

The Power Sector in India: An Inquiry into the Efficacy of the Reform Process



Saugata Bhattacharya

UTI Bank Ltd.

and

Urjit R. Patel

Brookings Institution

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Saugata Bhattacharya
UTI Bank Ltd.

Urjit R. Patel
Brookings Institution

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Abstract

The distribution segment of the Indian power sector – dominated by state government-sponsored utilities – has, after reaching a point of near collapse in 2000, reportedly undergone a transformation at the aggregate level, with an improvement in revenues and a reduction in technical and other losses. State government fiscal burden on account of the power sector has eased by some measures, although it continues to be high. The turnaround has broadly coincided with the introduction of financial and structural initiatives comprising debt rescheduling, incentive/penalty based schemes, and pro-reform legislation.

Within the general improvement (by some measures), we find that there is significant dissimilarity between states and utilities in performance and related top-level factors that influence outcomes. The paper deploys data on various parameters of utilities' operations – average revenue realisation, collection efficiency, composition of demand, tariff changes, power units input, cost of supply, physical losses and others – to get an indicative validation of the reform initiatives. The variability in performance has also increased over the last few years. In this context, the paper seeks to construct an Index that captures the migration in "Revenue Orientation" of individual utilities between 2001-02 and 2004-05.

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1. INTRODUCTION

The infrastructure deficit in India is immense, and in some sectors growing. Over the years, provision of essential but uneconomical services has become so vitiated by patronage mongering and political interference that, far from the laudable objectives of universal service coverage of the original programmes, these have become a fiscal millstone around the government's neck. This is especially true of the power sector.

India is power stressed. The increasing vibrancy and flexibility of the Indian economy is not matched by the power sector, which continues to be mired in mismanagement and poor governance. Experience and casual empiricism is vindicated by analysis that suggests electricity supply by government monopolies is the most important (infrastructure) constraint on overall economic growth, and is significant in growth regressions and investigations of FDI determinants (Virmani [2005]). Based on a firm level survey, it is estimated that for manufacturing firms the cost of private electricity is 24 percent higher than that of utility supply; 69 percent of firms have their own generators; and output lost due to power outages is 9 percent (World Bank [2002]).¹ One of the startling patterns to emerge is the sharp deterioration of energy adequacy, both at base and peaking periods. Given the recent record (say, over the 10th Plan), projections for the future, *prima facie*, would make the task of closing the gap between demand and supply appear almost insurmountable.

The sector is dominated by government-owned behemoths at both the national and state levels; 88 percent of utility-based power is produced by government generators (state government generating plants account for close to 60 percent of total installed utility capacity in the country), and transmission is almost entirely within the public

¹ It was recently reported that a major Indian tractor manufacturer lost production of 400-500 vehicles during February 2007 due to power cuts. One of the most important industrial centres in the country, Pune in the western state of Maharashtra, is deprived of power for its industrial consumers for an entire day of the week as scheduled load shedding. Implementation of daily 4-5 hour power cuts in Punjab will affect 430 steel rolling mills around Gobindgarh which accounts for 23 percent of the country's total production of 40 million tonnes; consequent fears of low production have contributed to the likelihood of a Rs. 500/tonne hike in price of rolled steel.

sector.² The *cash-generating distribution segment* – where responsibility for supply, billing and collection lies – is almost completely under the ambit and ownership of respective state governments (through State Electricity Boards (SEBs) or state government distribution companies (discoms))³. Private distribution is limited to Delhi and some parts of West Bengal, Maharashtra, Gujarat and Uttar Pradesh (U.P.). In the seventh year of the millennium, astoundingly, some power utilities still have single-entry book-keeping practices. Despite the sorry state of affairs, the inadequacy (until recently) of the commercial aspects of the sector that has “seized the attention” of decision makers is particularly bewildering. The clear and present problems in the distribution segment notwithstanding, the tone of official discussions remains skewed towards generation capacity. Each year, for instance, the Economic Survey devoted more than two thirds of the section on power on generation, transmission and “super critical technologies”, while relegating the remaining third to distribution.

Having said this, it is not that there has been lack of application of mind on the issues, or, paucity of strategies for addressing problems. Task forces, working groups and committees constituted by the central and state governments have, for the most part, proffered well-argued policy alternatives over the last decade.⁴ Specifically, the central government’s policies in early 2000s attempted to galvanise state governments to tackle mounting losses in the sector. The one-time settlement (OTS) scheme of SEB dues to central government-owned public sector units (recommended by the Expert Group on Settlement of SEB Dues (GoI [2001]), linked the capital restructuring of SEBs to a set of incentives and penalties. To ensure that the OTS remained precisely that, measures to accelerate state level reforms by rapidly restoring and then sustaining the financial viability of the power sector were considered important by the Empowered Group of (State) Ministers. Arising out of the OTS Scheme, the Accelerated Power Sector Development and Reform Programme, APDRP (recommended by the Expert Committee

² India has the fifth largest installed capacity for electricity – about 1.4 GW – in the world. Jurisdictionally, on matters of policy and regulation, the sector is divided – but clearly demarcated – between the Union and the state governments (see Chart A1 in the Appendix).

³ These are *de facto* an extension of the respective state government.

⁴ Report of the High Level Committee on Escrow Cover to IPPs prepared at the behest of the Government of Karnataka in February 2000 was probably the first official undiluted statement of the centrality of the distribution segment in restoring the sector’s health.

on State-Specific Reforms (GoI [2002])), has also become a landmark intervention. The central government, in addition, made an admirable effort to prod the states towards meaningful reform to infuse the sector with competition and efficiency by legislating the Electricity Act 2003 (EA), first introduced in Parliament in [2000]. In the aftermath of the reform measures instituted after 2000-01, various states have gone about their individual trajectories in terms of the operational steps to increase revenues and reduce losses. Some have been more assertive and changed the market structure of the sector.

Have the measures had the desired effect? In fact, it has now been several years since various (systemic) institutional initiatives were introduced to reform the state-dominated sector, hence (arguably) an apposite juncture to weigh their effectiveness. The perception of improvement in the sector five years into the reform process has received a jolt in recent months, with widespread shortages of power being reported from many industrialised states (which is now substantiated by official data). If the actions of recent years had more than a marginal effect, there would have been a respectable inflow of investment in the sector, especially given the projections of economic growth over the next couple of decades. Unfortunately, this does not seem to be happening. The majority of the (already inadequate) additions to generation capacity is in the public sector. Independent Power Producers (IPPs) have been attempting to achieve financial closure for their generation capacity plans, but continuing doubts about financial viability ensures that due diligence and related activity drags on. The evidence of the decrepitude and shortages are most startlingly demonstrated by the power cuts that have begun to creep into the island city of Mumbai like a malignant growth, to use a simile of cancer. For long having been “islanded” from the Maharashtra State Electricity Board’s distribution system, with standby charges levied on private suppliers of power to the city, this exclusivity is now about to end. One of the showpiece reform initiatives, the APDRP, has manifestly failed to achieve the desired objectives, with a committee having submitted a Report on Restructuring of APDRP (GoI [2006b]). These are not the signatures of a major sector turnaround.

The paper shows, *inter alia*, that the reform actions have not, by and large, resulted in the improvements in cash flows and revenues that would have given potential investors comfort about the debt service cover ratios of the utilities which are the buyers

of the IPPs' generation. But this is only one part of the story; turning a behemoth around financially is arguably likely to take some time. Has there been a change in the intrinsic functioning of SEBs over the period of reforms that is likely to induce profitability and keep the sector consistently remunerative? At a deeper level, the main objective of the multiple policy interventions had been to impart a "commercial orientation" to discoms (and SEBs), in order to ensure that the discoms utilised the transfers from the centre to the states in a financially productive manner and, moreover, capitalised on the leeway in terms of improved market structures and regulatory efficiencies to make the financial improvement sustainable and lasting.

To our knowledge, no exploration of the panel data of SEBs/discoms on the outcomes and key economic & financial parameters that indicate the effect of reform steps has hitherto been available in the public domain; towards this, inter-utility comparative analysis of high-level financial/commercial indicators is attempted. An important pivot of this objective is to quantify the unstructured concept of "commercial orientation", allowing for the development of a summary statistic on which utilities/states may be compared. In the process of this construction, the paper endeavours to decipher broad patterns in the components of the "Data Generation Process" of commercial operations of the power sector, while tracking changes since the inception of the reform process after the near breakdown in 2000-01. Throughout, the paper attempts to sensitise the reader to the immense fiscal and financial challenges and the institutional complexities involved in the reform process.

It is important to also delineate what this paper does NOT attempt. It does not deconstruct the microstructure of the reform process. The economic and financial logic for establishing appropriate market structures, restructuring of liabilities, tariff principles, process flows and regulatory oversight have been charted, largely through detailed case studies, by multilaterals, international development agencies, Indian academic institutions, consulting agencies and others; they have analysed these actions for certain key states at the inception of reform and designed road maps, identifying the exact steps needed to transition towards financial viability.⁵

⁵ See *inter alia*, IDFC [2001], Patel [2004a, 2004b], World Bank [2007] and references therein.

A literature has built up which explains the arcane technical minutiae of operational and financial elements of the power sector (see NTPC [2006] and GoI [2006b]). These relate *inter alia* to administrative measures (e.g., human resource management, including details like the designation of circle-in-charge as CEO, re-labeling of Junior Engineer as feeder manager, establishment of special courts for energy theft, and so on), technical parameters (whether a 33 kV line results in lower transmission losses than an 11 kV line, the rate of transformer burnout, the advantages of electronic supply meters, IT enabling with data logging, etc) and commercial issues (energy audits, metering, etc.).

Another strand has explored the details of financial engineering that must accompany the restructuring of the power supply system; these include the restructuring and treatment of existing liabilities, included unfunded one such as pensions, unbundling and power purchase systems, including decisions on whether the purchase should be via the transmission company in a single buyer model (see Tadimalla [2000, 2001] for extensive analysis of these processes). A third stream has looked at regulatory issues, including the impact on tariffs and accounting principles accompanying the restructuring (see TERI [2007] for a recent treatment).

All of this is beyond the scope of the paper, both from the viewpoint of feasibility and desirability. The former is almost self-explanatory; the power sector is one of the most operationally complex with characteristics that vary even in contiguous areas and the reform experience has been richly varied. The desirability of looking beyond these details relates to the evaluation of the effectiveness of the various steps to enhance revenues and reduce losses, among other indicators. This emphasis is important since it is the outcome of the multiple actions taken by utilities and regulators that ultimately determines the status of the financial viability of the sector, not the actions *per se*.⁶

As for the methodology used in investigating the effect of the drivers on performance outcomes, the paper does not dwell on statistical relationships between

⁶ The anecdote of the Chief Minister of a state prominent in the power sector reform radar directing utilities to make sure that burnt out transformers be replaced within 24 hours is illustrative in this context. A more effective measure would be to understand the demand characteristics associated with the transformer and steps taken to manage this.

various outcome indicators and causal reform processes. The reasons are many. First, there is just not sufficient data to effectively infer causal relationships in an environment where institutional eccentricities are predominant, and structural instability is high. There is also considerable inter-temporal volatility in individual states' parameters. In addition, even if the results turned out to be seemingly robust, there would be doubt about the spuriousness of the relations; there is significant revision of data in every version of release. Finally, the poor state of power flow audits in most states, arising from uneven and inadequate metering. A caveat is in order: There are diverse official sources for data on the Indian power sector, and we do not attempt reconciliation in this paper.⁷ Suffice it to observe that all sources manage to convey the magnitude of the challenges; for example, the payments crisis at the onset of this decade was plain regardless of the specific measure, or, source.

The plan for the rest of the paper is as follows. In the next section, initiatives designed to nudge the sector towards efficiency and financial discipline (especially on the distribution side) are discussed against the backdrop of the OTS scheme, the APDRP and the EA. Sections 3 and 4 review trends in the macroeconomic evolution of the sector, examine changes in key financial parameters and assess the dissimilarity in these changes across states. Section 5 explores these variations across utilities in terms of the paper's focus on commercial orientation; it then provides an accounting decomposition of the differences in revenue performance in terms of selected underlying factors. Section 6 constructs a summary measure – Index of Revenue Orientation – that captures a critical (commercial) aspect of the sector. Section 7 contains our conclusions.

2. REFORM STEPS AFTER THE PAYMENT CRISIS OF 2000-01

(a) Initiatives

2000-01 may well be considered a watershed year for the power sector in India. The central government by this time had been sufficiently exercised in the malaise afflicting the sector. The proverbial hay stack was outstanding dues – Rs. 415 bn (as

⁷ Agencies that publish data include Ministry of Power, Ministry of Finance, Planning Commission, Central Electricity Authority, Regional Load Dispatch Centres (RLDCs), Power Finance Corporation and Reserve Bank of India.

percent of 2000-01 GDP, about 20%) – owed by state-government power utilities to central government-owned PSUs such as NTPC, NHPC, Coal India Ltd., Indian Railways and PGCIL.⁸ Given the inherent limitations on account of the division of responsibilities between the states and the centre, and also that the sector is almost wholly government-owned, the central government could deploy only indirect instruments to influence changes in the (revenue generating) distribution segment, which is under the ambit of states. That there was also method to this can, perhaps, be appreciated by the following mapping of objectives to the specific initiative:

- The one-time settlement (OTS) scheme – restructure liabilities that had accumulated on account of SEBs’ persistent failure to make regular payments, and to settle surcharges and interest imposed as penalty; in other words, a financial workout to moderate burden on SEBs, but at the cost of a harder budget constraint on state governments (as owners of SEBs).
- The Accelerated Power Development and Reform Programme (APDRP) – to nudge states to address long standing problems related to the cash generating side of the sector.
- The Electricity Act 2003 (EA) – helped to coalesce thinking on the structure of the electricity sector by providing a framework for legislative changes at the state level for undertaking reforms.⁹ Although all aspects – distribution, tariff setting and market structure – of the problem end of the electricity business is under the ambit of state governments, the EA (passed with broad support) nevertheless was

⁸ Of the total outstanding amount on February 28 2001, Rs. 257 bn was principal and Rs. 157 bn was on account of surcharge and accumulated interest on delayed payments (GoI [2001]). By the time of the cut off date of September 30 2001, this figure had increased to Rs. 419 bn (Ministry of Power, Annual Report, 2002-03).

⁹ State governments did not require formal legislative action at the centre to initiate reforms. Procedurally, the EA would allow a state government to undertake reforms without state-specific legislation. However, in practice, no state government would exercise this option given the critical importance with which the sector is viewed. In other words, given the political economy importance of the sector, the executive will not do much without having strong legislative backing. It is noteworthy that Orissa established a regulatory commission and privatised the power sector as early as 1996 (under the purview of the Orissa Electricity Reform Act approved in November 1995), without enabling central legislation. In fact, Orissa’s approach to regulation spread to other states and was adopted by the central government in the form of an Electricity

important for introducing political suasion at centre-state forums,¹⁰ Planning Commission dialogue with states in the context of plan allocations etc.¹¹

(i) SEB Dues Restructuring Scheme

The Conference of State Chief Ministers and Power Ministers held in March 2001 noted that the large accumulated dues owed by SEBs, in turn, adversely affected the finances and investment plans of central public sector units (CPSUs). An expert group established to recommend a resolution of outstanding dues to the CPSUs submitted its report in May 2001 (GoI [2001]). The recommendations, *inter alia*, included securitisation of the accumulated dues through bonds – tax-free and tenor of 15 years – issued by respective state governments. A 50 percent waiver of the surcharge on outstanding surcharge as an incentive for states to accede to the securitisation scheme was also proposed. The OTS scheme linked the capital restructuring of SEBs to a set of incentives and penalties. In addition, to harden the budget constraint, a quasi-binding restriction on SEBs designed to recover defaults to central-government owned utilities and suppliers through adjustments from Central Plan Assistance, was introduced. The Empowered Group of Chief Ministers in July 2001 accepted the recommendations of the expert group with minor modifications (see Box 1 below). Under the scheme, state governments have issued bonds worth Rs. 350 bn.¹²

Regulatory Commissions Act 1998. The Andhra Pradesh Reform Act 1998 was similar to the Orissa act regarding regulatory structure and functioning.

¹⁰ Of which the National Development Council (NDC) is probably the most prominent.

¹¹ Another possibility is that reform minded leadership in state governments could deploy the EA as a lightning rod to goad their (recalcitrant) colleagues to support initiatives.

¹² Ministry of Power, Annual Report, 2005-06. This number has increased with each subsequent issue of the Annual Report since 2003-04, when it was Rs. 323 bn.

Box 1: Key features of One Time Settlement Scheme

1. 60% of interest/surcharge on the delayed payments as on 30th September 2001 would be waived.
2. The balance dues comprising the full principal amount as well as the remaining 40% of the interest/surcharge would be securitised through bonds issued by the respective State Governments.
3. The bonds would be issued through Reserve Bank of India (RBI) at a tax-free interest rate of 8.5% per annum, repayable over 10 years after a moratorium of five years; with the RBI's approval, 10% of the bonds can be off-loaded in the market each year for trading.
4. For ensuring timely payment of current dues in future, defaults in current payments for power/fuel would attract a graded reduction in the supply of power from central power stations and in coal supplies.
5. Where such defaults exceed 90 days from the date of billing, the Ministry of Finance can recover these dues through adjustment against releases due to the states from the central government. (To operationalise this aspect, Tripartite Agreements have been signed amongst the Government of India, the Reserve Bank of India and 28 state governments).
6. CPSUs will offer incentives to SEBs for complying with the scheme (and making regular payments towards their dues). During the first 4 years, bi-annual cash incentives would be paid by the CPSUs equal to 4% of the value of bonds.
7. Outstanding dues as on 30th September 2001 will be the basis of the OTS.

