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Restructuring and Regulatory Reform in the Power Sector: Review of Experience and Issues

Peter Choynowski

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May 2004

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FOREWORD

The ERD Working Paper Series is a forum for ongoing and recently completed research and policy studies undertaken in the Asian Development Bank or on its behalf. The Series is a quick-disseminating, informal publication meant to stimulate discussion and elicit feedback. Papers published under this Series could subsequently be revised for publication as articles in professional journals or chapters in books.

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ACRONYMS

ADB	Asian Development Bank
APEC	Asia-Pacific Economic Co-operation
AZE	Azerbaijan
BAN	Bangladesh
BHU	Bhutan
BOT	build-operate-transfer
BPDB	Bangladesh Power Development Board
CAM	Cambodia
CEGB	Central Electricity Generating Board
COO	Cook Islands
DESA	Dhaka Electric Supply Authority
DESCO	Dhaka Electric Supply Company
DMC	developing member country
ECNZ	Electricity Corporation of New Zealand
EGAT	Electricity Generating Authority of Thailand
EGCO	Electricity Generating Company
EO	executive order
ERA	Energy Regulatory Authority
ERC	Electricity Regulatory Commission
ERC	Energy Regulatory Commission
FMS	Federated States of Micronesia
FIJ	Fiji
IND	India
INO	Indonesia
KAZ	Kazakhstan
KEGOC	Kazakhstan Electricity Grid Operating Company
KESC	Karachi Electric Supply Corporation
KGZ	Kyrgyz Republic
KIR	Kiribati
LAO	Lao PDR
MAL	Malaysia
MEA	Metropolitan Electricity Authority
MEP	Ministry of Electric Power
MLD	Maldives
MON	Mongolia
MME	Ministry of Mines and Energy

NAU	Nauru
NEP	Nepal
NPC	National Power Corporation
NTDC	National Transmission and Dispatch Company
PAK	Pakistan
PDMC	Pacific developing member country
PEPCO	Pakistan Electric Power Company
PGCB	Power Grid Company of Bangladesh
PLN	Perusahaan Listrik Negara
PNG	Papua New Guinea
PEA	Provincial Electricity Authority
PHI	Philippines
PRC	People's Republic of China
PSRB	Power Sector Reforms in Bangladesh
PSRP	Power Sector Restructuring Plan
REB	Rural Electrification Board
RMI	Republic of the Marshall Islands
ROR	rate-of-return
SAM	Samoa
SEB	state electricity board
SOL	Solomon Islands
SRI	Sri Lanka
TAJ	Tajikistan
THA	Thailand
TKM	Turkmenistan
TON	Tonga
TUV	Tuvalu
UZB	Uzbekistan
VAN	Vanuatu
VIE	Viet Nam
WAPDA	Water and Power Development Authority
WESM	wholesale electricity spot market

ABSTRACT

A worldwide trend began in the 1980s in both developed and developing countries to restructure their power sectors and reform their regulatory framework. The motivation in developed countries to restructure and reform was mainly to improve sector efficiency, while in the developing countries, it was to move the sector away from reliance on scarce public resources to more private sector financing. Since the Asian Development Bank was involved in restructuring and regulatory reform in many of Asia's developing countries, this paper attempts to take stock of the progress made to date in these countries, review the relevant experience in some developed countries and Latin America, and identify the key issues that could have a bearing on its operations in Asia.

I. INTRODUCTION

Electric utilities in developing countries have generally performed poorly. With few exceptions, power sectors in these countries have been unable to satisfy the market demand for electricity, provide a reliable supply, or supply at least cost. These failures occurred because electric utilities faced no effective competition and lacked incentives to improve efficiency. In some cases, their operational and financial viability was guaranteed by the state through subsidies, equity injections, and debt forgiveness. Thus, they were under little pressure to cut costs and maintain efficiency.

Electricity tariffs were also not adjusted adequately or in a timely manner to keep pace with changing costs, leading to poor financial performance and to accumulation of large financial deficits. Large transfers to utilities from government budgets to cover these deficits put heavy burdens on government finances and contributed to the more general financial crisis that was experienced in the early 1980s and the late 1990s, with an increasing social impact as the drain on limited resources reduced the capacity for social investment. Thus, reform of the power sector was needed to solve a more general problem. Developing countries were also encouraged by the reforms in the power sector of countries of the Organisation for Economic Co-operation and Development and the success of the Chilean experiment in attracting foreign investment to the sector. By the mid-1980s, many developing country governments, including the developing member countries (DMCs) of the Asian Development Bank (ADB), began initiating reforms to restructure their power sectors and to improve regulatory capacity. These reforms took place within a wider reform and restructuring effort to move away from state ownership and centralized organization of industry to more private ownership, market orientation, and better regulation.

Multilateral financial institutions such as ADB encouraged reforms in the power sector. ADB's energy policy¹ encourages private sector participation in the power sector and promotes power sector restructuring. Policy dialogue on energy issues between ADB and governments has been a normal part of project financing and, more recently, it has been the basis for policy-based lending operations. Over the period 1989-2003, ADB provided \$10,735 million in lending to the power sectors of DMCs, of which program lending accounted for \$1,260 million, and \$113 million in technical assistance.

This paper reviews the progress and experience of reforms in the power sector in ADB DMCs and other regions of the world; assesses the direction that these reforms are taking, particularly with respect to regulation, privatization, and competition; and identifies key issues. The paper is organized into five sections. Section II provides an overview of organizational structures that power sectors could take. Section III reviews the organization of the power sector in 34 DMCs in the mid-1980s to provide a backdrop for the reforms that took place since that time. This is followed by an

¹ *Energy 2000: Review of the Energy Policy of the Asian Development Bank* (ADB 2000).

overview of the current organization of the power sector in the DMCs. The last part of this section briefly describes the plans for restructuring and regulatory reform in selected DMCs. Section IV reviews the experience with restructuring and regulatory reform in some developed and Latin American countries. Section V identifies and discusses the key issues that have been associated with restructuring and regulatory reform. Section VI summarizes and concludes the paper.

II. OPERATIONAL MODELS OF THE POWER SECTOR

Since the early days of the electricity industry, it was a commonly accepted view that electricity could be supplied most efficiently by vertically integrated monopolies. Economies of scale could be achieved by building larger and larger generation plants, in tandem with transmission and distribution networks. Because costs decreased with scale and coordination among different parts of the network was simpler, it was considered more efficient when a single producer supplied the entire market. In developed countries, electric utilities were often privately owned and operated. In developing countries, the state assumed the primary responsibility of developing and operating the electricity infrastructure because the state was often the only entity able to raise the required amount of capital for investing in capacity, and there was a widespread view that such a strategic asset must be under the control of a central government. In the vertically integrated monopoly, there is no competition and no consumer choice. The monopoly electric utility owns and operates all generating plants, transmission, and distribution networks. The utility is obliged to supply consumers with electricity, and consumers are captive and have no choice of supplier.²

The vertically integrated monopoly has been modified in some countries to a single-buyer, monopsony framework where there is a degree of competition at the generation level in which the private sector participates. The vertically integrated monopoly still controls the power sector, but private sector investment is made possible by licensing independent power producers to build and own generation capacity. Independent power producers are created by divesting existing generation capacity to the private sector and/or by new producers who compete to enter the electricity market. The introduction of independent power producers has been an attractive option because it relieves government from the burden of financing incremental generation capacity and the privatization of generating assets is often a lucrative source of revenue.

In the monopsony model, the vertically integrated monopoly, as the single buyer, enters into a long-term contract with the independent power producer. In most cases, the power-purchase agreements are structured to reflect the costs of owning and operating the generating plant (for example, through take-or-pay contracts), so there is little incentive after contract signing to reduce costs and improve efficiency on the part of the independent power producer.

Competition at the generation level may be enhanced by creating distribution companies and allowing them to bid for electricity supply from bulk electricity suppliers in a power pool or wholesale market. Independent generators assume the responsibility to plan new capacity additions based

² Large electricity consumers often have the option of installing their own captive power generation capacity.

on future demand forecast by the distribution companies, and compete on the basis of price to sell their electricity. As there is no longer a single buyer, market and technology risks are assumed by the generators, who in exchange have open access to the transmission network. Consumers are still captive and have no choice of supplier.

In full customer choice, competition is introduced into all levels of the industry, from the wholesale level to the individual consumer. The key to the full customer choice model is direct (or third party) access to transmission and distribution networks, thus, any electricity consumer may purchase from any retail supplier, who in turn can purchase electricity from a competitive wholesale market. The network functions of transmission and distribution, which are still natural monopolies, are completely separated from the functions of generation and retailing into which there is free entry by competitors.

The four organizational structures described above may be viewed in terms of a continuum of alternative operational models with no competition at one extreme (the vertically integrated monopoly), and full competition at the other (full customer choice), as shown below.



The regulatory structure associated with each operational model follows a similar pattern (Table 1). The vertically integrated monopoly is normally regulated, usually through the tariff that the electric utility can charge and the investments that it can undertake, with rate-of-return (ROR) regulation the most common approach in many developed and developing countries.

TABLE 1
OPERATIONAL MODEL AND REGULATORY STRUCTURE

OPERATIONAL MODEL	REGULATORY STRUCTURE
Vertically Integrated Monopoly	• Full regulation of generation, transmission, distribution, and retail components
Monopsony	• Full regulation of transmission, distribution, and retail components • Competition to enter generation level
Wholesale Competition	• Full regulation of transmission, distribution, and retail components • Generation regulated by the market
Full Customer Choice	• Full regulation of transmission and distribution components • Generation and retail regulated by the market

A power sector organized along the monopsony model is regulated as in the vertically integrated monopoly case with respect to tariffs and investment, but now regulation is extended to contracts that the vertically integrated monopoly enters into. ROR regulation is again usually the norm. In the wholesale competition case, competition provides an incentive to improve economic efficiency and the market is, in effect, the regulator. In practice, however, competition is often a matter of degree and the challenge is to attain workable competition, taking into consideration issues such as structural constraints and market power. Thus, the principal role of a regulator is to minimize market imperfections that may arise at the wholesale level and to control abuses of market power. The transmission and distribution components are still monopolies and some form of regulation is still required. In the full customer choice model, as in the wholesale competition model, the role of regulation is to minimize market imperfections that may arise in competitive segments and to control abuses of market power. The regulation of the monopoly transmission and distribution components is also still required.

III. RESTRUCTURING AND REGULATORY REFORM IN ASIA³

A. DMC Power Sectors before Reform

In South Asia,⁴ electric utilities were for the most part vertically integrated monopolies, owned and operated by a central government, except in India where state governments, through state electricity boards, assumed the responsibility for the sale of electricity and much of its supply. To improve the efficiency of generation in India, three national agencies were created in 1975 to generate bulk electricity from thermal, hydro, and nuclear sources for sale to state electricity boards through cooperative power pooling arrangements. Nevertheless, India's power sector was still plagued by capacity shortages, frequent blackouts, poor reliability, and a deteriorating physical condition of the power system. Heavily subsidized tariffs to domestic and agricultural consumers, together with theft and uncollected bills, placed a severe strain on the financial health of the state electricity boards and reduced their capacity to invest and maintain the transmission and distribution system. Losses at state electricity boards and subsidies were a major drain on state budgets that crowded out public spending on critical sectors such as health and education.

In Bangladesh, generation, transmission, and distribution were the responsibilities of the Bangladesh Power Development Board (BPDB), except in the rural areas where the Rural Electrification Board undertook the distribution function. In Pakistan, Karachi Electric Supply Corporation (KESC) and Water and Power Development Authority (WAPDA) were vertically integrated electric utilities that supplied electricity to the Karachi area and the rest of the country, respectively. Bangladesh's and Pakistan's power sectors shared similar operational and financial problems with India, mainly due to inadequate cost recovery and poor bill collection. The power sectors were also a major drain on the government budget. In the smaller DMCs, such as Bhutan, Maldives, Nepal, and Sri Lanka, a single government-owned vertically integrated monopoly was the main supplier of electricity. In Sri Lanka, a distribution utility sold electricity purchased from the Ceylon Electricity Board to

³ The main source of information presented in this section is ADB documents, such as the Report and Recommendation of the President, reports prepared under technical assistance, and other documents.

⁴ South Asia includes Bangladesh (BAN), Bhutan (BHU), India (IND), Maldives (MLD), Nepal (NEP), Pakistan (PAK), and Sri Lanka (SRI).

consumers in the southwest part of the country. Except for Nepal, the operational and financial performance of these electric utilities was better than that of the electric utilities in Bangladesh, India, and Pakistan, but resource mobilization was still a problem. In all cases in South Asia, regulation was the responsibility of the government ministry selected for the purpose, and regulation focused primarily on electricity pricing. Approval of investment proposals was usually the responsibility of a state planning authority.

