, L94, Q48

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REFORM AND REGULATION OF THE ELECTRICITY SECTORS IN DEVELOPING COUNTRIES

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1. Introduction

During the past two decades, many developed, transition, and developing countries have embarked on electricity sector reforms (APEC, 2000). These reforms have taken place within the backdrop of a wider paradigm shift from state ownership and centralised organisation of infrastructure industries to private ownership, public regulation, and market-oriented structures (OECD, 2000). The recent trend towards electricity sector reforms is not due to breakthroughs in economic theory. Rather, it reflects a general dissatisfaction with the performance of traditional organization and regulation of the industry and the desire to improve the efficiency of the sector. Also, reforms by pioneering countries and technological progress have contributed to adoption of reforms in other countries.

The driving forces behind the electricity sector reforms in developed and developing countries have been different. In developed countries, the main aim of the reforms has been to improve the performance of relatively efficient systems. In developing and transition countries, the burden of price subsidies, low service quality, low collection rates, high network losses, and poor service coverage have meant that many governments are no longer willing or able to support the existing arrangements (Newbery, 2002; Joskow, 1998). In addition, international development agencies have engaged in promotion and implementation of electricity sector reforms. This paper

[1] This paper is indebted to generous contribution of ideas and valuable comments from Paul Joskow, Yannis Kessides, David Newbery, Takis Papapanagiotou, Michael Pollitt, Mary Shirley, and Jon Stern.

reviews the experience with electricity sector reforms in developing countries to date and draws some lessons for reforms and regulatory design.

The reforms have sought to transform the state-owned and centralized electricity sectors into decentralized, market-oriented industries with private sector participation, competition in generation and supply businesses, and regulation of natural monopoly activities. In order for the decentralized industry to function, the reform and regulatory design must establish appropriate structural, institutional, and operational framework. The main steps of a stylised reform are to (i) restructure the sector, (ii) establish regulatory authorities, (iii) organise markets for generation, (iv) regulate transmission and distribution networks, (v) privatize existing assets and promote new investments, and (vi) allow for cost-reflective electricity tariffs (Newbery, 2002; Joskow, 1998).

Electricity sector reforms in developing countries have taken place within diverse political, economic, and structural contexts. In addition, many reforms were initiated at a time when the international experience with such initiatives was limited. Consequently, the reforms have taken a variety of forms and followed different paths (Bacon and Besant-Jones, 2001; Millan et al., 2001). Within this background, it is perhaps not surprising that many reforms have encountered unexpected problems and the degree to which they have achieved their goals varies across the countries (Fischer and Serra, 2000).

The international experience with electricity sector reform in developing countries has shown that achieving workable reforms is considerably more complicated than anticipated. Electricity systems in developing countries vary considerably with regard to size, structure, and resource mix. In addition, many of these countries are constrained by institutional endowment of their political and economic systems and lack of human resources with regulatory skills and experience (Stern, 2000).

It is generally recognized that regulatory design and implementation strategy should take the specific characteristics of the sector in question into consideration. However,

the reform models adopted have not always fitted the sectors of these countries and many reforms have encountered unexpected problems and unintended outcomes. The experience has shown that regulatory design is crucial to success and failure of reforms (IADB, 2001a). Successful reforms can improve the efficiency of the sector and offer lower prices, and better quality of service. At the same time, flawed regulatory design can undermine the benefits of reforms.

Section 2 of this paper reviews private participation in the electricity sectors of developing countries during the 1990s. Section 3 focuses on aspects of reforms in countries with considerable private investments. Section 4 discusses the reform in a few selected countries in more detail. Section 5 discusses some important reform issues in developing countries. Section 6 is conclusion.

2. Private Sector Participation in Electricity Sectors of Developing Countries

Private sector participation is arguably the most important element of electricity sector reforms. For many reforming countries faced with increasing burden of capital requirements for expansion of publicly owned electricity systems, private participation is an alternative source for securing the much-needed investments in the sector. In addition, to the extent that the required public expenditures are financed through taxation, the marginal cost of public funding in terms of the associated dead-weight loss constitutes an added social welfare loss. In developing countries, the magnitude of such losses can be significantly higher than 1. For example, the dead-weight loss in Malaysia, Philippines, and Thailand have been estimated at 1.2, 2.5, and 1.2-1.5 respectively (Beato and Laffont, 2002; World Bank, 1997).

Private ownership together with competition (and incentive-regulated networks) is expected to result in cost efficiency, lower prices, reduced system losses, and improved revenue collection (Newbery, 2002). The gains from the reforms are expected to exceed the higher transaction costs from breaking up vertically integrated systems, higher risk premiums required by private investors, and cost of regulation.

In addition, privatization of existing assets offers the prospects of significant proceeds for cash-strapped governments with foreign debts. The success of market-oriented reforms is, therefore, highly dependent on participation and functioning of private actors in the sector.

The 1990s witnessed a marked move towards reforming the electricity sectors in many developing countries. Between 1990 and 1999, private participation took place in the electricity sectors of over 75 developing countries. During this period, total private investments in these countries amounted to approximately US$160.7 billion. Divestiture of existing assets and greenfield projects stand for 50% and 45% of total private investments respectively with the balance committed under operations and management arrangements (Figure 1). The number of projects associated with the investments amounted to 695 in total and showed a similar distribution across the types of activities (Figure 2).

The distribution of private investments in electricity sectors across different activity areas and regions of the world has been rather uneven. Figures 3 and 4 show that more than two-thirds of total investments and projects in the sector between 1990 and 1999 have been in pure generation facilities. At the same time, distribution-only and vertically integrated utilities investments have attracted approximately 16% and 10% of total investments respectively. In contrast, transmission-only activities accounted for only 1% of the investments in the sector.

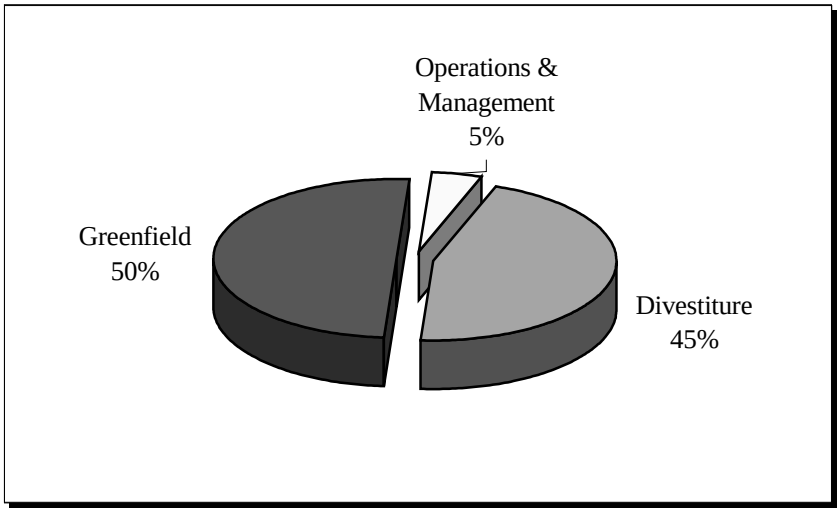


Figure 1: Private investments by type (1990-99)

Source: World Bank PPI Project Database

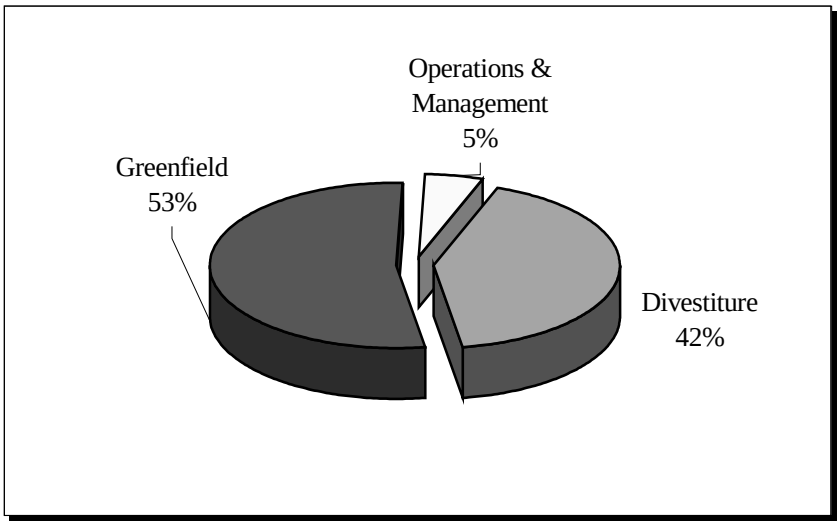


Figure 2: Number of projects with private participation by type (1990-99)

Source: World Bank PPI Project Database

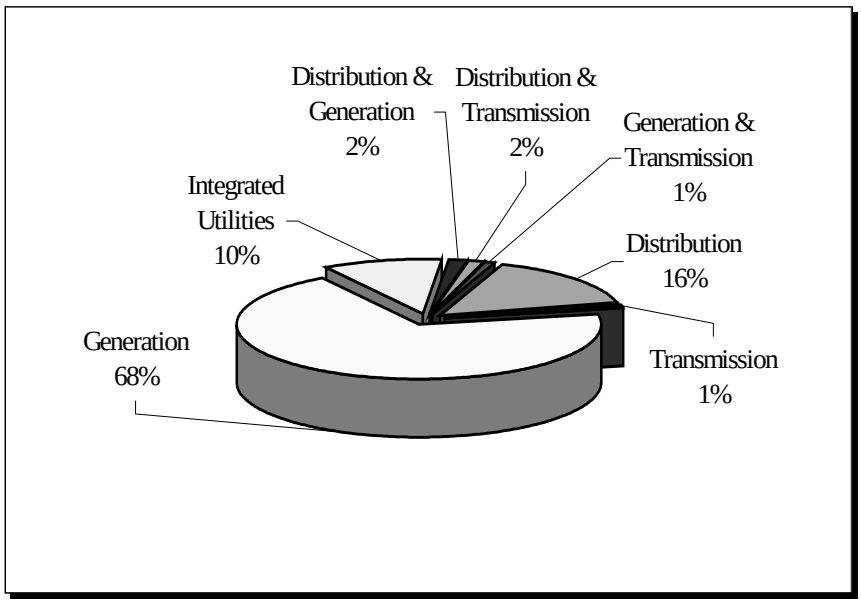


Figure 4: Share of investments with private participation by industry segment (1990-99)

Source: World Bank PPI Project Database

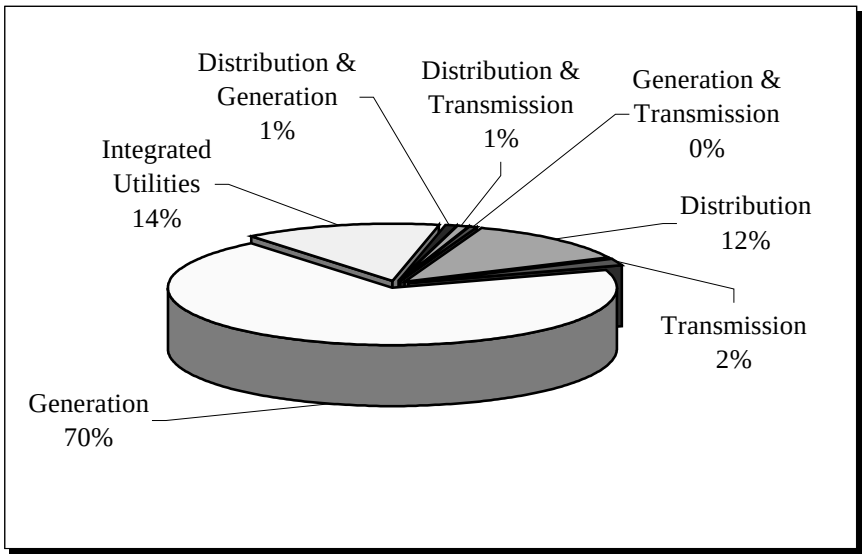


Figure 5: Share of number of projects with private participation by segment (1990-99)

Source: World Bank PPI Project Database

The investment patterns reveal notable differences among the main regions of the world. As shown in Figure 5, the Latin American and Caribbean (LAC) and East Asian and Pacific (EAP) countries accounted for 40% and 35% of total private investments. An additional 12% of investments took place in South Asian (SA) countries. The remaining 13% of private investments has taken place in Eastern Europe and Central Asia (ECA), Middle East and North Africa (MENA), and Africa.

Figure 5 also exhibits notable differences in the types of investments undertaken across the regions of the world. Approximately, 80% of the private investments in LAC and ECA countries have been in divestiture projects. In contrast, 80% of the investments in EAP and SA countries have taken place in greenfield projects. The considerably lower investments in MENA and African countries reflect lower levels of reform-related activities in these regions.

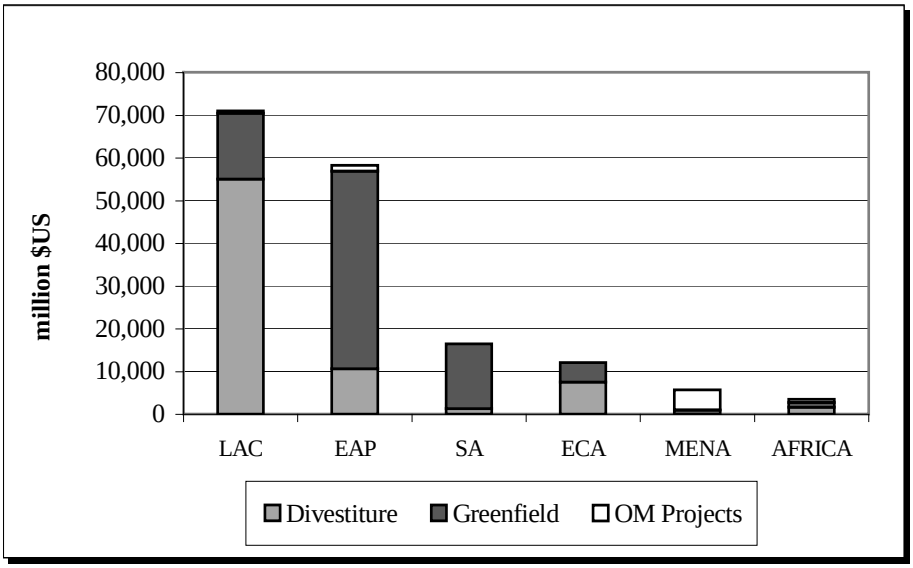


Figure 5: Private investment in electricity projects by region.
Source: Source: World Bank PPI Project Database

The apparent regional differences in investment patterns reflect the differences in the reform strategies adopted by the countries in these regions during the 1990s. By and large, the EAP and SA countries opted for power purchase agreements (PPAs) with independent power producers (IPPs) while maintaining state-ownership of existing

assets. In contrast, governments in the LAC adopted a more balanced approached by opening the sector for IPPs and privatization.

