

Alternating Currents: Introduction to an International Review of Electricity Restructuring

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Abstract: The Indian electricity sector is poised at a critical moment. Implementation of the sweeping Electricity Act, 2003 is under way, even as there is considerable ferment in international thinking about electricity restructuring. This paper introduces a collection of papers written for EPW that review international experience with electricity restructuring in order to inform the Indian debate. The paper also provides a brief recent history of electricity restructuring to set the context for the country and regional papers. The history traces the initial rise of electricity restructuring to the status of “conventional wisdom” in the sector, and the more recent questioning of the model due to a series of setbacks and crises in different parts of the world.

I. Introduction

The past decade has been a tumultuous one for the Indian electricity sector. The winds of change that have swept electricity sectors worldwide have also buffeted Indian shores, bringing the promise of an entirely new framework and approach for electricity, but also considerable uncertainty and few short term results.

The short history is quickly told. The introduction of private players in electricity generation, in 1991, marked the first departure from state owned and controlled electricity. In the second half of the 1990s, numerous states began a more fundamental reform that involved dismantling State Electricity Boards (SEBs), “unbundling” them, and in two cases so far, privatizing portions of the former SEB. Critically, during this period state and central electricity regulatory agencies were set up in order to pass control over decision-making to regulators intended to be independent from political, commercial and consumer interests. Following three years of debate, the national Electricity Act, 2003 was passed, enshrining these various changes in a law, and providing a skeletal framework for further reforms that provided for, but only partially mandated, a shift toward an electricity sector increasingly organized around the private sector and competition. Since 2003, the challenge has been to implement the sweeping changes introduced by the Act through policies and regulations.

This synoptic account does not do justice to the significance and scope of the underlying paradigm shift introduced by electricity restructuring. From the economics of natural monopoly, the goal is now to subject portions of the electricity production chain to competition among multiple entities, opening the door to private participation. From electricity as a social policy and basic service to be provided by the state, electricity is now to be a commodity like any other, to be supplied on a profit or loss basis. India is part of a third wave to adopt the model – the first being early movers largely in the industrialized world and the second being other industrialized countries – and Indian policies and approaches are heavily influenced by the theoretical model and empirical results derived from international experiences.

This overview and the collection of articles that follows is intended to provide the basis for a debate over the international experiences that inform and have shaped India’s efforts at electricity restructuring. There are two reasons why such a debate is timely.

First, Indian electricity is poised at a critical moment. The Electricity Act 2003 has been passed, but policies and regulations that will put into place the vision of the Act are only now being formulated and implemented. And has been abundantly clear from other countries, the devil may indeed lie in the details.

Second, there has recently been considerable ferment in international electricity. The global momentum toward electricity restructuring was seemingly unstoppable through the 1990s, although there were always some who questioned the empirical and theoretical basis for the rapid adoption of the model. The stunning failure of the California electricity experiment in 2001, followed by a rapid succession of additional setbacks has provoked a round of deep questioning. Some analysts have argued that the recently identified problems can be fixed through modifications; others suggest they point to underlying structural problems with the approach. All agree that electricity restructuring is far more challenging to implement than anyone had originally imagined. These insights and debates urgently need to be discussed and factored into Indian policy making.

The papers that compose this collection were expressly written for the *Economic and Political Weekly* and are intended to contribute to a discussion of what global experience with electricity restructuring means for India. The papers cover a broad range of regions and countries. The UK and Norway were among the first countries to develop and adopt a restructuring model. In addition, many scholars and international consultants have emerged from the UK experience, making the UK model the closest to a global template. The US experience dominates global intellectual discussion, both because of the sheer volume of scholarly material produced, but also because its federal structure allows multiple and varying state level experiments. Latin America has easily the most advanced electricity markets among developing countries, and includes early movers such as Chile and Argentina. Sub-Saharan Africa provides the extreme case of electricity reform undertaken in highly problematic conditions, while the specific case of South Africa provides an interesting comparison to India, as a large, developing country facing comparable challenges. A review of South-East Asian countries sheds light on debates occurring within neighbouring countries also facing the challenge of powering rapid growth. Lengthy though it is, the collection is invariably incomplete. For example, discussion of experiences with early movers such as Australia and New Zealand would have been instructive, as too would have been discussion of China.