Electricity in Southeast Asian DMCs⁵ was supplied mainly through government-owned electric utilities that, in most cases, integrated the generating, transmitting, and distributing functions, as in the cases of Cambodia, Indonesia, and Lao PDR. Malaysia was served by three vertically integrated monopolies: one each for Peninsular Malaysia, Sabah, and Sarawak. In the Philippines and Thailand, electric utilities were vertically separated into generation–transmission and distribution functions. In the Philippines, generation and transmission were the purview of the National Power Corporation (NPC) while distribution was undertaken by cooperatives (usually publicly owned) and private sector entities. There were also a number of small investor-owned utilities. In Thailand, the Electricity Generating Authority of Thailand (EGAT) generated and transmitted all electricity in the country while the Metropolitan Electricity Authority (MEA) purchased power from EGAT and distributed it in the metropolitan Bangkok area. The Provincial Electricity Authority (PEA) did likewise and distributed to the rest of the country. In Viet Nam, the structure of the power sector was a consequence of historical events when the government inherited two southern power companies at the time the northern and southern parts of the country joined as one political entity in 1976. As a result, electricity was supplied by three independent, vertically integrated electric utilities.

The performance of the power sectors in these DMCs was mixed. Electric utilities in Malaysia and Thailand operated soundly on a commercial basis. Investment in generation capacity and transmission and distribution facilities had generally been adequate to meet demand. Indonesia's power sector was also generally sound until the onset of the Asian economic crisis of 1997. Since then, the sector suffered from inadequate cost recovery and a deteriorating financial position. Serious capacity shortages at the generation level began to be experienced in the Philippines in the early 1990s. During the late 1980s and early 1990s, no significant generating capacity was commissioned in the country because of poor planning and NPC's weak financial position. As a result, power supplies were unreliable and load shedding was frequent. In Viet Nam, the three power companies were managed more as line ministries than business entities and were financially insolvent. The country also experienced an imbalance in generating capacity with a surplus in the northern part of the country and a deficit in the south, with no transmission link between the two regions to redress the imbalance. About half of the population was without access to electricity. The power sector in Lao PDR was similarly financially insolvent and electrification rates were low. In Cambodia, rehabilitation of the power sector was just beginning in the late 1980s after a long civil war. Most of the population was without electricity. Regulation in these DMCs was the responsibility of the government ministry selected for the purpose and focused primarily on electricity pricing. Approval of investment proposals was usually the responsibility of a state planning authority. In Cambodia, Lao PDR, and Viet Nam, the regulatory framework was rudimentary and lacked institutional capacity to effectively regulate the sector.

⁵ Southeast Asia includes Cambodia (CAM), Indonesia (INO), Lao PDR (LAO), Malaysia (MAL), Philippines (PHI), Thailand (THA), and Viet Nam (VIE).

The power sectors of the DMCs of the Pacific region (PDMCs)⁶ were similarly structured—a single government-owned enterprise that generated, transmitted, and distributed electricity to its customers. The only exception was Vanuatu where a private electric utility was awarded a monopoly franchise to supply electricity to the main island. This franchisee was regulated by the government. Most electric utilities were in poor financial health because tariffs did not cover the cost of supply. In all cases, a government ministry controlled the price that could be charged for electricity and sanctioned investment proposals.

The power supply system in the Central Asian republics⁷ was a single network until the end of the Soviet era in 1991. When the Central Asian republics gained independence, the power systems that were found within their borders were reorganized into vertically integrated monopolies, owned by the respective DMC government. The power system assets inherited at independence were in poor condition and investment in generation, transmission, and distribution was needed along with modernization of the management and administration of the electric utilities. Along with the inherited assets, tariffs that were charged before independence continued to be in effect. The tariff levels were significantly below full cost recovery and quickly led to a deterioration of the financial position of many of the electric utilities. Thus, few resources were available for investing in rehabilitation and expansion, and electricity supplies became unreliable and substantial load shedding was experienced in many of the Central Asian DMCs. The government of each Central Asian DMC regulated its respective electric utility by controlling the price of electricity and approving investments in the sector. The power sector in Mongolia (MON) was vertically integrated and comprised three separate grids (Central, East, and West). Its operational and financial difficulties were similar to those that affected the Central Asian DMCs.

In the People's Republic of China (PRC), the power sector was a single monopoly comprising generation, transmission, and distribution and was part of the government structure under the Ministry of Energy (in 1993, it was reorganized under the Ministry of Electric Power). The Ministry was also responsible for the operation of the power sector. Rapid economic growth in the PRC in the late 1980s and early 1990s led to rapid growth in the demand for electricity. The capacity of the power system in many regions of the country was insufficient and resulted in load shedding and generally poor reliability of the electricity service. Nevertheless, a 98 percent electrification rate gave most people in the country access to electricity. The tariff charged for electricity to all consumer groups was below the cost of service, resulting in electricity consumption being subsidized by the government budget.

Regulation of the power sector was shared by several government agencies. The State Economic and Trade Commission was responsible for planning, establishing rules, norms and technical standards, proposing pricing policies, and reviewing the feasibility of new power projects. The State Development and Reform Commission reviewed and approved new power projects, established pricing policies, and approved pricing changes. The Ministry of Finance was responsible for establishing and managing the financial system for the electric utilities, tax policy vis-à-vis the power sector, and accounting

⁶ PDMCs comprise the Cook Islands (COO), Fiji (FIJ), Kiribati (KIR), Republic of the Marshall Islands (RMI), Federated States of Micronesia (FSM), Nauru (NAU), Papua New Guinea (PNG), Samoa (SAM), Solomon Islands (SOL), Tonga (TON), Tuvalu (TUV), and Vanuatu (VAN).

⁷ Central Asia includes Azerbaijan (AZE), Kazakhstan (KAZ), Kyrgyz Republic (KGZ), Tajikistan (TAJ), Turkmenistan (TKM), and Uzbekistan (UZB).

for the capital assets in the sector. The power sector was governed by laws, administrative rules and regulations, and policy circulars that were generally not well coordinated or transparent.

Overall, the organizational structure of most electric utilities in DMCs in the mid-1980s was that of a state-owned, vertically integrated monopoly. In a few cases (India, Philippines, and Thailand), there was separation between the main system components, namely, generation, transmission, and distribution. Nevertheless, these components were still organized within a state-owned, monopoly framework. In the Philippines, private sector monopolies operated at the distribution level. In some of the larger DMCs, such as India, Malaysia, and Viet Nam, the vertically integrated monopoly was restricted to a particular service area. The financial performance of the electric utilities was generally weak with tariffs usually not covering costs. Electric utilities in Malaysia and Thailand were two exceptions. The weak financial performance of the electric utilities was the main cause of poor operational performance and resulted in load shedding and an unreliable electricity service.

Regulation was carried out by the government and focused primarily on electricity pricing and approval of investments in the sector. The regulator and the electric utility were state agencies, so the relationships between the two were not always at arm's length. Staff often served in both agencies at one time or another. Political influence was a common feature in the pricing of electricity. The most egregious example was in India where farmers, because of their political clout, were able to influence the regulatory process in many state governments to supply electricity to them free of charge. Political influence was also a factor in the theft of over 20 percent of electricity generated in India, with state governments unable to adequately address the problem. In Pakistan, political influence was the major factor in the electric utilities' inability to collect on bills for electricity consumption from some large electricity consumers and government departments. As a result, these electric utilities encountered serious financial difficulties that affected their solvency, ability to operate efficiently, and invest for the future.

B. Current Organization of DMC Power Sectors

Since the mid-1980s, restructuring efforts were undertaken by governments in a number of DMCs. Table 2 classifies the current structure of power sectors of 34 DMCs according to the taxonomy in Section II.

The majority of DMCs, 23 out of 34, are still organized as vertically integrated monopolies. All are public sector enterprises, except the electric utility in Vanuatu, which is still privately owned. In Cambodia, the main electric utility is Electricité du Cambodge, a government-owned vertically integrated monopoly that serves mainly the larger urban areas. The rural areas of Cambodia are now served by several hundred small, largely unregulated, privately owned electricity enterprises. In the Kyrgyz Republic, the monopoly, Kyrgyzenergo, was restructured in 2001 into one generation company, one transmission company, and four distribution companies. However, it is still state-owned and operates much like a vertically integrated monopoly. Overall, changes in the organization and structure of the power sector in these DMCs since the mid-1980s have been modest. Power sectors are still largely vertically integrated monopolies and regulation is carried out by the government or regulatory agency, focusing on electricity pricing and approval of investments in the sector.

TABLE 2
CLASSIFICATION OF DMCs BY OPERATIONAL MODEL

	GENERATION		TRANSMISSION		DISTRIBUTION	
	PUBLIC	PRIVATE	PUBLIC	PRIVATE	PUBLIC	PRIVATE
I. Vertically Integrated Monopoly	AFG AZE CAM INO KGZ LAO MLD NEP PNG SRI TAJ TKM UZB	CAM INO VAN	AFG AZE CAM INO KGZ LAO MLD NEP PNG SRI TAJ TKM UZB	 VAN	AFG AZE CAM INO KGZ LAO MLD NEP PNG SRI TAJ TKM UZB	CAM VAN
II. Monopsony	BAN BHU IND MAL MON PAK PRC PHI THA VIE	BAN MAL PAK PHI THA	BAN BHU IND MAL MON PAK PRC PHI THA VIE		BAN BHU IND MAL MON PAK PRC PHI THA VIE	PHI
III. Wholesale Competition		KAZ	KAZ		KAZ	
IV. Full Customer Choice				None		

Note: PDMCs include COO, FIJ, FSM, KIR, NAU, RMI, SAM, TON, TUV.

Most progress in restructuring was made in the generation component of the power system. Six out of the 10 DMCs were reorganized as monopsonies (BAN, MAL, PAK, PHI, THA, and VIE) and engage the private sector to supplement public sector generation capacity. Private sector generators sell power to the dominant public sector electric utility in the DMC through long-term contracts for resale to consumers or to a distribution utility directly, as in the case of the Philippines. Distribution utilities in the Philippines have the option to purchase power directly from private sector generators. In other DMCs, distribution is undertaken by public sector monopolies. In Bhutan, the Bhutan Power Corporation is the sole buyer of electricity from publicly owned generators. In India, a number of states have unbundled their power systems, but the entities that operate the generation, transmission and distribution functions are still mostly state-owned. Privatization has not yet been

undertaken on any large scale. The Mongolian power system is organized as a monopsony with the generation, transmission, dispatch, and distribution companies still under state ownership. In the PRC, the power sector was separated into five generating companies, two transmission companies, and a number of regional grids. However, all companies are state-owned. The power sectors are regulated by regulatory agencies in all cases except Bangladesh where the government assumes this responsibility. In 2003, a law to establish an energy regulatory commission in Bangladesh was promulgated, so the regulatory function will be transferred to this commission in the near future.

A competitive market at the wholesale level has been established only in Kazakhstan. As part of Kazakhstan's move to a market-based economy, Kazakhstanenergo divested itself of its power generation facilities in July 1997, creating independent generating companies, and then reorganized the remaining transmission and distribution facilities under the Kazakhstan Electricity Grid Operating Company (KEGOC), a wholly government-owned entity. About 85 percent of generation capacity was privatized. The generation assets were divested by means of asset sales to local and foreign investors, and others under concession agreements. Operations of the wholesale power exchange were launched by KEGOC in October 2001. The exchange arranged for the following day-in-advance power trading; calculation of a market price for energy on the basis of current supply and demand; and optimization of supply and demand mechanisms. By the end of 2001, the wholesale electric energy market was a system of free bid-and-ask relations and transmission of electric energy in accordance with contractual terms among market participants. Participants in the market include energy producers, the National Electricity Grid, regional transmission and redistribution networks, wholesale buyers, and other organizations working under centralized dispatch management. On 1 January 2002, the exchange began organizing hour-in-advance energy trading. Regulation in areas outside wholesale trading is undertaken by the government. Electricity prices at the wholesale level fell from about 4 cents per kWh before electricity trading was established to less than one cent per kWh in 2002.

Power sectors in most of the smaller DMCs have not undergone significant restructuring or reform. The main reason for this seems to be that economies of scale and scope are still present in these smaller power systems.⁸ Therefore, there may be benefits from continuing to vertically integrate the generation, transmission, and distribution functions. In the larger power systems, economies of scale have likely been largely exploited. Therefore, there may be scope for further improving efficiency by introducing competition.

C. Restructuring and Regulatory Reform in Selected DMCs

Although little significant progress had been made in the restructuring of the power sector in most DMCs, progress was made in nine of the larger ones. The main motive for restructuring was to attract private capital to the sector and improve efficiency. Restructuring usually began with the initial step of promulgating legislation. If legislation was not necessary, a comprehensive restructuring policy was developed. Table 3 lists the year of legislation or policy change in these DMCs—most legislation or policy changes were approved relatively recently. A review of key developments and plans for power sectors in these nine DMCs follows.

⁸ Stoft (2002) states that efficiency at the generation level increases significantly up to 100MW and at a slower rate up to 800MW. This is the case for thermal generation such as coal, oil, combined cycle, and nuclear. For hydroelectric generation, the economies of scale end at a lower level. Lovins et al. (2002) concur, but suggest that economies of scale are completely exhausted by the 500MW level.