Investments in different regions also exhibit variations across different areas of activity of the sector. Figure 6 shows that, in all regions, the percentage share of private investments in generation-only type of facilities has been higher than in other types of activities. In addition, integrated activities that include generation have attracted a considerable share of investments. The pattern corresponds with the anticipated strong growth in demand for electricity in most developing countries. LAC countries exhibit the highest level of investments in distribution-only and transmission systems. At the same time, there is a notable absence of distribution-only investments in SA and MENA countries. In contrast, the largest portion of private investments in MENA countries has been in integrated utilities.

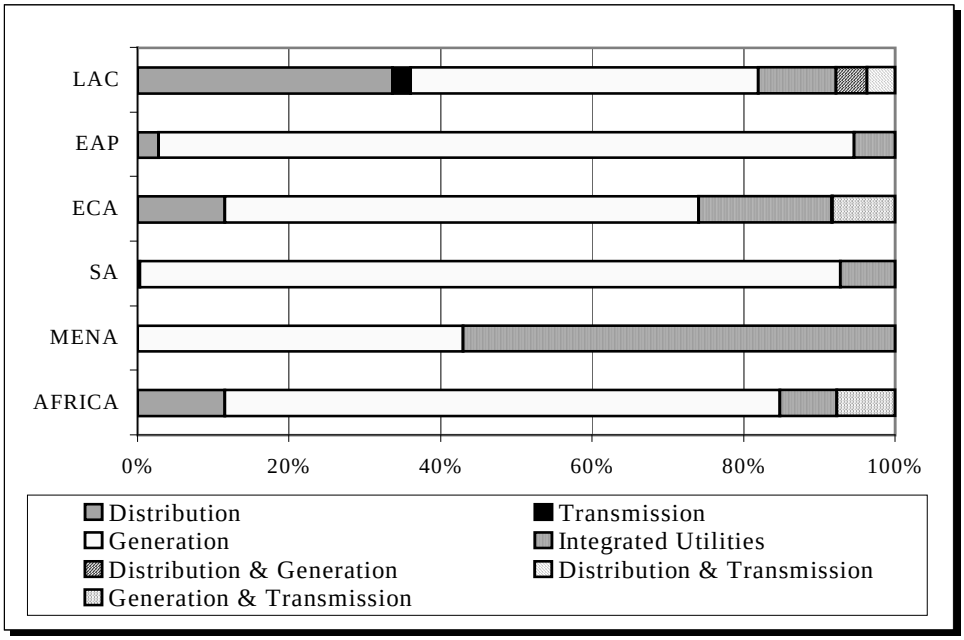


Figure 6: Private participation by segment and region

Source: World Bank PPI Project Database

Distribution of private sector participation during the 1990s has been rather uneven. Figure 7 and Table 1 reveal a clear divide between pre-1997 and post-1997 private

investments in the sector. From the beginning of the 1990s to 1997, electricity sector reforms and anticipated economic growth resulted in an increasing level of private investments in the sector. In the post-1997 period, however, financial problems in many countries in Asia, Latin America, and Eastern Europe have led to a sharp decline in investments in these regions.

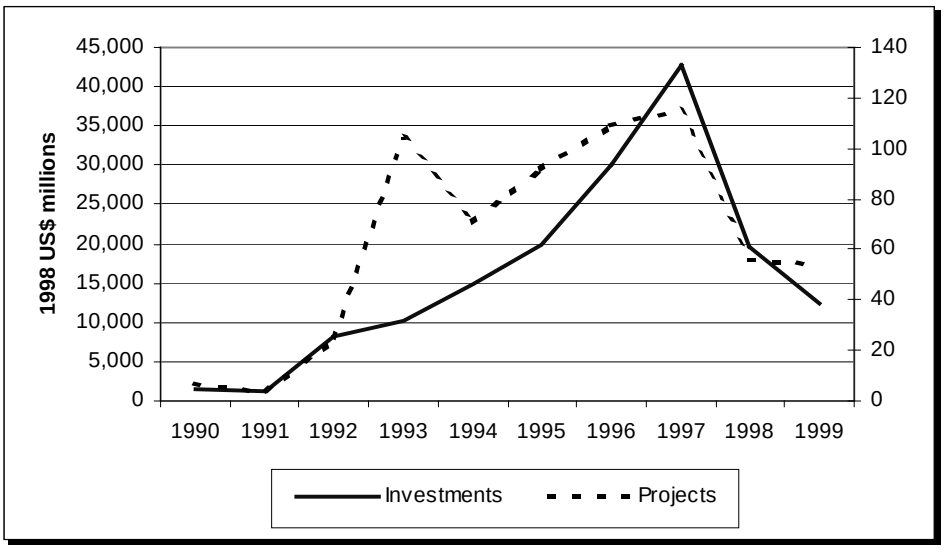


Figure 7:Investments and number of projects with private participation (1990-99)
Source: World Bank PPI Project Database

Table 1: Private investments in electricity projects in LDCs 1990-99 (1998 $ millions)
Source: World Bank PPI Database

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**Total**
Sub-Saharan Africa	49	0	27	1	84	42	1,014	503	709	455	2,884
East Asia & the Pacific	55	454	4,622	5,592	7,291	7,492	11,677	12,437	4,833	1,945	56,398
Europe & Central Asia	85	0	1,041	0	1,332	3,369	3,507	2,128	504	688	12,655
Latin America & the Caribbean	1,204	23	2,497	3,298	2,924	5,788	8,750	20,629	12,720	6,287	64,120
Middle East & North Africa	0	0	0	0	225	0	217	4,679	0	715	5,837
South Asia	169	735	37	1,186	3,081	3,193	4,934	2,319	926	2,227	18,805
Total	1,562	1,212	8,225	10,077	14,936	19,884	30,100	42,694	19,692	12,317	160,698

Figure 7 reflects the sensitivity of private investments to changes in economic climate and in particular currency fluctuations such as those experienced in Asia and Latin

America. Indeed, the extent of decline in private investments is likely to be more profound than those indicated in the table. As a result of economic downturn and revised estimates of demand growth in some reforming countries, many private investments committed in the pre-1997 period were, in particular PPAs with IPPs in South and East Asia, subject to renegotiations and some projects may not be materialized (see e.g. World Bank, 1998b).

It is difficult to predict the effect of the apparent decline in investments that may persist in the long run. A major concern is that the decline is occurring at a time when many developing countries are in various stages of reforming their electricity sectors. Some countries may increase their reform efforts to increase the attractiveness of their sectors to private investors. However, it is likely that some countries will, due to their economic conditions, face a lack of interest by investors. More recently, the financial crisis in Argentina and abolition of dollar-based electricity tariffs charged by privatized utilities owned by foreign firms has demonstrated the potential risks to private investors. The recent economic and sector level problems in Argentina, Brazil, and Venezuela are likely to have a lasting effect in private investments in other Latin American countries.

A decline in private investments means that governments in many reforming countries will have to maintain an active presence in the electricity sector. There is a lack of data on public sector investments in electricity sectors of developing countries. According to estimates reported in Fay (2001) the average investment needs of the electricity sectors in Latin America for the 2000-05 period are about $24 billion per year. In comparison, between 1990 and 1999, total investment in greenfield electricity projects in the region was approximately $ 16 billion.

The main purpose of attracting private participation has been to relieve governments from the burden of investment in the sector. However, in many cases such as in Asia, provision of contractual safeguards awarded to foreign investors in the form of government guarantees, take-or-pay assurances, and fuel and currency clauses, PPAs have in effect become foreign debt assumed by governments (see e.g. World Bank,

1998a). Macroeconomic instability and subsequent currency devaluations reduce the value of earnings of foreign investors. Also, currency devaluation reduces the dollar value of the potential proceeds from asset divestiture, which in turn can reduce the incentive among governments to privatize these.

3. Reform in Developing Countries

As mentioned previously, a central aim of electricity sector reforms in developing countries is to attract private sector investments. As private participation is an important indicator of reform-related activities, this section focuses on the main aspects of reforms in countries where there have been considerable private participation during the 1990s.

Table 2 shows the top 12 as well as 8 other developing countries with considerable private participation in the sector. The top 12 and the whole group of 20 countries in the table account for approximately 83% and 95% of the worldwide private investments ($US 161 billion) in the 1990s respectively.

Table 2: Countries with highest private investments in the electricity sector 1990-1999 (1998 $US million)
Source: World Bank PPI Database

1	Brazil	31,627	11	Malaysia	5,970
2	China	19,049	12	Morocco	4,820
3	Argentina	14,986	13	Korea	4,522
4	Philippines	11,672	14	Turkey	3,710
5	Indonesia	9,580	15	Peru	3,680
6	India	8,881	16	Hungary	2,446
7	Chile	6,836	17	Russia	2,070
8	Pakistan	6,693	18	Kazakhstan	1,508
9	Colombia	6,512	19	Czech Republic	1,300
10	Thailand	6,413	20	Guatemala	1,296

Figure 8 shows the divide in types of private investments in the top 10 countries. Latin American countries in general and Brazil and Argentina in particular have attracted more investments to divestiture of existing assets. In Asia, due to low level of

privatization activities, most private investment has taken place in greenfield projects such as IPPs.

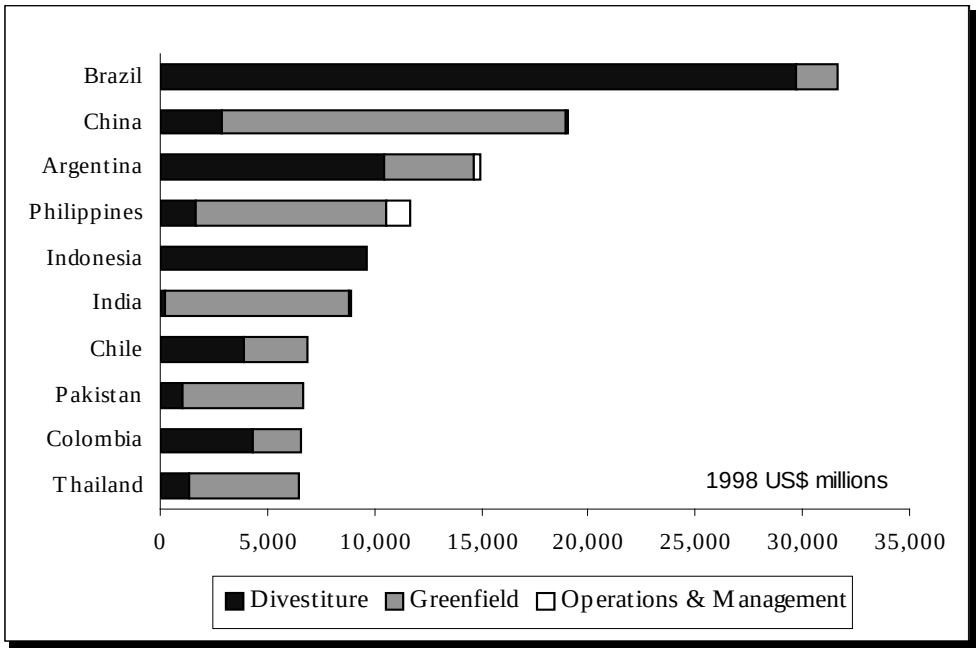


Figure 8: Countries with most private investments 1990-99 (1998-$US million)
Source: World Bank PPI Project Database

3.1 Competition and Market Power

Electricity supply industry is no longer viewed as a vertically integrated natural monopoly activity. Rather, the industry is regarded separate as separate but inter-related activities with distinctive economic characteristics. The new view of the electricity sector is that the generation and supply activities are potentially competitive while the transmission and distribution activities can, exhibiting natural monopoly characteristics, be subject to incentive-based regulation.

The main focus of electricity sector reforms has been on liberalization of electricity generation. However, many reforming countries have experienced difficulties in enforcing effective competition in this market. It has now become evident that

regulatory design is crucial for achieving effective competition in the sector. Lack of competition results in market power to existing actors that (i) reduces pressure on cost-saving efforts, (ii) limits consumer choice, (iii) distorts investments in new generation capacity, and (iv) prevents new entries.

Several conditions can lead to lack of real competition and market power. First, in the restructuring phase, the reform must ensure that existing generation resources are split into a sufficient number of potentially competitive units. The main issues here are to avoid establishment of dominant firms and ensure a balanced resource mix among the competing firms while taking the size of the sector into account. In the UK, the problem of market power became apparent shortly after the reform. It was only after a lengthy process of new entries by IPPs and forced divestiture of generation capacity by the incumbents that a more competitive market was achieved (Newbery, 1999).

Despite its obvious benefits, creating sufficient number of generation firms has not been easy. At the same time, in most reforming countries, energy companies have shown a strong tendency toward vertical integration and dominant position in the market. Complex ownership structures among large international energy companies and lack of experience on the part of regulators have also resulted in horizontal re-integration of the sector. Table 3 shows the market share of the three largest generating firms in a number of reforming countries. As shown in the table, there is a high level of concentration in generation in most countries. In order to limit market power, some regulators have adopted measures such as setting limits on market share of generators. In Argentina, the maximum size of the generators has been limited to 10% of the market.