In addition to the country or regional papers, this collection includes a critical overview of recent international experience with restructuring, which follows this introduction. The overview draws on the papers in this collection but also additional material, and concludes with a reflection on what India might learn from international experience thus far.

In the remainder of this introduction, we first set the stage for the papers by documenting and explaining the rapid rise of electricity restructuring as conventional wisdom for the sector and also provide a working definition of “restructuring.” We then provide a brief summary of the various papers, to serve as an introduction for readers perusing the collection.

II. A Brief History of Electricity Restructuring

Within a short decade, driven primarily by the power of ideas, electricity restructuring has turned the staid electricity industry upside down. From an industry associated with predictable and stable, if unexciting performance, the electricity industry has become associated with investment boom and bust cycles, spectacular bankruptcies such as that of Enron, and headlines about social protests. Some would argue these changes have improved performance in the sector; others would contest that claim. In sum, the electricity sector has become both more complex and deeply controversial.

A Working Definition of “Restructuring”

The intellectual principle behind electricity restructuring is that competition should be introduced wherever possible in the sector. Its motivating claim is that competition is possible to a far greater extent in electricity than had previously been thought feasible. In practice, as described below, several other components of restructuring – corporatisation, privatisation, unbundling – are essential parts of the package, and many have become important quite independent of competition.

This vision stands in direct contrast to the earlier organizational logic of the sector. Vertical integration and central coordination (and hence often public ownership) were necessary, it was argued, because of scale economies (bigger generating plants are cheaper), the need for coordinated operation (to ensure reliability, efficient plant operation and dispatch, and coordination of generation and transmission), and natural monopoly dimensions of networks (it only makes sense to lay one set of transmission and distribution wires) [Michaels 2004]. From a restructuring perspective, scale economies are less important than before, coordination can be better performed by the market, and network elements can continue to be subject to regulation, albeit with performance incentives. In reality, the debate about these two models is far more complex.

The end point of restructuring allows multiple electricity generators to sell electricity to multiple buyers – either final consumers or distributing companies – through open, but regulated, access to transmission and distribution wires. Advocates argued that restructuring brings considerable efficiency gains by: shifting decision-making from regulators with imperfect information to market participants exposed to price signals; shifting investment risk from consumers who have no control over exposure to risk to investors who do; giving consumers incentives for efficient consumption by exposing them to the true price of electricity they consume; and encouraging innovation and dynamism through competition and choice [Hunt 2002; Joskow 2003b; Van Doren and Taylor 2004; Malloy 2005].

Electricity restructuring has, over time, coalesced into a “standard model” composed of several steps.² Most fundamental is “restructuring” of existing utilities to create the entities that will compete in a market: “vertical unbundling” creates separate generation, transmission and distribution components, while “horizontal unbundling” creates multiple and competing entities in each market segment [Al-Sunaidy and Green 2005; Joskow 2003a]. A parallel set of management changes – commercialization and corporatisation -- and potentially ownership changes – privatization -- proceed in parallel to prepare incumbent utilities for the world of competitive markets [Hunt and Shuttleworth 1996]. In India, this process has taken the form of dismantling and

restructuring State Electricity Boards (SEBs) and has been the most visible face of electricity reform.

Since the number of entities created from unbundled incumbent utilities may be insufficient to ensure adequate competition, “liberalisation” of the sector to allow free entry to the sector is an additional necessary step [Al-Sunaidy and Green 2005].³ Where there is a prior history of regulated utilities (notably the U.S.) “deregulation” is also necessary, but as many observers have pointed out, “re-regulation” is a more accurate term, as portions of the sector - notably access to transmission and distribution wires -- remain under regulation [Teplitz-Sembitzky 1990; Al-Sunaidy and Green 2005]. Finally, critical market and technical system coordinating institutions, such as spot markets and system operators, are required to manage coordination tasks.

The terms discussed above -- restructuring, electricity liberalisation, and deregulation -- are often used interchangeably to describe facets of the same underlying process. Often the omnibus term “electricity reform” is also used to describe this transition. For the purpose of this paper, we will use “restructuring” to convey the larger process of deepening competitive processes in electricity.