The OTS can be deemed to have worked, against a simple measure (that of timely payments): the mechanism to recover dues through the Reserve Bank of India has, to the best of our knowledge, not been availed.¹³ (Has the prospect of being *named and shamed* concentrated the minds of state governments?) In other words, state utilities have regularly paid central government-owned suppliers of electricity and coal, and to transmission operators and Indian Railways. However, a comprehensive verdict on the scheme can only be made when amortisation of outstanding bonds will have to be honoured to the tune of about Rs. 35 bn annually. Given the cash position of state-owned utilities (extensively dealt with in sections 4 and 5), many state governments may well end up making repayments from general revenues.

¹³ The tripartite agreement has hardened the budget constraint. But its durability is, *per se*, not guaranteed since the potential for individual state governments to indulge in arm twisting exists, especially given the reality of a central government that is a coalition reliant on powerful regional parties.

(ii) Accelerated Power Sector Development and Reform Programme (APDRP)

To ensure that the OTS remained precisely that, measures to accelerate state level reforms by rapidly restoring and then sustaining the financial viability of the power sector were considered important by the Empowered Group of Ministers. Against this background, the Union Ministry of Power constituted an expert committee to examine (and recommend changes) in the method by which central government assistance for the power sector was given to states. Based on the recommendations of the committee (GoI [2002]), the central government decided to revamp an existing scheme, the Accelerated Power Development Programme (APDP) that had been introduced in February 2000 for providing financial assistance towards renovation and modernisation (R&M) of power plants and also for strengthening and improvement of sub-transmission and distribution network.¹⁴

The motivation and operational contours for broadening the scope of the APDP and change it to the APDRP were informed by two inter-related objectives, viz., a reduction of aggregate technical and commercial (AT&C) losses and increasing revenue collection. The change from the APDP to the APDRP reflected a change in emphasis from a project/input (engineering) orientation to performance and outcomes; the emphasis was shifted to the commercial aspects of the engineering actions. The tenor of central government assistance changed to a reform programme predicated on the realisation that an *ad hoc* and piecemeal approach to loss reduction needed to be replaced with sustaining reforms.

Access by state utilities to assistance under APDRP was made contingent on a state signing off on the OTS Scheme. There were two streams of support under the APDRP – one for investment and the other as an incentive based on reducing operational cash losses. The Union Budget, 2002-03 formally rechristened APDP as APDRP, and enhanced the allocation to Rs. 35 bn from Rs. 15 bn in the previous year with the stipulation that “*access of the States to the fund will be on the basis of agreed reform programmes, the centre piece of which would be the narrowing and ultimate elimination of the gap between unit cost of supply and*

¹⁴ The APDP financed 50% of the project cost with a grant to loan ratio of 50:50 to the state governments as advance Central Plan Assistance. The balance 50% funds had to be contributed by respective states.

revenue realisation within a specified time frame". The incentive stream provided for a "substantial reward", up to 50 percent of the actual cash loss reduction (without elevating tariffs) as a grant for states that were willing to go beyond "demonstration projects" for the investment component and undertake enterprise-wide reform for performance improvements. 2000-01 was the stipulated base year for calculating the reduction of loss during subsequent years.¹⁵

As part of the scheme, and some even before, states initiated steps aimed at restructuring the sector through measures relating to private sector entry into power generation, re-organisation of SEBs into separate corporations for generation, transmission and distribution, metering feeders, measures for reducing losses, rationalising tariffs and initiating statutory steps for establishing regulatory commissions. Over the four years 2002-03 – 2005-06, aggregate disbursement (investment and incentive) under the APDRP was Rs. 77 bn.¹⁶ Nineteen states submitted incentive claims to the Ministry amounting to Rs. 108 bn; on scrutiny by independent evaluators, eight states were found eligible, and the aggregate of incentives that has been released is Rs. 15.8 bn.¹⁷

Restructuring APDRP

The power ministry in Delhi felt that despite being a major improvement over the APDP, there were residual flaws in the structure of the APDRP. The performance of the APDRP, at least in terms of financial assistance to states, fell short of what had been envisaged (Rs. 200 bn was targeted in the 10th Plan). The thinking was that the programme had to be restructured to an outcome-driven programme based on monitorable targets against established baselines.

¹⁵ Losses are calculated net of subsidy & tariff compensation given by the state government, both in the base as well as subsequent years. Revenue is considered on net realisation basis only (increase in receivables is factored out). Incentive in subsequent years was given on the basis of incremental loss reduction by the utility with calculation of loss at the enterprise level. For the states where SEBs have been restructured, calculation for transmission and distribution utilities are used for assessing reduction in cash loss.

¹⁶ www.apdrp.com

¹⁷ In the most recent Union Budget documents released in February 2007, no figures were indicated for APDRP disbursements in 2006-07. However, subsequent media reports indicate that Rs. 10 bn were disbursed to states in 2006-07.

According to the committee established to restructure the APDRP (GoI [2006b]), some aspects transpired time and again as hindrances to the level of performance improvement that had been envisaged from the APDRP. All the agencies interacting with the Committee pointed out certain bottlenecks encountered during implementation of the schemes, including unrealistic investment project reports, delay in supply of equipment due to increased demand, heavy quantum of work, increase in price of materials and equipment, poor response to turnkey offers, and employees' resistance to outsourcing (especially on work related to information systems). Other flaws emerged consistently from responses of the utilities, most notably that state governments were tardy in transferring funds that had been released to them by the center.

It is difficult to ascertain how much of the improvement in the cash position of the sector has been due to central government initiatives, and how much has been on account of states desire to restore the sector's health. The payments made on account of APDRP have been modest. Some states have focused on top-level (revenue enhancing) instruments which has taken the form of (i) reduction of commercial losses; (ii) tariff rationalisation; and (iii) management of load composition, in particular handling agricultural supply and greater emphasis on supply to industrial and commercial consumers (these are investigated at length in sections 5 & 6) There are also instances (unheard of in the past) of some state power utilities swapping their high cost debt for debt with lower coupon, renegotiating power purchase agreements, shopping around for cheaper coal etc..¹⁸ Some state governments have also pitched in by financial restructuring through carving out liabilities of state utilities, and assuming responsibility for these.

(iii) *The Electricity Act 2003*¹⁹

The Act essentially provided a "process map" for a market-based transparent regime through progressive introduction of competition and choice by incorporating impressive panoply of features comprising liberalisation of captive generation,

¹⁸ Over 2002-03 – 2005-06, according to the Gujarat Energy Department, the state's power system negotiated savings of Rs. 7.7 bn on costs pertaining to fuel and power procurement.

introduction of open access in transmission and subsequently in distribution, and the provision for issuing multiple distribution licenses in a given area. A critically important change that the Act sought to encourage was replacing the present Single-Buyer model to a Multi-Buyer model. This would lead to a paradigm change in the environment whereby monopoly of the SEBs for buying/selling power would cease, thus leading to a market determined tariff structure. Towards harmonisation of regulation, the Act specifies that the principles laid out by the Central Electricity Regulatory Commission (CERC) in generation and transmission should guide SERCs. The Act wrote the code for the sector from a national perspective with regard to grid discipline and rationalised dispatch of power.²⁰ In May of this year Parliament also passed legislation that makes stealing of electricity a cognisable offence, and authorises establishment of special courts for prosecution of those indulging in power theft.

(b) Structural outcomes

All states, except Arunachal Pradesh and Nagaland, have constituted State Electricity Regulatory Commissions (SERCs). However, SERCs of three states (viz., Goa, Jammu & Kashmir and Meghalaya) were non-functional, and except for the ERC in Bihar, all SERCs that are functioning have issued tariff orders (Appendix Table A1 provides a composite summary on implementation of some of the reform measures discussed above). Thirteen states have unbundled their SEBs whereas nine states have sought extension; the mandatory date for unbundling SEBs into generation, transmission and distribution entities was June 2004.

The regulatory environment

The role of state electricity regulators has been extensively analysed (see, for example, Prayas [2003]). Although the function is critical in the reform process, it is by and large exogenous to the reform efforts of state governments/discoms. Being largely outside the scope of the paper since the metric for evaluating the regulatory function is

¹⁹ The Act, *inter alia*, consolidated the Indian Electricity Act 1910, Electricity (Supply) Act 1948 and Electricity Regulatory Commissions Act 1998.

²⁰ Transparent application of Availability Based Tariff (ABT) and Unscheduled Interchange (UI) are formal tools in this context. As part of implementation of EA, the government notified a National Electricity Policy in February 2005 and, subsequently, a National Tariff Policy, which *inter alia* facilitated Merit Order Dispatch in supply (giving priority to least costly generators).

very different from this paper's analysis, we will limit our observations to an assessment of some of their broad functions (see Bhattacharya and Patel [2003, 2005] for the relevant criteria and associated evaluation of national regulatory agencies).

The effectiveness of regulators has, decidedly, been mixed. They have been able to pry open the books of state power utilities, at least partially, which has led to state governments to explicitly provide subsidies (up to a point) to the utility from the exchequer, if it wants to pursue social objectives.²¹ While state regulators in recent years have contributed towards tariff rationalisation – altering tariffs for different consumer segments, reflective of cost of supply and occasionally stipulating (performance oriented) multi-year tariff methodology to enhance predictability – the pace of the initiative is uneven, and much remains to be done.²² SEBs often have been unwilling to follow the basic rules of the National Tariff Policy. One of these requires that utilities should file Annual Revenue Requirement (ARR) to the concerned SERC (filing the ARR initiates the process of tariff revision keeping in mind the viability of distribution utilities). Last year only some states had filed ARR petitions on time, and ten states had sent it in after the deadline. Important states such as Maharashtra, Gujarat and Tamil Nadu did not bother.²³ State governments of diverse hues promise gifting away power to favoured consumers – in 2006, Scheduled Castes in Punjab and farmers in Andhra Pradesh – in contravention of the rules for subsidies in the notified tariff policy. Therefore, not surprisingly, it is felt (and not without merit) that some SERCs have been ritually handing out tariff orders often (implicitly) endorsing populist initiatives at the behest of state governments. An interesting political economy aspect of regulation is provided by the comment of an eminent panel on a study on the SERCs: “...many State Governments have been brazen in defying the orders and directives of the [S]ERCs, year after year. Even the basic requirement of submission of full data in support of the tariff increase proposals is not being met by the utilities. This does not augur well for the [S]ERCs...”

²¹ State governments never pay the entire uncovered net cross subsidy balance, in part because they know that utilities include shortfall due to pilferage from the system as subsidy requirement.

²² Statutory requirements for hearings, access to information, and recourse in tariff determination have been positive (and useful) attributes of the regulatory framework that states have embraced (Dubash and Rao [2006]). Also see Rao [2007a].

²³ Maharashtra eventually did so in April 2007.

(Prayas [2003]).²⁴ The observation underscores the inherent difficulty of regulating government-owned utilities (Tadimalla and Patel [2005]).

The practice of quarterly up-to-date audited accounts is unheard of although this would increase transparency and allow for critical examination of accounting practices followed by SEBs. It will be difficult for state utilities and governments to publicly oppose introduction of twenty first century accounting practices. The EA provides flexibility for regulators to force the issue, but practically none have to the extent that the Companies Act enjoins corporations to prepare financial statements.

One of the most disappointing aspects of the reform process has been the slow (actually negligible) tangible progress on competition and open access to wires in the sector. This is an area that significant responsibility may be placed on state electricity regulators, who should have been more proactive in “encouraging” introduction of open access and third party sales to break the monopoly of state-owned utilities. There has been a marked lack of effort to advocate change of current practices and initiate debate.²⁵ It is noteworthy that consultation and discussion papers by other sector regulators, for example, Telecom Regulatory Authority of India (TRAI), now have a proven track record as change initiators.

Operational efficiency and sustainability

Even if there is improvement in top-line indicators such as revenue performance and cash profits, will it be sustainable? An important aspect in evaluating the sustainability of commercial improvements is analogous progress in the operational efficiency of the system. Capacity to withstand competition, reductions in system interruptions, quality of metering, grid discipline and electricity supply parameters (like voltage fluctuations) are “well-being” indicators of a power system, and improvements (or lack of them) are an important gauge for the underlying health.

²⁴ Recently, a staff member of the Uttar Pradesh ERC has bemoaned the same point: “The power ministry should take note of the fact that most of the government-owned utilities across states have chosen to ignore the mandated legislative structural arrangements despite time-bound provisions in the [Electricity] Act. Non-compliances of regulatory orders galore; delays, disobedience, frequent reviews and appeals are common responses to the orders of the regulatory commissions” (Singh [2007]).

²⁵ Of course, SEBs are extremely unwilling to allow choice to their “subsidising” customers since they are the major source of income for meeting expenses; loss of cash streams to private electricity suppliers, even with surcharges and open-access charges, would result in a severe cash shortfall.

(i) *Market Structure and Competition*

Market contestability may be considered to be a key factor for inducing efficiencies in electricity operations and reliability. Despite the advancement of many changes in the market structures of the erstwhile monolithic SEBs, there has been virtually no change in the levels and nature of competition for customers. While most developed markets, and many emerging ones, have progressed quite rapidly from competition in the wholesale segments to retail competition, there has been virtually no progress in most discoms in India despite an enabling environment in the EA. The quantum of electricity traded is only about 3 percent of the total power sold.

The transition from a single-buyer model to a multi-buyer multi-seller model should result in a competitive power market so as to provide incentives for new investment while providing affordable and quality power to consumers. In January 2006, the Forward Markets Commission (FMC) notified electricity to be included in the list of commodities permitted for futures trading. Unfortunately, the process seems to lack a roadmap towards development of a competitive bulk power market, which should comprise adoption of a direction sensitive and efficient transmission pricing regime, introduction of intra-state Availability Based Tariff (ABT) regimes, liberalisation of fuel markets, rationalisation of retail tariffs and competitive procurement of renewable energy. The Indian wholesale power market is characterised by long-term bilateral contracts, which will continue to play a dominant role.

An exposition on the design of power markets and dispatch mechanisms is a complicated and technical subject, and beyond the scope of this paper (see Deo [2007]). All we can comment on is that the development of this market requires the application of economic principles that incentivise the flow of power from the most efficient generators to the most credit worthy customers. The magnitude of wheeling charges and cross-subsidy surcharges has *de facto* made open access unviable. Maharashtra is probably the only state where the surcharge formula allows for the possibility of open access sales to be remunerative.

(ii) *Grid discipline*

A well functioning electricity system with balanced flows and seamless responsiveness to demand-supply imbalances is critical for the smooth operation of the grid as a whole. An acceptable international standard of deviations in electricity system frequency from 50 Hz is considered to be .005 percent; anything below 49.5 Hz is bad and below 49.0 Hz is a crisis. Appendix Table A2 shows the profile of grid frequency for each of the regions in 2006-07. On average, the chronically power-short northern region had a grid frequency below 49 Hz 21 percent of the time. The southern region was the most disciplined.

The kind of grid discipline that is being followed is inimical to the emergence of an actively traded market for power. The CERC has developed mechanisms for making inter-state transfers of power more efficient and commercially oriented. In this regard, the Unscheduled Interchange (UI) mechanism under the ABT regime could continue (albeit with modification) as a proxy for balancing market to help smooth transition from the existing practice. For instance, given the current prices at which short term power is being purchased by state and private discoms, the increase in the UI ceiling rate in April 2007 by CERC from Rs. 5.70/unit to Rs. 7.45/unit may not be binding.²⁶ A rate of Rs. 9.30 was suggested to the CERC, in keeping with the requisite practice of setting the UI rate at slightly higher than the cost of diesel generation (in some instances this is as high as Rs.10-13/unit). Moreover, the current regime's limitations are likely to be exacerbated with the emergence of a nationally synchronised power grid encompassing all the power regions of the country.

(iii) *Metering and energy audits*

One of the recommendations common across all committees on the power sector has been an insistence on energy audits, and as a precursor, metering of consumers, in order to be able to identify power flows and losses at the distribution levels. One of the basic problems of estimating the extent of commercial losses and theft in the system was the ability of utilities to disguise the extent of these losses by attributing losses to

²⁶ The UI rate is a penal rate for drawing unsanctioned power from the grid.