Second, vertical integration of generation firms with transmission and distribution utilities can create incentives for discrimination among the generation firms for gaining access to grid. Most countries have imposed limitations on cross ownership between generation and transmission utilities. As shown in Table 3, many countries have introduced “regulated” rather than “negotiated” third-party-access arrangements. However, in some countries, limitations on cross ownership in generation and

distribution has been less stringent. In Chile, since the introduction of reform, partly due to ownership of the main transmission grid by the largest generation firm and negotiated access arrangements, there has not been significant new entry into the market.

Table 3: Share of the three largest firms and network access arrangements in selected countries

	Share of Three Largest Firms in the Sector (%)			**Network Access Arrangement**	
	Generation	**Transmission**	**Distribution**	**Transmission**	**Distribution**
Argentina	30	80	50	RTPA	rTPA
Brazil	40	60	40	RTPA	rTPA
Chile	67	100	50	NTPA	nTPA
Colombia	50	100	60	RTPA	rTPA
Peru	100	100	100	RTPA	rTPA
Bolivia	70	100	70	RTPA	rTPA
El Salvador	83	100	88	RTPA	rTPA
Panama	82	100	100	RTPA	rTPA
Hungary	74	100	65	SB	SB
Poland	45	100	21	NTPA	nTPA
Czech republic	71	100	49	NTPA	rTPA
Pakistan	95	100	100	SB	SB
Thailand	100	100	100	SB	SB
Malaysia	62	100	97	SB	SB
Indonesia	100	100	100	SB	SB

SB: Single-buyer nTPA: negotiated third-party-access rTPA: regulated third-party-access

Third, rules concerning allocation of common transmission costs, congestion pricing, and arrangements for financing investments for expansion of grid system can affect competition in the sector. The main issue in allocation of common costs is to develop an appropriate and workable procedure for calculating operating, maintenance, and capital costs. For example, allocation of costs is complicated by existence of economies of scale in transmission activities.

Most Latin American countries have adopted two-part transmission tariff systems where a fixed payment is added to the system marginal income. Another issue is how the

transmission cost should be distributed among the users of the network. In Chile and Argentina, transmission costs are covered by the generation companies, while in Bolivia and Colombia, costs are split equally among the generation companies and consumers.

Another issue is whether the owners of the transmission system should keep congestion charges or these should be assigned grid users based on some form of ownership rights. In Argentina, congestion rents enter a fund designated for expansion of the network (Fisher and Serra, 2000). In Brazil, failure to ensure sufficient grid capacity prior to the reform has created transmission bottlenecks that in turn result in segmentation of the system and give some firms regional market power.

Although there are various models in place, there is currently a lack of workable models that satisfactorily address the above issues. The main problem here is the difficulty of developing theoretically efficient models that is, at the same time, simple enough for implementation. **Avoidance of market power should be a major concern already at the design and implementation of sector restructuring.** Addressing the issue at later stages through introduction of new rules or further major post reform restructuring tend to be difficult and face resistance form the vested interests in the existing structure.

3.2 Incentive Regulation of Distribution Networks

In most electricity systems, distribution networks account for 30%-40% of total costs of supply and exhibit substantial potential for efficiency improvements. In developing countries, due to technical and non-technical losses (e.g. unauthorized connections), the actual share of distribution costs may be substantially higher. In addition, distribution utilities are a crucial link between generators and franchise customers. Financial health of distribution companies affects the generators as counterparts in market transactions, provision of service to end-users, and financing necessary investments.

A central part of restructuring of the electricity sector is to introduce competition and price mechanism into generation and supply activities. The natural monopoly characteristics of distribution networks require that these remain under regulation. **However, experience from reforming countries such as the UK and Norway suggests that establishing a regulatory framework for distribution utilities should be integrated in the reform design.**

Indeed, the costs of failure to implement an effective regulatory framework for distribution utilities can exceed the efficiency improvements gained in the competitive activities of the sector. For example, following the reform in New Zealand, between 1991 and 2000, the real wholesale price of generation for residential users decreased significantly. However, the distribution companies operated under self-pricing based on information disclosure. In the absence of a firm framework for regulation of networks, the distribution charges have increased. As a result, the end-user price of electricity in real terms has increased considerably (Todd Energy, 2000). Table 4 shows that, in effect, network monopolies have captured the efficiency gains achieved in wholesale generation as well as a monopoly rent.

Table 4: Real residential electricity prices in New Zealand before and after reform (cents per KWh-2000-prices)
Source: Based on Todd Energy (2000)

	31 March 1991	**31 January 2000**
Wholesale price	6.41	3.64
Transmission	1.97	1.45
Distribution and Supply	1.17	8.41 (Distribution 5.24 + Supply 3.17)
Total	9.55	13.5

Many of the countries that have liberalized the electricity generation activity have also engaged in regulatory reform of the distribution network activities in the form of incentive-based regulation. As opposed to rate-of-return regulation which is essentially cost-based and guarantees a pre-determined return on capital, incentive regulation

rewards (or penalizes) the regulated firm based on comparison of some measure of actual performance against a reference performance.

The most widely used incentive-based regulation schemes are price and revenue cap regulation based on the RPI-X model first adopted in regulation of telecommunication sector in the UK (see e.g. Jamasb and Pollitt, 2001). In general, price and revenue cap regulation models have promoted cost savings in electricity and other network industries. Some Latin American countries, have adopted the "efficiency standard" approach to incentive regulation which uses efficient model firms (as opposed to actual firms) as reference for performance and determining allowable costs. Many developing countries have adopted some form of incentive regulation scheme for the network activities as part of their reform.

Price and revenue cap models promote cost savings and can be combined with other incentive schemes. The main challenge for regulators is, on the one hand, to ensure that utilities can finance their investments and, on the other hand, to prevent above normal profits. In the United Kingdom, at privatisation, the government underestimated the potential for efficiency improvement in distribution utilities. This was only corrected by successive price control reviews.

Profit sharing mechanisms can be incorporated into incentive schemes to reduce the potential for windfall profits. This approach has often been often used in regulation of investor-owned electric utilities in the United States. Table 5 shows that, in the United Kingdom, between 1991/2 and 1998/99 savings to residential customers from reduction in distribution and transmission charges have been 9%. During the same period, price reductions originating from competitive generation market have been 10% although this can largely be attributed to reduction in the cost of fuel.

The focus of price cap regulation is on overall efficiency of the network utilities. Also, it is important that cost savings are not achieved at the expense of quality of service. **It is often necessary to combine overall incentive regulation with targeted-incentive**

schemes aimed at specific priority aspects of utilities operation. For example, minimum performance standards or targets coupled with reward and penalty schemes can be used to reduce network losses and increase the quality and availability of supply.

Table 5: Sources of price reduction to UK domestic users 1991/2-1998/9 Source: Littlechild (2000)

Sources of Reduction	%
Lower generation costs (mainly fuel)	10
Lower distribution and transmission charges	9
Lower supply business margin	1
Lower fossil fuel levy*	9
Total	29

* The fossil fuel levy was introduced to limit the effect of reform of the sector on coal industry. The levy was gradually phased out. Price reduction due to lower levy can therefore not be attributed to the effect of reform on prices.

Failure to incorporate quality of service standards in price and revenue cap regulation can result in lower quality of service. The case of Hungary shows that following the introduction of price cap regulation for transmission and distribution networks in 1997 and in the absence of quality standards in the incentive schemes, some key indicators of quality of supply worsened (Table 6).

Table 6: Performance change in Hungarian transmission/distribution utilities Source: ARERC-CEEE (2000)

Indicator	1996	1997	1998	1999
Outage per customer (KWh)	0.895	0.726	**0.838**	**1.294**
No. of breakdowns - high voltage	53	36	24	35
No. of breakdowns - medium voltage	10,493	8,570	**10,207**	**9,670**
Energy loss due to middle voltage breakdowns (MWh)	4,510	3,452	**4,096**	**3,788**
Duration of middle voltage breakdowns (hours)	15,928	11,900	**16,240**	**13,888**
No. of low voltage Breakdowns	241,760	225,421	214,325	233,049
No. of single faults per 1000 customers	35,65	32,05	29,31	24,32
No. of multiple faults per 1000 customers	13,32	13,06	13,26	12,00

3.3 Tariff and Subsidy Restructuring

The concept of market-oriented electricity sector reforms is centered on the use of price mechanism in both competitive and regulated activities of the sector. Prices send strong signals to market participants and influence their behaviour and decisions. In order for the prices to be efficient and send correct signals, they need to be based on the true cost of providing the service and reflect the long-run marginal cost of addition of new capacity to the system.

In many developing and transition economies, introduction of cost-reflective prices requires considerable restructuring of electricity prices and subsidy arrangements. The tariff structures often contain cross subsidies in the form of transfers from industrial and commercial users to residential customers and/or cross subsidies among different groups of residential customers. In practice, restructuring of tariffs generally involves substantial price increases for residential customers, as these are the main beneficiaries of cross-subsidy arrangements. At the same time, commercial and industrial users generally pay above-cost prices and are the likely beneficiaries of cost-reflective pricing and competition.

Table 7 illustrates the tariff structure and cross subsidies in Thailand among different end-user groups in 2000. It should be noted that in many countries the extent of price distortions is considerably higher than in the case illustrated here. As shown in the table, small residential customers are partially subsidized by large residential customers. Also, the average residential tariff is below long-run marginal cost of serving this segment. In turn, residential customers, government institutions, and agricultural pumping are partially subsidized by consumer groups who pay above-LRMC tariffs. At the same time, the average tariff for all consumer groups is about the long-run marginal cost of the system.

Figures 9a-b and 10a-b illustrate that, in recent years, residential electricity prices in several developing and transition economies have moved closer to average prices in the

OECD. At the same time, prices for industrial customers have tended to decrease. Figures 11a-b shows that in some countries, the ratio of residential to industrial prices has moved closer to average OECD price ratio. It is apparent from the figures that some of the Latin American and Eastern European countries have made significant progress in re-balancing their electricity prices. It should be noted that the reforms in many of these countries are still in early stages of implementation and it is likely that this trend will continue in the coming years.

Table 7: Average electricity tariffs and marginal costs in Thailand in 2000
Source: NEPO (2000)

Customer Category	Existing Retail Tariffs (Baht/kWh)	Marginal Cost (i.e. no cross-subsidies) (Baht/kWh)	Existing Retail Tariffs as Percentage of Marginal Cost(%)
Residential	2.2924	2.5988	88.2
< 150 kWh/month	1.8836	2.7760	67.9
> 150 kWh/month	2.5440	2.4359	104.4
Small General Services (business customers with demand < 30kW)	2.8563	2.6966	105.9
Medium General Services (business customers with demand of 30kW-2MW, and avg. use of < 355,000kWh per month)	2.3097	2.3061	100.2
Large General Services (business customers with demand in excess of 2MW, or consumption > 355,000 per month)	2.0705	1.9974	103.7
Specific Business (mainly hotels)	2.1604	2.0050	107.8
Government Institutions	2.3240	2.4912	93.3
Agricultural Pumping	1.7969	2.2861	78.6
Total	2.25573	2.2767	99.1

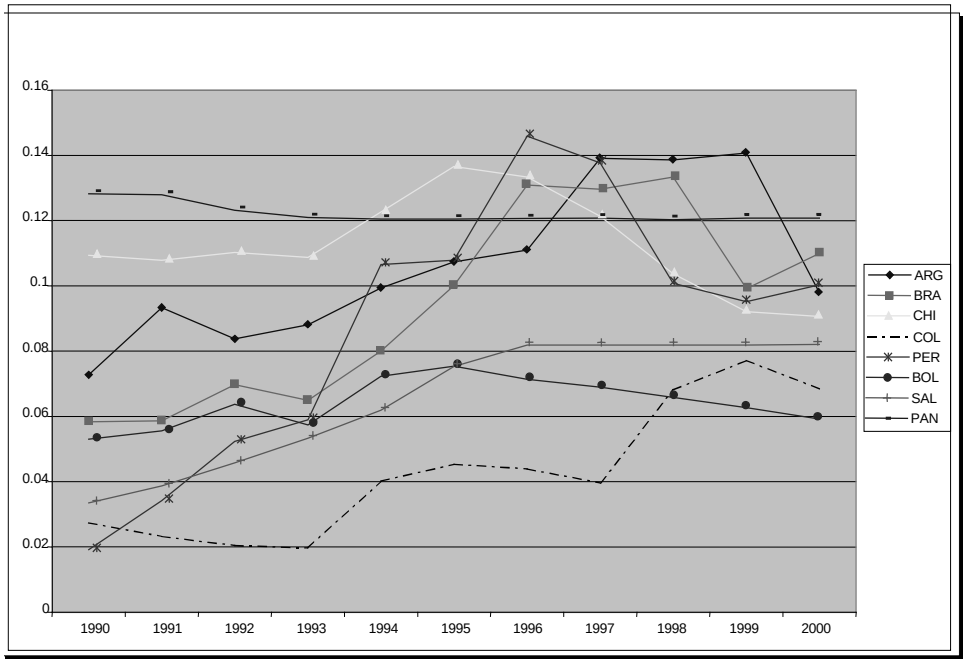


Figure 9a: Average residential electricity prices (US$/KWh)
Source: SIEE Database, OLADE

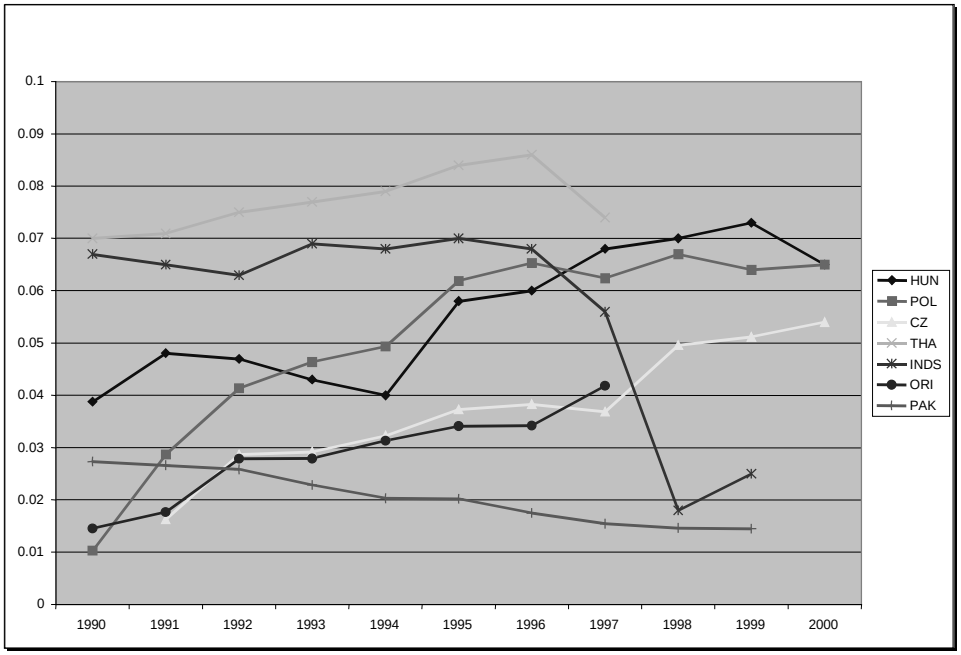


Figure 9b: Average residential electricity prices (US$/KWh)
Sources: IEA Energy Prices & Taxes; Pakistan Power System Statistics; and Planning Commission, Government of India.