TABLE 3
YEAR OF LEGISLATION/POLICY CHANGE FOR POWER SECTOR RESTRUCTURING

DMC	YEAR
Bangladesh	1996
People's Republic of China	2002
India	2003
Indonesia	2002
Mongolia	2001
Pakistan	1998
Philippines	2001
Sri Lanka	2001
Thailand	1998

(i) Bangladesh

Access to electricity in Bangladesh has been one of the lowest in the world with less than 32 percent of the population connected to an electricity supply. The government recognized that access could not be improved simply by expanding the electricity supply because of the poor performance of the sector and the lack of resources for investing in the power supply system. To improve sector efficiency and attract capital, the government embarked on a program to reform the power sector. As a first step, Dhaka Electric Supply Authority (DESA) was created in 1991 to take over the electricity distribution system of the capital city Dhaka from BPDB as part of the unbundling process. In 1992, the Industrial Policy was amended to open the power sector for private investment, except in nuclear energy. The government firmed up its intentions regarding power sector reforms in 1994 in a document entitled Power Sector Reforms in Bangladesh (PSRB). PSRB recommended that constraints in the sector be removed through improvements in sector and corporate governance, introduction of competition, and public-public partnerships.

As a result of PSRB, the government took a number of additional steps. In 1996, a Private Sector Power Generation Policy was adopted that stipulated that independent power producer projects be implemented on a build-own-operate basis. Power produced by independent power producers was to be purchased by BPDB, DESA, the Rural Electrification Board (REB), or any distribution company to be created in the future, as decided by the government. Several other measures were instituted in 1996 to restructure the power sector. Another power company named Rural Power Company was established. The REB owned 28 percent of its shares and the remaining 72 percent was held by nine rural electric supply cooperatives. The Power Grid Company of Bangladesh (PGCB) was created to take over the transmission business from BPDB and the Dhaka Electric Supply Company (DESCO) was created to take over a part of the distribution business of Dhaka from DESA.

The first private sector power generating plant started operations in 1998. Since that time another 1430MW of private sector generation was constructed. Independent power producers now account for more than 40 percent of the power generation in the country. Nevertheless, Bangladesh still faces a generating capacity shortage over the next 5 years and the main power sector institutions

are still in poor financial condition. Institutional capacity and general skill levels are also weak. To meet the future demand for electricity, the power sector will likely depend increasingly on the private sector for generation capacity. Therefore, it will be important to establish a wholesale market for electricity in the near term to attract investment in generation and maximize efficiency in this segment of the market. Concurrently, an independent regulatory agency needs to be established, staffed with capable and knowledgeable personnel, to regulate the monopoly components of the power system.

(ii) People's Republic of China

Electricity shortages and unreliable power supplies were the main motives for reforming the PRC's power sector. Efficiency was to be improved by introducing competition in the sector and rationalizing the tariff system. The government permitted foreign investors in 1997 to directly acquire a limited interest in power plants, provided that the owners reinvested the revenues in follow-on power projects. Domestic investors had been allowed to finance generation projects, but wholly foreign-owned power generation enterprises were not permitted, except under BOT guidelines. Majority shareholding by foreigners was also not allowed in nuclear and hydro plants, nor were terms of the agreement to go beyond 20 years. Foreign capital contributions needed government approval prior to withdrawal, transfer, or assignment. Because of these restrictions on investment, few foreign investors took up the opportunity. Domestic investment in the power sector was also limited to a few joint ventures with the government.

The State Power Corporation was established in 1997 as a separate corporate entity under the Ministry of Electric Power (MEP) to own and manage the country's generation assets and power transmission grid. In the following year, reforms resulted in the abolition of MEP and the State Power Corporation was moved to the State Economic and Trade Commission that was responsible for regulation and policy formulation in the power sector. The move transferred responsibility for the regulation of the power sector in each province to the provincial government. During 1998-1999, pilot reform programs were started in Shandong, Shanghai, and Zhejiang to develop competitive generation markets for selling electricity to a single buyer.

The Power Sector Restructuring Plan (PSRP) of March 2002 recommended the dismantling of the State Power Corporation into several national power generation enterprises. Except for 20 percent of the total generation capacity to be withheld by the grid companies for the regulation of peak demand, including pumped storage plants, all other generation capacity was to be restructured into four to five generation companies to ensure that the market share of each generation company did not exceed 20 percent. The power sector was restructured in December 2002 into five power generating companies and two transmission companies, in line with the PSRP proposals. The transmission companies also became responsible for the regional power grids that distribute electricity.

The State Electricity Regulatory Commission, established in October 2002, is responsible for regulation of the power sector. Its main responsibilities are:

- (a) to propose laws and regulations for power sector regulation and rules for electricity market operations;
- (b) to propose development plans for electricity markets, design regional power markets, and establish electricity trading institutions;

- (c) to monitor electricity market operations, ensure orderly and fair competition in the market, and regulate transmission / distribution / noncompetitive generation;
- (d) to propose tariffs and adjustments to the government pricing authority; and
- (e) to investigate any possible violations of laws and regulations and resolve disputes in the sector.

Despite the reform efforts, the power sector has still been unable to meet the rapidly growing demand for electricity, with 21 of 31 provinces currently experiencing power shortages. There are plans to create a competitive wholesale electricity market with, initially, the five public generating companies selling their output to a single company. Private sector companies are to participate later. Competition should improve efficiency, however, it will not likely solve the current power shortage problem without a substantial increase in investment in generation. Therefore, the government will need to promote more active participation of the private sector.

(iii) India

Regulation of the power sector in India up to the mid-1980s was defined by the Electricity (Supply) Act of 1948 and was essentially in terms of tariff setting at the retail level. For the private sector, tariffs were based on a rate of return on invested capital that allowed the utility to maintain financial viability. For state electricity boards (SEBs), the Act simply urged that the SEB not conduct its business at a loss. The Act was amended several times since its promulgation. In 1978, the Act required that SEBs earn a surplus after accounting for all subventions and costs, including taxes. In 1983, the Act was amended to require that SEBs earn a surplus of 3 percent on net fixed assets.

However, regulation was largely ineffective. India's power sector suffered from capacity shortages, frequent blackouts, and poor reliability. Less than full cost recovery, together with theft and uncollected bills, put a severe strain on the financial health of the sector, reducing its capacity to invest and maintain the power system. Losses at SEBs and subsidies were a major drain on state budgets. To relieve some of the burden on the budget of the central government, the Electricity (Supply) Act was amended in 1991 to allow private entities to establish, operate, and maintain generating power plants of any size and to enter into long-term power purchase agreements with SEBs.

Many states recognized the weak financial position of their SEBs and the need to separate social obligations from commercial considerations. Several states initiated power sector reforms in the mid-1990s by passing power sector reform bills to provide a legal basis for the reorganization of the SEB to increase the sector's self-generation of funds and to reduce its reliance on budget transfers from the state's budget. To strengthen regulation, the Electricity Regulatory Commissions Act 1998 was passed to create the Central Electricity Regulatory Commission and provide a legal environment for the establishment of state electricity regulatory commissions (ERCs). The main task of the Central Electricity Regulatory Commission is to regulate tariffs for central generating agencies and for interstate transmission of power. The scope of responsibilities of the ERCs was to be determined by the respective state government.

The Electricity Regulatory Commissions Act 1998 and legislation at the state level led to reforms that permitted the unbundling of the generation, transmission, and distribution functions and the creation of ERCs in nine of India's 28 states and one union territory (Delhi). Table 4 summarizes the main reforms in these jurisdictions. Each of the nine states and Delhi established an ERC and

five of the 10 states and Delhi unbundled their SEBs into separate generation, transmission, and distribution companies. Two of the other four SEBs unbundled only the generation component, while the other two SEBs have not yet taken steps to restructure their SEBs. Of the eight SEBs that were unbundled, only one state and Delhi engaged the private sector. In Delhi, a controlling interest in three distribution companies was sold to the private sector while, in Orissa, controlling interest was sold in four distribution companies. A minority interest in Orissa's thermal generating company was also sold to the private sector.

TABLE 4
RECENT STATE-LEVEL REFORMS IN THE INDIAN POWER SECTOR

STATE	SCOPE OF REFORMS	YEAR OF REFORMS
Andra Pradesh	Generation unbundled	1999
	ERC created	1999
	Distribution unbundled	2000
Assam	ERC created	2001
Delhi	ERC created	1998
	Generation, transmission and distribution unbundled	2002
	Partial privatization of distribution	2002
Gujarat	ERC created	1999
	Legislation to allow restructuring passed	2003
Haryana	Generation unbundled	1998
	ERC created	1998
	Distribution unbundled	1999
Karnataka	Generation unbundled	1999
	ERC created	1999
Madhya Pradesh	ERC created	1999
	Generation, transmission, and distribution unbundled	2002
Orissa	Generation unbundled	1996
	Partial privatization of generation	1996
	ERC creation	1996
	Distribution unbundled	1998
	Partial privatization of distribution	1998
Rajasthan	ERC creation	1999
	Generation, transmission, and distribution unbundled	2000
Uttar Pradesh	ERC creation	1998
	Generation unbundled	2000
	Partial unbundling of distribution	2000

ERC = Electricity Regulatory Commission.

In May 2003, the Electricity Act 2003 was passed in the Indian Parliament. This Act replaced the Electricity (Supply) Act of 1948 and the Electricity Regulatory Commissions Act 1998, as well as other legislation related to the power sector. The Act eliminated the need to license nonhydro generation, deregulated captive generation, opened access to transmission lines, opened access to distribution facilities (in phases), and mandated the establishment of state electricity regulatory commissions.

The full impact of the legislation and restructuring that has taken place so far has yet to be felt. The initial steps of introducing legislation and unbundling are important, but need to be followed up by measures that foster competition at the generation level and encourage the private sector to invest. The unbundled generation, transmission, and distribution companies are still under the control of the state and have little operational or financial independence. The ERCs also lack independence and have insufficient capacity to carry out their regulatory responsibilities. The central and state regulatory commissions do not have common approaches to regulation and responsibilities vary substantially from commission to commission.

(iv) Indonesia

Law No. 15 (Electricity Act) of 1985 provided the legal framework of the power sector, permitting private and cooperative franchise participation in the supply of electricity and affirming the dominant role of Perusahaan Listrik Negara (PLN) in public power supply. However, rapid growth in the demand for electricity in the 1980s constrained PLN's ability to invest in generation to meet the anticipated demand. Thus, the government issued Presidential Decree No. 37/1992 to encourage private power participation in the sector under build-own-operate schemes. To regulate private sector power projects, the Directorate of Private Power was established in the Ministry of Mines and Energy (MME) in 1993. In 1996, MME was charged with the responsibility for carrying out the oversight function in the power sector, including issuance of electricity supply licenses and the setting of (end-user) tariffs, prices charged by IPPs, and other customer charges. In 1994, Government Regulation No. 23 corporatized PLN and allowed it to undertake joint ventures with the private sector. As a result, 27 private sector power projects were approved between 1994 and 1997, although only six were implemented.

The 1997 Asian economic crisis had a profound impact on Indonesia's power sector. Demand for electricity fell precipitously, resulting in a surplus generation capacity of about 70 percent. The electricity tariff was not sufficiently adjusted to meet the cost of supply and PLN's financial performance deteriorated. A Power Sector Restructuring Policy was approved by the government in 1998 to improve the performance of the power sector. The Policy aimed to create a financially independent and efficient power sector through the unbundling of PLN, establishing a competitive electricity market in Java-Bali, gradually increasing the retail electricity tariff to allow full cost recovery, and enlarging private sector participation in a competitive environment. A competitive bulk power market based on the multiple buyer/multiple seller model was also planned.

Law No. 20 (The Electricity Law) was enacted in September 2002 and provided the legal framework for a competitive electricity market in Indonesia. It introduces multiple players and gradually reduces PLN's monopoly, not only in power generation, but also in the transmission and distribution of electricity. The Law stipulated that electricity prices for generation and for medium and high voltage customers are to be based on market competition. Competition will start in power generation within 5 years of implementation of the law by designating at least one area for free

competition where licensed private companies will be free to develop power plants.⁹ PLN will retain its primary license for power generation, transmission, and distribution in Indonesia until it is unbundled in accordance with the Law. The Law allows the regulator to extend licenses to interested sales agents who may buy electricity from the electricity market on a competitive basis and sell to medium and high voltage consumers. However, the regulator will set the electricity price for all consumers where there are no sales agents.

Notwithstanding the Power Sector Restructuring Policy, restructuring of the power sector has been slow and major problems persist. PLN's financial performance has improved little because the electricity tariff continues to be set below cost recovery and PLN's dependence on government subsidies. As a result, PLN has few resources for investing and maintaining the power system. Its obligations under power purchase agreements to the IPPs are still beyond its financial capacity, even though PLN has had some success in renegotiating these agreements. These financial difficulties have led to power shortages and blackouts in large parts of the country. The government's ability to put PLN on a sound financial footing will dictate whether the reforms enacted so far will be sustainable.