(unpaid) consumption in agriculture. Appendix Table A3 provides a summary of the current status of metering. The striking aspect of these numbers is the completely inadequate metering at the level of distribution transformers; nationally, only 11 percent of these transformers are metered. Even worse is the metering status at the consumer level at end-2006, after years of reform funds for metering and audits; large states in terms of sales of electricity units have metering levels of anywhere between 2 percent to 34 percent. While metering at the 11 Kv level is high, it only provides a rough idea of the approximate location where the supply is being dispersed. The numbers on meters themselves may not be entirely reliable given the lack of information on how many meters are in a working condition, properly calibrated or actually read.²⁷

3. MACROECONOMIC ASSESSMENT

There are several (interrelated) aspects that convey the extant status of the power sector at the aggregate level. The principal markers deployed in this paper comprise fiscal indicators, technical and commercial aspects, and physical performance.

a. Fiscal aspects

Poor financial performance of state government-owned power utilities as well as the fact that SEBs account for the bulk of the states' investments in PSUs, has been a major fiscal challenge for state governments for two decades. The proximate reasons have been the state-mandated subsidy to some consumers, and the attendant scope (indeed, incentive) for camouflaging outright theft for supply to these categories that a skewed tariff policy has engendered. In macroeconomic terms, the sector, by some measures, is currently perched more or less where it was about a decade ago (and the position then was not considered to be healthy). Recent strong economic growth and the concomitant buoyant tax revenues have given state governments some elbow room for financially supporting the power sector.

²⁷ The evidence on this aspect can, almost inevitably, only be anecdotal. The purchase of low voltage meters (about two years back) by the Maharashtra distribution utility is apocryphal. "Meters" were procured on the basis of lowest-price bidding at about Rs.200 each, which is ridiculously low by any standards; what, in fact, was purchased were metallic boxes that looked like meters! Regarding transformers the story is that (occasionally) existing units are removed (at night) and sold back to the utility.

How far the sector had fallen can be appreciated when one notes that despite increase in subventions – 2-3 times the 1994-95 level – the burden on SEBs that remained uncovered (and which almost brought their operations to a virtual halt by 2001) almost doubled (as a percent of GDP) towards the end of the last decade (see Table 1 below). This is because in tandem, the net subsidy to consumers (after taking into account over-charging to industry and the commercial sector), increased sharply over the same period, from 0.8 percent of GDP to 1.5 percent of GDP. After 2001-02 there has been a sharp correction in net subsidy, and, commensurately the uncovered gap, and currently both measures are at about the same level that they were a decade ago.

As a percent of GDP, subventions by the state governments to partly compensate SEBs for below cost sale of electricity to agriculture and domestic sectors have declined in recent years. However, despite a supportive macroeconomic environment, budgetary support, both in absolute terms and as share of state Gross Fiscal Deficit (GFD), has increased in the last couple of years. Though this, of itself, is not bad, since the states seem to be taking more responsibility for social objectives, risk of aggravating the fiscal situation as subventions gradually creep up as percent of GFD remains high. For some states, the scope for vulnerability on this score is significant. Consider, for example, subventions in 2004-05 (last year for which state-wise data is available) as percent of respective GFD for the following states: Haryana (91.3 percent), Punjab (56.6 percent), Karnataka (38.8 percent), Gujarat (23.3 percent), Tamil Nadu (16.6 percent) and Andhra Pradesh (15.9 percent). Other states have some buffer; for instance, the ratio is relatively modest for Orissa (1 percent), Assam (3.4 percent), Uttar Pradesh (5.3 percent), Rajasthan (11.2 percent) and Madhya Pradesh (12.6 percent).²⁸

²⁸ A word of caution: a low ratio for some states may be due to under-payment of subsidy, rather than the requisite subsidy bill being low.

Table 1: Overall fiscal indicators of the power sector (Rs. bn)

	Gross cross-subsidy (as % of GDP in brackets)	Surplus from subsidising sectors	Net cross-subsidy (as % of GDP in brackets)	Subventions from State Govts. (as % of GDP in brackets)	State govt. subventions as % of State GFD	Uncovered cross-subsidy loss	Uncovered subsidy as % of GDP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			(1-2)			(3-4)	
1991-92	74.5 (1.1)	21.7	52.8 (0.8)	20.5 (0.3)	10.8%	32.3	0.5%
1992-93	93.5 (1.2)	33.1	60.4 (0.8)	19.1 (0.3)	9.1%	41.3	0.5%
1993-94	114.5 (1.3)	35.0	79.4 (0.9)	20.7 (0.2)	10.0%	58.8	0.7%
1994-95	133.1 (1.3)	53.1	80.0 (0.8)	18.3 (0.2)	6.6%	61.7	0.6%
1995-96	172.8 (1.4)	66.6	106.2 (0.9)	72.3 (0.6)	23.0%	33.9	0.3%
1996-97	201.5 (1.5)	78.5	123.0 (0.9)	62.8 (0.5)	16.9%	60.1	0.4%
1997-98	245.2 (1.6)	90.6	154.6 (1.0)	72.1 (0.5)	16.3%	82.4	0.5%
1998-99	303.5 (1.7)	68.8	234.7 (1.3)	78.5 (0.4)	10.6%	156.2	0.9%
1999-00	338.1 (1.7)	42.4	295.7 (1.5)	109.4 (0.6)	12.0%	186.3	1.0%
2000-01 (P)	344.3 (1.6)	34.4	309.9 (1.5)	88.2 (0.4)	9.9%	221.7	1.1%
2001-02 (P)	345.9 (1.5)	37.0	308.9 (1.4)	86.8 (0.4)	9.0%	222.1	1.0%
2002-03 (P)	305.7 (1.2)	48.0	257.7 (1.0)	130.0 (0.5)	12.7%	127.8	0.5%
2003-04 (P)	331.5 (1.2)	61.3	270.2 (1.0)	110.8 (0.4)	9.0%	159.4	0.6%
2004-05 (P)	361.9 (1.2)	63.9	298.0 (1.0)	104.8 (0.3)	9.6%	193.2	0.6%
2005-06 (P)	364.0 (1.0)	60.6	303.4 (0.9)	116.1 (0.3)	10.2%	187.3	0.5%
2006-07 (RE)	401.3 (1.0)	50.6	350.7 (0.9)	138.7 (0.3)	12.7%	212.0	0.5%
2007-08 Plan	395.4 (0.9)	88.2	307.3 (0.7)	124.6 (0.3)	10.1%	182.7	0.4%

Note: GFD is consolidated gross fiscal deficit of state governments. Source: Economic Survey [2006-07], and previous years; Handbook of Statistics on Indian Economy [2006].

In 2006-07, while (estimated) subvention from state governments to SEBs was Rs. 138.7 bn, an (estimated) uncovered subsidy of Rs. 212 bn remained, which, as the 2006-07 Economic Survey politely observes, “the large reform potential for improving not only the electricity sector itself but also the fiscal position of the States”. Cost recovery by government for the power sector (not a non-excludable commodity) has been low at 13.1 percent, compared to 17.7 percent for irrigation, 11.6 percent for roads, 5 percent for public health and 1.2 percent for education (RBI [2006]). In addition to subventions and loans to utilities, governments have also provided substantial guarantees to financial institutions for enabling state utilities to raise requisite resources. With

persistently negative rates of return of SEBs (on capital employed), resources forgone continue to be very large.

Agricultural power and subsidies

Politicians have used state distribution utilities to deliver populist measures like (almost) free power to agriculture; over the last two decades this has been the primary contributor to the financial weakness of the sector (see Table 2 below). Promise of free power has reached epidemic levels with most political parties doing so in practically every election (see Narendranath *et al* [2005] on the underlying political explanations).

Table 2: Power sector cross-subsidy indicators (Rs. bn)

	Subsidy to Agricultural Consumers (as % of total gross subsidy in brackets)	Subsidy to Domestic Consumers	Subsidy on Inter-state Sales	Gross cross-subsidy	Gross cross-subsidy as % State GFD
	1	2	3	4 (1+2+3)	6
1991-92	59.4 (79.7)	13.1	2.0	74.5	39.4%
1992-93	72.1 (77.1)	19.2	2.3	93.5	44.7%
1993-94	88.8 (77.6)	24.2	1.4	114.5	55.6%
1994-95	101.1 (76.0)	29.6	2.3	133.1	48.0%
1995-96	137.9 (79.8)	31.6	3.3	172.8	55.0%
1996-97	156.3 (77.6)	42.3	2.9	201.5	54.1%
1997-98	190.9 (77.9)	51.7	2.6	245.2	55.5%
1998-99	225.4 (74.3)	72.7	5.4	303.5	40.9%
1999-00	241.8 (71.5)	91.7	4.6	338.1	37.0%
2000-01 (P)	240.7 (69.9)	99.7	3.9	344.2	38.5%
2001-02 (P)	240.1 (69.4)	103.5	2.3	345.9	36.0%
2002-03 (P)	218.5 (71.2)	85.3	1.9	306.7	29.9%
2003-04 (P)	233.5 (70.4)	88.9	9.2	331.5	26.6%
2004-05 (P)	252.4 (60.7)	104.3	5.2	361.9	33.1%
2005-06 (P)	244.7 (67.2)	108.4	10.9	364.0	31.9%
2006-07 (RE)	273.3 (68.1)	130.1	-2.12	401.3	36.2%
2007-08 Plan	270.9 (68.5)	118.4	6.1	395.4	32.0%

Sources: Economic Survey [2006-07], and previous years; State Finances, a study of budgets of 2006-07, Reserve Bank of India [2006].

For the most part, accounting practices of SEBs have continuously disguised non-technical losses (essentially pilferage) as consumption of power by agriculture. Since a

large part of the supply to agriculture is unmetered, utilities can under-report the systems' actual distribution losses by ascribing a significant portion of non-technical losses and theft as supply to agriculture. As a result of overstating agricultural consumption and using flat rates, actual unit tariffs to agriculture are higher than nominal tariffs, and non-technical distribution losses are higher than reported. Ultimately, subsidies expected to benefit poor farmers in fact benefit the large farmers and the pilferers of power, many of whom are not farmers (see Katiyar [2005] on power theft in rural areas). While this reality is well known, existing estimates are largely based on anecdotal evidence or non-representative samples.

b. Commercial losses of utilities

In consonance with improvement in their finances (at least in cash terms), the overall financial losses of state-owned power utilities have declined from Rs. 293 bn (\$6.1 bn, 1.3 percent of GDP) during 2001-02 to Rs. 221 bn during 2004-05 (\$4.9 bn, 0.7 percent of GDP). But Aggregate Technical and Commercial (AT&C) losses, which include theft, non-billing, incorrect billing, inefficiency in collection, and transmission and distribution losses, are about 36.8 percent nation wide in 2004-05, the last year for which data is officially available²⁹.

Box 2: Definition of AT&C losses

AT&C losses are calculated as follows:

$$(1 - \text{ATC Loss}) = (1 - \text{T\&D Loss}) \times (\text{Collection Efficiency})$$

$$= [(\text{Units billed})/(\text{Units input})] \times [(\text{Rupees realised})/(\text{Rupees billed})]$$

There is another interpretation of this formula. Rearrange the two terms in parentheses on the right hand side as follows:

$$= [(\text{Rupees realised})/(\text{Units input})] \times [(\text{Units billed})/(\text{Rupees billed})]$$

The first term in square brackets is the "Average Realisation Rate". The inverse of the second term is the "Average Billing Rate". Therefore,

²⁹ There are informal indications that AT&C loss levels might have fallen in 2005-06, based on a selective survey of tariff filings. See Appendix Table A4 for various measures of losses.

$$(1 - \text{ATC Loss}) = (\text{Average Realisation Rate})/(\text{Average Billing Rate})$$

Reduction of losses is the proximate determinant of the financial viability of the power sector; in a sense, it is the overarching outcome of various reform measures that have been instituted by states/discoms. And it is here that the progress (or lack of it) has been the most disappointing. AT&C losses have declined from 38.9 percent in 2001-02 to 33.8 percent in 2004-05³⁰ (although it is likely that the data will show an improvement in 2005-06)³¹. It is instructive that the Report on State-Specific Reforms (GoI [2002]), which initiated the APDRP, had envisaged a reduction of losses from the then (estimated) 60 percent levels to around 15 percent over 5 years, thereby implying an annual reduction of about 9 percentage points.

Aggregate financial data do not convey the whole picture, given that business and the underlying physical supplies are also changing. A look at some of the above trends in per unit of electricity supplied provides an alternative and important perspective (Table 3 below).

³⁰ These numbers were culled from the Report on Restructuring of APDRP (GoI [2006b]), which are the latest available estimates of AT&C losses. The percentages are somewhat different from those reported in the Power Finance Corporation Report on State Utilities [2005, 2006], which report them to be 37.2 percent and 36.77 percent for 2001-02 and 2004-05, respectively.

³¹ According to GoI [2006b], provisional accounts for 2005-06 show that the states of Andhra Pradesh, Goa and Tamil Nadu have reported AT&C losses below 20% during the year, and that Punjab and two discoms of Gujarat (Madhya & Uttar) have reported AT&C loss of 20% - 25%. Further, utilities in the states of Andhra Pradesh, Goa, Himachal Pradesh, Punjab, Gujarat, Meghalaya, Chattisgarh and West Bengal have reported profits. States of Jharkhand, Madhya Pradesh, Haryana, Rajasthan, Uttaranchal, Karnataka, Kerala and Assam have also reported reduction in their losses during 2005-06.

Table 3: Electricity tariffs and costs (paise/unit)

	ACS (1)	ARR w/o subsidy (2)	ARR- ACS (2-1) (w/o subsidy) (3)	ARR - ACS gap (w/o subsidy) (4)	ARR for agriculture (5)	ARR for industry (6)	ARR-ACS gap for agriculture (7)	ARR-ACS gap for Industry (8)
1991-92	--	--	--	-24.91	--	--	--	--
1995-96	--	--	--	-28.10	--	--	--	--
1999-00	--	--	--	-70.53	--	--	--	--
2000-01	--	--	--	-65.38	--	--	--	--
2001-02	246	181	-65	-81.34	58.7	410.0	--	--
2002-03	239	196	-43	-48.05	77.5	412.7	-161.5	173.7
2003-04	239	202	-37	-37.00	70.1	387.5	-168.9	148.5
2004-05	250	208	-42	-42.00	73.3	384.2	-176.7	134.2

Sources: Cols. (1), (2), (3), (5), (6), (7) and (8) are from Power Finance Corporation Report on State Utilities [2005, 2006], which do not carry long time series for each of the data fields. The gap in col. 4 is from State Finances, a study of budgets of 2006-07, Reserve Bank of India [2006].

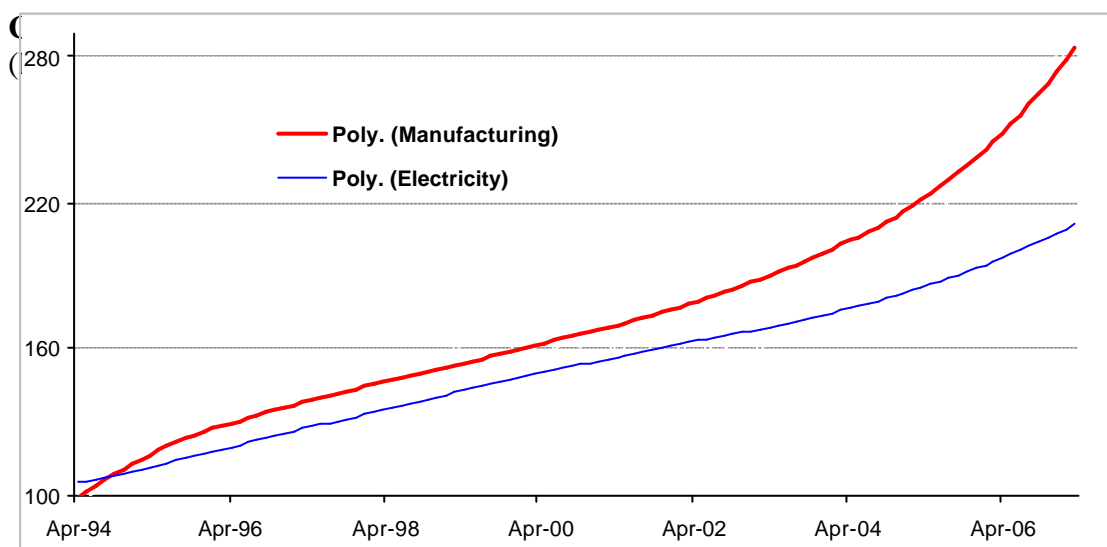
All the available data indicate that after a fairly sharp improvement over 2001-02, improvements are stagnating in the last couple of years. In fact, the reported worsening of the rate of return in 2006-07, at a time when the economy is strong and state government finances are solid, bode ill for the underlying performance of the sector. One adverse trend that shows up in Table 3 is a marked deterioration in the revenue gap of the agriculture sector, although this needs to be looked at with more care, given the problems with metering and weak energy audits of agriculture feeders.

c. Energy shortage and projections of power requirements in the future

While the financial hemorrhage has been stemmed, this is a far cry from beginning to address the huge shortages that already plague the country and are projected to reach gargantuan and unmanageable proportions in the future. Nationally, power generation increased by 8.4 percent per annum in the 1980s (when average annual GDP growth was 5.8 percent), 6.7 percent in the 1990s (annual GDP growth was same as the previous decade), and there was further deceleration to a mere 4.7 percent per year in the first half of this decade (average annual economic growth of 6 percent). Power shortages

are endemic across the country.³² Industries are wilting under power cuts and the sections that are the most affected are the small and medium industries. These are growth engines of an emerging economy, and they are the ones to be hit the hardest, since they do not have access to captive power and on the other hand pay very high tariffs for their electricity consumption, which impact their competitiveness.