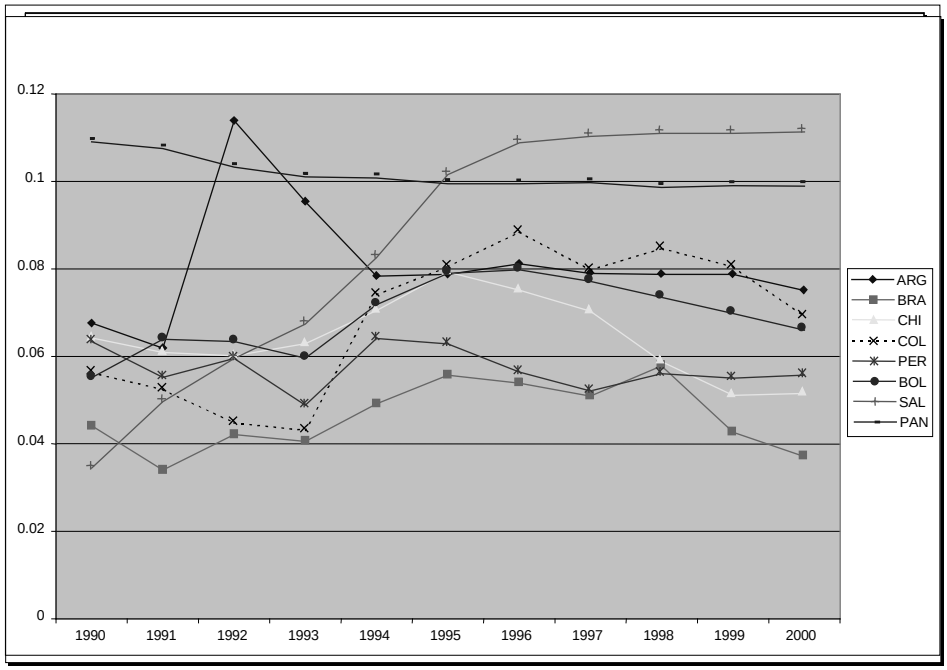


Figure 10a: Average residential electricity prices (US$/KWh)
Source: SIEE Database, OLADE

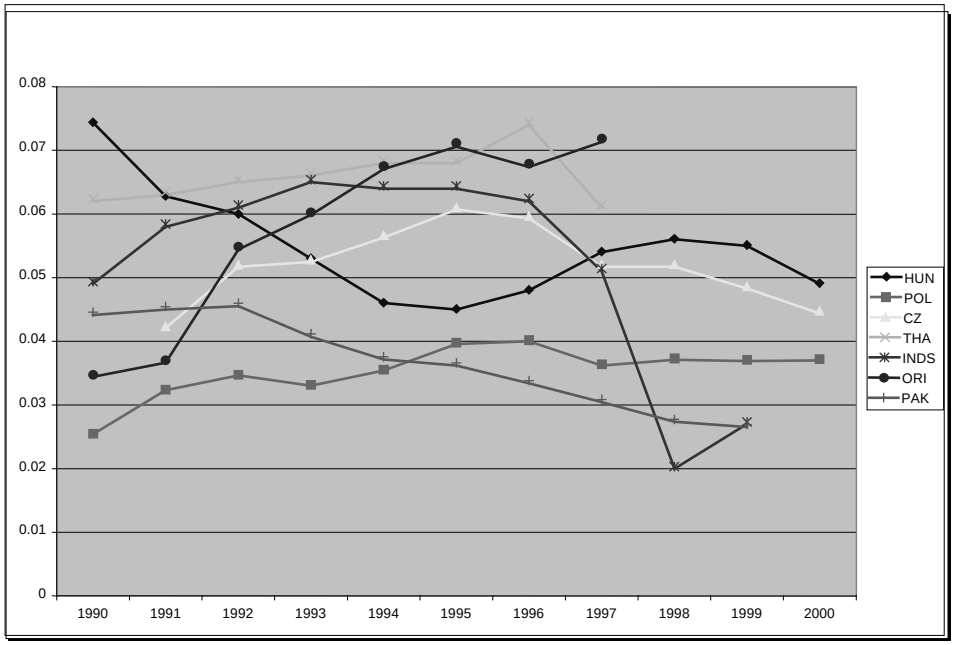


Figure 10b: Average residential electricity prices (US$/KWh)
Sources: IEA Energy Prices & Taxes; Pakistan Power System Statistics; and Planning Commission, Government of India.

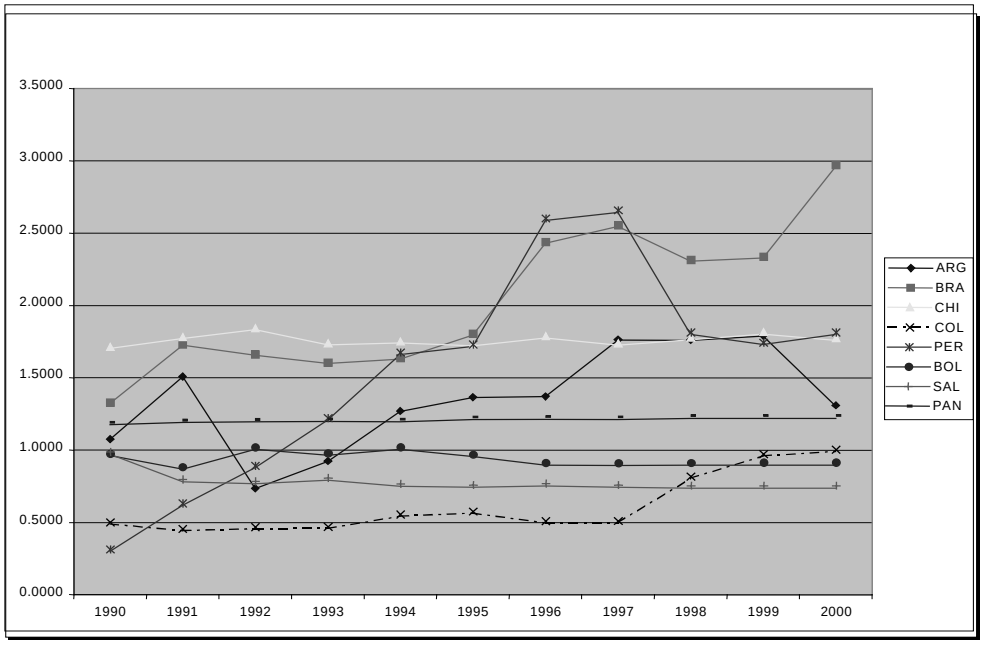


Figure 11a: Average residential electricity prices (US$/KWh)
Source: SIEE Database, OLADE

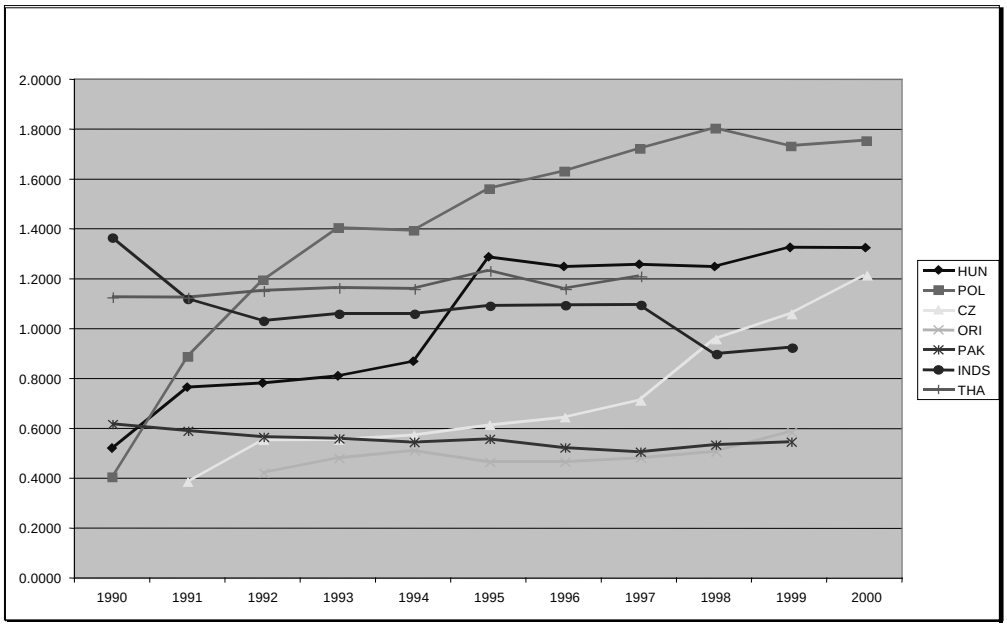


Figure 11b: Average residential electricity prices (US$/KWh)
Sources: IEA Energy Prices & Taxes; Pakistan Power System Statistics; and Planning Commission, Government of India

Economic theory suggests that cost-reflective prices result in net social welfare gain. This implies that the welfare economic gains by those who benefit from lower prices exceed the welfare losses incurred by those who stand to lose from price increases. However, without public interference no automatic transfer from gainers to (targeted) losers will take place to compensate the latter. At the same time, mapping and measurement of distributional aspects of tariff adjustments is an inherently complex task (Chang, 1997). In some circumstances a price increase to efficient levels may also be socially defendable. For example, in countries with very low rates of access the service is often only available to richer consumers. Therefore, a rate increase that eliminates the system's deficit financed by the whole population and frees resources for improving access to others can be justifiable.

For example, two important questions are the intensity and distribution of gains and losses across different groups of consumers. Welfare losses to some disadvantaged consumer groups can be much larger than the benefits accrued to many gainers. Also, in poorer countries losers generally constitute a very large portion of the population while the number of gainers can be far fewer. In addition, the higher the level of existing subsidies is the more noticeable are the distributional impacts of tariff re-balancing.

There is considerable scope for efficiency improvement in distribution utilities. At the same time, tariff adjustments can play an important role in financial health of electricity distribution utilities and their ability in achieving these efficiencies. Price adjustments are therefore closely linked to the issue of privatization of distribution utilities. However, in many developing countries, the need for subsidies will be present for the foreseeable future. **The important issue is to design subsidy schemes that address undesirable social impacts while limiting price distortions and adverse impacts on the economic efficiency of reforms.** Some subsidy schemes can be either very costly as they also tend to benefit ineligible consumer groups (inclusivity issue), or that they do not reach the targeted groups (exclusivity issue).

Inadequate attention to the distributional implications of price increases can severely affect the progress of the reform process. In India, the state of Orissa restructured and privatized the distribution companies. Despite substantial and politically difficult tariff increases (11% in 1997, 9.3% in 1998, and 4.5% in 2000), the privatized utilities experience severe financial difficulties. The companies are unable and lack incentives to invest in efficiency improvement measures (TND, 2002; Business Line 2001a; 2001b).

Price changes should also take the prevailing macroeconomic conditions of the country into consideration. For example, price adjustments in a high inflationary economic environment can be particularly difficult. Table 8 shows that, in Estonia, despite tariff increases between 1995 and 1997, electricity prices in real terms have actually declined. At the same time, high economic growth can help the tariff adjustment process by reducing the impact of price increases.

Table 8: Development of electricity prices in Estonia. Source: Kraav (2000)

	Avg. Price (cent/kWh, excl. VAT)	**Price Index**	**Real Price Index**
1992	9.2	100	100
1993	13.1	143	62
1994	18.6	203	58
1995	30.5	332	75
1996	35.2	382	68
1997	44.5	409	65
1998	51.0	469	69
1999	53.0	576	81

Political sensitivity of tariff increases can even affect the regulatory design and divert this from desired models. For example, in most Eastern European countries, political sensitivity of tariff increases has contributed to maintaining a formal degree of ministerial influence in the activities of electricity sector regulators concerning prices (Stern, 1999). For example, in Hungary, the regulator's decisions regarding prices have to be approved by the Ministry of Economic Affairs.

World Bank (2000a) evaluates the performance of the major subsidy schemes for utility bills in Eastern and Central European countries. The evaluation uses household survey data and information from government agencies to assign scores to coverage, targeting, predictability, pricing distortion, and administration costs and difficulty of the schemes as assessment criteria. The 'lifeline tariff with 3 blocks', ‘lifeline tariff with floating blocks’ and 'non earmarked cash transfer' subsidy schemes obtained among the scored scores while 'no disconnection', ‘across-the-board price subsidy’ and 'burden limit on actual utility expenditure' arrangement received among the lowest total scores.[2]

Carefully designed subsidy schemes can gain important popular support from tax payers as providers of subsidies. A consumer survey in the UK suggests that between 67% of respondents were in favor of electricity subsidies for low-income groups (Doble, Markou, and Waddams, 1998). Tariff restructuring should be carefully planned ahead of the reform process and explicitly included in the reform implementation strategy. **In developing countries, tariff adjustments should be introduced in steps.** Gradual efficiency improvements in utilities and effective transfer of the gains can also reduce the negative impact of price increases.