Finally, the standard model of electricity restructuring reviewed above is, in reality, an intellectual construct that pulls together disparate and varied national experiences into a single cogent model and prescription. In practice, countries have groped their way piecemeal toward competition in electricity, driven by global forces and national circumstances.⁴

The Early Drivers of Restructuring

The conventional wisdom of vertically integrated public power give way in a little over a decade to the radically different vision of restructuring and competition for at least three complementary and intersecting reasons. The rise of neoliberal economic policies in the 1980s shrank the scope of the state and unfettered markets and the private sector as the basis of a new globalized economy. These ideas were sharpened by international financial institutions such as the World Bank into a “Washington Consensus”, and spread to the developing world largely through policy-linked lending [Haggard and Kaufman 1992; Williamson 1994]. Over time, the restructuring model came to be wrapped into the larger fold of neoliberal economic reform.

Second, patterns of electricity demand and supply changed, which undermined the centralized public utility model. Electricity demand tapered off in the industrialized world, undermining the predictable sources of income on which utilities had relied [Rosenzweig and Voll 1997] even as costs and risks in the sector rose due to growing regulation, heightened environmental consciousness, and burdensome investment in high capital cost nuclear plants (particularly in the U.S.) [Patterson 1999]. Electricity supply was radically changed by the emergence of small, cheap and modular gas turbine based electricity generation technology, which reversed a decades old trend toward greater economies of scale in electricity generation [Hunt and Shuttleworth 1996]. Simultaneously, even as the rapid growth and declining costs of information technology made possible control techniques necessary for decentralized electricity and competition [Graham and Marvin 1995; International Energy Agency 1999].

Third, these factors intersected with country specific drivers to introduce a series of key innovations at the national level in various countries, which coalesced over time into a standard model of restructuring. In 1978, the US passed the Public Utilities and Regulatory Policies Act (PURPA) requiring utilities to purchase electricity from non-utility generators at “avoided cost” thereby creating “Independent Power Producers” [Williams and Dubash 2004; Al-Sunaidy and Green 2005]. In the early 1980s, Chile created the first wholesale power market in an attempt to fix its run-down electricity sector [Pollitt 2004]. However, arguably the real benchmark for electricity markets was the UK’s “power pool” established in 1990, and driven largely by Thatcherite ideology in favour of markets [Newbery and Green 1996; Al-Sunaidy and Green 2005].⁵ At around the same time, Norway experimented with an electricity markets but without privatization, providing an example of competition largely among public entities [Midttun and Thomas 1998].

Well before these models were fully put into practice, and certainly before results became clear, the propagation of electricity restructuring as a model worth replicating had begun.

The Propagation of Electricity Restructuring in the Developing World

Reforms in the industrialized world took place in the context of well functioning electricity systems providing reliable power to all on a financially viable basis [Dubash 2002; Williams and Dubash 2004].⁶ By contrast, the developing world faced quite different problems: public debt in Latin America, capacity shortfalls in Asia, low levels of electricity access in Africa and South Asia, and crumbling facilities and mismanagement in many different countries [Dubash 2002; Williams and Ghanadan 2005; Williams and Dubash 2004; Karekezi and Kimani 2002]. Electricity restructuring was certainly not designed to solve these problems of the developing world, but to squeeze greater efficiency out of essentially well functioning systems. Nonetheless, the model spread rapidly to the developing world driven by the drying up of public funding for electricity, the growing availability of private financing and the available ideology of electricity restructuring to provide a template for reform.

In 1993, a new World Bank policy explicitly required countries to encourage private investment, corporatise state agencies, and establish independent regulators as conditions of continued funding [World Bank 1993]. This new policy all but foreclosed the option of fixing public power.⁷ Meanwhile, private capital flows to the developing world were growing at an unprecedented rate during what Joseph Stiglitz (2003) has dubbed the “Roaring Nineties.”⁸ For example, companies such as AES and Enron faced flat demand at home and aggressively sought new opportunities overseas, often backed by their home governments.

For cash-strapped developing countries seeking to get into the act, liberalization of the electricity sector was essential for foreign investment. And restructuring, in turn, quickly became a litmus test for foreign investors. Latin American countries adopted the entire model at once, while in Asia the more typical pattern was to liberalise sub-sectors of the industry in stages. By 1998, a World Bank survey of 115 developing countries found that 44% had corporatized, 33% had passed a new electricity law, 29% had established a regulator, 40% had allowed the entry of IPPs, 35% had restructured and 18% had allowed private distributors [Bacon 1999]. By 2004, a subsequent survey of 134-138 developing

countries (depending on the question) showed that 51% had an independent regulator, 47% allowed private participation in generation, and 36% allowed private participation in distribution [Estache and Coicoechea 2005].