The divergence in growth between manufacturing and electricity generation is particularly stark (see Chart 1 below). Manufacturing is currently only a fifth of overall GDP and electricity is increasingly catering to the services sector; much of the fastest growing segment within services is quite IT- reliant, and consequently (not only energy-intensive) but also sensitive to the quality of power. Over the same period, the growth in the electricity sub-index of the Index of Industrial Production has been much more volatile than the manufacturing sub-index.



One of the startling patterns to emerge is the deterioration of energy adequacy (both at base and peaking periods) that is sharpening seemingly on a month-to-month basis. During the period April 2006-February 2007 the country recorded a base shortage of 14.2

³² See Seetha [2003] on how small entrepreneurs cope with endemic power shortage.

percent in comparison to 2005-06, which itself showed signs of deterioration from the previous year, though not as markedly (in 1999-00, the national energy and peaking shortages were 6.2 percent and 12.4 percent respectively).³³ These shortages include scheduled cuts, reported load shedding and frequency corrections; however, unscheduled outages are not included. Although the extent of power shortage varies from state to state, hardly any state or region is spared (Table A5 in the Appendix shows the trends in base and peak shortages for individual states).

The prognosis for the future looks grimmer (if that is possible!), against the background of recent projections of power requirements, and the nation's performance in the recently concluded 10th Plan period (see Tables 4 and 5 below). Estimates by the Expert Committee on Integrated Energy Policy (Government of India [2006a]), indicate that the national power requirement (in billions of units (Kwh) generated) will triple over the next 15 years.

Table 4: Projections of energy requirements

	Total Energy Requirement* Billion kWh		Projected Peak Demand (GW)		Installed Capacity Required (GW)	
	@ GDP Growth		@ GDP Growth		@ GDP Growth	
	8%	9%	8%	9%	8%	9%
2003-04	592	592	89	89	131	131
2006-07	712	724	107	109	153	155
2011-12	1026	1091	158	168	220	233
2016-17	1425	1577	226	250	306	337
2021-22	1980	2280	323	372	425	488
2026-27	2680	3201	437	522	575	685
2031-32	3628	4493	592	733	778	960

* At bus-bar, assuming 6.5% auxiliary consumption.

Source: Report of the Expert Committee on Integrated Energy Policy (GoI [2006a]).

³³ In Maharashtra, India's most industrialised state, total generation over April-December 2006 was actually *lower* by 2.2 % than that in the corresponding period of the previous year.

Table 5: Capacity additions in generation during 8th, 9th and 10th Plans

	8 th & 9 th Plans		10 th Plan (2002/03-2006/07)				
	Achievement	Shortfall	Target*	Commissioned		Under execution	Likely shortfall
	(MW)	%		(MW)	(MW)	%	(MW)
Central	12,661	49%	22,832	11,115	49%	2,610	40%
State	16,285	36%	11,157	5,460	49%	2,135	32%
Private	6,491	68%	7,121	1,931	27%	--	73%
Total	35,437	50%	41,110	18,505	45%	4,745	44%

*The aggregate target was revised downwards to 36,956 MW during Mid-Term Appraisal.
Source: Economic Survey (various years).

4. FINANCIAL PERFORMANCE OF STATE GOVERNMENT UTILITIES

a. Overall assessment

Most SEBs (and successor entities after unbundling) are unable to earn a rate of return (RoR) of even 3 percent on their net fixed assets after providing for depreciation and interest. (This is one of those quaint features of the Indian electricity sector; the Electricity (Supply) Act 1948 mandates a minimum return on assets). In fact, despite significant improvements in many financial and commercial parameters over the years at the aggregate level (that are evidenced in the tables up to 2004-05), there seems to have been a significant deterioration in the projected RoR in 2006-07 (see Memo item in Table 6 below); the cause is unexplained.

During 2004-05, although state utilities had incurred (book) losses of Rs. 221 bn (before subvention), cash losses of the sector (on a revenue- and subvention-realised basis) have improved dramatically from Rs. 189 bn in 2001-02 to Rs. 34 bn in 2004-05 (and are likely to have lessened even more in 2005-06 (Table 6)).³⁴ Subventions provided by governments are important; transfers have increased, as state fiscal situations have improved since 2002-03, and this has contributed to incomes of utilities; unpaid subventions have fallen from Rs. 52 bn in 2001-02 to overpayments of Rs. 7 bn in 2004-05.

³⁴ One of the problems in interpreting financial data of the power sector is the multiplicity of accounting conventions used in different contexts; revenues booked and realised are often used interchangeably. This makes it difficult to compare revenue streams from different sources for different years, especially given the large revisions that are made in the data. Very different pictures of the health of the sector emerge depending on the particular definition of revenue adopted.

Table 6: Consolidated cash profits/losses (Rs. bn)

			2001-02	2002-03	2003-04	2004-05	CAGR (04-05 over 01- 02)
A		Income (without subvention) – Utilities selling directly to the consumers	809.0	882.4	981.5	1,068.8	9.7%
B		Expenditure (without depreciation and tax) Utilities selling directly to consumers	1,035.4	1,009.5	1,090.5	1,203.9	5.2%
C1	A-B	Profit/ (Loss) without depreciation, subvention and tax for DISCOMs	-226.4	-127.1	-109.0	-135.1	-15.8%
C2		Add Gencos and Transcos (Profit without depreciation, ,subvention, tax)	24.5	18.2	24.1	30.7	7.8%
	C1+C2	Total Profit / (Loss) without depreciation, subvention and tax	-201.9	-108.9	-84.9	-104.5	-19.7%
D		Tax	0.8	1.6	1.6	2.4	45.0%
E		Depreciation	90.6	100.7	110.2	112.2	7.4%
F	C-E	Profit / (Loss) (without subvention and tax)	-292.5	-209.6	-195.0	-216.7	-9.5%
G		Subvention booked	146.0	136.7	104.3	110.2	-9.0%
H	(F – D + G)	Book Profit/ (Loss)	-147.4	-75.2	-92.3	-111.1	-10.2%
	(H-G)	Profit/loss without subvention	-293.3	-211.9	-197.2	-221.3	9.0%
I		Subvention Unpaid (subvention booked less received)	51.5	13.3	-2.1	-7.4	-42.6%
J		Unrealized revenue	80.9	61.4	42.7	45.0	-17.8%
K	(C-D+G-I-J)	Profit /(Loss) (without depreciation but on revenue and subvention realised basis)	-189.2	-48.5	-22.7	-34.4	-43.3%

Source: Power Finance Corporation Report on the Performance of the State Power Utilities [2005, 2006].

The data covers state power utilities, power departments, and distribution companies that were an outcome of the reform process, in all 29 states as well as the Union Territory of Pondicherry.

Memo items:

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Collection efficiency (% in income terms)	90	93	96	96	--	--
Units sold (Mn Units)	287,138	309,725	329,647	358,905	--	--
Income (w/o subvention) / unit sold (Rs./unit)	2.82	2.85	2.98	2.98	--	--
Rate of Return (%)*	-32.8	-31.6	-28.3	-28.0	-24.8	-27.4

Note: We have not reported units sold for 2000-01, to preserve continuity; earlier estimates in the *Annual Report of SEBs and EDs* from the Planning Commission vary widely from the PFC estimates thereafter.

*RoR data (provisional/estimated) is from Economic Survey, various years.

The financial liquidity to cover losses of this magnitude is likely to be manageable through working capital loans, deferred payments to their state government owners, some increase in dues to suppliers and, presumably, assistance under the APDRP. The sector manages to (barely) keep its head above water, just about able to meet operational expenses, but being in no position to invest adequately in strengthening the distribution infrastructure or investing in generation capacity.³⁵ While the financial position has improved, it is noteworthy that the debt service coverage ratio of utilities is hardly likely to inspire confidence among lenders (Table 7 below):

Table 7: Distribution of debt service coverage ratio (DSCR)

(no. of utilities)

DSCR	2002-03	2003-04	2004-05
0-0.50	4	10	7
0.5-1.0	11	9	11
>1.0	15	20	18
-ve	10	8	17

Source: Power Finance Corporation Report on State Utilities [2005, 2006]. Note: Among the discoms that have DCSR > 1, there are two each from Andhra Pradesh & Karnataka; ratios of the SEBs of Gujarat, Punjab and Madhya Pradesh are also larger than one.

The system – at least on a cash basis – appears to have settled down (albeit at a *low level equilibrium*), which has contributed to a perception in recent times that the sector is at the cusp of turning the corner, and that this would soon snowball into full fledged commercial revitalisation and crowd in new investment. The data in Tables 6 and 7 is part of the extensive information memorandum of the show-piece initiative (Ultra Mega Power (UMP) Projects) of the central government. It is a programme of coal-based power stations of 4,000 MW each, which the government hopes can be developed with private sector participation. Open tenders (with lowest tariff as the bidding variable) for executing the UMP projects have been invited for locations across the country and one has been awarded in Gujarat. The private sponsors of UMP utilities would need robust and credible mechanisms to ensure that governments honour their payment commitments

³⁵ Of course, the stress in the system is felt in the dilapidated physical assets of the utilities because of inadequate capital expenditure; net fixed assets grew in nominal terms by only 4 percent in 2004-05 from the previous year. Recently, the Prime Minister said that by 2012 (end of the 11th Plan), investment of Rs. 6 tn is required in the power sector (Address to Chief Ministers at Centre-States Meeting on the Power Sector, New Delhi, May 28 2007).

under the power purchase agreement (PPA) with multiple states. Public sector financial institutions, it can be argued, may be better placed to assume the counter-party risks of these large projects in which linkages to government-dominated sectors (coal supply & transport, and transmission) are critical for success. The financial shock could be overwhelming; for instance, a back-of-the-envelope calculation indicates that discoms would have to essentially, albeit not legally under the PPA, “ earmark ” distribution circles with revenue collections of Rs. 58 bn to provide “ comfort ” to *one* UMP (at, say, 75 percent PLF, @ Rs. 2.20/unit)) for meeting procurement costs. To put this in perspective, aggregate income of discoms was about a trillion Rupees in 2004-05.

The following is a summary of the positives and negatives at the aggregate level that we can discern:

Positive	Negative/unchanged
<ul style="list-style-type: none"> • Cash flows have improved. • Collection efficiency has improved. • Subventions from state governments have become more stable. 	<ul style="list-style-type: none"> • AT&C losses remain stubbornly high. • Performance indicators seem to have plateaued in 2004-05.

b. Disaggregating the financial turnaround by states/utilities

Is the overall pattern at the all-India level that we have reviewed above, representative of most states? This section examines disaggregated numbers and finds that there is considerable variability between states and distribution utilities (discoms).³⁶

The concentration of losses and profits is immediately apparent from the state-wise distribution of cash profits/losses (on a subsidy realised basis) (see Chart 2 below).³⁷ Of

³⁶ See Data Appendix for a discussion on the choice of states and performance metrics in the paper; it also includes nomenclature for discoms in the sample. We will consistently use “utilities” to denote power utilities of individual states. Note that this will include integrated utilities (i.e., where SEBs have not been unbundled) *as well as* unbundled distribution utilities (i.e., discoms where SEBs have been broken up).

³⁷ We look at cash profits and losses on revenue and subvention realised basis. In the interest of fairness to discoms, to the extent that their losses are due to supply to subsidised segments, including agriculture, the onus is on state governments to recompense for what is considered to be essentially a “social (political)” obligation. In sections 5 and 6, however, we consider revenues, profits, etc. before subsidies, since we are mostly concerned with the commercial aspects of the utilities’ performance.

the gross cash losses of around Rs. 110 bn in 2004-05 from thirteen states, 80 percent originated in five states (U.P., Jharkhand, Jammu & Kashmir, Bihar and Assam). Gross cash profits of Rs. 78 bn were slightly more dispersed across the nine states generating it, with five states accounting for 78 percent (Maharashtra, Punjab, Andhra Pradesh, West Bengal and Gujarat).

One of the main inferences from Chart 2 is the higher variability in the cash position. In 2001-02, the cash positions were clustered more closely around a higher average loss (Rs. 8.4 bn); and, by 2004-05, the average loss had reduced significantly (Rs. 1.4 bn), but the spread around this lower loss level had widened. The Coefficient of Variation for states' loss levels had increased from -1.23 in 2001-02 to -8.23 in 2004-05, due to the Standard Deviation increasing from 10.4 to 12.0 over this horizon.

Of the improvement that we have seen in the last three years, a few states have contributed a disproportionate share. The most remarkable turnarounds (in terms of loss reduction) were in the states of Tamil Nadu, Maharashtra, Punjab, West Bengal Madhya Pradesh and Karnataka. Andhra Pradesh, Orissa, Gujarat and Chattisgarh significantly improved their profits.³⁸ Uttar Pradesh, Jharkhand and Bihar had contributed the most to the higher loss levels in 2004-05.

Even within states, there is large variability between the unbundled discoms. For the individual discoms of unbundled state utilities, the Coefficient of Variation had increased from -1.11 to -2.33 over this period. Chart 3 below shows that very few discoms had made the transition from a cash loss situation to cash profits (prominent among them were the Bangalore circle of Karnataka, Delhi North, AP North, AP East, Orissa West and Delhi Rajdhani).³⁹

³⁸ In fact Gujarat, according to a state energy department presentation, has earned profit before tax (PBT) after depreciation of Rs. 1.8 bn in 2005-06. The per unit (ACS-ARR) gap has been reduced from a deficit of 66 paise in 2003-04 to a surplus of 5 paise in 2005-06.

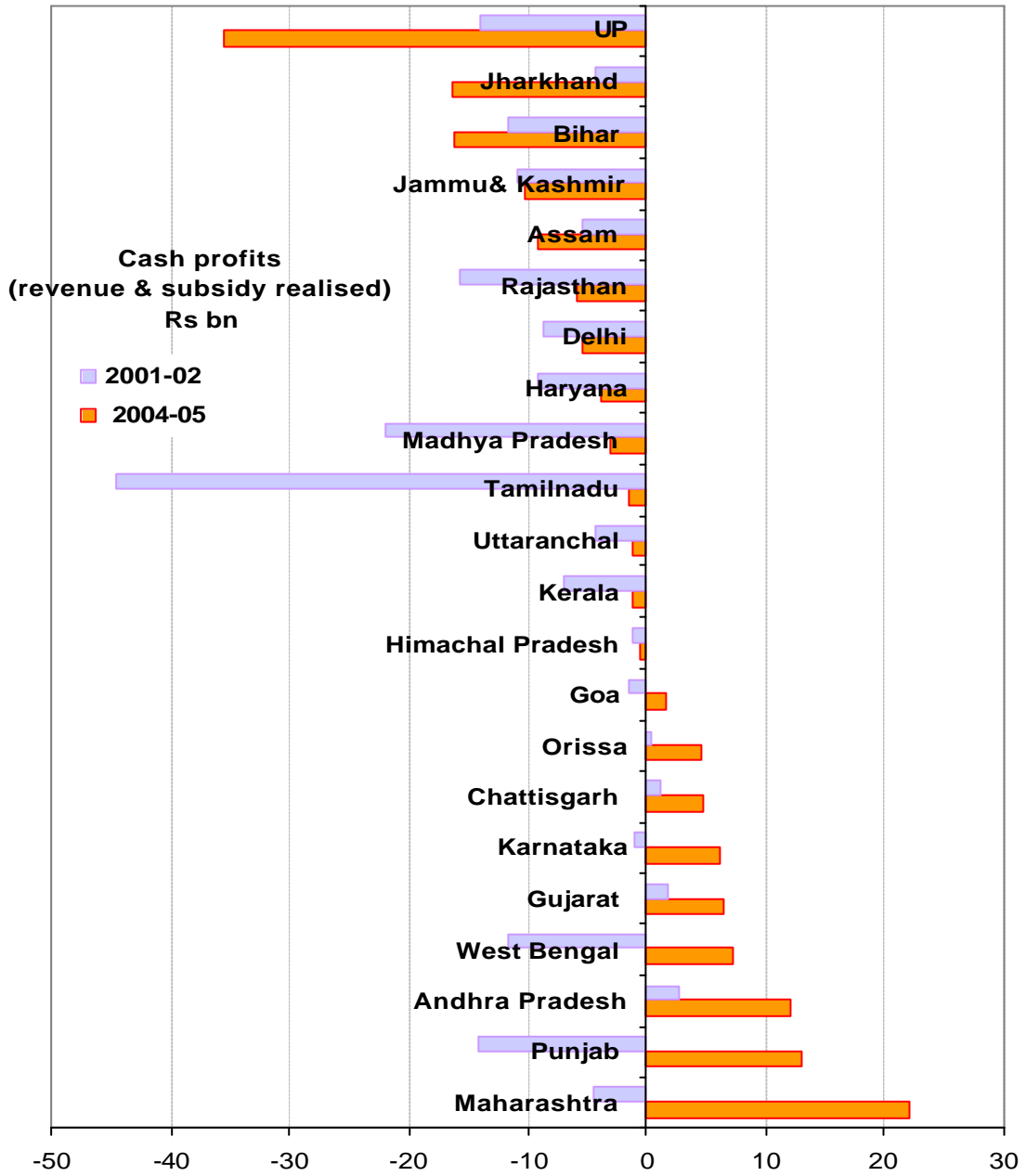
³⁹ It is notable that *after* depreciation (i.e., on a book basis), only three (unbundled) discoms made profits in 2004-05, notably Delhi North, AP East and Karnataka Bangalore. Among the vertically integrated utilities (SEBs, which are not part of Chart 3), Punjab, Chattisgarh, Maharashtra West Bengal and Goa made significant profits after depreciation.