Further, in the absence of public intervention, private participation and cost-reflective tariffs are likely to have adverse consequences on improving access to low-income groups and rural populations. Many developing countries are yet to provide access to large groups of populations. For example, in some African countries the overall rate of electrification is below 10%.

Private actors often lack incentives to extend service to “unprofitable” and often low-usage customers. At the same time, it is believed that while many low-income groups can not afford to pay for connection to the service they are willing and able to pay for the electricity they use. Recognising this, some developing countries have adopted

[2] Double weights assigned to coverage and targeting criteria. Burden limit schemes cap the maximum share of income spent on utility bills for specific consumer groups.

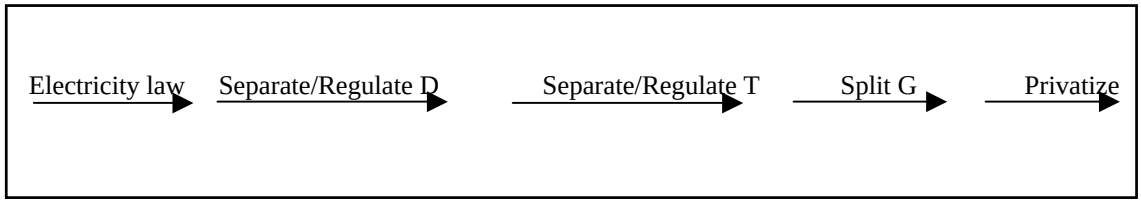
innovative approaches to improving access to service. Some successful schemes such as in Chile are based on facilitating access through mobilization of local communities combined with one-off subsidies to lowest-bidding private sector actors providing the connection (see e.g Tomkins, 2001; World Bank, 2000d).

Although some innovative approaches to address poverty alleviation and electrification issues have emerged, more progress is yet to be made in tackling these issues. **In order to ensure popular backing for and sustainability of reform, it is important that efficiency gains from the reforms are passed on to consumers. For the foreseeable future the governments should be prepared to play an active role to protect low-income consumers and ensure that services are extended to un-served rural areas.**

3.4 Sequence of Reform Measures

As the body of evidence from reforms in different countries has grown, there is some agreement among practitioners and academics with regard to the main steps of a sound reform design and the order in which these can be introduced. The main elements of the reform models, in the suggested order, are: (i) regulation, (ii) restructuring, (iii) and privatization (see e.g. IADB, 2001a). At the same time, it is generally recognized that the design of particular reforms should adapt to specific characteristics of the sector in question such as resource availability, size of the system, and institutional endowment.

Therefore, generalized models could only serve as a broad reference when designing or assessing specific reforms. Within this background, this section outlines a generic reform model based on the framework suggested in Newbery (2001) before reviewing the actual international practice to date. Figure 12 shows a schematic illustration of the main measures and implementation sequence of the generic reform model described in the above.



Regulator	Access/Pricing	Access/ Pricing	Power mkt.	D, T, G

Figure 12: Main steps in a generic reform model

i. The electricity sector reform must have a clear legal basis. Some of the most important reform measures such as restructuring of the sector, private participation, and establishment and role of regulatory bodies often require new legislation. In reforming (developed and developing) countries, this has generally been achieved in the form of adopting an electricity law or act. The law also signals a country's intentions and indicates commitment to undertake the reform and reduces the uncertainty associated with crucial issues such as property rights and conflict resolution procedures.

ii. Introduction of most types of reforms requires some degree of restructuring of the sector. The main aim of restructuring is to separate the potentially competitive activities (generation and supply) of the sector from the natural monopoly segments (transmission and distribution). In general, careful consideration should be given to the initial restructuring of the sector, as they often tend to create vested interests that may resist or complicate subsequent adjustments to the structure of the sector.

Unbundling should often start with separating the distribution business from the generation and transmission activities of the system. The main argument for this is that much of the inefficiencies in the sector originates from, or is perpetuated through, the distribution activity. Distribution is the closest link in the chain of activities to customers and revenue collection. In many developing countries, subsidized and low tariffs combined with poor bill collection rates have weakened the financial health of the distribution segment. Also, distribution networks in many developing countries exhibit very high technical and non-technical losses of electricity and poor quality of service. In addition, in many countries many urban and rural areas are yet to be connected by the distribution system. Further, experience in developed and developing countries

suggests that there is considerable scope for efficiency improvement in the distribution segment.

Other structural issues concerning the distribution system can also be addressed at this stage. For example, the desired number of distribution utilities should also be decided at this stage. Important considerations here are maintaining sufficient number of firms for the purpose of yardstick regulation, availability multiple sources of information to the regulator while, and ability of firms to benefit from economies of scale. Also, separation of supply business from distribution could take place at this stage. However, if the feasibility of retail competition is not certain this can be deferred to a later time.

iii. Distribution business should be subject to regulation. In particular, experience from developed and developing countries have shown that incentive regulation has resulted in considerable efficiency improvements. Cost-reflective pricing through tariff re-balancing can take place at this stage to eliminate or reduce (cross) subsidies.

Appropriate measures for reducing the rate of non-collection and terms of disconnection should be introduced. It may be argued that privatization can reduce non-collection and system loss. However, these issues are highly political and sensitive in nature and rate increases and disconnection for non-payment ultimately need political approval and privatization will not remove the government's responsibility and role. It can also be argued that if the government is not able to initiate these measures, private (and often foreign) ownership alone could at best only partially achieve this. Such important issues should ideally be addressed before ownership structure of distribution business could be decided. Failure to do so will inevitably be reflected in the price that private investors will be willing to pay for the distribution networks and their future investments in the acquired assets.

In addition, rules for access to the network and appropriate charges should also be set out at this stage. A regulated third party access (rTPA) is generally the preferred arrangement as negotiated third party access (nTPA) in some countries has lead to disputes and uncertainty. The main considerations here are to avoid discrimination among the users of the networks, reduce uncertainty for new entries, and define the framework for future expansion of the system.

iv. Separate the transmission activity from generation and establish the former as separate entity. A clear division of these activities is a prerequisite for effective competition in the generation segment. Vertical ownership between generation and distribution can lead to discrimination against independent generators, distort competition, and discourage new generators to enter. As with the distribution activity, clear rules for access to the grid (preferably rTPA) should be defined at this stage. Also, an independent system operator (ISO) should ideally be in charge of dispatch and reliable operation of the system. Similar to distribution segment, transmission should be subject to incentive regulation.

The central issues in transmission regulation are to develop procedures for managing and pricing of congestion and to create incentives for efficient investments in expansion of networks. Although the transmission system accounts for approximately 10-20% of total costs of electricity supplies, under-developed transmission grids can distort competition and lead to very high generation prices. The experience of some reforming countries some reforming countries such as in Brazil has shown that network congestion can result in segmentation of the system and regional market power. Although reforming countries have adopted various approaches to network congestion management and pricing, problems still persist and this aspect of reform is still work in progress. As the economic costs of under-developed transmission systems are usually very large a plausible case for some over-dimensioning of the grid during the initial years of the reform can be made.

v. Split the existing generation capacity into several units and establish a wholesale electricity market. Effective competition and market-oriented arrangements require several generators. Wholesale markets can be structured as single-buyer model, marginal cost-based pools, and price-based spot market. The critical issue at this stage is to create sufficient number of units with varied generation mix for a competitive market. It is important to avoid having incumbents with dominant positions as this leads to market power and may discourage new entry into the sector. Changes to the structure of the generation segment at later stages of the reform tend to be difficult. Allow new entry by independent power producers (IPPs). These firms can enter the generation market as merchant plants that assume all the risk or through long-term power purchase agreements (PPAs) with existing generators or large customers.

Countries with small electricity systems face limitations with regard to the number of firms that can be formed from the existing generation capacity. This has bearings for the type of market and competition-oriented solutions that will be discussed in other section. For some small systems, competition can emerge in the long run through new entries in the sector, as growth in demand and electrification will gradually increase the size of the system. However, new entry can be a slow process and will need some time to contribute to competition.

vi. Where privatization of the existing is feasible and desirable, this should preferably start with the distribution function. Distribution utilities are the generators' counterpart in most market arrangements. Privatization of generation can take place after the structure, regulation, and ownership status of distribution companies is clear. Privatization of transmission grid is less pressing and can take place at the same time or later when workable network congestion and system expansion arrangements are in place.

Appendix 1 illustrates of the main features and sequence of reform measures for the countries in Table 2. The figure reveals noticeable similarities as well as differences across the countries. The reform in most Latin American countries have evidently followed broadly similar paths to the generic model outlined in the above.

For example, the sequence of reform measures reform in Argentina almost resembles a textbook case. The main exception here is Brazil to which we will return later. Also, apart from Chile and Argentina, the main stages of reforms in Latin America have been implemented in relatively short matter of time (1-2 years). In contrast, the reforms in South Asia, East Asia, and Eastern Europe have been rather lengthy processes. Indeed, most of these reforms may be regarded as work in progress.

The context and starting points of reforming electricity sectors differ considerably in terms of stage of economic development, size, and structure. However, here the evidence as whether or how these factors affect the success or failure of reform is inconclusive. In order to highlight this point, the next section examines the reforms in a few selected cases in some detail.

4. Focus on Selected Reforms

4.1 Flawed Regulatory Design: Crises in Brazil and California

A crucial test of electricity sector reform and regulatory design is whether they ensure dynamic efficiency through private investments. The recent electricity crisis in Brazil and California has shows that, in developed as well as in developing countries, the costs of flawed regulatory design and failure to secure new investments can surpass the benefits of reform. Although the two electricity systems do not share many characteristics, they exemplify failures in regulatory design in two large (one developed and one developing) economies to secure dynamic efficiency of their electricity sectors.

The main objective of electricity sector reforms is to improve the overall efficiency of the sector. Reforms seek to achieve this objective through (i) the introduction of market mechanisms into potentially competitive activities (generation and supply), (ii) incentive regulation of natural monopoly segments (transmission and distribution), and (iii) increased private participation. The prerequisite for a well functioning reform is a carefully designed regulatory framework that is sensitive to the specific characteristics of individual power sectors and country-specific economic conditions.

Electricity supply industry is highly capital intensive and the bulk of expected efficiency gains from the reforms can therefore be achieved in the long run through prudent and timely investments. In a well-functioning market-oriented sector, investments in new generation capacity play a dual role. First, new investments will ensure necessary expansion and reliability of the system as demand for electricity gradually grows. Second, threat of new entry limits consistent opportunistic behavior and exercise of market power by existing generators.

However, the relatively long lead-time in new investments in the sector must be aligned with short-term technical requirements of the system. The transition from a regulated to a market-oriented sector can result in tighter balance of supply and demand. In order to ensure sustainability of the reform in the long run, regulatory design must be capable of effectively dealing with short-term contingencies and imbalances that may arise.

A prerequisite for new investments to fulfill their role in functioning of the market is unconstrained and demand-responsive supply of generation capacity. Joskow (1983) foresaw a comfortable margin of generation capacity, a slow growing demand, and abundant supply of natural gas, as important preconditions for a successful reform. The Brazilian and Californian electricity sectors were liberalized at a time when there was surplus generation capacity in the systems. However, it was not long before that strong demand growth reduced the excess capacity. California and Brazil both experienced high natural gas prices during their crisis.

In principle, due to the long lead-time of generation projects and price inelastic demand, sudden increase in growth rate of demand for electricity is inherently difficult to match by new investments. **Access to unconstrained new electricity generation resources is critical to sustainability of power sector reforms.** The regulatory designs in Brazil and California failed on this point.

The electricity crisis in California was the result of a combination of unfavorable exogenous factors exacerbated by deficient regulatory design. The crises affected California and other states connected to western grid. However, the fact that those municipal utilities in California that opted out of the deregulated market and other states fared better than California suggests that regulatory design played an important role in transforming a power shortage into a crisis situation (World Bank, 2001b).

During the 1960s and 1970s, California began to import electricity through new transmission lines connecting the state to Northwestern states (mainly hydro) and Arizona. During the years prior to the reform in California, existence of excess capacity, low demand forecasts, uncertainty about sector restructuring meant that little new generation capacity was built in the interconnected system in the western states.

However, strong growth in demand for electricity fueled by increased economic activity and hot summer created an imbalance between supply and demand. Indeed, during the 1990s, the rate of growth in California was slower than in other western states. This coincided with emergence of dry years with reduced hydroelectricity production in northwest. Above-average hydroelectricity production in the years prior to the reform had helped mask the emerging mismatch between demand and supply.

During the crisis the western states also experienced unusually high natural gas prices. This together with steep increase in the price of tradable NOx emissions permits resulted in increases in generation costs and in particular sharp rise in marginal cost of natural gas-based peak load plants. The market imbalance was further exacerbated by

significantly higher than normal levels of unavailable capacity due to maintenance (Joskow, 2001).

The main flaw in California's regulatory design was to prevent utilities from entering long-term contracts. Having been forced to divest much of their generation assets, the utilities were referred to the spot market for nearly all their supply requirements. Long-term contracts can limit the volume of trade in the spot market and thus reduce short-term price fluctuations. A well-functioning contract market can also reduce uncertainty in new investments and facilitate access to reserve capacity and a stable stream of new generation resources.

The retail price caps intended for recovering stranded costs of past over-investments de-coupled end-user prices from competitive wholesale prices leaving utilities unable to recover their costs and with credit problems. Also, retail price caps removed price-responsiveness and incentive to energy saving from the demand side. When wholesale price caps were eventually imposed they were not always sufficient to cover the generation costs caused by high costs of natural gas and NOx permits. Further, political influence and interest groups created a 'market design be committee' and alienated the reform initiative from the technical characteristics and realities of the sector (Joskow, 2001). Finally, inter-dependence of federal and multi-state energy and environmental regulation resulted in delayed response to market conditions as the crisis was unfolding.