By 1997, investment in the electricity sectors of the developing world spiked to an astonishing \$40 billion a year (see Figure 1), a figure about equivalent to total volumes of development aid for all purposes before collapsing in the aftermath of the Asian financial crisis of 1997, and only partially recovering since. Latin America and East Asia attracted the most money, while South Asia was a relative laggard.

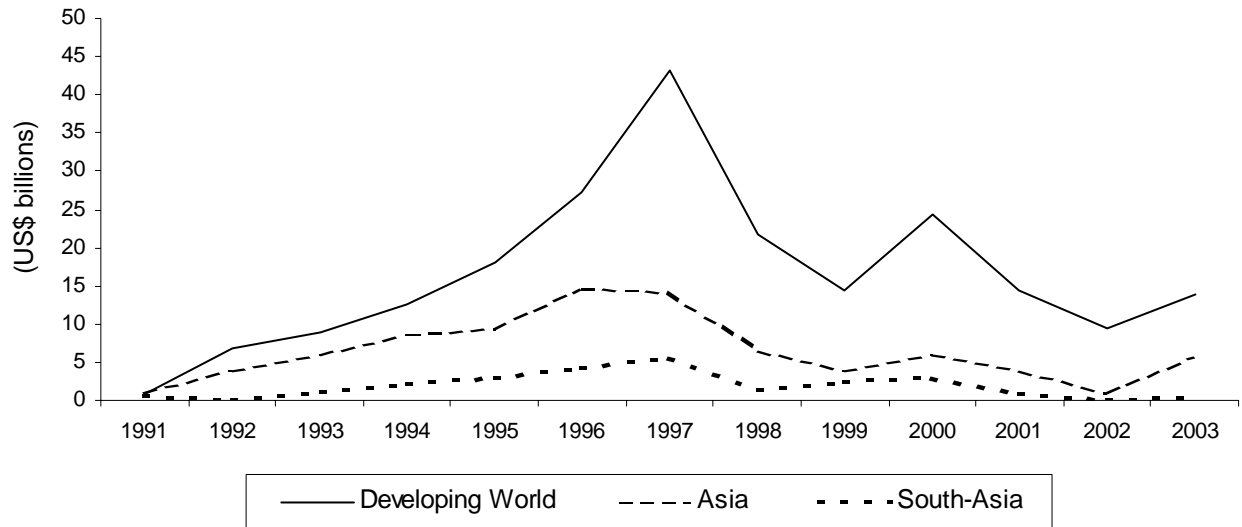


Figure 1. Private Investment in Developing World (Non-OECD) Electricity Sectors.

Source: World Bank, *Private Participation in Infrastructure Database*, (Available at <http://ppi.worldbank.org/> accessed on 13. 06. 2005)

The failure of private flows to return to the heights of 1997 suggests the relationship between restructuring and investment finance has weakened since the mid-1990s, and perhaps appropriately so. While many developing countries were undoubtedly cash-starved, and the logic behind attracting private capital was compelling, private capital increasingly became an end in itself, rather than a means to a more effective and viable electricity sector.

“Horsemen of the Electricity Apocalypse”

Until the early 2000s, most reviews of experience with electricity restructuring concluded that restructuring had realized at least some of its promise in terms of efficiency gains from privatization, mobilization of capital, and performance of wholesale markets [Joskow 2003b; Hunt 2002; Newbery and Pollitt 1997].⁹ By mid 2005, however, the weekly newsletter of the US-based Centre for the Advancement of Energy Markets (CAEM) sombrely invoked the “Four Horsemen of the Electricity Apocalypse” to describe what they believed to be the inhospitable climate for electricity restructuring in the US. In the original biblical reference the four horsemen are plague, pestilence, drought and death; in the electricity version they are the California crisis, the collapse of the Enron corporation, an enormous black out in the North East US in August 2003, and

high, volatile energy prices [Center for Advancement of Energy Markets 2005]. Countries ranging from the UK, to Norway, to Brazil had experienced setbacks or complications of various sorts that complicated the early assessment of electricity restructuring.