The performance of the six privately owned discoms (in Delhi and Orissa)⁴⁰ was all the more remarkable since they did not receive (direct) subsidies from their respective governments in 2004-05; despite this, four of them made profits in 2004-05, which amounted to 41 percent of the profits of the unbundled discoms and 4 percent of total profits.

To lend credence to having qualified under the incentive component of the APDRP, the qualifying discoms generally have been some of the most improved among their peers but, at the same time, have also been dispersed by the metric of cash profits. However, it is not to say that states that did not qualify under the incentive scheme have not done well, the most striking being Tamil Nadu.

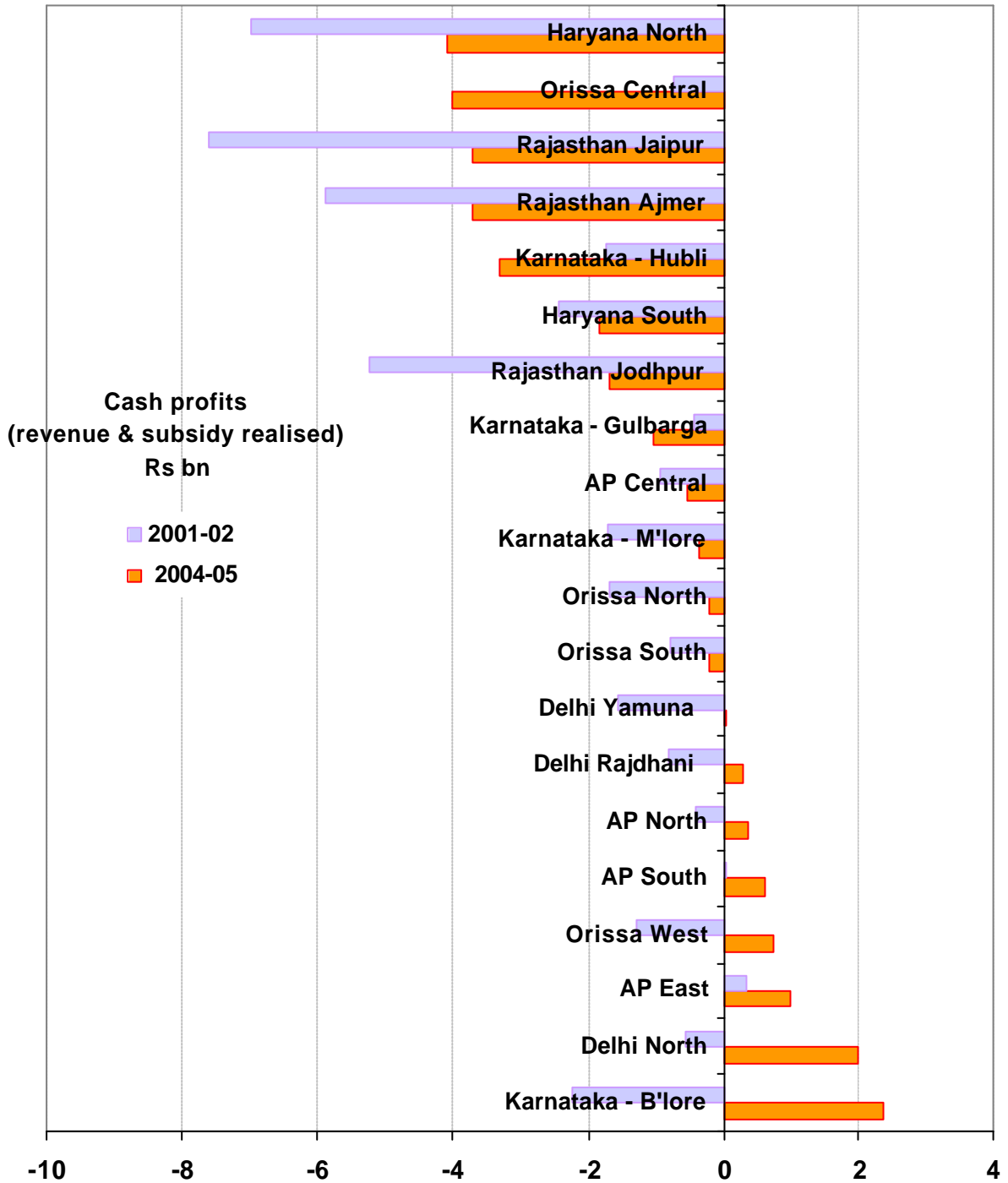
⁴⁰ CESCO (Orissa Central) reverted from private majority to the Government of Orissa (through GRIDCO assuming control) in 2002, following the exit of AES Corporation from the joint venture operating the discom.

Chart 2: Distribution of cash profits/losses by states (Rs. bn)



Note: The cash profits and losses for states that had unbundled their gencos and transcos in our reference period (2001-02 to 2004-05) include the losses and profits made by these entities, in addition to those by their discoms. This is to enable comparability with those states that had not unbundled.

Chart 3: Distribution of cash profits/losses by discoms (Rs. bn)



5. UTILITY-SPECIFIC OUTCOMES

Why have some states done well and some so poorly? We would argue that the main motivator of performance is the degree to which individual utilities are commercially oriented⁴¹. In particular, it comprises of measures to enhance revenues (and hence cash flows). The following sections investigate aspects of the focus on revenues in greater detail and attempt to answer why some states have succeeded more than others in devising a turnaround.

a. Focus on revenues

There are three broad aspects that determine revenue orientation. The first is reduction of commercial losses, which, in turn, comprises of several sub-areas, including loss reduction, metering and collection efficiency. The second is management of overall load composition, with greater emphasis on supply of power to industrial and commercial entities. The third is tariff rationalisation. Are overall tariffs moving towards the cost of supply? Are industry, domestic and agriculture tariffs converging towards cost?

(i) Commercial losses

As with most outcome indicators in the power sector, there is a wide dispersion in the AT&C loss levels and reduction (shown in Appendix Chart A2). The chart is a cross plot of utilities with AT&C losses in 2004-05 and loss reduction (from 2001-02 to 2004-05). Although the distribution of utilities at various loss levels seems more or less random, high loss ones (i.e., those with losses above 50 percent) seem to have predominantly deteriorated. Among the others, though, a dominant majority have reduced their losses.

(ii) Tariff rationalisation

One of the important contributors to India's relatively low rankings in most competitiveness indices is the high cost of power to industrial and commercial

⁴¹ The market microstructure and political economy aspects of commercial orientation have been the subject of much discussion elsewhere. The following quote in a recent article by a former chairman of the CERC is instructive: "Government owns all transmission and distribution, and the bulk of the country's generation. They are run by government servants with no *commercial* experience, adding to inefficiencies, poor maintenance, tolerance of indiscipline and theft by employees." (Rao [2007], our emphasis.)

enterprises, which is an outcome of the fiscal necessity to offset the subsidy on account of sales to agriculture and domestic customers. Since these latter accounts for over half of total units sold, the cross-subsidy loading on to the subsidising segments is significant. Tariff rationalisation entails moving tariffs towards cost, mostly by reducing the gap between subsidised and subsidising segments. At the same time, managing demand growth in subsidised segments and increasing supply to paying customers also moves the average revenue towards average cost.

Utilities with a large gap were far more likely to have deteriorated over the four reference years (Appendix Chart A3); this relationship seems to be among the strongest that we have found. On the other hand, those with the lowest gap in 2004-05 have managed a loss reduction on average. The threshold ACS-ARR gap below which the change seems to become random across utilities is about 60 paise/unit. Among the measures that we deploy, this is about the only one with a cost component. Power procurement costs, i.e., the cost of purchasing power from external entities account from anywhere between 30 to 70 percent of total expenditures of utilities. Management of these costs, of course, is important and a few utilities have taken initiatives to negotiate better deals on PPAs.

(iii) Demand Composition Management

Those states that have managed to shift their incremental load composition towards industries and commercial enterprises will have tended *ceteris paribus* to have better cash flows and would therefore be more financially viable. It is important to note that the potential of some states to increase their industrial and commercial demand has been higher in part due to their ability to attract investments by offering a better investment climate and fiscal incentives. At the same time, one of the key determinants of investment decisions is the cost competitiveness conferred upon commercial units through reliable supply of power at reasonable cost

Appendix Chart A4 shows the outcomes of utilities over the four reference years in shifting the composition of load demand. It shows the ratio of units supplied to subsidising segments (i.e., commercial, high- and low-tension industries) compared to

subsidised segments (i.e., agriculture and domestic consumption). It is striking from the graph that the modal change from 2001-02 to 2004-05 has been fairly small. A substantial majority of utilities sell more units to the subsidised segments than to subsidising ones (which is an important reason why ARR is below cost). A telling observation on the commercial orientation of utilities is that only a bare majority of them have managed to increase the share of the subsidising segments in the overall supply. Two of the most mineral rich states – Jharkhand and Chattisgarh – have had a major drop in this ratio.

b. Decomposition of changes in utility revenues

In the previous subsection the operational levers of revenue focus of utilities in terms of the most important components of their strategies to enhance income, were identified. We now attempt to gauge the relative contributions of each of these components, however much as an approximation, through the algebra of revenues realised.

The revenues realised can be decomposed by the following equation:

$$R = U \times T \times (1 - L) \tag{1}$$

Where:

R: Revenues realised (in Rupees billions), before subventions.

U: Energy units input (in Million Kilowatt Hours).

T: Effective Tariffs (in Rupees/Energy Unit input).

L: Aggregate Technical and Commercial Losses (in percentage).

While each of these parameters is influenced by the various factors discussed in detail above, we focus on the broad aggregates in the interest of tractability.⁴²

⁴² Effective tariffs are computed by dividing revenues booked by total energy units input, which is meant to account for all accounting transactions relating to the sale of energy. Actual revenue realised then depends

In computing the contribution of the sub-components to total revenue change, we ignore not just second order effects, but also implicitly assume that the components of (1) are functionally independent. While this assumption would be mostly true for L, the loss levels, it would hold only weakly for U and T. While unit tariffs, T, might be rightly considered an exogenous variable in this relation, the energy units sold would be a function of T, even if the relationship is not clear. However, in a demand-constrained environment, energy demand might be considered to be relatively inelastic with respect to tariffs. In sum, treating the three components as independent might be a valid (working) assumption.

The three components in (1) are not strictly a one-to-one mapping with the operational “instruments” discussed in the previous subsection. While the losses and effective tariffs correspond closely with the first two drivers, the third (i.e., load composition management) is blended into both the energy units and effective tariffs. The algebra, however, is reasonably close to warrant such a decomposition of contributions.

The methodology for the decomposition is straightforward. Keeping constant two of the components in the right hand side of (1), we calculate the change from 2001-02 to 2004-05 in the third and then compute the share of this in the change in revenues (see Technical Appendix for details). Obviously, the sum of contributions does not add up to one hundred percent of the actual change in revenues, given the approximations that have been assumed. Chart 4 below shows the contributions of the changes in energy sales, tariffs and losses to total revenues realised. The utilities in the chart are arranged in descending order of their improvement in AT&C levels over 2001-02 and 2004-05, since commercial loss reduction is normatively the most desirable driver of increasing revenues. Although the story on tariffs is also complicated, it is in some sense the least desirable means.

on the level of AT&C losses. Note that there still remains some overlap in the calculation of effective tariffs and AT&C levels, in terms of billing and collection efficiency.

Chart 4: Decomposition of revenue changes in terms of energy sold, tariffs and energy loss reductions; change in revenue realised (bottom)

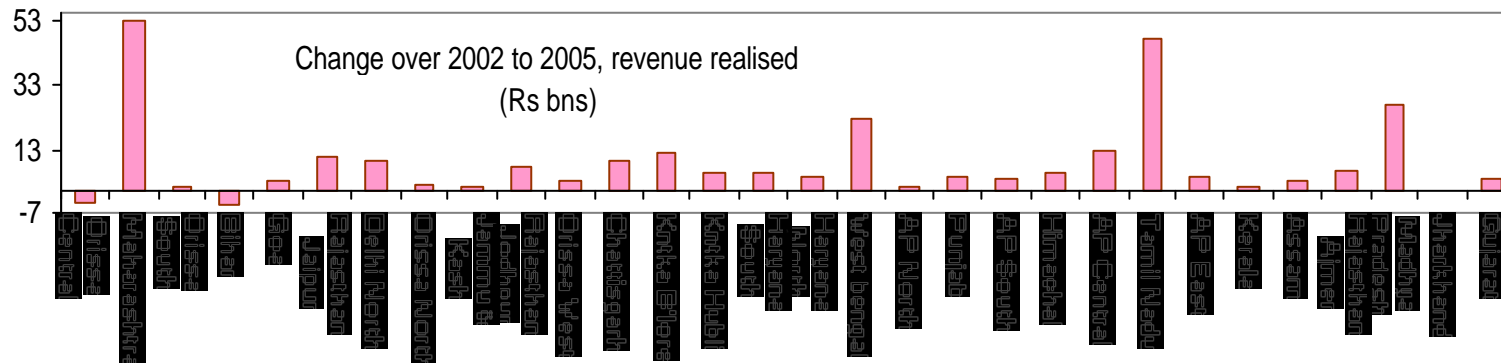
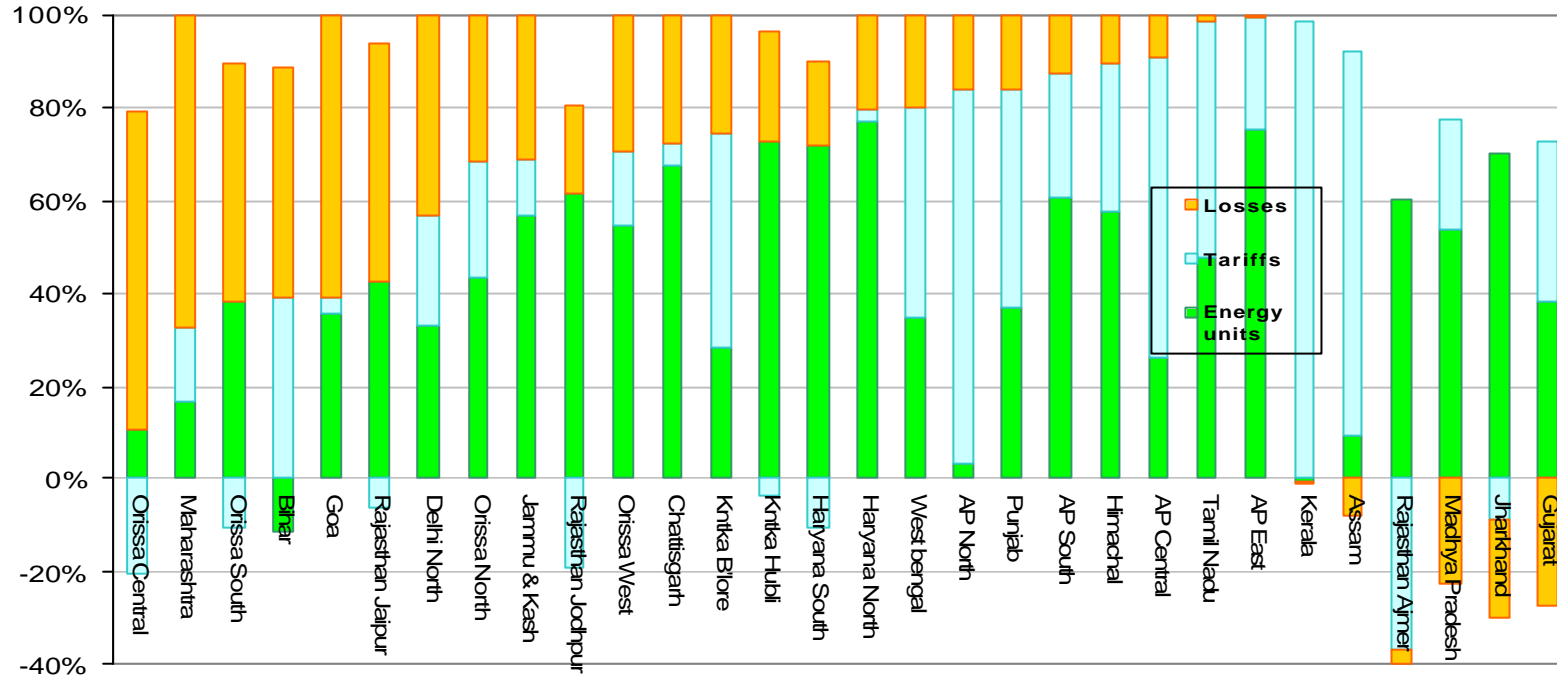


Chart 4 is a visual descriptor of the direct components that have contributed to increase in revenues. The secondary chart at the bottom of Chart 4 shows the magnitude of changes in revenue realised over the period 2001-02 to 2004-05. The charts show the wide diversity in the underlying drivers for changes in revenues realised across utilities.⁴³ For instance, Orissa Central, whose income position has worsened, has managed a large loss reduction, but has suffered a tariff regression; note that its load composition (i.e., more subsidised customers than subsidising ones) has remained more or less the same over this period (see Appendix Chart A4; Appendix Table A6 has details of the decomposition shares). Among the utilities that have managed significant improvements in revenues realised, only Maharashtra has managed this through significant loss reduction; Madhya Pradesh has actually suffered higher loss levels. Tamil Nadu and West Bengal have managed this primarily through increased sales, aided by loss reduction though in much smaller magnitudes.