(v) Mongolia

The Government of Mongolia recently took a number of steps in response to the poor operational performance of the power sector and its heavy dependence on subsidies from the budget. In 2001, an Energy Law was passed to establish a legal basis for restructuring the energy sector, including the electricity industry. Subsequently, in the same year, the power sector was unbundled, establishing 18 companies from the generation, transmission, load dispatch, and distribution assets. One of the distribution companies was privatized in 2003 and another one is planned for 2004. An Energy Regulatory Authority (ERA) was also established that separated regulation from operations. ERA is responsible for setting electricity tariffs and regulates the 18 power sector companies. In 2002, the government approved the Mongolia Sustainable Energy Sector Development Strategy Plan (2002-2010), a set of guiding principles for reforming the power sector. The main goals of the strategy are (i) to improve the financial performance of the power sector, (ii) to increase people's access to electricity in the rural areas and ensure an affordable minimum level of electricity consumption, and (iii) to promote private sector participation in the power sector.

In 2002, the Central Electricity System—the largest of the three grids and serving 50 percent of the population—was restructured into a single-buyer, monopsony arrangement. The Central Electricity System comprises five power plants, one transmission company, and seven distribution companies. The transmission company purchases electricity from generators and resells to the distribution companies at prices set by ERA. Although the monopsony arrangement has been put in place only recently, it has been working satisfactorily to date.

In a relatively short time, Mongolia made major strides in restructuring the power sector that should improve the sector's operational and financial performance. The second stage of the restructuring process will involve further privatization of the generation and distribution companies. However, this will take place only when these companies achieve commercial viability.

⁹ Competition will likely be introduced only in the Java-Madura-Bali system. The remaining 20 percent of the electricity market will be served by vertically integrated monopolies.

(vi) Pakistan

To ensure that sufficient generation capacity was available to meet the rapid growth in the demand for electricity, the Government of Pakistan formulated a power policy in 1994 to permit the private sector to invest in the power sector in Pakistan. The policy allowed full flexibility to independent power producers to bring capacity on line as quickly as possible at predetermined power purchase prices. The government guaranteed implementation, fuel supply, and power purchase. By 2001, the private sector's share of installed capacity reached 5,551MW, all of which were oil-fired thermal plants.

In 1997, the government established the National Electric Power Regulatory Authority. The Authority is responsible for issuing licenses, franchising monopoly business, setting and enforcing performance standards and codes of practices, enforcing competitive policies, and setting charges for the monopoly parts of the industry. It is also mandated to protect consumers against monopolistic prices, encourage efficiency in licensee operations through financial incentives, encourage economic efficiency by promoting competition, and eliminate cross-subsidies between regions and consumer groups.

Because of the power sector's poor operational and financial performance since the mid-1990s, the government decided to restructure the sector from an inefficient state-controlled monopoly to a competitive, market-driven system. Its first step was to amend the WAPDA Act in December 1998, which allowed the establishment of the Pakistan Electric Power Company (PEPCO) for unbundling of the WAPDA's Power Wing into eight distribution companies (formed from existing area boards); three generating companies (comprising 11 of WAPDA's generating plants); and the National Transmission and Dispatch Company (NTDC). The competitive power sector will consist of (i) competitive generation with independent system operators and a bulk power market; (ii) unbundled, open, and undiscriminating access to transmission and distribution services; and (iii) an independent regulatory body for effective market governance.

The second step of the government's plan is to (i) sell PEPCO's generating and distribution companies and (ii) privatize KESC. The transformation of the power sector into a privatized electricity market is expected to take a number of years and will comprise two phases. In the first phase, the system will be a single buyer type where all electricity will be bought by NTDC from various private and public generating companies for resale to the distribution companies. In the second phase, the system will be of a multiple buyer and seller type where the distribution companies and large consumers will have a choice of which generating company to buy from.

Nevertheless, reforms in the power sector have been slow to materialize. WAPDA still exercises strong oversight and control over the unbundled corporate entities. Heavy financial losses continue to plague WAPDA and KESC and drain the government budget. WAPDA and KESC have also failed to generate sufficient funds for investment in urgently needed transmission and distribution capacity. A regulatory agency for the power sector has been established, but it lacks predictability and transparency. Although reforming the power sector is part of the government's agenda, there seems to be a lack of political will to implement it aggressively.

(vii) Philippines

To improve regulation and promote private sector participation in the power sector, President Corazon Aquino signed two Executive Orders (EOs) in 1987. EO172 created the Energy Regulatory

Board whose responsibilities included the setting of electricity tariffs. In 1992, the Board's responsibilities were subsequently expanded to include: (i) regulating tariffs charged by NPC, distribution utilities, and electric power cooperatives; and (ii) reviewing and approving private power purchase contracts entered into by NPC and private utilities. E0215 withdrew NPC's exclusive rights to power generation and permitted private sector participation in electricity generation. The government further stimulated private sector participation by liberalizing the import of generating plants and permitting the private sector to directly contract with distributing utilities such as Meralco. The first build-operate-transfer (BOT) agreement for a generation project between the private sector and NPC was signed in 1989. Since that time, a total of 35 independent power producers have entered the power generation market in the Philippines. The success of the Philippines in attracting private sector investment to the power sector was largely due to government guarantees in the power purchase agreements signed by NPC with independent power producers.

In the latter part of the 1990s, the government acknowledged the operational and financial problems of NPC and recognized the need to restructure the power sector. In June 2001, Republic Act 9136 (the Electric Power Industry Reform Act) was passed that allowed the restructuring of the power sector to one with a market orientation. The envisioned market structure comprised independent generating companies in an open and competitive market; a private but regulated transmission company; and distribution utilities that could be private, public, or cooperatives. Large consumers would also be able to purchase electric power directly from the wholesaler. The transmission company and the distribution utilities were to be regulated by the Energy Regulatory Commission (ERC; formally the Energy Regulatory Board) on the basis of ROR regulation or some performance-based regulation.

The key to power sector restructuring was the creation of the Wholesale Electricity Spot Market (WESM). Wholesale prices are to be determined on an hourly basis through a bidding procedure. Participants in WESM will include generating companies, distribution utilities, independent suppliers, and large electricity consumers to be administered by an independent market operator. Although the cost of wholesale electricity will be determined by the market, wheeling charges will be regulated by ERC.

Although firm plans for the restructuring of the power sector have been made, progress in their implementation has been slow. In the three years since passing the Electric Power Industry Reform Act, no generating assets have been sold because NPC documentation does not show clear title to all assets and their valuation has not always conformed to government standards. The government has also had difficulty in attracting interest from the private sector for the transmission assets. Thus, transmission will probably remain in the public sector with the assets managed by the private sector through a concession agreement. Nevertheless, wholesale trading in electricity is expected to commence in 2005.

(viii) Sri Lanka

The Government of Sri Lanka recognized the need for power sector reform in 1998 and approved a restructuring model, which called for the unbundling of the power sector into separate companies for generation, transmission, and distribution. In 2001, the government approved a new power sector structure after extensive study of the issue. The restructuring is to involve the unbundling of the Ceylon Electricity Board and Lanka Electricity Company and the establishment of (i) one generation company; (ii) one transmission company with two subsidiaries for bulk power activities (purchase

and sale of electricity) and transmission activity; and (iii) four distribution companies. An independent regulator will be established to regulate all the activities of the new power sector structure. In the meantime, the government established a multisector regulatory commission, by enacting the Public Utilities Commission Bill, which will initially regulate infrastructure sectors such as the electricity and water sectors. The new companies will be initially government-owned, but private sector participation will be allowed later when the companies need funding for future investments. Implementation of the restructuring of the power sector is just beginning and a Power Sector Reform Office has been established.

(ix) Thailand

The Government of Thailand began promoting a greater role for the private sector in sharing in the financing of future generation projects in 1992 when it approved the establishment of the Electricity Generating Company (EGCO) and the Regulations for the Purchase of Power from Small Power Producers. EGCO was established through a partial privatization of EGAT (1,950MW of generation) and sells electricity to EGAT under long-term contracts. The Regulations stipulate that the maximum capacity that may be sold by each small power producer to EGAT is 90MW. The government also approved a policy on power purchase from independent power producers to encourage private sector participation in the electricity supply industry. EGAT issued the first solicitation for power purchase from independent power producers in December 1994.

In 1998, the government endorsed a Master Plan for State Enterprises Reform that would serve as a framework for determining the scope and direction of restructuring and privatization in major economic sectors, including the energy sector. The goal was to improve efficiency in the sector. The Master Plan envisaged that the future structure of the electricity supply industry would follow a competitive model in which generation companies compete in a power pool. The first stage of the Master Plan ended in 2001 and involved the formulation of the legal framework for the restructured industry, and preparation of the three main institutions for restructuring. EGAT retained its dominant role as primary bulk purchaser and provider of electricity. EGAT's Ratchaburi power plant was privatized. The Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) retained their respective franchise customer bases, except for those customers who wished to purchase power directly from small power producers.

In the second stage, EGAT will retain its position as the main supplier of electric power, but its thermal generation business units will be corporatized, converted into subsidiaries, and privatized. Noncore businesses of MEA will be corporatized as wholly owned subsidiaries and then divested. The regulatory framework for third party access will be gradually introduced to allow power producers to sell directly to consumers by using the wheeling services of EGAT's transmission and MEA's or PEA's distribution lines.

In the long term, a competitive power pool will be established. Competition will be introduced at both the wholesale and retail levels. Generation companies will offer competitive bids to sell power through the pool, using the transmission system of EGAT or the distribution systems of the MEA and PEA. Additional private sector generation will be licensed to ensure fuel diversity and adequate competition. Transmission and distribution systems will be regulated to ensure reasonable charges on third party access. Eventually, an independent system operator will be responsible for dispatch and development of the national system grid. MEA and PEA will be transformed into regulated electricity

delivery companies responsible for power distribution within their respective customer franchise areas. An independent regulator will regulate distribution services and charges for delivery-related services. Retail companies will compete for retail customers by offering customer-related services.

The power sector in Thailand has been successful in attracting substantial private sector investment in generation. A little more than one third of the country's installed generating capacity is now owned by the private sector. However, restructuring and privatization of EGAT has been slow because of opposition from power sector labor unions and some of the public. With the exception of the private sector generators, the power sector essentially retains the same structure as in the 1980s.

IV. RESTRUCTURING AND REGULATORY REFORM IN OTHER REGIONS

In contrast to the DMCs, restructuring and regulatory reform began earlier in developed countries and Latin America, mainly in the 1980s. The view of the state's role in the economy in developed countries was changing at the time, most notably in Britain, where free and competitive markets were seen as more efficient than public sector intervention. It was believed that divestiture of publicly owned assets would lead to improved resource allocation and innovation. The experience with deregulation in the United States in the late 1970s showed that markets were better at reducing prices and increasing efficiency, thus reinforcing this view. In Latin America, restructuring and regulatory reform was an outgrowth of the Washington Consensus that called for privatization, liberalization, and a greater reliance on market forces. The aim of the reforms was to create a more commercially oriented power sector that was more efficient and less politicized. It was also expected that private sector investment in the power sector would ease the financial burden on government budgets. The following is an overview of the more prominent cases of power sector restructuring.

A. Developed Countries

(i) Australia

The provision of electricity in Australia had traditionally been the responsibility of individual state governments and had been organized on the basis of vertically integrated and publicly owned utilities operating in a monopoly market. Because of Australia's political history, demographics, and geography, the power sector was characterized by regional markets and limited interconnections. During the 1980s, there was a growing concern about domestic and international competitiveness of Australian manufacturers and recognition that reforms were needed in many sectors of the economy (APEC 2000). As a consequence, a Commonwealth Government commission recommended in 1991 the restructuring of the power sector to improve its efficiency.

In late 1998, the National Electricity Market was established to create a competitive wholesale market for trading electricity in New South Wales, Victoria, Australian Capital Territory, and South Australia. A similar system was concurrently implemented in Queensland. Generators compete in the spot market by submitting offers for dispatch. The National Electricity Market dispatches generation to meet demand at any point in time as determined by bids made by electricity retailers and large, high-voltage industrial consumers. The price established by the power pool is the spot price for wholesale electricity.

Reforms in the power sector at the state level were also pursued. The State Electricity Commission of Victoria was vertically separated into generation, transmission, and distribution, and generation was reorganized into five companies that were subsequently privatized. Several private sector generators also began operations in the state. The transmission component was privatized along with the distribution companies. All power sector entities participate in the National Electricity Market. New South Wales followed a similar process as Victoria but did not privatize any of the newly formed electricity companies. However, two small private sector generators subsequently began operations in the state. In Queensland, the entire power sector was separated into competing state-owned enterprises and the state government permitted private sector generation to compete with state entities for the supply of electricity. All power sector entities participate in the National Electricity Market. The vertically integrated Electricity Trust of South Australia was corporatized in 1995 and separated into four subsidiaries along functional lines: generation, transmission and system control, and distribution and marketing. The generation, distribution, and retail businesses were subsequently privatized over the 1999-2001 period. In Western Australia, the State Electricity Commission of Western Australia is still a vertically integrated monopoly but permits private sector generation in the state. In Tasmania, the Hydro-Electric Corporation was separated into its three component parts (generation, transmission, and distribution) but still remains state-owned.