The set-backs of the early 2000s have brought about reflection on the costs and the benefits of the restructuring model and even outright dissent.¹⁰ Chao et. al. (2005) suggest that there are pros and cons to both liberalized markets and vertical integration, and propose a “third way” that seeks to draw on both. On consideration of the various problems that restructured markets have demonstrated, Lave et. al (2004) conclude these problems can be fixed, but doing so may make the costs greater than any presumptive benefits. Most startlingly, the libertarian Cato Institute has entirely disavowed electricity restructuring and advocated that “...states that have already embraced restructuring... return to an updated version of the old, vertically integrated, regulated status quo” [Van Doren and Taylor 2004].¹¹ Indeed, since 2000 no new US states have introduced reforms, while nine states that had planned to do so have cancelled or scaled back their programs [Joskow 2003a]. While the issue is by no means resolved, and there remain staunch advocates, there is little doubt that by mid-2005, there is far greater realism and debate about both the underlying assumptions of electricity restructuring and the implementation challenges than just a few years earlier.

California was certainly the single largest dent in the image of restructuring.¹² For many observers, the problem with California was one of flawed design [Joskow 2001; Economist 2001c; World Bank 2001]. For others, the real conclusion from the mis-managed transition and rampant market power of deregulation in California is, ironically, that there is a powerful rationale for regulation in electricity markets [Duane 2002]. While California by no means showed that restructuring would always go bad, it did show that it could, even with a robust policy-making apparatus and enormous state capacity, and that the costs could be immense.

If California showed the potential for market power in electricity markets, Enron provided a public face to those ready and willing to exploit it. Enron paid millions of dollars in lobbying and political contributions to create electricity markets [Wayne 2002], and then devised the cutting edge strategies to make money in these markets [Banerjee et al. 2002].¹³ As the Chairman of the Federal Electricity Regulatory Commission commented on the experience with Enron and other firms, US regulations had “a long way to go” to match the sophistication of the companies it regulates [Gerth 2001].

Other parts of the world, including countries cited as success stories, have their own versions of the “horsemen”. The much vaunted UK Power Pool, arguably the single most revolutionary change from the old model of electricity, was replaced by a new arrangement that relied largely on bilateral trades, even as many developing countries around the world were planning to replicate the UK pool [Thomas this volume]. In Norway, widely considered an improvement on the UK, the system was stretched to its technical and political limits by a price spike of 600% over a four month period in 2002-2003, suggesting political limits to using markets and high prices alone as a means of ensuring adequate capacity [Finon, Johnsen, and Midttun 2004]. In Italy a massive blackout in September 2003 that impacted almost the entire population of 57 million

people was attributed in part to issues related to trading electricity across borders and technical requirements of electricity trades [World Energy Council 2003].

In 2001 Brazil recorded perhaps the most severe crisis in attempting a transition to competitive electricity markets, which required emergency measures at conservation and a severe rationing system [Millan this volume]. In much of the developing world nervous governments are giving restructuring a second thought. Driven by a range national concerns as diverse as stability of supply and rural electrification that policy-makers feel will not be met under a restructured environment, countries such as South Africa [Eberhard this volume], South Korea [Byrne et al. 2004], and Indonesia [Saraswati 2004] have either shelved restructuring or put their efforts on hold.

This litany of set-backs points to an underlying change in perception and in the nature of the debate over electricity restructuring. Prior to 2000, the professional literature focused on when restructuring would occur, and how it was to be accomplished. After the stuttering performance of the model in several countries, the debate has increasingly focused on the relative costs and benefits of restructuring, the nature and degree of the transition challenges, and more open questioning of whether the costs outweigh the benefits in some situations. This more complicated and more critical debate, which is surveyed in the overview paper that follows, is the context within which the papers in this collection have been written.

III. A Brief Introduction to the Papers

The authors are deeply rooted in the countries and regions they write about, and are active participants in their national or regional debates. Each was requested to cover a common set of themes:

- the core of the reform approach followed;
- the outcomes in terms of efficiency, and gains or losses to different consumer classes;
- the measures taken to manage competition and the success or failure of those efforts;
- the biggest challenges faced thus far, and the biggest challenges looking to the future.