On the basis of the above chart, Table 8 attempts to identify the utilities that seemed to have increased their revenues in the most robust manner. Since loss reduction is one of the healthier and durable means of revenue enhancement, utilities which rank high in both measures are more likely to be able to sustain their improvements than those which disproportionately resort to higher tariffs and energy sales.⁴⁴

⁴³ Note that comparisons of the results of this decomposition might differ from the results of other charts. This is due to the definitions on revenues and profits used. It is important to keep in mind that the definition of revenue used here is revenue realised before subvention. Charts 2 and 3, on the other hand, reflect changes in profits realised after subventions received from government.

⁴⁴ Even this needs to be qualified since increased tariff levels might reflect higher agriculture and domestic tariffs, which is generally thought to be a desirable action.

Table 8: Classification of utilities in terms of robust revenue enhancement

Revenue increase	High	Medium	Low/Negative
Loss reduction			
Greater than 50%	Maharashtra	Delhi-North, Rajasthan-Jaipur	Orissa-Central, Orissa-South, Orissa-North, Bihar, Goa,
Between 20-50%	K'tka-B'lore, West Bengal	Chattisgarh, Rajsthn-Jodhpur, K'tka-Hubli, Haryana-South, Haryana North	Orissa-West, Punjab
Less than 20%	Tamil Nadu, Madhya Pradesh, Andhra-Central	Rajasthan-Ajmer Himachal	Jharkhand, Assam, Kerala, Andhra-South, Andhra-East, Andhra-North, Gujarat, Punjab

It is important to reiterate once more the indicative nature of this decomposition, given the assumption of independence of the “factors” noted above.

6. A COMPOSITE INDEX OF REVENUE ORIENTATION

While the previous section tried to decompose contributions of intermediate outcomes (loss reduction, tariff increases and higher energy sales) to the final revenue realisations, another perspective of the results of reform might emerge by ranking utilities on the basis of their operational decisions that result in both the intermediate and final outcomes. In other words, the implicit assumption underlying such a decision-based ranking is to control for exogenous factors that were beyond the control of the utility in evaluating revenue and profit outcomes. A summary indicator that captures the various aspects of what we have described as “commercial orientation”⁴⁵ of a utility might be a useful “sufficient statistic” for the revenue and cash performance of a utility. Towards

⁴⁵ We construe “Commercial Orientation” as a wider construct than “Revenue Orientation”, encompassing actions that are likely to result in sustainability of increasing revenue realisations, which is the objective of the latter concept. Although key aspects of commercial orientation were earlier elaborated in section 2b (Operational efficiency and sustainability), it is difficult to adequately quantify and grade since there has been little action on many of these aspects, and patchy data where there has been progress.

this end we construct a utility-specific Index of Revenue Orientation (IRO) for 2001-02 and 2004-05.

The authors are aware of one previous attempt in constructing such a composite measure, but in a somewhat different context. ICRA and CRISIL, two of India's credit rating agencies had been mandated by the Power Finance Corporation at the instance of the Union Ministry of Power to carry out a performance rating exercise for state electricity boards/discoms. The first report was for data available up to 2003 and the fourth edition was released in June 2006 (ICRA and CRISIL [2006]). There are several problems with the methodology of this exercise. First, the scope of the variables included was too extensive and unwieldy for drawing inferences on financial performance, which is the bottom line outcome measure. Input and output indicators could have been combined in a more logical manner. Second, the methodology for translating the indicated metric into the final score is not publicly available, although the list of variables that have been deployed is. Third, the weights assigned to the aggregated grouping of individual metrics, are not only subjective but have also undergone significant change during the four years over which the ratings score were calculated. If that was not enough, the scores were changed "based on the feedback obtained from the Ministry of Power and the utilities, as also the most recent developments in the sector".

Although a better understanding of the rating process is certainly useful, some of the parameters are too blunt and unquantifiable. Others are open to a mechanical interpretation, ignoring ground realities. For instance, the measure of progress in attaining one hundred percent rural electrification and electrification of households is likely to provide a much distorted picture since the extant definition of an electrified village is the provision of an electricity pole and that some wires have reached the outskirts of the village.

Given the shortcomings associated with such an omnibus measure, we decided to focus on a few parameters that are relatively well-defined; those that are based on more or less observed outcomes and might be thought to be the upshot of several processes

instituted over the years. The aggregation is meant to capture one very important aspect of commercial orientation, specifically, what we term “Revenue Orientation”.

Electricity provision is a commercial business, like any other service provision such as banking or healthcare. Admittedly, there is a *merit* good aspect in this service, involving the provision of access to economically disadvantaged sections of consumers or in remote areas. These functions, however, are best enabled through subventions from the government, and should not be embedded in the tariffs and provisions of supply to designated segments. At the end of the day, the electricity supply business has to generate returns on capital employed regardless of ownership (government or private sector).

The Index is composed of the following elements:

- (i) AT&C loss levels.
- (ii) Collection efficiency.
- (iii) The gap between the Average Revenue Realisation (ARR) and the Average Cost of Supply (ACS).
- (iv) The gap between the ARR from the industry segment and ACS (as a percentage of ACS).
- (v) The ratio (in terms of units supplied) of the subsidising segments (i.e., commercial, industry (high tension) and industry (low tension) to the subsidised segment (i.e., agriculture and domestic).

The formula for the Index is as follows:

$$\text{IRO} = (1 - \text{AT\&C losses}) + \text{Collection Efficiency} + (\text{ARR} - \text{ACS}) - (\text{Industry ARR} - \text{ACS}) + \text{Ratio of subsidising to subsidised segments} \quad (2)$$

The weights are uniform, and are simply +1 or –1 depending on the appropriate definition of the respective measures. Consequently, the simplest aggregation of the indicators comprising each of the indices is an arithmetic mean. Punctilious analysts might argue that the effect of particular elements might be more significant than those of others, in terms of their impact on the extent of revenue orientation. However, in the absence of statistically significant measures of the relative magnitudes of such impacts, the best (in the sense of least biased) weights may be uniform ones. The rationale for the components of the Index is as follows:

- The two sets of numbers for a state electricity system that are relatively reliable and robust is the number of electricity units input in the system and the actual cash collected. The best portmanteau measure, by definition, to capture this is AT&C loss, which is measured as a percentage of energy units input.
- The next measure is collection efficiency, which although a component of the AT&C loss, provides a measure of the effectiveness of energy audits, metering and billing processes. Collection efficiency is being included separately to reinforce the importance of AT&C loss reduction, and to emphasise the importance of this step within it since it is probably less likely to be susceptible to political and administrative imperatives that characterise a large part of AT&C losses. The measure has to be interpreted a little carefully, since annual changes in the ratio can be exaggerated by collecting arrears from previous years; however, the movement over a period of four years is likely to mitigate this distortion.
- The ARR is in some sense the summary outcome measure of revenue *orientation*, with the others contributing to improvement (or deterioration) in the ARR. Reduction of the gap between the ACS and the ARR is the basic objective of reforms in the power sector.
- While overall ARR needs to move towards ACS, so that the system's losses are brought down, this should generally not be the result of tariffs for industry and

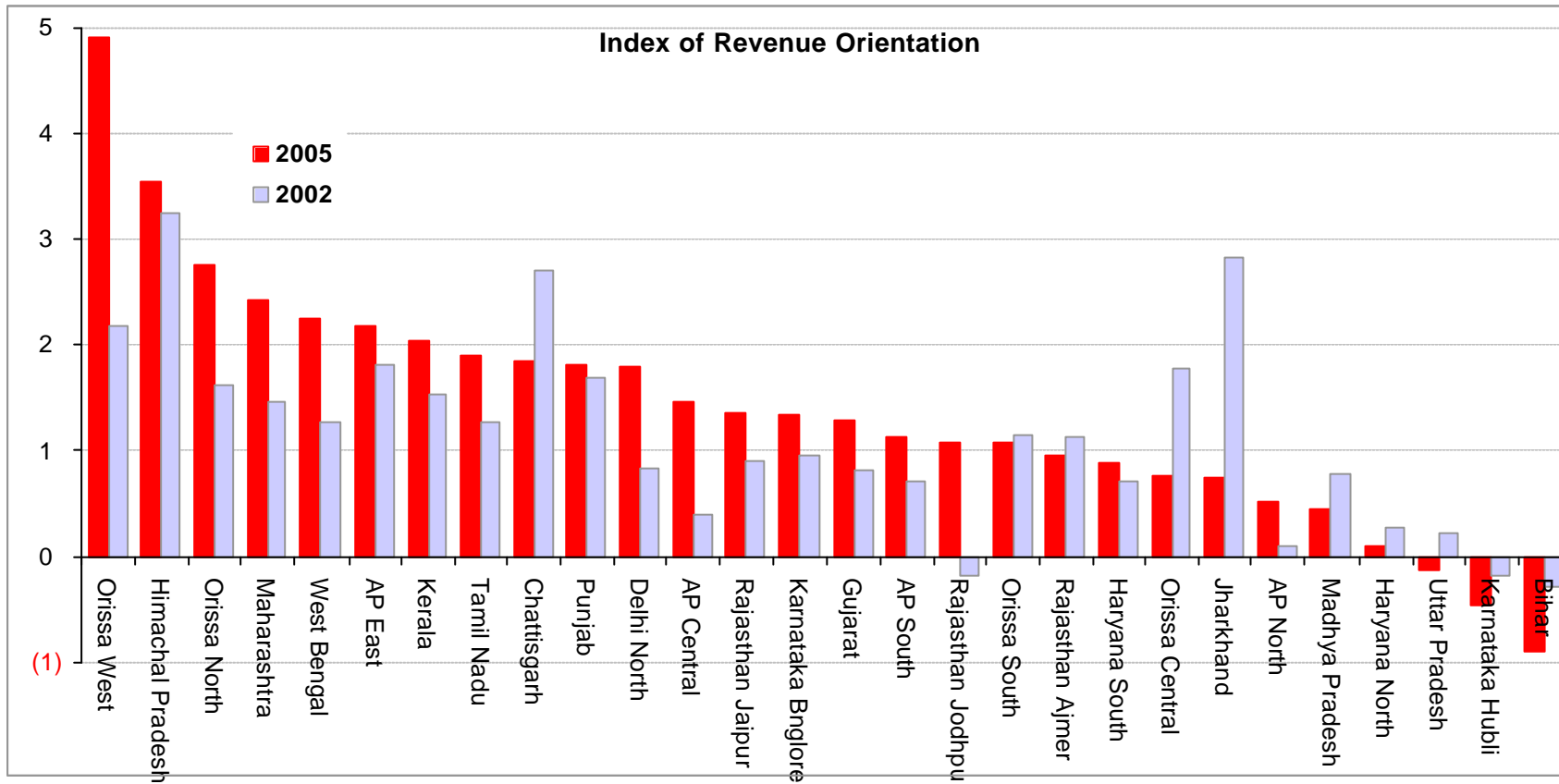
commercial segments becoming prohibitively high, consequently leading to business uncompetitiveness and exit from the grid.

- The last measure is demand load management. From a business perspective increased focus on enhancing the share of paying customers in comparison to those on which the utility incurs a loss is desirable.

There are some obvious limitations in the construction of such an Index. The choice of metrics constituting the Index involves a degree of ambiguity in the separation, an inevitable degree of double counting inherent not just in the separation of the metrics, but also in the nature of the variables used as constituents of the Index. For instance, there is a degree of overlap between AT&C losses and collection efficiency, and consequently a problem akin to collinearity.

Keeping in mind the caveats, Chart 5 below allows us to draw the following inferences. In line with our observations regarding the change in the state (and discom)-wise cash losses/profits positions, the spread between utilities has opened out in 2004-05, compared to the situation in 2001-02. While the average Index value increased from 1.14 in 2001-02 to 1.3 in 2004-05, the associated standard deviation also increased from 0.9 to 1.2. In other words, utilities had a much more homogenous ordering of revenue orientation in 2001-02 than in 2004-05. The strongest influences on extreme ends of the rankings in the IRO are those of the ratio of subsidising to subsidised segments (the values of the constituent components for the IRO for 2001-02 and 2004-05, respectively, are presented in Appendix Table A7). The next important variable was the AT&C loss level. There does not seem to be a systematic pattern in the middle range of the IRO rankings.

Chart 5: Composite Index of Revenue Orientation



(1)

Note: The utilities are arranged in descending order of Revenue Orientation in 2004-05.

Most utilities have improved their performance (and orientation), some significantly. The most notable of these were Rajasthan Jodhpur, AP Central, Delhi North, Orissa West and Orissa North. Among the utilities that had contributed the most to cash losses (UP and Bihar), both show a substantial deterioration of their revenue orientation, which had been poor to begin with. Some others, also with high losses, for example, Jharkhand, and Orissa Central, have shown a significant deterioration in orientation. The Index, therefore, reflects the popular perception of the utilities that have improved and those that are perceived to have deteriorated significantly.

Some other generalisations are also possible. First, most of the utilities that had been privatised have done fairly well, and have improved. Of course, some utilities that had been privatised are still not performing well; Orissa South, for instance, is not just relatively low on the scale, but has also deteriorated since 2001-02. At the same time, other utilities have improved as much or more than those privatised. Secondly, there is a significant variation between the rankings of individual utilities within a state. Stating, for instance, that Andhra Pradesh has done well as opposed to say, Haryana, masks the differential performance of the utilities within this. Haryana South has a higher ranking than AP North and Karnataka Hubli has done much worse than the Bangalore circle.

The states that have qualified for the incentive component of APDRP are spread along the entire spectrum of the Index, but are grouped along the upper deciles of utilities in terms of the improvements in their rankings over the four-year window. The picture among those that were privatised is less uniform, and shows a higher dispersion in terms of their ranking in the Index as well as improvement.

7. CONCLUSIONS

Following a series of policy interventions instituted after a default crisis in the power sector around 2000-01, the rot in the power sector has been stemmed. The financial situation of the sector has eased, and together with the improved fiscal position of states, the strain on the states' fiscal deficits has lessened. Deficits as a share of GDP have declined.

The sector, nevertheless, is still far from financial viability. AT&C losses, while having dipped slightly from the 2000-01 crisis levels, have remained stubbornly high; so have state government subventions, in both absolute terms and as a ratio to state Gross Fiscal Deficits (GFD). For some states the latter ratio is worrisome, and poses wider risks. Another source of fiscal vulnerability emanates from demand for increased supply of power at below cost to rural areas that could come about on account of the politically important flagship rural electrification scheme of the central government to expand the distribution network. The rate of return on capital is reported to have deteriorated in 2006-07. Shortages in many states have worsened over the past couple of years, and supply reliability and quality of power delivered have declined. Industries and commercial enterprises have had to invest heavily in high-cost captive generating capacity, which undermines business competitiveness. Investments in upgrading, improving and R&M in wires, transformers and feeders have been reported to be inadequate, let alone large investments in new generating capacity. Moreover, many of the indicators, after having improved significantly in the immediate aftermath of the reform measures, seem to have plateaued after 2003-04.

The basic problem is that although the sector at an all-India level is expected to have made a small cash profit in 2005-06, there are simply not enough resources in the state government-owned system to add capacity on any appreciable scale let alone that which is required to power India's economic growth. (The cash profit, of course, does not capture the burden of principal repayments.) By and large, it is likely that there will be incremental improvement in many metrics of performance in utilities over the next couple of years. These, unfortunately, will be nowhere close to those levels required for meeting the soaring demand for energy. There is little likelihood of fresh lending to the sector on account of poor debt service coverage ratios. Utilities will need to generate vastly higher cash flows to attract significant investments in generation and transmission, which are unlikely to be forthcoming if there are no major improvements in the variables discussed in the paper.

Five years into the reform effort, we believe that it is time to take stock of the effectiveness of reform measures. If significant change is needed in the reform process to speed up restructuring, an understanding of deep cause-and-effect relationships between inputs and outcomes is critical. An important motivation for

the paper was to examine improvements in revenues and cash flows of utilities, delve into the underlying causal factors and then map these factors into a composite metric of commercial orientation; this allows a ranking of utilities on the basis of this quantified metric. We believe that this orientation is the key to inferring the long term outcomes of the reform steps.

Beyond a point, it is not very meaningful to talk of the power sector as a monolith in terms of commercial and financial viability. Variability in outcomes (and in many of the underlying explanatory variables) has increased after the reform measures; the dispersion was much lower in 2001-02. Some states have improved significantly, some have deteriorated sharply. Five utilities contribute 80 percent of the total cash losses and another five to 78 percent of cash profits. The variation across states and even between utilities within states is so significant that it only makes sense to talk of the finances of the power sector in a fiscal context, with the probable impact of overall deterioration affecting sovereign ratings. The unevenness in performance between discoms warrants granularity in tariff setting, that is, at the level of a discom (rather than at the state), or, even distribution circle and city, which would only be fair to honest consumers (they would attract reliable suppliers because they are paying their bills, and lower tariffs if AT&C losses are lower in a particular area).