The case of California has also shown that flawed regulatory design can lead to market power and exercise of strategic behaviour by market participants. Joskow and Kahn (2002) examine the crisis in summer 2000 and find that market fundamentals natural gas prices, NOx emissions prices, increase in demand, and supply shortages during the period could not explain the observed price levels. The study found that generators and marketers exercised market power through unilateral withholding of generation capacity contributed to worsening the electricity crisis in California. Similarly, Borenstein, Bushnell and Wolak (2002) examine the California power market between June 1998 and October 2000. They found that increased production costs, competitive rents, and

market power were responsible for 21%, 20%, and 59% respectively of increased expenditures on electricity.

In Brazil, generation is predominantly based on hydroelectricity and some very large plants produce a substantial portion of the total output. A complicating factor is that the water used by hydroelectric plants has alternative uses. This has created conflicts of interest among the users of water. These conflicts have traditionally been resolved internally within the public ownership framework and there is resistance against leaving the management of these resources to private enterprises. In addition, there are considerable economic benefits in operational coordination of the plants. The economic benefits of coordination of these hydro-resources are estimated at approximately $2.2 bill. per year (Araúo, 2000).

The reform in Brazil has failed to adequately address particular features of the sector's resource-base. The uncertainty surrounding the future of ownership and operational aspects of hydroelectric resources has led to decline in private involvement in hydro as well as in thermal resources. Instead, private investors have shown more interest in acquiring existing plants than investing in new resources. In contrast to the objectives of the reform, most of the investments in the sector have in recent years been undertaken by public entities.

As a result of the under-investment in new generation capacity that preceded the reform, the country has experienced extensive power outages that can further aggravate the current economic problems. In addition, lack of investment in the transmission network has resulted in periodic bottlenecks in the system and segmentation of the market that has effectively divided the market into four regional markets (Araúo, 2001).

A new regulatory body (National Water Agency, ANA) has recently been established to draw the rules for water use and settlement of conflicts. However, this task and thus the prevailing uncertainty are likely to take several years. Newbery (2002) suggests that while early privatization signals government’s commitment to reform, it could also take

place after introduction of competition and regulatory reform. In Brazil, the pressure to relieve the state from financial burden of required investments in the sector and the need for privatization proceeds led to divestiture of assets before the rules of the wholesale electricity market and ownership issues of vast hydroelectric resources had been settled.

The examples of electricity sector reforms in Brazil and California highlight the importance of coordination among different regulatory agencies and energy-environmental objectives. **In order to attract private investments, the regulatory design must ensure a workable framework for division and coordination of mandates among the different regulatory agencies**.

An additional issue is the interdependency of regulatory design with regional and local interests. In both reforms, lack of institutional arrangements for resolving the conflicts between reform objectives and these interests has affected addition of new generation capacity. In Brazil, approximately 40% of generation capacity were outside of the federal government's control and many of the states did not support the reform. In California, in addition to strict environmental regulations and lengthy approval processes, local interests have been able to block new projects. **The regulatory design must take areas of conflict with political interests and judicial rights of regional and local interests into consideration**.

In conclusion, a fourth condition for implementation of a market-oriented reform can be added to those mentioned above. Transmission systems are generally not designed with a view of operating in a deregulated market. The transmission system at the time of reform should be sufficiently developed for the existing and expected generation capacity and avoid bottlenecks that lead to segmentation of the power market. **A comfortable transmission capacity margin lowers the risk of failure of reform by reducing service outages, market power, and siting of generation plants.** In Brazil under-investment in transmission systems began prior to the sector reform, while the transmission grids need to be improved prior to reform in order to support a liberalized electricity market.

4.2 Workable Reforms - The Cases of Bolivia and Norway

The aim of this subsection is three-fold. First, workable electricity sector reforms can be implemented in developed as well as in developing countries. Second, contrary to some beliefs, small countries can implement and sustain workable regulatory reforms. Third, reforms can, under some circumstances, be implemented without full-scale privatization. The cases of reforms in Bolivia and Norway show that appropriate regulatory design is crucial to a successful reform.

Norway was among the first countries to liberalize her electricity sector. The Norwegian electricity sector is almost entirely based on hydroelectricity. Availability of low-cost hydroelectric resources has played an important role in the industrialization of the country. These resources are spread in the country and establishment of energy intensive industries in the vicinity of generation plants has contributed to economic development of many local communities where these resources are situated.

The Norwegian reform was initiated in 1991, and involved functional unbundling, and introduction of competition into the generation and supply segments of the sector. The Norwegian electricity sector consists of over 340 utilities, of which 190 have generation facilities and over 200 are involved in distribution, serving a population of 4.2 million. Many of the utilities are either vertically integrated or have formed alliances. The generation capacity is owned by the state (30%), private (15%), and municipal/county (55%) owned utilities and has not been affected by the reform.

The restructuring of the sector involved separation of the transmission network from the state-owned company (Statkraft) and establishment of this as a new state-owned corporation (Statnett). A spot market for electricity was established and administered by a subsidiary of Statnett which, later merged with a subsidiary of the Swedish grid

company and formed the Nordic spot market (Nord Pool). A common carriage system for access to transmission and distribution networks was also established.

The Norwegian reform did not attempt to privatize the sector. Instead, it introduced a market-oriented reform in a sector dominated a by state-owned and a large number of municipal and county-owned utilities. Norway has traditionally been successful in maintaining state-owned enterprises that operate on a commercial basis at arms-length from direct political intervention. In addition, regional and local communities are well organized and politically influential and the government could not initiate a change in the ownership of utilities owned by these authorities. The reform in Norway followed a pragmatic approach to regulatory design that avoided conflict areas that could complicate or hamper the restructuring process.

The Bolivian reform involved the restructuring of the National Interconnected System (NIS) which covers most of the country. The transmission and generation activities of the state-owned utility ENDE were separated. The transmission system was established as a common carrier, which was subsequently privatized. The generation capacity of the largest utility ENDE (402 MW) was split into three separate companies and the assets of these new companies were capitalized in 1995. The second largest generator COBE, (142 MW) which was already in private hands divested its distribution business the same year. All distribution utilities were privatized with the exception of Santa Cruz utility CRE, which remained a cooperative.

The post-reform NIS consists of four generators, one transmission, and six distribution companies. The isolated systems outside NIS consist of a number of rural cooperatives. Vertical integration is allowed only outside the NIS. The capitalized generation companies have invested in new capacity and four new generation companies have also entered the sector. Since 1995, generation capacity has grown from 544 MW to 1,234 MW in 1999. The generation mix of the sector is approximately one-third hydroelectric and two-thirds thermal.

The Bolivian and Norwegian reforms have succeeded in transferring some of the benefits of the reform to the consumers in terms of lower prices. In Bolivia, between 1996 and 2000, the spot price of electricity has decreased from US$18/MWh to US$14/MWh. Another sign of relative success of the Bolivian capitalization model is the willingness of foreign companies to participate in the program and future investments in the sector. Unlike electricity reforms in Brazil and California, the Bolivian restructuring effort functioned reasonably well during a period of high-growth demand. In 1999 alone, demand for electricity grew by 7% (Moen, 2000).

Implementation of large-scale privatization programs may require a forceful political agenda such as the one in the case of the UK. The Bolivian and Norwegian reforms show that broad public or mixed ownership forms may reduce potential political, environmental, and ownership conflicts that can complicate the reform process. It is noteworthy that also in the UK a substantial portion of the privatized companies' shares was offered to the public. The Bolivian reform shows that while transmission and distribution activities were privatized, a public-private co-ownership through capitalization was chosen for the generation segment. This was due to the fact that the transmission and distribution companies were not in urgent need of new capital. The case of Norway shows that different ownership forms can co-exist in a generation market dominated by a large number of competing state and locally owned firms.

It should be noted however, that both Bolivian and Norwegian power sectors are well-endowed with endogenous energy resources. This provides a convenient starting point for implementing the electricity sector reforms. In an attempt to explain the occurrence of electricity sector reforms across OECD countries, Drillisch and Riechmann (1998) find that a country's overall energy fuel sufficiency is a significant factor, and even more significant than fuel independence of the electricity sector. Another characteristic shared by Bolivia and Norway is that both countries had relatively efficient and financially viable electricity sectors prior to the initiation of their reforms.

The Bolivian Capitalization

Under the Bolivian reform model, strategic investors committed to investments equal to the market value of assets being capitalized in the generation companies. The new capital entering the companies remained within the companies and these funds were earmarked for modernization and further development of the sector. In addition, the management of companies was transferred to private investors. At the same time, ownership of the share of the state in the companies (50%) was transferred to national pension funds for the benefit of the whole population. In 1997, these funds paid US$ 248 to elderly citizens (World Bank, 1999). The Bolivian capitalisation and reform model presents a number of potential benefits that are of relevance for some developing countries:

i. Capitalization secures new investment in the sector and ensures a degree of expansion of the sector through existing companies and contributes towards sustainability of the reform during the initial years.

ii. Capitalization encourages efficiency improvements in the use of existing assets by transferring the management of companies to new investors.

iii. Broad ownership base resulting from capitalization allows consumers to benefit from efficiency gains from the reform on the ownership side as well as in the form of lower prices.

iv. Capitalization can create mutual interests between the companies and the public. This can reduce the potential for future conflicts, which in turn reduces uncertainty to private investors.

The examples discussed here indicate that small developed as well as developing, countries can implement workable reforms. However, there remain significant challenges ahead. In Norway, since the early 1980s, investments have gradually declined from a peak of NKr 15 bill. to NKr 4.9 bill. in 1998 (NMPE, 2000). A

significant portion of the investments in recent years has taken place in improving the existing facilities.

Norway has traditionally been a net exporter of electricity. However, excess capacity at the time of the reform has now been surpassed by a growing demand. The impact of a few dry years on the hydroelectric system is unclear. Interconnections with other Nordic systems have served as a buffer and Norway has, since 1996 (with the exception of 1999), been a net importer of electricity. Long-term reliance on imported electricity does not represent a sustainable energy policy and implications of this clearly demonstrated during the recent California electricity crisis.

The main challenges in the Bolivian electricity sector are similar to those of many developing countries namely tariff restructuring and electricity coverage. Bolivia has one of the lowest electrification rates in Latin America. In 1999, urban electrification in the country was 72% and, since the reform, rural electrification has seen a considerable increase from 14% to 19%.

In Bolivia, the proceeds from the award of concessions to distribution utilities are directed towards electrification of rural areas. In addition, in order to encourage distribution utilities to expand their service territories, the Bolivian Electricity Law allows for inclusion of the immediate 100 meters surrounding the lines to companies' concession areas.

5. Special reform issues in developing countries

5.1 Reforming small electricity systems

In the light of the difficulties experienced by some reforming developed and developing countries, an emerging and increasingly important issue that is posed is whether or to what extent countries with small electricity systems can reform their sectors. As many

developing countries are at some stage of or contemplating to embark on reforming their electricity sectors, the sheer number of developing countries with small electricity systems stresses the importance of reform issues in such systems. About 60 developing countries have systems with peak demands that are smaller than 150 MW, while another 30 countries are between 150 and 500 MW, and further 20 countries are between 500 and 1000 MW (IADB, 2001b).

Broadly, the main reform issues in small developing countries can be divided into systemic and regulatory constraints. The systemic aspect is mostly concerned with the physical size of the electricity systems in these countries. While most textbook reform models prescribe competitive electricity markets many of the systems are simply too small to be divided up into several competing firms. In addition, there is a trade-off between having several competing generators and economies of scale. For example, efficient size of a combine cycle gas turbine (CCGT) is about 400 MW.[3] **The issue is whether the efficiency gains from competing small or sub-optimal units out-weights diseconomies of scale and increased transaction costs of an unbundled system.**

In addition, most international investors tend to favor having a major presence in the countries they are involved. For small countries, attempts to limit the size of participants in the market can indeed further reduce the already limited number of potential investors and entry in the market. Further, costs and resource requirements of complicated spot markets and trading arrangements make applicability of advanced markets such the UK model less advantageous.

Many developing countries with small electricity systems will be well advised to replace the pursuit of 'competition in the market' in their sectors with the more modest and simpler models of 'competition for the market or contracts'. Three such models are the single-buyer, bilateral contracts markets, and management contracts.

[3] Some countries may however have the benefit of having smaller hydroelectric resources.

In the contract market model, generators compete to sell electricity to unbundled distribution utilities. Within this framework the transmission utility can be in charge of administering the contracts, dispatch, and power balancing. A problem with bilateral contracts model is, in the absence of retail competition, to provide the distribution utilities with the correct incentives to purchase electricity at the best price and delivery terms rather than a simple cost pass through method. A possible solution to the problem is however through benchmarking of purchased power by distribution utilities.

In the single-buyer model, an independent entity or the transmission utility is mandated to purchase electricity from competing generators and resell to distribution utilities. Some of the potential problems with the single-buyer model are possibility of corruption and political interference in the operation of the system (see e.g. World Bank, 2000b). However, for small countries with fewer reform options a workable arrangement may still be found to be preferable to the traditional regulated vertically integrated utility model.

The benefits and feasibility of single-buyer and multiple-contracts models for individual countries of should also weighted against adoption of management contract arrangements. The main advantages of management contracts are that these can be cheaper to implement and require less regulatory resources. However, the benefits of management contracts must be viewed against the backdrop of difficulties such as creating appropriate incentives, negotiating terms of contracts, and defining performance standards (see e.g. World Bank, 1995).

In addition to the systemic issues, many developing countries with small systems are faced with the lack of regulatory resources. In many of these countries, the economic and political institutions necessary for well functioning of regulatory authorities are weak. In addition, many developing countries face shortage of qualified human resources to staff the new regulatory and supervisory bodies established as part of the reform. Lack of economic resources and shortage of regulatory experience and skills leads to a disproportionate asymmetry of expertise necessary to implement and oversee

reform measures and counter the weight of major international investors (see e.g. Stern, 2001).