For each region or country, there is certainly no single point of view on these four themes. The viewpoints presented here are the authors own, but they were also requested to cite or note alternative points of view. The short profiles below offer a brief snapshot of what are rich and complex case studies.

Thomas (this volume) casts a sceptical eye on the often-cited success of the British experiment. Far from a competitive structure, he finds that the industry is best characterized as “an oligopoly with a veneer of competition.” Moreover, the highly innovative auction-based “power pool” failed to establish a competitive wholesale market, leading to its replacement in 2001 by a system organized around bilateral contracts. Instead, market arrangements have benefited large customers whose gains have come at the expense of small customers. Finally, although electricity prices have decreased since reforms, these gains owe more to effective regulation of the monopoly segments than to the impact of competition. Thomas’ paper succinctly captures both the

challenge of designing electricity markets and the complexities of assessing their performance.

Blumsack, Apt and Lave (this volume) provide a succinct but highly evocative account of the complex efforts at electricity restructuring in the U.S. They describe how high expectations have collided against a far more sober reality, leaving about two thirds of US states still regulated and refusing to start down the path of electricity deregulation. In addition to the disastrous example of California, the US has experienced a boom and bust cycle in merchant generation, that has left private investors leery of entering the generation market and that has undermined competition in wholesale and retail markets. Ensuring adequate transmission investment also continues to be a puzzle. Mirroring the experience in the UK, large industrial consumers have benefited more than small consumers, but even in their case, regulated states appear to have outperformed deregulated states. Blumsack et. al. take away the lesson that in electricity, markets have too often been an end in themselves rather than a considered means to a larger end.

Bye and Hope (this volume), both of whom have been closely involved with the Nordic market (Norway, Sweden, Finland and Denmark) provide a detailed account of market design, highlighting the unique features of the Nordic market. Examining price data since market inception, they find that deregulation has indeed exerted downward pressure on electricity price. Looking to the future, they identify incentives for investment in new capacity, investment in networks, and the potential for exercise of market power as potential problems that will challenge the market. Finally, Bye and Hope discuss an extreme energy shock in 2002 caused by a drought. Prices rose steeply, leading to some public and political unrest, but the system weathered the shock much as it had been designed to do.

In the developing world, Latin America stands out as a region where optimism about restructuring remains robust, although dented by the Brazilian electricity crisis of 2001. As Millan (this volume) describes, early reforms such as Chile and Argentina recorded efficiency gains and price reductions. However, these gains have not been evenly distributed – large consumers have benefited disproportionately -- undermining political support for privatization-based reforms, which remains low in much of the region. Market concentration, regulatory challenges, and security of supply remain major concerns. Finally, the challenges and potential downside risks of restructuring were dramatically highlighted by a major electricity crisis in Brazil in 2001, which led to emergency conservation and rationing measures. If there is a single lesson from Latin America, it is that of pragmatism and caution: despite some successes, reform design needs to better match existing institutional conditions and constraints.

The partial successes reported from Latin America are largely missing in Africa. Wamukonya (this volume) notes that reform efforts have failed to attract the necessary capital to the sector, a problem perhaps compounded by a global downturn in investor interest in the sector following the late 1990s. Competition has been even more elusive under African conditions, with private monopolies replacing public monopolies in some cases. In an effort to attract capital and get the sector on an even footing, tariffs have gone up, but commensurate increases in service quality have been elusive. However, rural electrification is increasingly being integrated into reform efforts, a step in the right direction.

Of all African countries the conditions are most ripe for restructuring in South Africa because of a larger commitment to economic reform. However, Eberhard (this volume) reports that after initial steps in this direction South Africa has all but scrapped the idea of introducing competitive wholesale markets in electricity. Facing a looming power shortage, driven by concerns about rural electrification for historically disadvantaged black populations, and with an overwhelming concern for security of supply, South Africa has scaled back its plans to reform the sector, and has fallen back to greater reliance on the public monopoly provider, Eskom. While private investment may be possible in the future, it will likely be in the context of public-private partnerships, and efforts to reform Eskom will likely operate within the framework of a “hybrid market” where the state remains dominant.