What does this entail for policy? Different utilities have placed emphasis on different strategies for enhancing revenues. Fragmented information indicates that there is sufficient progress in many of the basic inputs of utilities. These, however, do not seem to be rapidly translating into higher revenues and cash flows, which would presumably have happened more swiftly had there been a more widespread focus on the top line. One of the showpiece reform initiatives, the APDRP, has patently had limited success in attaining the objectives for which it was initially established. The variation in improvement in different states is also a warning sign of the increasing disparities in the ability of states to attract investments and foster growth.

One of the deeply held beliefs of the authors is that the objectives of revenue and cash flow enhancement are likely to improve faster and more consistently if market structures and incentive signals are designed to make utility actions more consistent with these objectives. Deeper reforms are needed to advance these two

objectives. These structures and signals are, in turn, synonymous with *inter alia* competition and private (as opposed to state) ownership.

While the data in the paper shows evidence of only a weak relationship between ownership and profitability, it is important to bear in mind that the more successful subset amongst the discoms which have been privatised (i.e., Delhi) is a relatively nascent experiment, which has still managed to outperform many of its more mature peer utilities, while having started from a more disadvantaged initial condition. Private utilities have also come out relatively better in terms of one of the key indicators of revenue orientation, i.e., ACS-ARR gap reduction.

The other measure of a competitive market structure, with the ability of the most efficient generators of electricity being allowed to sell power to the most credit worthy customers has been a non-starter in the context of the prevalent single-buyer model. This is a hypothesis that cannot, as of now, be validated by data, since states have not implemented the policy in an effective manner.

REFERENCES

Bhattacharya, Saugata, and Urjit Patel. 2003. "Markets, regulatory institutions, competitiveness and reforms." Working Paper No.184, Stanford Center for International Development, Stanford University.

_____. 2005. "New regulatory institutions in India: White Knights or Trojan Horses?", In *Public Institutions in India: Performance and Design*, D. Kapur and P. B. Mehta (Eds.) (Oxford University Press, New Delhi).

Deo, Jayant. 2007. "Power Exchange." January.

Dubash, Navroz, and Narasimha Rao. 2006. "Emergent regulatory governance in India: Comparative case studies of electricity regulation." Paper presented at a conference on "Frontiers of regulation: Assessing scholarly debates and policy changes," University of Bath. September.

Government of India. 2001. Report of the Expert Group on 'Settlement of SEB Dues', Planning Commission. May.

_____. 2002. Report of Expert Committee on State-Specific Reforms: 'Structuring of APDRP, Reform Framework and Principles of Financial Restructuring of SEBs', Ministry of Power. September.

_____. 2003. Report of Expert Committee on State-Specific Reforms: 'Power Sector Reform – Transition Financing Windows', Ministry of Power. March.

_____. 2006a. Report of the Expert Committee on Integrated Energy Policy, Planning Commission. August.

_____. 2006b. Report on Restructuring of APDRP, Ministry of Power. October.

Government of Karnataka. 2000. Report of the High Level Committee on Escrow Cover to IPPs. February.

ICRA and CRISIL. 2006. State Power Sector Performance Ratings, Final Report to the Ministry of Power, Government of India. June, and three previous reports.

Infrastructure Development Finance Company Limited (IDFC). 2001. "Six Steps to Accelerated Privatisation of Electricity Distribution." Mimeo. January.

Katiyar, Sudhir. 2005. "Political economy of electricity theft in rural areas: A case study from Rajasthan." *Economic and Political Weekly*, February 12: 644-648.

Narendranath, G, Uma Shankari, and K. R. Reddy. 2005. "To free or not to free power: Understanding the context of free power to agriculture." *Economic and Political Weekly*, December 31: 5561-5570.

National Thermal Power Corporation (NTPC). 2006. "Retrospection of reforms in distribution - A way forward." Presentation by Lead AcCs. May.

Patel, Urjit. 2004a. "Plug power financials – Now!" *Business Standard* (March 10).

_____. 2004b. "Time to go back to basics." *Business Standard* (March 19).

Power Finance Corporation Limited (PFC). 2005. Report on the Performance of the State Power Utilities for the years 2001/02-2003/04. New Delhi.

Power Finance Corporation Limited (PFC). 2006. Report on the Performance of the State Power Utilities for the years 2002/03-2004/05. New Delhi.

Prayas. 2003. A Good Beginning but Challenges Galore: A Survey Based Study of Resources, Transparency, and Public Participation in Electricity Regulatory Commissions in India. Pune.

Rao, M. G. 2007a. "Issues in electricity governance." *Business Standard* (May 1).

Rao, S. L. 2007b. "Darkness at noon." *Times of India* (May 22).

Reserve Bank of India .2006. State Finances, a study of budgets of 2006-07.

Seetha. 2003. "People power: Market for electricity from below." Policy Paper No.7, Julian L. Simon Centre for Policy Research, Liberty Institute. New Delhi.

Singh, Sanjay. 2007. "Power reforms: Reality or chimera?" *Economic Times* (June 9).

Tadimalla, Srikumar. 2000. "Privatisation of Kanpur Electricity Supply Company (KESCO): A case study." Mimeo. December.

_____. 2001. "Extricating the Orissa power sector from the current crisis." Mimeo. December.

Tadimalla, Srikumar, and Urjit Patel. 2005. "Regulation: Only one piece of the infrastructure jigsaw." Mimeo. January.

The Energy Research Institute (TERI). 2007. "Analysis of tariff orders (distribution) of nine states: A study undertaken for the Ministry of Power." <http://powermin.nic.in>. May.

Virmani, Arvind. 2005. "Policy Regimes, Growth and Poverty in India: Lessons of Government Failure and Entrepreneurial Success!" Mimeo., Indian Council for Research on International Economic Relations, New Delhi.

World Bank. 2002. "Improving the Investment Climate in India: An Investment Climate Assessment."

_____. 2007. "Closing the Electricity Supply-Demand Gap."

Data Appendix: Rationale for inclusion and exclusion of utilities for computation of the different metrics

The paper, using data in PFC [2005, 2006], has included the following states (and the associated utilities) in its analysis: Andhra Pradesh, Bihar, Chattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. On occasion, there might be other states like Assam, Goa, Jammu & Kashmir and Uttaranchal included, but this is usually limited to those analyses where only one metric is involved. These states together accounted for 86 percent of the total units of power sold in 2004-05. Some states were excluded due to missing data for the relevant periods.

Also note that while most indicators using multiple metrics use data from 2001-02 to 2004-05, some utilities do not provide the complete data series. In such instances, we have used the starting date of 2002-03. Occasionally, some utilities have not released data for 2004-05. If the relevant data point was available for 2001-02, we have used the last available data point for 2003-04 in these cases. If none of these end-point data were available, the utility was omitted (e.g., Delhi Rajdhani and Delhi Yamuna in the Index of Revenue Orientation).

Another aspect to keep in mind is that the Electricity Boards of some states were unbundled during the period of investigation (Delhi, Karnataka and Uttar Pradesh). Data for relevant parameters are for the entire electricity system for the initial years, but for only the unbundled discoms for the later years. Although the contribution of these segments to the overall indicators is often relatively small, the resulting discrepancy should be kept in mind. A final point to note is that comparisons between the Charts (and the associated data sets) across sections of the paper may not be entirely valid. Various definitions of revenues and profits have been used in the respective sections, depending upon the context of the analysis in that particular section.

Cont'd...

Data Appendix Cont'd. : Mapping of formal discom name to our nomenclature

State	Official name	Name used in text
Andhra Pradesh	APCPDCL	AP Central
Andhra Pradesh	APEPDCL	AP East
Andhra Pradesh	APNPDCL	AP North
Andhra Pradesh	APSPDCL	AP South
Delhi	BSES Rajdhani	Delhi Rajdhani
Delhi	BSES Yamuna	Delhi Yamuna
Delhi	NDPL	Delhi North
Haryana	DHBVNL	Haryana South
Haryana	UHBVNL	Haryana North
Karnataka	BESCOM	Karnataka Bangalore
Karnataka	GESCOM	Karnataka Gulbarga
Karnataka	HESCOM	Karnataka Hubli
Karnataka	MESCOM	Karnataka Mangalore
Madhya Pradesh	Poorva KVVCL	MP East
Madhya Pradesh	Pashchim KVVCL	MP West
Madhya Pradesh	Madhya KVVCL	MP Central
Orissa	CESCO	Orissa Central
Orissa	NESCO	Orissa North
Orissa	SESCO	Orissa South
Orissa	WESCO	Orissa West
Rajasthan	AVVNL	Rajasthan Ajmer
Rajasthan	JDVVNL	Rajasthan Jodhpur
Rajasthan	JVVNL	Rajasthan Jaipur
Uttar Pradesh	Dakhinachal VVN	UP South
Uttar Pradesh	Madhyanchal VVN	UP Central
Uttar Pradesh	Paschim VVN	UP West
Uttar Pradesh	Poorvanchal VVN	UP East

TECHNICAL APPENDIX: Methodology of Revenue Decomposition

The base equation for revenues realised is the following equation (in section 5b):

$$R = U \times T \times (1 - L) \quad (1)$$

Where,

R: Revenues realised (in Rupees billions), before subventions.

U: Energy units input (in Million Kilowatt Hours).

T: Effective Tariffs (in Rupees/Energy Unit input).

L: Aggregate Technical and Commercial Losses (in percentage).

Eqn. (1) is a static equation to calculate the revenue realised (before subsidy) for each year in the dataset. The objective of the decomposition is to understand the relative contributions of the three components to the changes in revenues realised over the sample period of 2001-02 to 2004-05. The steps of this decomposition are as follows:

$$\Delta R^1 = \Delta U \times T(1) \times (1 - L(1))$$

$$\Delta R^2 = U(1) \times \Delta T \times (1 - L(1))$$

$$\Delta R^3 = U(1) \times T(1) \times \Delta [(1 - L)]$$

Where $\Delta x = [x(T) - x(1)] = [x(2004/05) - x(2001/02)]$

The contribution of the i^{th} component ($i = 1, 2, 3$) is:

$$C_i = \Delta R^i / \Delta R$$

Where $\Delta R = \Delta R^1 + \Delta R^2 + \Delta R^3$.

Appendix Table A1: Status of reforms in 24 states as on end-March 2006

Source: State Finances, a study of budgets of 2006-07, RBI

	MoU/MoA signed with Ministry of Power, GoI	State Electricity Board Unbundled	Constitution of State Electricity Regulatory Commission (SERC)	Tariff/ ARR Order Passed	Others
Andhra Pradesh	Yes	Yes	Yes	Yes	Anti-theft law passed, strategy for privatising distribution is being finalised
Assam	Yes	Yes	Yes	Yes	–
Bihar	Yes	No, extension sought	Yes	–	Anti-theft law passed
Chhattisgarh	Yes	No, extension sought	Yes	Yes	–
Goa	Yes	No, only Electricity Department	Yes (non-functional)	–	–
Gujarat	Yes	Yes	Yes	Yes	Anti-theft law passed
Haryana	Yes	Yes	Yes	Yes	–
Himachal Pradesh	Yes	No, extension sought	Yes	Yes	–
Jammu & Kashmir	Yes	No, only Electricity Department	Yes (non-functional)	–	–
Jharkhand	Yes	No, extension sought	Yes	Yes	–
Karnataka	Yes	Yes	Yes	Yes	Anti-theft law passed
Kerala	Yes	No, extension sought	Yes	Yes	Anti-theft law passed
Madhya Pradesh	Yes	Yes	Yes	Yes	Anti-theft law passed
Maharashtra	Yes	Yes	Yes	Yes	Anti-theft law passed
Meghalaya	Yes	No, extension sought	Yes (non-functional)	–	–
Orissa	Yes	Yes	Yes	Yes	Distribution privatised
Punjab	Yes	No, extension sought	Yes	Yes	–
Rajasthan	Yes	Yes	Yes	Yes	–
Tamil Nadu	Yes	No, extension sought	Yes	Yes	–
Tripura	Yes	Yes	Yes	Yes	–
Uttaranchal	Yes	Yes	Yes	Yes	–
Uttar Pradesh	Yes	Yes	Yes	Yes	Anti-theft law passed
West Bengal	Yes	No, extension sought	Yes	Yes	Anti-theft law passed
NCT Delhi	Yes	Yes	Yes	Yes	Distribution privatised

Appendix Table A2: Grid frequency

(% of time when the grid frequency was ...)

	Northern		Eastern		Southern		Western	
	Below 49 Hz	49.0-50.5 Hz	Below 49Hz	49.0-50.5 Hz	Below 49Hz	49.0-50.5 Hz	Below 49Hz	49.0-50.5 Hz
Apr-06	74.11	25.89	33.92	66.08	23.7	76.2	33.29	66.7
May-06	11.7	86.32	3.29	96.4	4.32	95.6	2.65	96.8
Jun-06	17.81	81.59	2.58	97.14	1.2	98.74	1.92	97.62
Jul-06	28.8	70.47	1.18	96.34	0.48	99.41	0.88	97.39
Aug-06	39.22	60.76	0.76	97.91	0.37	99.22	0.65	97.41
Sep-06	1.97	98.02	2.28	97.71	1.38	98.6	1.7	98.29
Oct-06	9.59	90.29	11.22	88.68	10.53	89.46	9.02	90.9
Nov-06	13.93	86.07	13.93	86.07	0.69	99.3	11.18	88.82
Dec-06	8.46	91.54	16.16	83.84	10.4	89.6	12.81	87.19
Jan-07	38.36	61.64	38.36	61.64	9.26	90.7	38.36	61.64
Feb-07	7.32	92.53	7.32	92.53	2.92	97.01	7.32	92.53
Mar-07	3.15	96.76	3.15	96.76	6.26	93.66	3.15	96.76
2006-07	21.2	78.49	11.18	88.43	5.96	93.96	10.24	89.34

Appendix Table A3: Metering status, 2005-06

	11 Kv feeders			Distribution transformers			Consumer connections		
	No.	Metered	%	No.	Metered	%	No.	Metered	%
Andhra Pradesh	9,239	8,674	94%	351,751	38,729	11%	15,746	15,047	96%
Assam	709	709	100%	21,980	1,528	7%	1,274	1,209	95%
Bihar	1,125	465	41%	15,000		0%	1,250	623	50%
Chattisgarh	2,030	2,030	100%	42,664	7,012	16%	2,459	1,696	69%
Delhi	1,850	1,850	100%	8,000	3,500	44%	2,665	2,665	100%
Goa	179	179	100%	3,562	1,781	50%	396	386	97%
Gujarat (GEB)	5,307	5,307	100%	236,632	1,500	1%	7,477	6,957	93%
Guj.(Torrent AEC)	752	266	35%	4,228	4,228	100%	1,264	1,264	100%
Guj. (Torrent SEC)	303	303	100%	2,300	2,300	100%	520	520	100%
Haryana	3,888	3,888	100%	133,364		0%	3,917	3,612	92%
Himachal Pradesh	762	727	95%	18,133	16,730	92%	1,747	1,747	100%
J&K	1,558	1,480	95%	30,015		0%	1,000	400	40%
Jharkhand	461	396	86%	16,500	15,000	91%	653	490	75%
Karnataka	4,570	4,570	100%	144,000	34,500	24%	12,889	10,568	82%
Kerala	1,334	1,334	100%	35,442	5,506	16%	7,799	7,799	100%
Madhya Pradesh	5,660	5,660	100%	160,000	3,000	2%	6,492	4,650	72%
Mah. (BEST)	594	0	0%	2,570	0	0%	66,700	66,600	100%
Mah. (MSEB)	6,148	6,148	100%	215,241	52,923	25%	13,532	11,812	87%
Mah. (REL)	600	300	50%	4,067	3,917	96%	2,495	2,495	100%
Manipur	193	40	21%	--	--		170	140	82%
Orissa	1,792	1,699	95%	22,000	20,500	93%	2,149	1,745	81%
Punjab	5,928	5,928	100%	217,000	11,660	5%	5,894	5,039	85%
Rajasthan	8,411	8,411	100%	188,170		0%	5,845	5,478	94%
Sikkim	115	115	100%	1,370	531	39%	66	61	92%
Tamil Nadu	3,777	3,777	100%	161,092	4,703	3%	17,033	14,813	87%
Uttar Pradesh	8,507	8,507	100%	330,000	6,652	2%	8,806	8,038	91%
Uttaranchal	1,106	1,106	100%	27,681	9,360	34%	1,060	1,004	95%
West Bengal	2,347	2,347	100%	53,420	13,500	25%	5,731	5,670	99%
Chandigarh	174	174	100%	--	--		197	197	100%
Total	80,425	77,136	96%	2,449,613	259,730	11%	198,322	183,549	93%

Source: Powerline, December 2006, sourced from the Ministry of Power.