Many countries with small systems may be well advised to initially aim for simpler but more feasible solutions such as the single-buyer model. This should however be combined with maintaining some degree of flexibility for adjustments in the future to avoid market and ownership conditions that constrain future development of the reform process. For example, a key issue is to ensure some flexibility for integrating the existing IPPs into the future structure of the sector (see e.g. Wolf and Halpern, 2001). An evolutionary approach to reform can benefit from the following future developments:

i. emergence of regional electricity markets in some parts of the world such as in Central America increases the level of competition,

ii. technological progress can reduce the scale disadvantage of smaller plants,

iii. the size of the market will slowly grow as the growth rate of demand in most developing countries is high and electrification will gradually increase the size of the system, and

iv. regulatory expertise and experience can be built-up gradually to meet the challenges of more complex market forms. In addition, simpler models of wholesale power markets allow the existing scarce regulatory resources to be spent on regulation of distribution and transmission utilities. The experience of many reforming countries has shown considerable potential for efficiency gains in the networks (see Domah and Pollitt, 2001).

5.2 Weak institutional endowment

There is a strong case for the notion that the design of electricity sector reforms should take the specific characteristics of the sector in question into consideration. The experience emerging from reforming countries suggests that the scope of this argument extends beyond the systemic characteristics of the sectors such as size, resource mix, and structure. **The reform will ultimately have to fit into and function within the larger framework of the country's institutional capacity. Therefore, policy makers should make realistic assumptions with regard to the political and institutional endowments of the countries** (see e.g. Bergara, Henisz, and Spiller, 1997).

In many developing countries, the electricity sector reforms take place within institutional settings that are characterised by unstable political systems, interventionist governments, unclear legislation on property rights, and lack of judicial independence and credibility, and corruption. In addition, shortage of skilled human resources combined with the lack of regulatory experience and traditions constraint their ability to initiate and sustain the reform process.

It is important that those engaged in reform recognise a country's institutional capabilities that have a bearing for the electricity sector and reform process. Recognition of institutional weaknesses will lead decision-makers to more realistic and suitable regulatory designs and reform measures.

Most reforming countries have signalled their commitment to reform and established its legal basis in an electricity law or act. Although this does not necessarily guarantee a correct implementation and success of the reform, it is an important step forward. Lack of clarity in property rights can also to some extent be addressed through appropriate legislation.

Establishment of credible dispute resolution and appeal procedures can reduce the risk of regulatory taking and compensate for the lack of independent judiciary. For example, in Bolivia, a new authority was established to resolve the disputes between regulatory agencies and companies. In many countries reform initiative have not been

limited to the electricity sector. Assessment of reforms in other sectors can provide some indications with regard to institutional endowment of the country.

Lack of regulatory experience, lack of funding, and shortage of human resources expertise results in weak regulatory agencies. Regulatory agencies need to oversee the generation markets, regulate the networks, and award concessions and licenses while having experienced and resourceful corporations as their counterparts. Performing the variety of specialized regulatory tasks requires a level of fixed costs and resources. Many poorer and smaller countries are less able to provide the necessary basis for establishing the agencies.

Measures such as the use of consultants, regional regulatory agencies, and international cooperation may enable some small and poor countries to provide minimum necessary regulatory oversight for modest reforms that by some accounts is estimated at around 30-40 staff (Stern, 2000). **International development organizations can play an important role by sponsoring cooperation, training, and exchange of experience among the regulators**.

It should also be noted that establishment of electricity regulatory agencies can coincide with those of other infrastructure industries such as gas, telecommunication, and transport. **For some countries, the resource requirements for regulation of multiple industries may render establishment of multi-utility regulatory agencies a feasible and resource-saving option** (Samarajiva et al., 2002; World Bank, 2001a).

5.3 Corruption and political opportunism

Another challenge to electricity sector reforms is that many of the required measures create opportunities for political opportunism and economic corruption (see e.g. World Bank, 2002). The experience with reforms to date has shown that vested political interests can oppose the reform or try to take advantage of the political process.

Corruption can hamper the reform process and result in political pressure to stop the reforms. **Corruption also tends to increases the cost and risk of business and limits private participation and competition in the market**.

Vested political interests and opportunism may also distort the reform measures. These could be in the form of attempts to preserve control over economic resources. For example, in Colombia, local politicians who enjoy influence in distribution utilities have shown considerable resistance to privatization of these firms. Political opportunism may take the form of gaining political scores with the constituencies. Also, the fact that reforms in LDCs generally involve restructuring of subsidies and tariffs makes them susceptible to political opportunism. For example, in India, the prospect of political gain and existence of considerable subsidies (in particular in the agriculture sector) has led some politicians to vow to maintain the low tariffs.

While it is not possible to eliminate corruption entirely certain measures can reduce the problem. For example closed negotiated privatization or tendering PPAs from IPPs make corruption and irregularities easier. This has resulted in allegations and indications of low selling prices for privatized assets, high purchase prices for PPAs, and/or forcing selected business partners on firms.

Corruption is also partly a consequence of a lack of appropriate rules, procedures, and institutions. For example, improving transparency and local participation in a Venezuelan municipality governance reform reduced corruption and increased performance and satisfaction with services (World Bank, 2000c). Therefore, transparency of procedures and participation for interest parties can help reduce corruption. In practical terms this means, for example when seeking IPPs or privatization open and competitive bidding process should be implemented. The rules and process should be transparent for the participants and other interest parties.

Credibility of pricing policy and subsidies is crucial to financial health of companies and attracting private investments to the sector. In Chile, placing much of the decision

making power in the electricity law signaled assurance for private investments. Although such approach reduces the risk of regulatory taking, it tends to weaken the regulator. It also reduces the regulator's flexibility to adopt to the changing conditions that emerge in the course of the reform process (Fischer and Serra, 2000). A weak regulator also increases the possibility of regulatory capture.

Transparency of decision-making process can help the reforms strike a balance between possibility of regulatory taking and regulatory capture. In Colombia, for example, the regulatory decisions are made public on the internet. Transparency and free flow of information of regulatory process and decisions (i) reduce corruption, (ii) open for participation and insight by other interested parties such as consumers associations, potential investors, and (iii) put some pressure on participants to behave.

5.4 A Role for International Organizations?

The systemic and institutional characteristics of electricity sectors across developing countries offer different initial conditions to reform and capability to implement them. This has also bearing for international organizations that promote and support such reforms. The potential for and benefits of reforms should therefore be assessed on their individual merits.

International organizations should distinguish between three groups of countries with respect to feasibility and approach to reform. First, some countries exhibit the basic conditions to reform and have the commitment and capacity to carry these out more or less independently. Second, some countries may have potential to reform in the future. These countries can develop institutional capacity and competence and can carry out reform with regulatory and financial assistance to restructure the sector in a transition period.

The third group of countries, in particular those with very small systems, lacking the conditions for developing institutional capacity, and unattractive to foreign investors. These countries have little realistic prospects for private participation and market-oriented solution in the foreseeable future and need to be supported to achieve gradual improvements or to adopt measures such as management contracts.

In many countries, corruption, bilateral negotiations, and lack of experience have resulted in costly PPAs whose terms and legitimacy have later been disputed. **Another possible role for international organizations is to devise a mechanism of quality control and verification for bidding processes and award of contracts**.

Such system will promote transparency and reduce the scope for political and economic corruption in award of major contracts such as PPAs. This mechanism can also reduce the possibility of accusations of irregularities and renegotiations in award of contracts. The main benefit of the quality control arrangement is that it ultimately reduces the debt and equity risk to international investors. If the system obtains the status of a recognized mechanism that is beneficial to investors and governments, both parties will be interested or obliged to satisfy the requirements of such mechanism.

6. Conclusions

The experience form the past two decades has shown that achieving sustainable private participation and market-oriented electricity sector reforms are more complex than initially anticipated. The cases of the UK and California have demonstrated that even in developed economies reforms encounter problems and exhibit intended consequences. Developing countries have had to reform technically and financially less efficient systems with less developed private sectors, weak economic and political institutions, and shortage of human resources and regulatory experience.

It is now recognized that reforms need to pay ample and equal attention to systemic characteristics of the sector in question as well as inherent institutional capabilities of the country. However, while some systemic and institutional issues may be improved upon others should be regarded as given and reflected in the choice and design of reform model. The generic reform model discussed earlier highlighted much of the experience to date with reforms in developing countries. In this conclusion we revisit the model and supplement it with some additional remarks.

The importance of cost-reflective tariffs and clear arrangements for necessary cross subsidies and transfers for continuity of reforms can not be under-emphasized. The pricing and subsidy issues should be addressed at the early stages of the reform. Lack of broad political commitment on pricing policy can distort the entire reform process. Indeed, as witnessed in the 1950s and 1960s in some Latin American countries, it was political opportunism and unsustainable tariffs that eventually led to nationalization of private electricity companies (Gómes-Ibáñez, 1999).

Pricing and subsidy policy should ensure sufficient revenue streams for the distribution companies. The financial strength of these companies is important for their ability as counterparts in transaction with single-buyer agencies and generators. Also, financial weakness reduces the prospects of privatization and value of distribution companies. In addition, inadequately low prices reduce the companies' incentive to improve revenue collection or investments in efficiency improvements. Incentive regulation of distribution companies has showed considerable potential for efficiency improvements and passing on cost savings to customers. Further, incentive regulation and private ownership can be separated. In some cases (e.g. Norway), incentive regulation can be a viable option under state and local ownership prior to or even without privatization.

Another lesson of experience is that reformers must ensure that a well-functioning transmission grid is in place at the time of reform. The existing transmission systems at the time of reforms are not designed with a view of supporting liberalized electricity markets. Therefore, conditions such as network congestion, barriers to access, and

vertical integration with generators will create market power and prevent competition and new entry. The existing models for congestion management, allocation of common costs, and efficient system expansion of the grid leave some scope for improvement.

Although well-developed systems may benefit form these regimes, it is doubtful that they can result in efficient configuration in under-developed and poorly managed electricity systems. For example, considerable mis-matches between transmission and generation can result in new production capacity that could be avoided with less costly grid improvements. At the early stages of reforms, the transmission grid could remain in state ownership. Considering the small share of transmission in total system costs, it is best to ensure the transmission design and capacity can support the system through the initial years of reform.

The main expectations from wholesale markets are that competition will improve efficiency in the generation segment and lead to lower prices. In many countries with wholesale markets (or even IPPs) is that while profit incentive has brought about efficiency gains, the savings are, due to insufficient competition and market power, not necessarily passed on to consumers. Many reformers could justifiably concentrate on more modest reform models through competition for markets approaches such as single buyer arrangements and market for long-term contracts. A key issue here is to maintain a degree of flexibility for the future development of the reform.

Many countries can benefit from adopting a single-buyer model combined with competition among the generators for supplying large users. Even at this modest level of reforms, some countries may find they do not have enough industrial customers to help competition among producers. Retail competition at best may remain an elusive long-term objective for most countries. At present, the implementation costs and potential benefits of supply competition at the presence of subsidies, low average consumption, and insufficient competition do not seem promising.

With regard to the pace of reforms, an evolutionary progress is generally more plausible than window of opportunity approach that is sometimes advocated. The case of the state of Orissa in India shows that the timeframe required for reforms to develop roots tends to be longer than limited windows of opportunities. In addition, the time necessary for the development of regulatory experience and institutions as well as training human resources skills strengthen the case for a gradual approach to reform. Although, restructuring should be completed in a relatively short time, emergence of competition can take longer. A trade-off is however that existing arrangements tend to create vested interests and rent seeking behaviour.

Stable macroeconomic conditions are crucial for securing a steady flow of foreign investments into the new generation capacity. While economy-wide matters are beyond the control of reformers, policy makers' commitment to reform and regulators' credibility through transparent and consistent practice can increase confidence among private investors. Also, countries should to the extent possible explore the possibilities for mobilizing and directing domestic capital to the sector.

Benefits and costs of reform vary from country to country, the more efficient a sector is at the starting point, the closer the potential gains will be to increased transaction costs. There is considerable experience and lessons from reform to date. However, the task of designing well-functioning reforms for individual countries still remains work in progress. In the light of the problems that reforming countries have faced, questions that remain unanswered, and our incomplete understanding of some consequences, a gradual approach or delay in this may not after all be a major loss to some countries.