The ASEAN region also remains largely moored in state control over electricity. Sharma’s (this volume) overview of reform in Indonesia, Malaysia, Philippines, Thailand and Vietnam tells a larger story of ambitious reforms initiated, only to be stalled or halted in the face of domestic political pressures such as opposition from parliamentarians, opposition from unions, and public disquiet. In at least one case, Malaysia, the California crisis had an explicit chilling effect on national policies. In all these countries, caution now seems to be a watchword, with the state only cautiously releasing its control, if at all. Sharma argues that the lack of political viability of reforms is partly due to the underlying reform vision itself, and the lack of correspondence between the socio-political and technical realities of the region and the electricity market model.

As the papers show, some authors approach the topic with an underlying optimism about the future of electricity restructuring in their country or region, while others view the shortcomings in a far more pessimistic light. What is striking, however, is the degree to which all authors highlight the enormous complexity of the task and the steep challenge involved in re-making the electricity sector around the model of competition and choice.

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² Hunt and Shuttleworth (1996) remains a standard and highly referenced, if now somewhat outdated, handbook of the standard model.

³ Conversely, liberalisation without unbundling may be ineffective as unbundled, typically large, incumbents may have the ability to discriminate against newcomers.

⁴ Midttun and Thomas (1998) illustrate this point nicely through a comparison of the UK and Norway experiences.

⁵ By all accounts, the decision to privatize power and create markets was largely ideologically driven, and preceded any real sense of how this was to be accomplished [Midttun and Thomas 1998]. Indeed, UK reformers are candid that even as they introduced the model, they had no clear idea how competition in electricity should be established [Hunt and Shuttleworth 1996].

⁶ As a developing country, Chile was the exception. But even in Chile, the conditions were far better than in other parts of the world which faced quite a different set of problems

⁷ An internal evaluation ten years later concluded that in reality the policy became a mandate to advocate privatization [Manibog et. al. 2003].

⁸ Stiglitz describes the 1990s as a period of unprecedented capital flows, financial market deregulation, new commercial interests, and aggressive persuasion by Northern governments.

⁹ There were also some early critics, such as Watts (2001) and Rosen (2001).

¹⁰ Academic articles now have titles like “The Shocking Truth about Restructuring ...” [Costello 2003] “Deregulation: Magic or Mayhem” [Blauvelt 2004] and “Rethinking Electricity Deregulation” [Lave, Apt, and Blumsack 2004].

¹¹ The CATO Institute couched this conclusion in a broader overarching statement that the first best solution would be “total abandonment of restructuring and a more thoroughgoing embrace of markets” but acknowledge that such an approach is politically difficult.

¹² The brief history is as follows: A key provision in a 1996 restructuring plan froze retail rates for a fixed period and allowed wholesale electricity rates to vary. The assumption that competition would drive down wholesale prices and allow utilities to recover their “stranded costs” – prior investment in high cost plants that would be uneconomic in the new regime. Instead, a combination of drought-induced power shortfall, higher than expected demand, and high gas prices led to wholesale prices that soared beyond retail prices. By the peak of the crisis, wholesale prices often hit the price cap of \$750 /MWh within California, and rose to more than ten times this amount on the bilateral market outside California. However, utilities were forced to sell electricity for \$65/MWh and were losing some \$50 million per day. While manipulation of the electricity market had long been suspected, only long after the crisis did the full extent of this manipulation come to light. The crisis effectively ended only after enforcement of price caps, the effective nationalization of the industry, and additional public debt of \$40 billion due to power purchases by the State of California on behalf of the utilities. The following are a short list of commentaries on the

California electricity crisis: [Harvey, Paulos, and Heitz 2001; Reddy 2001; Duane 2002; Joskow 2001; Economist 2001b; Sharma 2001; World Bank 2001; Borenstein 2002; Bushnell 2004; Muller 2004; Hoge and Coyle 2003].

¹³ In the wake of California, Enron was found to be involved in widespread manipulation of power markets, such as shutting down plants and creating transmission congestion to artificially create shortages only to sell power later at far higher prices [Egan 2005]. Leaked memos and tapes caught Enron employees gleefully gloating about creating power shortages and joking about stealing money from “poor grandmothers.” Enron went into financial free-fall soon afterwards, driven in part by these disclosures but also by an accounting scandal which revealed the extremely weak base on which it was juggling considerable financial risk [Economist 2001a]. Most of the other energy firms who were culpable in the California crisis are in bankruptcy or have left the power business.