Power sector reforms in Australia focused on unbundling the sector into its constituent parts and creating a competitive market for electricity at the wholesale level. Some of the newly formed companies were privatized and some states introduced private sector participation at the generation level to provide additional capacity and spur competition. Policymakers in some states were of the view that a fully competitive power sector can be substantially achieved without full privatization of the competitive elements with the right regulatory controls and incentives, provided that publicly owned electric utilities operate commercially on a level playing field with the private sector (APEC 2000). This form of competition in the electricity market resulted in wholesale prices declining substantially (Newbery 1999), although they have recently risen. Rising wholesale prices signaled the need for additional investment in capacity to which the market responded and new investments were made. Power station availability also improved from an average of 70 percent to more than 95 percent and labor productivity tripled. Customer surveys have indicated that consumers generally feel better off as a result of the reforms with a better and more reliable service and lower prices.

(ii) Japan

Power sector reforms in Japan have been limited. Japan is divided into 10 franchise areas, each supplied by a private, vertically integrated electric utility. Electricity is traded between these electric utilities on a bilateral basis to ensure security of supply. In addition, there are three wholesale suppliers of electricity. All the electric utilities are regulated by the central and prefectural governments. Electric utilities must obtain government permission to enter or exit the sector and tariffs are based on ROR regulation.

In 1995, the Electricity Utilities Industries Law was amended to liberalize the entry for independent power producers and to allow small power producers to sell directly to retail customers. In 1999, the Electricity Utilities Industries Law was amended again to enhance retail market competition by allowing extra-high-voltage customers to select their electricity supplier.

The purpose of power sector reform was to improve efficiency through competition. However, key legislative reforms that would give all electricity generators open access to the transmission grid have not yet been passed and thus the full potential for efficiency gains has not yet been exploited. Reform and restructuring is difficult in Japan because the electricity industry comprises many vertically integrated private sector companies with limited interconnections. The political environment also requires a high degree of consultation between government and private sector firms (APEC 2000).

(iii) New Zealand

In the mid-1980s, electricity generation and transmission were the responsibility of the Ministry of Energy with electricity distribution handled by Electricity Supply Associations. Electricity tariffs, investment in capacity, and other matters related to the power sector were regulated by the central government. The power sector suffered from a number of inefficiencies under this structure, largely resulting from a number of poor investment decisions, a lack of incentives to improve service and lower costs, a lack of consumer choice, and cross subsidization in the tariff structure between industrial, commercial, and domestic customer classes.

In response, the central government promulgated legislation in 1986 to establish the Electricity Corporation of New Zealand (ECNZ) to own all state-owned power sector assets. The transmission grid was set up as a separate corporate entity, but still a subsidiary of ECNZ. In 1992, the Electricity Supply Associations were corporatized and subsequently some were privatized, sold to local governments, or organized in trusts. In 1996, the New Zealand Electricity Market was established for wholesale trading in electricity, hedging contracts, providing market information, and recording and reconciling transactions between market participants. Market power is regulated by the Commerce Act 1986, providing a framework for limiting monopoly powers and promoting the development of competitive markets.

In 1999, the generation assets of ECNZ were reorganized under the Electricity Industry Reform Act into four competing companies. One of the companies that accounted for 25 percent of ECNZ's generation was privatized. The Act also required that the electricity distribution companies separate the functions and ownership of the "lines" activities and electricity retailing. As of April 2000, there were 31 lines companies and 10 electricity retailers with about 36 percent of the generation capacity privately owned.

Although the power sector in New Zealand has been substantially restructured and a competitive market established on the wholesale and retail levels, the major components—generation and transmission—are still state-owned. As in Australia, there is a view in some quarters that full privatization of the competitive elements of the sector is not necessary, provided that state-owned enterprises operate in the same business climate as the private sector and are free of political influence. Since reforms were implemented, the average national real consumer price of electricity has been stable, although slightly increasing in recent years. This may indicate that public sector entities still may not have sufficient incentives to innovate and improve efficiency that would lead to lower retail prices. New Zealand espoused "light-handed" regulation that relied on existing antitrust legislation and institutions (Newbery 1999). This has proved slow to deal with corporate abuses and may be a disincentive to improve efficiency.

(iv) Norway

Norway first set up an electricity market in 1971 to coordinate the use of the large number (about 80) of hydroelectric generators in the country. The electricity pool was run as a generators' cooperative and designed to allow trading between generators to meet their and municipally owned distribution company demands at least cost (Newbery 1999). The electricity pool acted as a voluntary balancing market for surplus electricity, about 20 percent of the total electricity produced. Because of the small proportion of total electricity production that was traded, the pool price had little effect on retail and long-term contract electricity prices.

Reforms in the power sector began in 1991 with the unbundling of the main vertically integrated electric utility into a generation company and a transmission company. The main goal was to improve efficiency by introducing competition, without necessarily privatizing them (Newbery 1999). Other generation facilities owned by the state, private sector, and municipalities were not affected by the reforms and the restructuring of the power sector involved no change in ownership. The power sector comprises over 340 electric utilities, of which 190 have generation facilities and over 200 are involved in distribution. Of these, 25 electric utilities are vertically integrated. Generators and distributors are licensed and the natural monopoly parts of the power sector are regulated. Electricity producers have access to all transmission and distribution grids and all consumers are free to select their electricity supplier.

There is some evidence that restructuring of the power sector led to improved electricity service and lower electricity prices to some larger consumers. Electricity prices at the retail level since 1991 have been remarkably stable in nominal terms. The dispersion of electricity prices was high before restructuring because of the large number of electric utilities and the wide range of long-term contract prices for large electricity consumers. Since the reforms, however, the dispersion decreased (Moen 1995). Restructuring does not appear to have had an appreciable impact on electricity service at the retail level. However, competitive forces may be at work that keep electricity prices low because consumers are free to select their supplier.

(v) United Kingdom

Prior to 1990, the power sector in the United Kingdom was under public ownership. In England and Wales, the Central Electricity Generating Board (CEGB) owned and operated the generation and transmission parts of the industry while 12 area boards acted as regional distribution monopolies. In Scotland, the power sector comprised two vertically integrated, geographically distinct electric utilities, combining generation, transmission, and distribution, one serving the north and the other the south. Northern Ireland was served by a single vertically integrated monopoly.

The restructuring of the power sector in the United Kingdom was part of a more general trend in the 1980s to move away from government intervention in the economy (blamed for the United Kingdom's economic decline) toward an economy more dependent on free markets. Since the government's fiscal position was in a precarious state, privatization of state assets emerged at the time as an attractive way to raise revenue for the treasury and to restructure simultaneously. The Electricity Act 1989 divided CEGB into four public limited companies: conventional generating capacity was transferred to two companies; one company acquired the nuclear power plants; and one company the transmission assets. The 12 area boards responsible for distribution were also converted to

public limited companies. The distribution companies and the two conventional generation companies were completely privatized by 1990 and 1995, respectively. The distribution companies were subject to price cap regulation. The newer nuclear power plants were eventually sold to the private sector while the older ones remained in the public domain because they were not salable. After privatization, the regional distribution companies began to invest in generation capacity and enter into joint ventures with independent power producers because electricity from new generating plants cost less than purchases from existing generating plants. By 1998, the monopoly franchises inherited by the regional distribution companies came to an end with the right of electricity consumers to freely choose their supplier.

In Scotland, the two electric utilities were privatized as vertically integrated regulated companies in 1991 after ownership of the nuclear power plants was transferred to a state-owned company. These electric utilities are free to sell to the English market and use the English wholesale price as a reference price for Scottish trading. These utilities also compete for customers to supply. In Northern Ireland, the generation assets of the state-owned electric utility were sold to three companies in 1992. The rest of the assets (transmission and distribution) was subsequently privatized in 1993 and operates as a regulated franchise monopoly. All electricity produced by the generating companies is sold under long-term contracts for resale to the public.

Reforms in the power sector in England and Wales introduced competition that led to significant efficiency gains at the generation and distribution levels. Plant availability also improved markedly. In contrast, continued vertical integration of the utilities in Scotland appears to have muted incentives to improve efficiency. The price-cost margin widened in England, Northern Ireland, Scotland, and Wales because producers had little incentive to pass on efficiency gains to consumers. The duopolies that were created in England did not bid competitively into electricity pools and limited the extent to which prices would fall when there was excess capacity. The lack of price competition in electricity pools also induced excess investment, thus reducing the gains in efficiency of individual investment projects (Newbery 1999).

(vi) United States

Each state developed its own electricity industry, usually based on private sector ownership, but also municipal and state electric utilities, rural electric cooperatives, and federally owned power systems. The majority of the electric utilities were vertically integrated monopolies. A bulk power system eventually developed into 3 major networks (the interconnected Eastern, Western, and Texas power grids) that consisted of extra-high-voltage connections between individual electric utilities for the transfer of electricity from one part of the country to another.

The power sector is subject to regulation by municipal, state, and federal level authorities to control prices at which electric utilities can sell electricity to retail customers. Price control is normally based on the principle that utilities should be able to recover costs of providing the service and earn a fair rate of return on their investment.

Several factors motivated the introduction of reforms in the power sector. In the early 1980s, electricity consumers became concerned with rapidly rising electricity prices. Conversely, electric utilities believed that electricity prices were not rising fast enough to cover costs. There was also a growing view that protected monopolies that were isolated from the discipline of the marketplace and regulated prices result in serious inefficiencies (Joskow and Schmalensee 1983). In 1978, the Public Utility

Regulation Policies Act was enacted that required electric utilities to interconnect and buy, at the utility's avoided cost, capacity and energy offered by nonutility power generators. This was followed by the Energy Policy Act of 1992 that opened access to transmission networks, thereby establishing wholesale competition. These two pieces of legislation significantly reduced electricity prices at the wholesale level. In the early 1990s, there was also an effort to examine the possibility of retail competition at the state level. By 1998, California made the most progress by establishing a competitive wholesale market and introducing full direct retail access for all consumers.

Despite the reforms, a crisis in the power sector developed in California in 2000. Wholesale electricity prices increased to unprecedented levels and produced enormous profits for generating companies. At the same time, a financial crisis developed in the regulated electric utilities that were required to buy the electricity in the wholesale markets and sell at much lower regulated prices in the retail market. As a result, several of the state's electric utilities declared bankruptcy. Restrictions on the consumption of electricity were introduced and power blackouts were experienced in parts of the state. Two factors are credited as the cause for the crisis: (i) capping of the retail tariff that did not allow for electricity demand to adjust to changing supply conditions; and (ii) the ability of electricity suppliers, even relatively small ones, to exercise significant market power.¹⁰

Although the California experience is unique to the United States, the experience highlighted two issues. Retail tariffs must recover all costs of supply and should be flexible enough to allow consumers to respond to changes in prices at the wholesale level. Market power needs to be monitored closely and mechanisms established to minimize the potential for any electricity supplier to exercise it.

B. Latin America

(i) Argentina

Restructuring and regulatory reform in the power sector in Argentina began in the early 1990s because of the government's inability to invest in the sector. Power sector reforms began in 1992 with the separation of the main vertically integrated monopoly into generation, transmission, and distribution. Generation was divided into 44 private sector companies with no generating company allowed to own more than 10 percent of total capacity. Generating companies are also not allowed to own transmission assets to mitigate the exercise of market power. Transmission assets were completely privatized by 2000. Over 20 distribution companies were created and about 60 percent of the distribution market is owned by the private sector. The distribution function is maintained as a monopoly and regulated.

A private firm operates the wholesale electricity market that includes scheduling, dispatch, price setting, setting reserve levels, and settlement. The wholesale market operates under a merit order rule and computes hourly spot prices based on fuel prices declared by thermal generators and the value of water for hydro generators. The spot price is the price of the last generator dispatched and defines the system marginal price. In addition to the system marginal price, generators receive a fixed payment for capacity (on a per kW basis) for supply in offpeak hours, and a variable capacity payment during peak hours based on the value of lost load. The wholesale market is highly competitive.

¹⁰ A succinct analysis of the California power crisis may be found in Borenstein (2002). World Bank (2001) provides a synopsis of lessons learned from the California experience for developing countries.

The power sector is regulated by an independent regulatory agency that awards licenses, determines retail tariffs, and resolves disputes. It also authorizes the construction of transmission lines. Retail prices are set on the basis of price caps. However, large customers can buy electricity directly on bilateral contracts from generators or from the wholesale electricity market.

Reforms in the power sector increased plant availability and reduced power outages. Prices determined in the wholesale electricity market fell steadily since the establishment of the market. Argentina experienced a severe recession in 2001 and 2002 that reduced the demand for electricity, causing the government to impose a freeze on electricity tariffs. Together with the large devaluation of the peso, companies in the power sector experienced heavy financial losses and several companies went bankrupt. These developments discouraged investment in new capacity. With the recovery of the economy and low electricity tariffs, the demand for electricity is again rising and additional investment in capacity at the generation and transmission levels is needed immediately. The regulatory framework also needs to be reformed to remove political influence in the setting of electricity tariffs and the tariffs need to be brought to levels that reflect costs. This should encourage investment in the sector.

(ii) Bolivia

The power sector in Bolivia was relatively small with a total installed capacity of 755MW in 1994. Although the power sector in Bolivia operated efficiently, the sector was restructured and reformed to attract private capital because fiscal difficulties precluded the government from investing in the expansion of the electricity system. Reforms in the power sector began in 1994 and involved the unbundling of the generation and transmission activities of the main state-owned electric utility. Generation capacity was subsequently vested in three separate private companies and the transmission system was established as a common carrier and then privatized in 1997. All publicly owned distribution companies were privatized. The other main generator in the private sector divested its interest in distribution. Thus, the power sector comprised four generating companies, one transmission company, and six distribution companies, along with several small isolated power grids in the outlying areas of the country. All of the generating companies owned less than 200MW of generating capacity.