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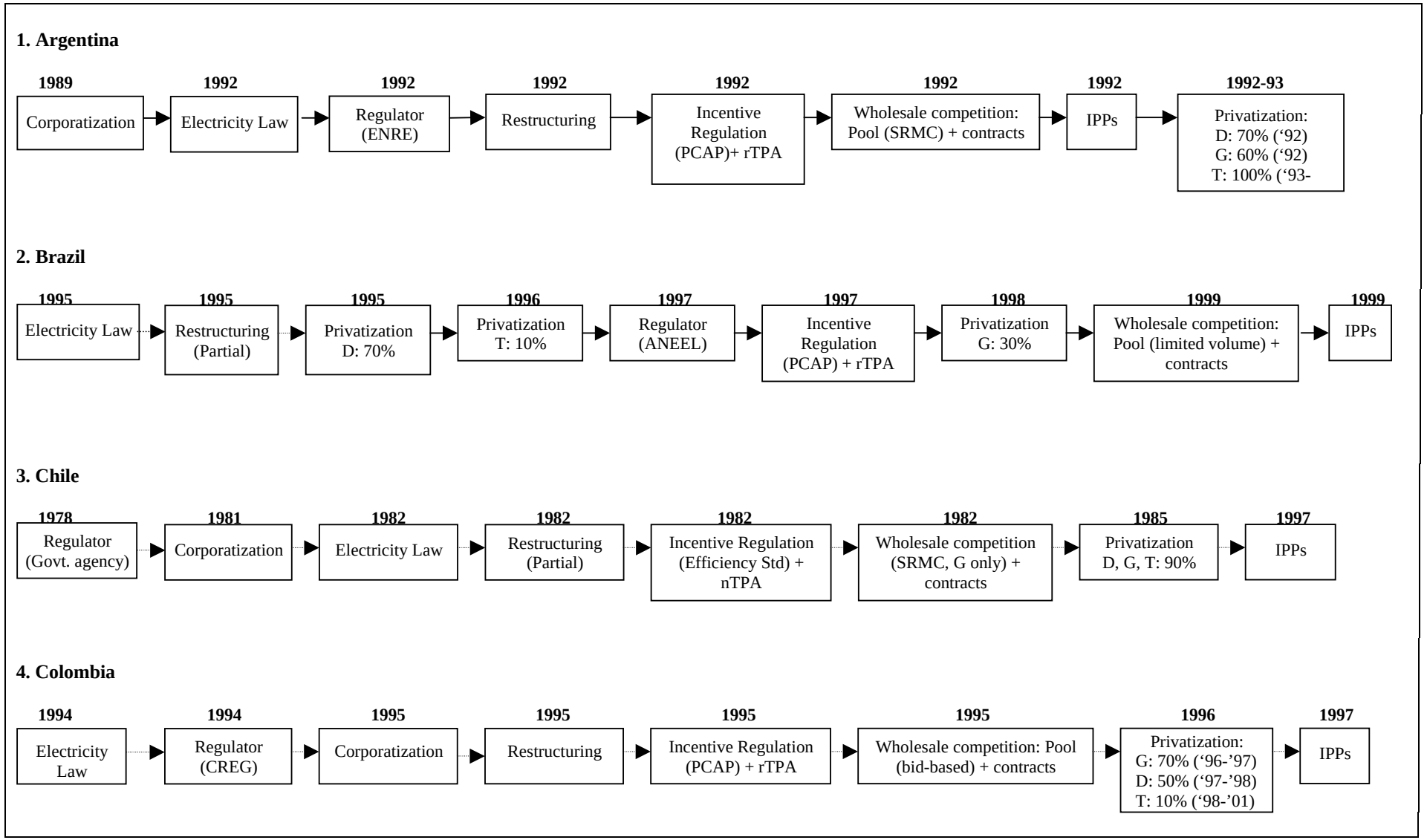
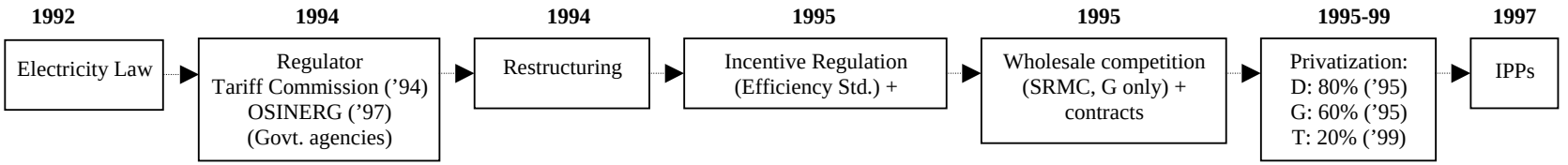
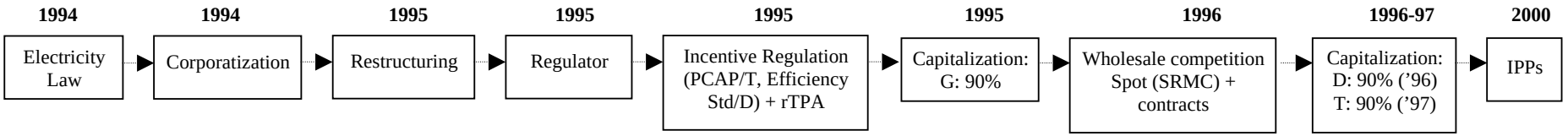
Appendix 1: Sequence of Electricity Sector Reform Measures in Selected Countries



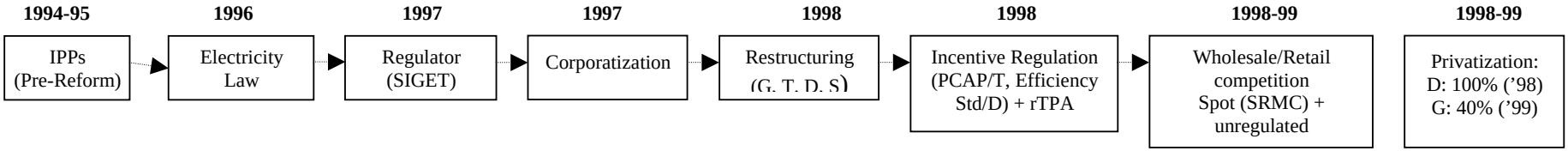
5. Peru



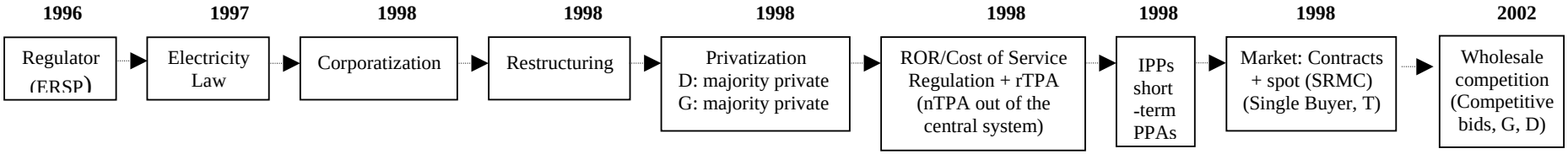
6. Bolivia



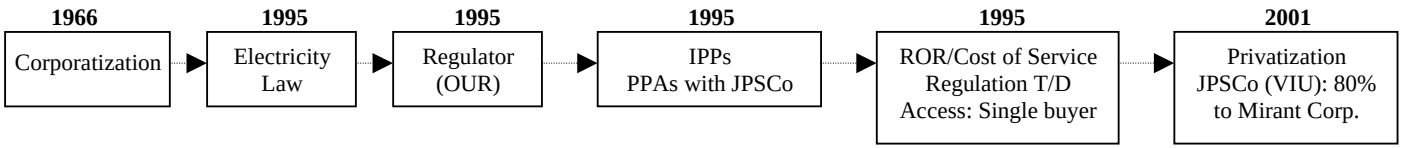
7. El Salvador



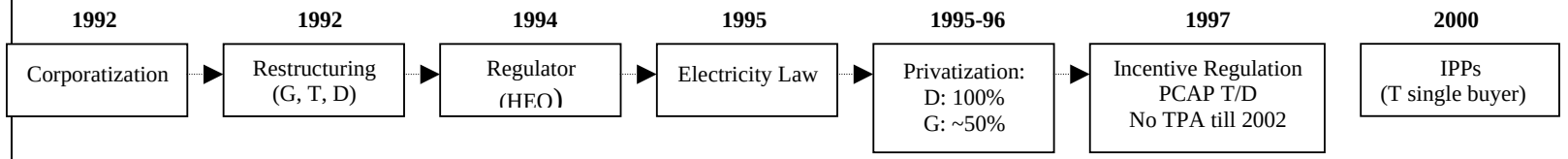
8. Panama



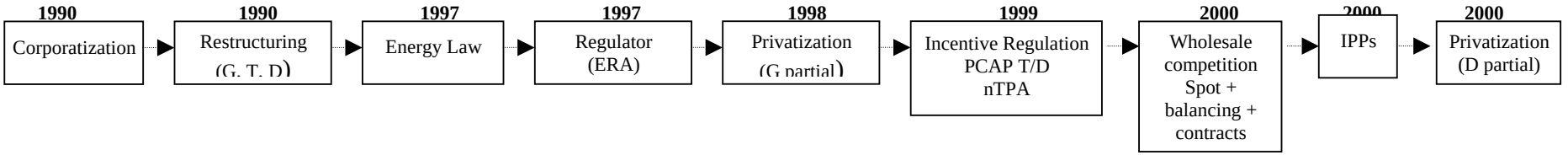
9. Jamaica



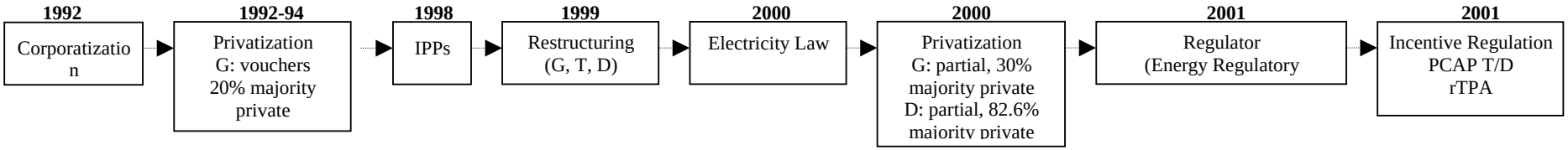
10. Hungary



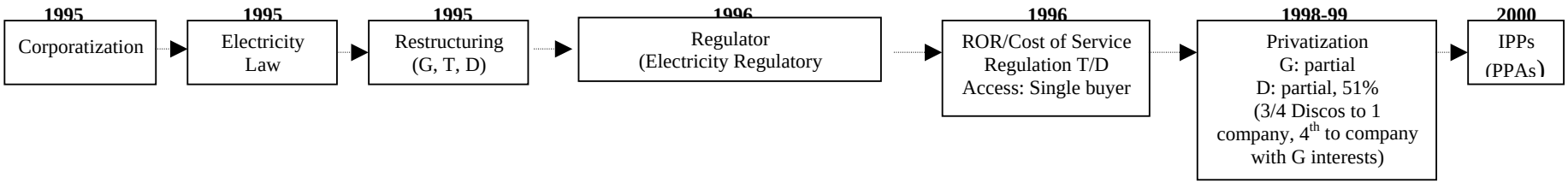
11. Poland



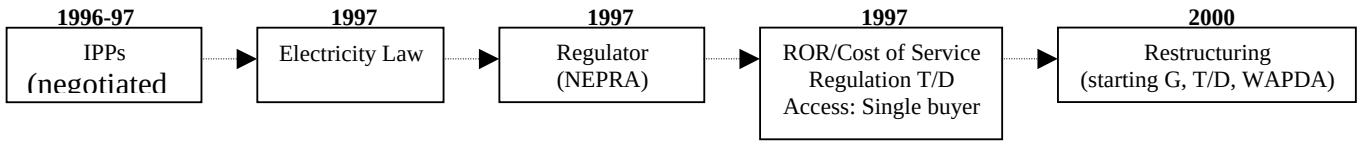
12. Czech Republic



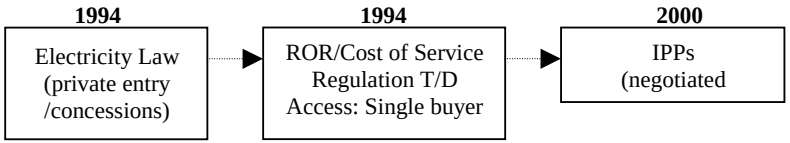
13. Orissa (India)



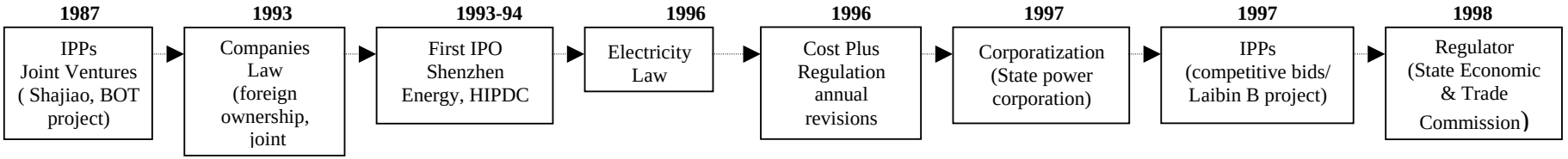
14. Pakistan



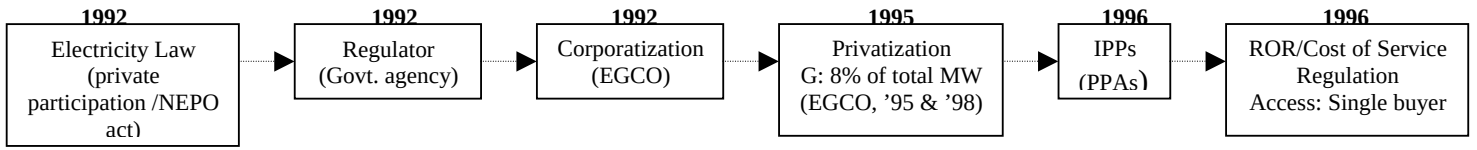
15. Morocco



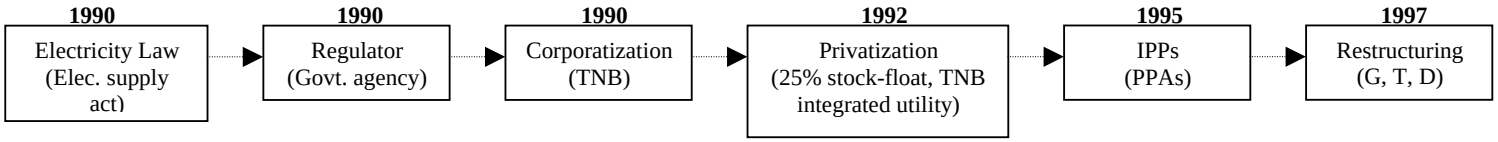
16. China



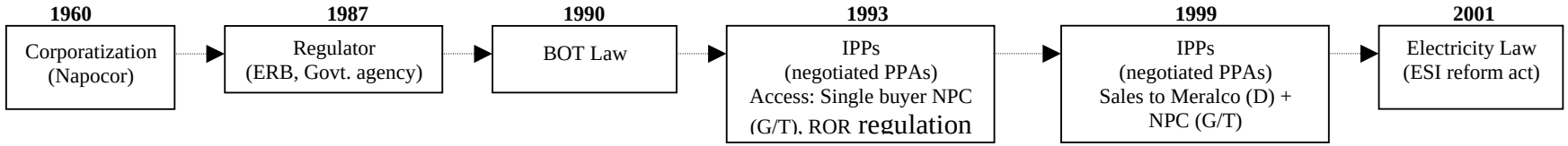
17. Thailand



18. Malaysia



19. Philippines



20. Indonesia