The method adopted to privatize the publicly owned assets was specified in the 1994 Capitalization Law. Under this Law, 50 percent of each company was sold to the private sector and the other 50 percent was given to private pension funds. The shares sold to the private sector were issued by the respective companies and the funds raised from their sale were kept by the companies for investment purposes. Bolivia is the first country to use the capitalization method and seems to have worked well with substantial new investment in generation, transmission, and distribution capacity.

The 1994 Electricity Law stipulated that no one generator can own more than 35 percent of the country's installed generation capacity and that generators have open access to the transmission grid. Distributors buy power from generators on a wholesale electricity market determined by merit order dispatch. Generators are paid the system marginal price and a capacity payment for firm power. Distribution tariffs are based on price caps that are in force for a 4-year period. Distributors are also required to buy 80 percent of their anticipated demand through 3-year contracts to mitigate

price fluctuations. Transmission tariffs are based on the average cost of providing the facility. A government regulator is responsible for granting concessions and licenses, approving international transmission connections, setting prices and retail tariffs, and ensuring the efficient operation of the sector.

The introduction of competition at the wholesale level resulted in wholesale electricity prices falling in the first 4 years after restructuring. However, retail tariffs were not significantly affected because lower wholesale prices were offset by lower electricity subsidies, mainly to households. Despite lower prices on the wholesale market, the restructured power sector attracted new entrants at the generation level and new investment, indicating a potential for good returns on investment.

(iii) Chile

Power sector in Chile is also relatively small and comprises two power grids with a relatively even mix of hydro and thermal generation. Electricity prices were determined on a cost plus basis and cross subsidies between rural and other areas were substantial. To attract investment into the power sector, the government began the reform process in 1981 with the unbundling of the generation and distribution functions from the two major vertically integrated monopolies in the country. This created five generating and 11 distribution companies. All of these companies were privatized by 1990. Although more generating companies entered the electricity market since restructuring, one generator in the main grid still represents about 65 percent of the electricity produced. The transmission function was separated from generation and privatized only later in 1993.

The power system has two load dispatch centers to coordinate generation and to ensure orderly and economic trading between the two grids. The load dispatch centers operate under a merit order rule and compute short-run marginal costs used for determining the spot price at the wholesale level. A firm power component, equal to the nonfuel cost of a reference gas turbine plant, is also included in the spot price. Distribution companies, other generating companies, and large consumers of electricity may purchase electricity under short or long-term contracts or on the spot market. The contractual sales are not regulated. Transmission charges are based on the capital and operating costs of the line.

Electricity prices for regulated consumers supplied by distribution companies are determined in two stages. Prices between generators and distribution companies (node prices) are calculated every 6 months based on projected short-run marginal costs. Retail prices between distribution companies and customers reflect node prices plus a charge for the electricity distribution service. Retail prices are calculated every 4 years with monthly indexation and function as a price cap. The price cap provides strong incentives to reduce costs, but also allows for increases or decreases in costs that are eventually passed on to the consumer.

The reforms undertaken in Chile created a conducive climate for investment in the power sector. Thus, investments generally kept pace with demand. Efficiency of the power system also improved but though the efficiency gains were reflected in lower wholesale prices on the spot market, not all of which were passed on to final consumers through lower retail prices (Fischer and Serra 2000). Two main issues confront the power sector. The ownership structure (vertical integration, cross ownership) and the dominance of some participants in generation deter greater competition in the wholesale market. The transmission system, initially organized as a private sector monopoly, gave preferential treatment to its own generating facilities and limited access of other generators. There

were also disputes regarding transmission charges. These issues were partly addressed in 1997 with the transfer of the transmission system and responsibility for pricing to the state-owned load dispatch centers (APEC 2000, Newbery 1999). Nevertheless, investment in transmission is discouraged by an antiquated transmission pricing policy that does not allow full recovery of costs.

(iv) Colombia

Unlike other Latin American countries, Colombia's power sector was highly decentralized with seven publicly owned companies generating, transmitting, and distributing electricity within the country. About 70 percent of electricity generated was from hydro sources. By the early 1990s, the power sector was nearly bankrupt, accounting for 30 percent of total foreign debt and 33 percent of the nonfinancial public deficit (Millán and von der Fehr 2003).

In 1994, the National Congress passed Public Utilities Law 142 and Electricity Law 143 to counter the crisis in the power sector. The aim of the legislation was to open the sector to private capital, introduce competition, and regulate the noncompetitive segments of the sector. By 2000, the private sector controlled about 56 percent of generation and 48 percent of distribution, concentrated in 5 electric utilities that supplied more than 60 percent of the electricity produced to regulated consumers and the open market (Millán and von der Fehr 2003). The transmission grid is a single interconnected system and still largely under public control. The transmission grid operator coordinates the dispatch of electricity. The Energy and Gas Regulatory Commission regulates electricity tariffs based on independent power producer costs and inflation. Tariffs are implemented for a 5-year period. Large electricity consumers can choose their supplier without restriction, either through long-term power purchase agreements or buying power on the spot market.

Electricity is traded on the wholesale market and, in 2000, more than 40 traders participated in the market. The market is centralized where generators bid on the next 24 hours and declare their hourly availability to the dispatch center. The dispatch center sorts the bids by merit order and programs the next day's dispatches accordingly. The last price bid to meet market demand at any particular hour is the reference price received by generators that provided supply. Generators participating in the wholesale market also receive a capacity charge that pays for their long-run marginal capacity cost and encourages capacity investment. The wholesale market is complemented by a market of long-term financial contracts for power purchase agreements. Since the beginning of operations of the wholesale market in 1995, tariff levels for end users fell significantly, about 25 percent. Because the power system is largely hydro-based, spot prices on the wholesale market have tended to be sensitive to external events (such as droughts, attacks by insurgents on transmission lines, etc.) and consequently spot prices have been volatile at times. To hedge consumers from wholesale market price volatility, distributors are required to enter into power purchase agreements for 60 percent of their demand.

Reforms in the power sector resulted in lower electricity prices and generation costs in real terms. Despite these reforms, problems persist. Most distribution companies are again nearly bankrupt because of excessive political interference in the management of the companies, high electricity losses of 35 percent, nontransparent contracting practices related to power purchase agreements and BOT arrangements, nonpayment of bills by government bodies, delays in payment of subsidies by the government, and inadequate tariffs. Because of their lack of solvency, the distribution companies accumulated a large and increasing volume of outstanding debt to the wholesale market operator.

This in turn has jeopardized the solvency of the wholesale market operator and weakened incentives for future investments in generation (Millán and von der Fehr 2003).

V. KEY ISSUES

The review of regulatory reform and restructuring of power sectors in developed and developing countries in the previous sections highlights a number of issues. Although traditional regulation was largely effective in developed countries, it was felt in the 1980s that regulation of the power sector was inherently inefficient and that competition could improve efficiency, and thus lower costs. In developing countries, regulation of the power sector had generally been weak and led to serious inefficiencies and financial difficulties. The question facing developing countries wishing to restructure is whether competition can effectively substitute for regulation in some segments of the power sector to achieve improvements in efficiency and power sector performance. A second issue involves the best approach to power sector reform given that the size and structure of power systems vary from country to country. The common approach to reform in developing countries had been to privatize the generation component and introduce some degree of competition at that level. However, smaller power sectors may not have the ideal conditions for competition and the sequence may be an important factor in successful restructuring. Most restructuring efforts in developing and Latin American countries involved the privatization of power system assets. Thus, the third issue is concerned with the role privatization plays in the restructuring of a power sector. A fourth issue considers how market power can be mitigated in a competitive environment. And lastly, what options are available for regulating segments of the power system that are still natural monopolies? Each of these key issues is discussed below.

A. Competition versus Regulation

From a conceptual perspective, the simplest way of providing electricity is to give the utility a protected franchise monopoly and then regulate the monopoly. This was the usual approach taken in developed countries in Europe and North America and, for the most part, this arrangement worked well, despite some inefficiencies. In developing countries, including DMCs, the approach was similar, but with the public sector acquiring the monopoly franchise and the government acting as the regulator. However, in most of these cases, electric utilities were unable to satisfy market demand for electricity, provide a reliable supply, or supply at least cost. DMCs in South Asia were particularly notable in this regard with their low electrification ratios, chronic load shedding, and high cost of supply. The capacity of regulatory agencies to provide adequate oversight of the power sector was also insufficient. As a result, regulation had been weak and tended to be unduly influenced by political considerations.

The introduction of competition in Argentina, Australia, Bolivia, Chile, Colombia, Kazakhstan, Norway, United Kingdom, and United States resulted in improvements in power sector efficiency in those countries. Electricity prices generally fell, at least at the wholesale level, because competition put pressure on generators to reduce costs. In the Latin American countries, competition also resulted in reductions in system losses and improvements in revenue collection. Plant availability also rose in many cases by considerable margins.

Efficiency gains were generally passed on to consumers through lower tariffs. In two cases, Chile and the United Kingdom, electricity tariffs did not fall substantially. The duopolistic nature of the restructured power sector in the United Kingdom restricted competition at the wholesale level and resulted in excessive profits for the largest participants in the market. In Chile, regulation at the distribution level was not sufficiently effective to ensure that lower wholesale prices were transferred to consumers.

Despite these exceptions, experience appears to suggest that competition provides strong incentives for efficiency improvements and that the trend to competition in the power sector away from regulation of vertically integrated monopolies is justified. Perfect competition should provide the strongest incentives for efficiency and should transfer all gains to consumers. But competition is a matter of degree and the practical question is how competitive markets have to be in order to yield efficiency. The evidence from the United Kingdom suggests that any amount of competition will result in efficiency gains. Therefore, the lesson for developing countries appears to be two-fold. First, although improvements in the regulation of vertically integrated monopolies may be achieved, inefficiencies will continue to exist. Second, competition provides the strongest incentives for efficiency improvements and should be introduced into the power sector where feasible.

B. Restructuring the Power Sector

The important issue in restructuring the power sector is the choice of a structure that will maximize competition and limit the need for less efficient regulation. A power system typically comprises four distinct components: generation; transmission; distribution; and retailing (contracting, metering, billing). Restructuring a previously vertically integrated electric utility to separate the competitive parts requires the identification of those parts of the network that are able to compete and the core natural monopoly parts that need regulation. This usually means that regulation is confined to the transmission and distribution systems, with competition introduced in the remaining parts of the network, that is, generation and the retail component.

Experience with power sector reform in developed and developing countries has shown that achieving workable and sustainable reforms is considerably more complicated than previously thought. Successful reforms can improve the efficiency of the sector but, at the same time, flawed restructuring can seriously undermine the benefits of reform. The power crisis of 2000 in California amply demonstrates that restructuring without creating an appropriate market structure at the outset can lead to serious performance problems. It is now generally recognized that restructuring and regulatory reform should take into account the sequencing of reforms and the specific characteristics of the power sector such as size, structure, resource mix, and institutional endowments.

(i) Sequencing Reforms

The order of the main elements of power sector reform has been the following: (a) establishing a legal and institutional framework, (b) restructuring, and (c) privatization. This generally follows the recommendation of most practitioners and academics in the field (Bacon and Besant-Jones 2001, Jamasb 2002).

- (a) **Legal and Institutional Framework.** Power sector reforms must have a clear legal basis. The most important reforms often require new legislation to restructure the sector, permit private sector participation in the sector, and establish regulatory authorities. Legislation may also be required to oblige state-owned electric utilities to operate according to commercial principles, for example, to pay taxes; follow market-based interest rates; earn market rate of returns on equity; and exercise autonomy to manage their own budgets, borrowing, procurement, and employment.

The establishment of a legal and institutional framework was the first step taken to initiate restructuring in a number of DMCs. The most notable were in India where two laws were passed: the Electricity Regulatory Commissions Act in 1998 requiring the establishment of electricity regulatory agencies; and the Electricity Act in 2003 to deregulate and liberalize activities in the power sector. Indonesia enacted the Electricity Law in 2002 that permitted competition in the power sector, while Pakistan amended the WAPDA Act in 1998 to allow its unbundling. In the Philippines, the Electric Power Industry Reform Act of 2001 allowed the restructuring of the power sector to one with a market orientation. In other DMCs, such as Bangladesh, PRC, Sri Lanka, and Thailand, legislation was not necessary. However, reforms in the power sector were underpinned by policies developed specifically for the restructuring of the sector.

Although legislation is often required to restructure a power sector, the time required for drafting legislation, introducing it in the legislature, holding debate, and enacting into law may be considerable. For example, in India, the Electricity Act of 2003 took almost two years to promulgate. In the Philippines, the Electric Power Industry Reform Act of 2001 was introduced in late 1998 and enacted in June 2001, almost three years later. This stage of the restructuring and regulatory reform process may be slow, but it is a characteristic of the democratic process in many developing countries and should be accommodated.

- (b) **Restructuring.** Liberalization of the power sector in the DMCs and other developing countries typically began at the generation level (Table 1) because generation and its associated financing was often the constraint on electricity supply. Returns on capital invested in generation have usually been guaranteed by power purchase agreements, therefore, it is often easier to attract foreign interests to invest in generation than in the “lines” business. From the government’s perspective, investment in generation is attractive because less regulation is involved and issues involving the public do not arise often. Unbundling at the generation level also gives large electricity consumers an option to purchase directly from generators, thus ensuring a more reliable supply. In developed countries, such as Australia, New Zealand, and United Kingdom, unbundling and privatization of generation, transmission, and distribution generally occurred simultaneously.

The restructuring experience in Colombia provides another perspective and an argument for beginning the unbundling process at the distribution level. Insolvency of public and some private sector distribution utilities jeopardized the solvency of the wholesale market operator because of nonpayment of accounts for purchased electricity. Unbundling and subsequently privatizing the distribution component first could resolve any operational and financial issues present and the wholesale market could be

established on a sounder financial footing. Jamasb (2002) has also suggested that unbundling should first begin with the separation of the distribution component from the generation and transmission components. His main argument was that much of the inefficiencies in the sector originate in the distribution activity because in many developing countries, tariffs are low and subsidized, and poor bill collection rates weaken the financial health of the distribution segment. Distribution networks also exhibit high technical and nontechnical losses and poor quality of service, and therefore there is likely to be considerable scope for efficiency improvements.¹¹

After the distribution component has been reorganized into one or more independent companies, the transmission system should be separated from generation and open access to the transmission system established. Combined ownership of generation and transmission has the potential to discriminate against independent generators, distort competition, and discourage entry of new generators. This was the experience in Chile until the transmission system was separated from generation in 1993. A transmission company would also be well placed to act as an independent system operator and be responsible for the load dispatch function.

The final step in the restructuring process is to create several independent generating companies from the existing generation capacity and establish a wholesale electricity market. It is important that sufficient numbers of generators be created with a varied mix of generation to instill effective competition. Too few participants in the wholesale electricity market or generators with dominant positions lead to market power and may discourage new entry into the market. The creation of only two generators in the United Kingdom's power sector restructuring led to excessive profits for these companies and prevented electricity consumers from benefiting from the efficiency gains that restructuring made possible. Argentina avoided this problem by creating a greater number of generating companies that initially held no more than 10 percent of the country's generating capacity. To maximize competition, measures should also be taken to allow new entry of generators such as merchant plants to vary the mix of generation types. Different types of generation have cost advantages for different periods of load demand, so there should be several competing generating plants at any point in time.

- (c) **Privatization.** This issue is discussed in Section V.C.

(ii) Reforming and Restructuring Smaller Power Systems

Countries with small power systems are limited in the scope for restructuring, especially in the number of independent generating companies that could be created from existing capacity. Scale economies make it possible for monopolies to produce more cheaply than competitive markets because efficiency increases significantly to about the 100MW level and beyond to the 500-800MW range, although more slowly (footnote 6). Thus, in smaller power systems, the cheapest way to

¹¹ If possible, the retail component should be separated from distribution and open access to the distribution system established. If retail competition is not immediately feasible, it may be deferred to a later time. In any case, electricity consumers should be able at some time to switch between retailers to ensure quality of service.

supply electricity may be with a few large power plants. Otherwise, competition at the generation level would comprise smaller plants and would likely result in additional costs, for example, costs of coordinating dispatch from several generators, leading to consumers paying more for electricity.

Even if large plants are not more efficient, efficiency gains may be possible from the operation of multiple plants by a monopolist. A large company can hire specialists and share parts and repair crews and, consequently, if multiplant efficiencies continue to large enough scales, a competitive market would be less efficient than a monopoly.¹² Thus, if a monopolist can produce electricity at a significantly lower cost than the best competitive market, the introduction of competition would make little sense. Such economies of scale are most likely found in smaller power systems and the case for competition is not strong under such circumstances. For these reasons, the power sectors of Pacific DMCs and other smaller DMCs are organized as vertically integrated monopolies.

Nevertheless, for some small power systems, competition can emerge in the long run because of growth in demand and the size of the power system. In the meantime, a less ambitious competition in the form of single buyer arrangements, bilateral contracts, or management contracts could be pursued. Thus, regulation in smaller power systems will continue to play an important role in ensuring economic and technical efficiency. Regulation of private sector entities has also been found to be more effective and efficient than regulating public sector entities. Therefore, privatization of vertically integrated monopolies could result in efficiency improvements. Vanuatu is a case in point.

C. Public versus Private Sector Ownership

The conventional reason for privatization to accompany competition is the belief that it is impossible to sustain improvements in the performance of electric utilities as long as they remain in public ownership. It is also thought that competition is difficult to sustain in state-owned electric utilities and so there is a natural complementarity between competition and privatization. Newbery (1999) confirms that this has been the case for developed as much as for developing countries.

Although many developed and developing countries privatized when introducing competition, in the United Kingdom, the main goal of power sector reform was to transfer ownership to the private sector rather than introduce competition on the assumption that private ownership was the main source of efficiency. Newbery (1999) pointed to the experience of British Telecom and British Gas that were first privatized without restructuring and subsequently proved to have many of the same drawbacks of the public monopolies, with the added disadvantage that the government no longer had the power to order their reorganization and restructuring. The lesson learned from this experience was that privatization alone will not achieve the benefits of competition.

In contrast, in some Australian states, New Zealand, and Norway, the main goal was to improve efficiency through competition without necessarily privatizing electric utilities. The view taken in New Zealand was that competition between publicly owned electricity generators would be effective, given an appropriate business climate, and that full privatization is not required. However, competition had not made a significant impact on electricity prices in the wholesale market and some questions

¹² Joskow and Schmalensee (1983) discuss firm-level economies of scale.

have been raised about the effectiveness of competition between public sector companies. Competition in Australia and Norway lowered electricity prices, but the private sector in those countries is an important player in the wholesale market, thus competition is more effective.

Culy, Read, and Wright (1996) also noted that there has been evidence of political influence in the operation of state-owned companies in New Zealand. They suggest that the recruitment of good senior managers is more difficult for state-owned electric utilities because of the potential for increased exposure to public criticism. If some state-owned companies made profits while others lost, Newbery (1999) contends that the state might attempt to broker a more collusive and less competitive outcome to avoid such losses. State-owned companies may also be able to borrow financial resources on more favorable terms than private sector ones, resulting in an inefficient allocation of investment funds between them. State ownership may be used to secure political goals for the government or extract monopoly profits for the state.

The experience in Chile indicates that improvements in power sector performance may be more due to regulatory reform, specifically tariff reform, rather than privatization per se. Tariff increases dictated by the regulatory agency generate the resources required to operate and maintain a power system and for future investment to meet growing electricity demand, thus improving sector performance. Therefore, the quality of regulation may be a key determinant of performance, whether the utility is public or private. Nevertheless, there seems to be evidence that privatization prompts more effective regulatory reform and that there may be a better chance of high-quality regulation under private than public ownership (Newbery 1999).

Privatization and private sector participation has arguably been the most prominent element of power sector reforms for developing countries. For these countries, the private sector is an alternate source of investment to meet the future growth of electricity demand. Moreover, privatization of existing assets offers the prospect of significant proceeds for cash-strapped governments with large debts. Jamasb (2002) notes that during the 1990s total private investment in 75 developing countries amounted to about \$160.7 billion, of which 50 percent was earned from the divestiture of existing assets, 45 percent from investment in greenfield projects, and 5 percent committed under operations and management arrangements.

On balance, there seems to be little justification in maintaining state ownership of electric utilities that can operate effectively in a competitive market except, perhaps, in a transitional phase when legislation needs to be passed, regulatory institutions created, and interest group opposition overcome. The main arguments for privatization, even the regulated, monopolistic part, is that capital markets can still apply a competitive threat to inefficient management that encourages cost reductions and stimulates innovation (Newbery 1999), and that the public sector does not have sufficient resources to meet the future investment requirements of the power sector. Therefore, privatization should be an integral part of the reform process.

As in restructuring, the sequence of privatization of power system components is important. It should also start with distribution to further reduce inefficiencies in that function. Privatization of generation can take place after the structure, regulation, and ownership status of the distribution companies is clear. Privatization of the transmission system is less pressing and is often kept under public ownership. This has often been the case in developed and developing countries. Privatization of the components of the power system should ensure a wide dispersion of ownership because

competition is unlikely to develop properly between entities that are under common ownership (Bacon and Besant-Jones 2001).

D. Market Power

Some countries that restructured their power sectors to create a wholesale electricity market experienced difficulties in enforcing effective competition, for example, in the United Kingdom and the United States (specifically, California). A lack of competition leads to market power and can (i) reduce pressure to improve operational efficiency, (ii) limit customer choice, (iii) distort investment in new generation capacity, and (iv) discourage new entrants into the market. Several sources of market power have been identified: (i) insufficient numbers of competitors that encourage collusion, (ii) presence of dominant firms that promote oligopolistic behavior, and (iii) continued presence of vertical integration in which generating companies that own transmission or distribution discriminate against other generating companies.

The power crisis in California in 2000 demonstrated that even small power producers have market power in certain circumstances. Rapid economic growth in 2000 fuelled electricity demand but, at the same time, sufficient capacity was not being installed because of a cap on electricity prices. Demand became inelastic on the margin and thus, when a power producer removed itself from the electricity market when demand was near capacity, the price of electricity rose dramatically in response. Since there was no spare capacity to bring online, the price remained at the higher level to the financial benefit of the remaining power producers. In such situations, even small power producers could be endowed with market power.

To minimize the potential for market power, several measures have been suggested (in addition to ensuring sufficient numbers of participants and avoiding structures with dominant firms in wholesale electricity markets). From a technical perspective, an effective and well-functioning wholesale electricity market requires a robust transmission system that reduces congestion on the network and ensures a high degree of reliability (Borenstein, Bushnell, and Knittel 1999). Thus, sufficient investment in transmission should be encouraged, even to the point of overinvestment because underinvestment in transmission can be more costly when costs of regulatory responses to market power and high prices are taken into account. The blackout in northeastern United States and Ontario in 2003 demonstrated that underinvestment in transmission can have major economic impacts.

Borenstein (2002) suggests the use of long-term contracts that guarantee a predictable price for the bulk of wholesale electricity supplied, with the balance purchased from the spot wholesale market. Although, on average, a buyer of electricity through long-term contracts will not receive lower electricity prices than buying on the spot wholesale market, long-term contracts have a potential price-lowering effect in both the forward (contract) and spot markets if buyers purchase more electricity through long-term contracts. The basic idea behind this suggestion is that once a firm has sold some of its output in advance, it has less incentive to restrict its output on the spot market in an attempt to push up prices since it does not receive the higher prices on the output already sold through the long-term contract. In anticipation of more aggressive competition on the spot market, firms are likely to price more aggressively on the forward market as well.

To ensure that no generator exercised market power in the wholesale electricity markets in Argentina, Bolivia, and Chile, wholesale prices were based on generation costs under a merit order

rule rather than free and open bidding procedures.¹³ Under the merit order rule, the wholesale market operator ranks plants on the basis of short-run marginal operating costs and dispatches those with the lowest costs first. In a world of perfect information, no uncertainty, and perfect competition, this system of wholesale pricing would lead to the same efficient dispatch order as the bidding system. However, the real world is not perfect and the merit order dispatch system has some disadvantages. The main ones are disputes about the determination of marginal costs and lobbying the wholesale market operator to bend rules in their favor that alters the order of dispatch (Fischer and Serra 2000). However, Joskow (in Fischer and Serra 2000) points out that the situation in developing countries is far from ideal and given the problems that have emerged in bid-based markets in developed countries, it would be unwise for many countries to abandon the cost-based system without first dealing with the very significant market power issues that would likely arise under bid-based systems.

One of the reasons that electricity prices can be sustained at a high level where marginal capacity is constrained and market power is exercised is that the demand for electricity is insufficiently price-responsive, that is, the price elasticity of demand is low. Borenstein, Bushnell, and Knittel (1999) suggest that demand responsiveness to price movements can be improved by instituting real-time or time-of-use pricing at the consumer level. Stoft (2002) also recommends the use of real time pricing to improve demand responsiveness to price changes. In addition, Stoft suggests the use of distributed generation for increasing the price elasticity of demand, especially during peak periods of demand when market power is normally exercised.¹⁴

E. Regulation of Monopoly Components

Transmission and distribution are natural monopolies and regulation of these power system components is necessary and unavoidable. The purpose of regulation is usually to achieve two objectives: efficient production and lowest possible price of the regulated output.¹⁵ The most common and earliest form of regulation was ROR regulation and is found in most countries of the developed and developing worlds. Under the ROR approach, the regulated firm is allowed to earn a “fair” return on its investment in capital. The firm can freely choose its level of inputs and price as long as the chosen levels do not result in profits in excess of the fair return.

Although ROR regulation is simple, Averch and Johnson (1962) demonstrated that this form of regulation leads to inefficiency, namely, the regulated firm is induced to use an inefficient input mix,¹⁶ reduces incentives to lower costs, and there is less incentive to increase output (Averch and Johnson 1962, Baumol and Klevorick 1970). ROR regulation creates allocative distortions resulting from setting prices at average cost rather than marginal cost. It also discourages time-of-use pricing (Wellisz 1963). ROR regulation reduces the electric utility’s incentive to innovate (Bailey 1974, Sherman 1989). The task of regulation is complicated by the presence of informational asymmetry: regulators

¹³ The Philippines and Thailand also have plans to introduce the merit order rule in the wholesale market.

¹⁴ A detailed discussion of the benefits of distributed generation may be found in Lovins et al. (2002).

¹⁵ There are often other ancillary objectives such as consumer protection, quality of service, reliability, and environmental and social goals.

¹⁶ The presence of stranded costs as a result of restructuring the power sector in such cases as California and the Philippines indicates that uneconomic investments had been made in the past. Westfield (1965) also demonstrates that ROR regulation could result in “goldplating”, that is, investing capital with a marginal product of zero.

usually have less information about costs and demand conditions facing the firms they regulate than the firms themselves. This leads to complex and costly regulatory hearings to satisfy the public that the price of electricity being charged is fair. Regulation has also been associated with waste, mismanagement, missed opportunities, and other social ills (Posner 1969 and 1970).

The finding of Averch-Johnson gave rise to other regulatory procedures that provide firms with less incentive to be inefficient. The most recent innovation is “price cap” regulation¹⁷ where (i) the regulator sets a cap on the price level or, in multi-output situations, the price cap is a weighted average of prices; (ii) the price cap is subject to predetermined adjustments based on exogenous factors; and (iii) over longer intervals, the price cap is reviewed by the regulator. Perfect price cap regulation induces the firm to produce efficiently and, over the longer term, prices approach the Ramsey structure (in the case of a multiproduct firm). A substantial body of recent research finds that price-cap regulation is superior to ROR regulation in that many of the distortions associated with the latter are reduced or eliminated entirely (Beesley and Littlechild 1989, Weisman 1993). Although superior to ROR regulation, efficiency improvements under price caps are sometimes achieved at the expense of service quality. The regulator must ensure that this is avoided. The price cap approach to electricity pricing at the retail level has been used effectively in Argentina, Chile, and United Kingdom. Price caps are also used in Colombia, however, it has not been possible to assess their effectiveness because of the financial difficulties of the distribution companies.

A variant of the price cap is the revenue cap and one recommended by Train (1991) is the Vogelsang-Finsinger mechanism.¹⁸ Regulation takes the form of allowing the firm in each period to charge whatever prices it chooses as long as these prices, when multiplied by the last period’s quantities, equal the last period’s costs. This mechanism induces the regulated firm to move, over time, to Ramsey prices and outputs and, at the same time, improve efficiency. It is also simple, both conceptually and in implementation, and the information requirements by the regulator are minimal.

Beesley and Littlechild (1989) and Stoft (2002) point out that ROR and price-cap regulation are actually two opposite extremes of the regulatory spectrum. Perfect ROR regulation holds prices down to long-run costs (the lowest price objective of regulation) but takes away the incentive to minimize cost (the efficiency objective). On the other hand, perfect price-cap regulation provides incentives to hold down costs but price caps must be substantially higher than long-run costs to take into account uncertainties over the long term in the cost of inputs. In their efforts to simultaneously minimize costs and hold prices down to marginal costs, regulators must consider the trade-offs that exist between ROR regulation and price caps. As price caps are reviewed over shorter and shorter periods of time in an attempt to reduce prices and capture a larger share of efficiency gains for consumers, price cap regulation becomes more like rate of return regulation. Conversely, as the time between the ROR regulatory hearing and approval of a new set of prices that the regulated firm may charge increases (the regulatory lag effect), ROR regulation becomes more like price-cap regulation because firms have more incentive to minimize costs during that time period.

A third form of regulation, first proposed by Chadwick (1859) and later revived by Demsetz (1968), is temporary franchising, or competition for the market rather than competition in the market, as Joskow (1999) puts it. A franchise is periodically auctioned and awarded to the bidder offering the lowest price for the service. The incentives for efficiency are similar to those under price cap

¹⁷ Train (1991) provides a succinct overview of this form of regulation.

¹⁸ Originally published in Vogelsang and Finsinger (1979).

regulation but prices are also determined in a competitive process. However, under this system, if the assets are owned by the government, there is a need to ensure that the franchisee provides adequate maintenance. If all of a substantial part of the investment is financed by the franchisee, the challenge is to provide appropriate incentives for the operator to make the required investments, especially close to the end of the franchise period (Fischer and Serra 2000). Although this form of regulation could be an option for consideration, Joskow (1999) points out that the experience with franchise contracts for infrastructure services had not been good.

The regulation of monopolies may be approached in several ways, but not all are equal regarding information requirements for decision making, cost of the regulatory process, or effectiveness of the regulatory framework. In many developed countries, especially in North America, traditional ROR regulation is still found in most jurisdictions, primarily because there still has not been a broad, concerted effort to reform regulation in those jurisdictions. In Europe and Latin America, price cap regulation is generally the preferred approach. The choice of the regulatory system in countries where the regulatory system underwent significant reform largely favors price caps. In Asian countries, regulatory reform is still in its early stages and no firm decisions on regulatory frameworks have been made in most countries. Given the shortcomings of ROR regulation, it would seem that price or revenue caps would be the most cost-effective way of regulating power sector monopolies. Joskow (1999) also recommends that developing countries not use ROR regulation.

It is generally recognized that, regardless of the regulatory regime selected, the power sector can perform well only if regulatory institutions are in place to enforce rules and regulations consistently. This has not normally been a problem in developed countries but, in developing ones such as those in Asia and Latin America, regulators have not been equipped with the necessary skills and other resources to effectively carry out regulation, and have often been subjected to pressures from populist politicians. Thus, regulatory independence and regulatory capacity are two critical areas for effective regulation that must be addressed as part of any regulatory reform effort (Millán and von der Fehr 2003).

Regulatory independence may be hard to achieve. Regulation for balancing utility and consumer interests and monitoring and enforcing rules and orders could be alien to an environment that was previously highly politicized, as had been the case in Asia and Latin America. Millán and von der Fehr (2003) suggest that regulatory independence should not be viewed as a goal in itself, but rather the goal should be to achieve coherent and consistent regulatory decisions to ensure that industry and government do not act opportunistically. Although this requires a certain degree of regulatory autonomy, the regulatory decision process should be seen closed to arbitrary interference from political or other interests. Regulatory decisions should also be seen as being made on informed deliberations within the rules of law. The issue is essentially one of credibility and requires openness and transparency to make regulators accountable for their decisions. From surveys of East Asia, Jacobs (2003) concluded that the single most important characteristic of a regulatory authority was credibility.

VI. SUMMARY AND CONCLUSIONS

This paper reviewed the progress and experience of reforms in the power sector in ADB's DMCs and other regions of the world and assessed the direction that these reforms took, particularly with

respect to regulation, privatization, and competition. The review highlighted five key issues that need to be considered during the process of restructuring and regulatory reform. These are (i) competition versus regulation, (ii) restructuring the power sector, (iii) public versus private sector ownership, (iv) market power, and (v) regulation of monopoly components.

Many developed countries created competitive markets for electricity at the wholesale level, if not the retail level. Many Latin American countries are well advanced in the process. In Asia, some progress in restructuring and regulatory reform has been achieved in a few of the larger DMCs, but in most cases restructuring and regulatory reform has not yet started. The notable exception is Kazakhstan where a wholesale electricity market has been established.

The general experience with restructuring and regulatory reform has been positive with significant gains made in efficiency of operation, improvements in plant availability, and lower retail prices. Investment decisions in new generating capacity and the upgrading and expansion of networks have become more transparent as power sectors become more commercially oriented. Substantial investment in the power sector in the developed and developing countries has been made by the private sector, thus alleviating the public sector from some of this responsibility. The view that is becoming increasingly prevalent is that competition should be preferred to regulation and introduced where possible.

Nevertheless, experience over the past two decades has also shown that restructuring and regulatory reform is more complex than anticipated. Not all developed countries have enthusiastically embraced the concept of competition in the power sector—most notably Japan and some parts of Europe—for political reasons. There have also been difficulties in restructuring, such as the case of California, which has created a more cautious approach to restructuring and regulatory reform. Since the hurdles to restructuring and reform may be significant, governments must make a serious political commitment if progress is to be made.

In the developing countries of Asia, progress has lagged behind the rest of the world because most countries have had to restructure and reform technically and financially less efficient power systems with less developed private sectors, weak economic and political institutions, and shortages of capacity and regulatory experience. Nevertheless, firm plans for restructuring and regulatory reform have been made in some of the larger DMCs—Bangladesh, PRC, Philippines, Thailand, and Sri Lanka—with a view to establishing wholesale electricity markets. The speed with which these reforms will be implemented will depend on these DMCs' ability to overcome systemic obstacles and institutional shortcomings. In some cases, these issues will have to be regarded as given and reflected in the choice and design of the organizational structure of the power sector. Thus, international financial institutions such as ADB have important roles in promoting and assisting reforms in the power sector by clarifying the determinants of successful restructuring and regulatory reform and pointing out the risks of inappropriate approaches.

Restructuring to introduce competition has several requirements. The industry must have a sufficient number of firms with none dominant, allow free entry and exit, disallow collusion among firms, and exhibit no externalities. In developing countries with small power systems, economies of scale still exist and the lack of participants is often a major problem. Collusion will also likely exist, facilitated by entry barriers, market concentration, and capacity constraints. In such cases, significant restructuring and regulatory reform may not be feasible, so developing countries should strive for achieving gradual and less ambitious improvements in efficiency. Consideration may be given to adopting monopsony models, entering into bilateral contracts or management contracts.

As a last resort, some form of traditional regulation, such as ROR regulation, could be considered if the institutional capacity is developed and cost is not prohibitive. Regulation of private sector entities has been found to be more effective and efficient than regulating public sector entities. Therefore, efficiency improvements may be achieved from the privatization of the vertically integrated electric utility in the smaller DMC. International financial institutions such as ADB can assist DMCs with smaller power systems to design optimal organizational structures for their power sectors.

Experience with restructuring and regulatory reform has shown that the sequence of reforms is important. The recommended process is for the legal and institutional framework to be established first, followed by restructuring, with privatization at the end of the process. The practice in many countries was to begin restructuring with the generation component. However, many of the sector's inefficiencies are found at the distribution level. Unbundling the distribution function first and managing it as a separate profit center will eliminate many of these inefficiencies and provide a sound footing for restructuring of the generation and transmission components.

There does not seem to be a strong consensus regarding the issue of private or public ownership of the assets of the power sector. In Australia, New Zealand, and a few other developed countries, there is a view that the benefits of restructuring and regulatory reform may be achieved without the introduction of the private sector. However, the conventional view that state-owned firms do not have the same motivation to compete in an open market as a private sector firm appears to be still valid. Capital markets are effective in putting pressure on the management of private sector firms to be efficient and innovative. There also seems to be some evidence that privatization prompts regulatory reform, and that there may be a higher chance of high-quality regulation under private than public ownership. For developing countries, private sector investment in the power sector relieves the burden of financing power sector projects and enables the government to focus on more socially oriented objectives. Therefore, privatization should be integral to the restructuring and regulatory reform process.

Market power reduces efficiency, limits consumer choice, and distorts the allocation of resources. Too few participants in the wholesale electricity market or generators with dominant positions lead to market power and may discourage new entry into the market. There are several ways to minimize market power and avoid the high prices for electricity and excessive profits that result. Adequate investment in transmission will minimize congestion on the network and ensure reliability. Long-term contracts between generators and some electricity consumers for a substantial portion of the generator's output will reduce incentives to restrict output on the wholesale market and attempts to push up prices. In developing countries, a less sophisticated approach may be taken where wholesale electricity prices are based on generation costs under a merit order rule rather than through a bidding procedure. The threat of market power may also be minimized by increasing the price elasticity of demand for electricity by implementing time-of-use or real-time pricing.

Transmission and distribution are natural monopolies and the regulation of these power system components is often necessary and unavoidable. There are several ways that these monopolies may be regulated, the most notable being (i) ROR regulation, (ii) price caps, (iii) revenue caps, and (iv) temporary franchising. Although there is no preferred method by which to regulate, the regulatory approach should take into account the specific characteristics of the power sector in question, such as structure, informational requirements, cost, and institutional endowments. Whatever the form of regulation selected, the single most important characteristic of the regulatory authority

should be credibility to ensure openness and transparency for protecting the interests of the consumer and utility owner alike.

Restructuring and regulatory reform in power sectors are becoming common phenomena around the world. Restructuring and regulatory reform is a complex undertaking that has not always progressed smoothly. This paper provided an overview of the experience thus far in a number of select developed and developing countries and identified some of the more important issues. Restructuring and regulatory reform is still continuing in these and other countries and should be investigated in greater detail to provide perspectives and lessons. More research on this topic is still needed. As restructuring and regulatory reform progresses, there is also a need to institute monitoring and evaluation mechanisms to keep track of latest developments.

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