Appendix Table A4: Losses

	Net cross subsidy* (Rs. bn) (1)	Commercial losses* (Rs. bn) (2)	Financial losses* (Rs. bn) (3)	T&D loss (%) (4)	AT&C loss (%) (5)	AT&C loss (%) (6)
1966-67	--	--	--	15	--	--
1989-90	--	--	--	23.3	--	--
1991-92	52.8	41.2	--	--	--	--
1992-93	60.4	43.6	--	21.8	--	--
1993-94	79.4	50.0	--	21.4	--	--
1994-95	80.0	63.3	--	21.1	--	--
1995-96	106.2	83.2	--	22.3	--	--
1996-97	123.0	94.5	--	24.5	--	--
1997-98	154.6	118.2	--	24.8	--	--
1998-99	234.7	180.8	--	26.5	--	--
1999-00	295.7	249.2	--	30.9	--	--
2000-01	309.9	254.0	--	--	--	--
2001-02	308.9	240.6	293.3	34.0	37.2	38.9
2002-03	257.7	213.8	211.9	--	38.6	--
2003-04	270.2	203.8	197.2	--	37.8	--
2004-05	298.0	235.6	221.3	--	36.8	33.8
2005-06	303.4	211.1	--	--	--	--

*Excluding subventions.

Sources: Columns (1) & (2): Economic Survey, various years (provisional data for 2000-01 onwards); cols. (3) & (5): PFC [2005, 2006]; col. (4): Ministry of Power Annual Report, 2002-03 for 1966-67, 1989-90 and 1992-93 – 1999-00, and for 2001-02, Economic Survey, 2003-04 (where it is stated that for 1992-93 and 2001-02 the figure for T&D loss includes energy unaccounted for). (The Ministry of Power Annual Report, 2003-04 does not have any T&D loss estimate, but on page 11 alludes to AT&C losses being in excess of 50%); and col. (6): Report on Restructuring of APDRP (GoI [2006b]).

Appendix Table A5: Energy shortages

		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Delhi	Energy Availability (MUs)	16184	17141	17667	18741	19567	20160	20952	21294	15,834
	Energy Shortage (%)	1.9	2.8	4.9	3.1	1.9	1.4	1	1.5	2.1
	Peak Shortage (%)	8.1	12.4	13.3	7.7	9.2	3	1.9	3.3	6.6
HY	Energy Availability (MUs)	13808	13808	16793	17839	19688	19779	20562	21625	16,339
	Energy Shortage (%)	2.1	2.1	2.8	1.6	3	4.6	5.7	8.9	11.8
	Peak Shortage (%)	8.3	0	3.3	3.3	2.5	5.4	10.3	9.3	13.1
PU	Energy Availability (MUs)	24300	26164	26923	27577	28313	30520	30383	32585	25,333
	Energy Shortage (%)	2.2	0.6	2.7	4.2	5.9	2.9	9	8.7	11.5
	Peak Shortage (%)	0	0	2	8.9	6.7	5.1	21.9	20.3	26.9
RJ	Energy Availability (MUs)	22766	24024	24178	24495	25382	26486	28974	30883	20,357
	Energy Shortage (%)	2.5	4.5	3.6	1	2.1	0.5	0.8	3.5	4.1
	Peak Shortage (%)	4.2	0	2.5	1.2	1.5	0	7.8	13.7	6.4
MP	Energy Availability (MUs)					26493	28417	30097	31623	20,237
	Energy Shortage (%)					16.4	13.2	13.5	14.2	11.8
	Peak Shortage (%)					14.2	22.1	18.5	21.7	7.3
CH	Energy Availability (MUs)					9561	9876	11553	11553	8,568
	Energy Shortage (%)					3.1	2.7	1.7	1.7	5.8
	Peak Shortage (%)					3.6	9.5	7.6	7.6	15.8
GU	Energy Availability (MUs)	42835	46994	47877	47530	53316	50292	52724	52428	34,918
	Energy Shortage (%)	6.2	8.2	9.7	11.5	11.4	12	11.7	8.2	11.3
	Peak Shortage (%)	16.3	21.1	11.5	16.3	15.1	26.6	25.4	22	30.6
MH	Energy Availability (MUs)	63778	63778	71184	73438	75472	78966	81541	84132	57,926
	Energy Shortage (%)	3.9	3.9	10.5	8.8	13.4	10.2	12.1	18.1	15.3
	Peak Shortage (%)	18.7	18.7	15.5	12.5	19.8	18.2	16.8	23.1	23
AP	Energy Availability (MUs)	38293	42832	44055	44302	44014	46680	50061	52154	38,072
	Energy Shortage (%)	8.7	6.6	7.8	8.5	6.8	2.9	0.7	1.1	2.4
	Peak Shortage (%)	9.3	11.7	14.6	19.9	19.2	10.5	2.3	2	9.7
KK	Energy Availability (MUs)	22626	25851	27490	28493	29008	31145	33687	34327	25,100
	Energy Shortage (%)	13.2	8.3	9.1	12.5	9.8	13.9	4.2	0.7	1.4
	Peak Shortage (%)	15.5	15.5	13.2	17	21.5	12.4	5.3	9.8	8.5
KL	Energy Availability (MUs)	22626	25851	27490	28493	29008	31145	33687	34327	9,588

		1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
	Energy Shortage (%)	13.2	8.3	9.1	12.5	9.8	13.9	4.2	0.7	1.5
	Peak Shortage (%)	15.5	15.5	13.2	17	21.5	12.4	5.3	9.8	2.6
TN	Energy Availability (MUs)	33268	35797	39462	42951	43346	45062	47570	53859	40,181
	Energy Shortage (%)	11.8	7.9	7.6	7.1	6	1.4	0.6	0.6	1.3
	Peak Shortage (%)	12.8	12.5	15.3	13.1	4.4	3	1.2	8.6	1.9
BI	Energy Availability (MUs)					7422	5878	6476	7218	5,021
	Energy Shortage (%)					8.3	22.5	10.1	9.3	8
	Peak Shortage (%)					4.6	19	0	15.1	16.9
JH	Energy Availability (MUs)					1318	3161	3550	3550	2,680
	Energy Shortage (%)					0.8	4.2	2.2	2.2	4.7
	Peak Shortage (%)					2.9	12.7	1.7	1.7	2.3
OR	Energy Availability (MUs)	11115	11143	12070	12318	13087	13375	13875	15010	11,025
	Energy Shortage (%)	-3.3	-2.8	-3.1	0.1	2.3	1.7	0.8	1.3	1.5
	Peak Shortage (%)	2	5.2	0	7.3	6.4	6.5	0	1.7	1.4
WB	Energy Availability (MUs)	16778	18298	18958	20575	20249	21608	22789	24509	17,955
	Energy Shortage (%)	-2.8	-1.9	-0.9	0.5	1.5	2.2	1.6	1.7	1.8
	Peak Shortage (%)	5.8	6.4	4.7	5.5	8.9	4.8	3.7	3	2.4

Source: Power Scenarios January 2007, Ministry of Power

Appendix Table A6: Components of revenue decomposition

	Energy units	Tariffs	Losses	AT&C loss level 2004-05
APCPDCL	26.4%	64.4%	9.2%	24.0%
APEPDCL	75.0%	24.4%	0.6%	14.3%
APNPDCL	3.3%	80.5%	16.2%	21.9%
APSPDCL	60.6%	26.9%	12.5%	20.6%
ASEB	11.1%	98.3%	-9.4%	39.3%
BSEB	-14.7%	50.7%	64.0%	74.1%
CSEB	67.6%	4.5%	28.0%	30.0%
NDPL	32.7%	24.0%	43.3%	32.9%
Goa PD	35.5%	3.4%	61.1%	17.3%
GEB	83.9%	77.1%	-61.0%	30.3%
DHVN	90.1%	-12.9%	22.8%	36.4%
UHVNL	76.8%	3.2%	20.1%	43.1%
HPSEB	57.2%	32.2%	10.6%	21.7%
J&K PDD	56.6%	12.1%	31.3%	68.3%
JSEB	173.9%	-21.3%	-52.6%	69.2%
BESCOM	28.1%	46.0%	25.9%	24.8%
HESCOM	78.4%	-4.1%	25.7%	41.6%
KSEB	-0.7%	101.4%	-0.7%	32.1%
MPSEB	98.2%	43.3%	-41.5%	52.8%
MSEB	16.5%	16.2%	67.3%	26.6%
CESCO	17.8%	-35.1%	117.4%	76.0%
NESCO	43.4%	24.9%	31.7%	40.4%
SESCO	48.2%	-13.5%	65.3%	35.6%
WESCO	54.3%	16.1%	29.6%	35.9%
PSEB	36.5%	47.3%	16.2%	24.0%
AVVNL	295.5%	-179.7%	-15.8%	49.8%
JDVVNL	101.0%	-31.8%	30.8%	47.6%
JVVNL	48.9%	-7.3%	58.4%	43.2%
TNEB	47.6%	51.1%	1.4%	18.8%
WBSEB	34.6%	45.6%	19.8%	23.9%

Appendix Table A7: Constituent components of the Index of Revenue Orientation

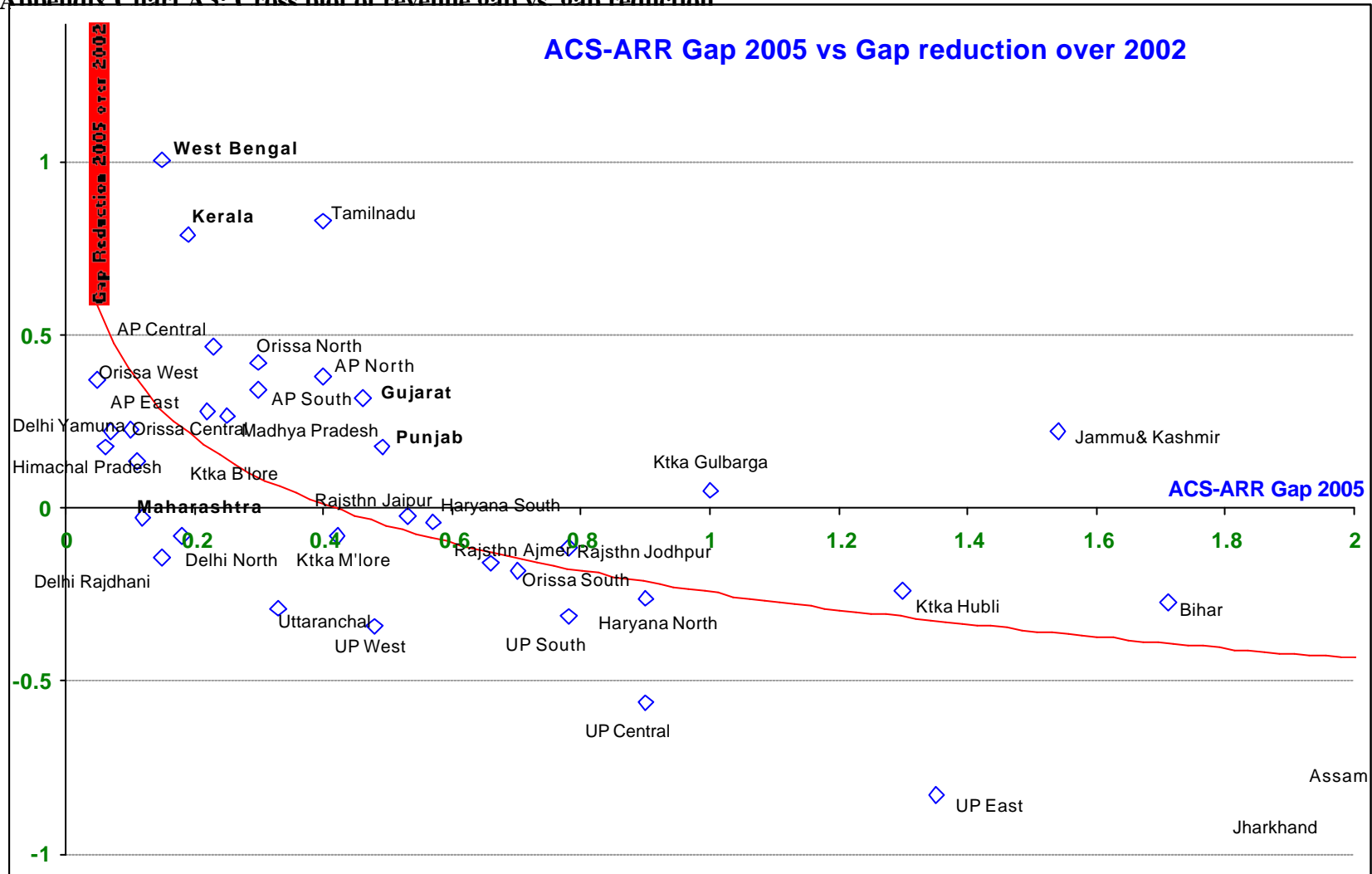
	2005 ATC loss levels	2005 Collection efficiency	2005 ARR-ACS gap	2005 Industry ARR minus ACS	2005 Subsidising ratio	2005 IRO	2002 ATC loss levels	2002 Collection efficiency	2002 ARR-ACS gap	2002 Industry ARR minus ACS	2002 Subsidising ratio	2002 IRO
AP Central	0.24	0.95	-0.23	0.7	0.67	1.45	0.289	0.9745	-0.70	0.98	0.41	0.41
AP East	0.14	0.99	-0.22	0.47	1.01	2.16	0.145	1.005	-0.50	0.32	0.77	1.81
AP North	0.22	0.97	-0.40	1.12	0.29	0.52	0.265	0.958	-0.78	1.07	0.25	0.10
AP South	0.21	0.97	-0.30	0.72	0.39	1.13	0.245	0.967	-0.64	0.72	0.36	0.72
Bihar	0.74	0.42	-1.71	0.31	0.43	-0.91	0.66	0.55	-1.44	0.25	0.52	-0.28
Chattisgarh	0.45	1.03	-0.42	0.92	1.62	1.85	0.39	0.9	0.23	0.93	1.90	2.71
Delhi North	0.34	1.00	-0.18	0.89	1.20	1.79	0.564	0.812	-0.10	1.34	1.02	0.83
Gujarat	0.30	0.98	-0.46	0.69	0.76	1.29	0.233	0.994	-0.78	0.68	0.51	0.81
Haryana South	0.36	0.95	-0.53	0.81	0.64	0.88	0.407	0.897	-0.51	0.80	0.52	0.70
Haryana North	0.43	0.82	-0.90	0.76	0.36	0.09	0.459	0.84	-0.64	0.84	0.37	0.27
Himachal Pradesh	0.22	0.95	-0.07	0.21	2.08	3.53	0.283	0.93	-0.29	0.31	2.20	3.25
Jharkhand	0.69	0.66	-1.94	0.08	1.81	0.75	0.602	0.75	-0.59	0.36	2.63	2.83
Karnataka Bangalore	0.25	0.97	-0.06	0.93	0.62	1.35	0.357	0.852	-0.24	0.83	0.53	0.96
Karnataka Hubli	0.42	0.81	-1.30	0.77	0.22	-0.46	0.477	0.764	-1.06	0.66	0.25	-0.18
Kerala	0.32	0.92	-0.09	0.47	1.01	2.05	0.318	1.005	-0.98	0.21	1.05	1.55
Madhya Pradesh	0.45	0.84	-0.25	1.19	0.51	0.45	0.486	0.885	-0.52	0.72	0.64	0.80
Maharashtra	0.27	1.11	-0.12	0.51	1.21	2.42	0.463	0.888	-0.09	0.92	1.05	1.47
Orissa CESCO	0.49	0.41	-0.11	0.99	0.95	0.77	0.488	1.00	-0.25	0.33	0.83	1.76
Orissa NESCO	0.43	0.98	-0.30	0.51	1.83	2.57	0.51	1.00	-0.72	0.58	1.43	1.62
Orissa SESCO	0.46	1.08	-0.66	0.54	0.65	1.07	0.405	1.00	-0.50	0.64	0.69	1.15
Orissa WESCO	0.41	1.01	-0.05	0.48	3.83	4.91	0.464	1.00	-0.42	0.76	1.82	2.18
Punjab	0.21	1.00	-0.49	0.38	0.89	1.81	0.277	0.972	-0.67	0.27	0.94	1.70
Rajasthan Ajmer	0.50	0.95	-0.70	0.57	0.79	0.97	0.49	0.773	-0.52	0.51	0.88	1.13
Rajasthan Jodhpur	0.48	0.97	-0.78	0.36	0.73	1.08	0.528	0.782	-0.67	1.27	0.52	-0.17
Rajasthan Jaipur	0.43	0.97	-0.57	0.50	0.89	1.36	0.593	0.662	-0.53	0.43	0.79	0.90
Tamil Nadu	0.18	0.99	-0.40	0.52	1.02	1.91	0.193	0.966	-1.23	0.18	0.91	1.27
Uttar Pradesh	0.42	0.75	-0.88	1.01	0.42	-0.13	0.469	0.842	-0.54	1.02	0.42	0.24
West Bengal	0.36	1.09	-0.15	0.54	1.20	2.24	0.353	1.013	-1.16	0.19	0.97	1.28

Appendix Chart A1: Institutional framework

FUNCTION	CENTRAL LEVEL	STATE LEVEL		
POLICY	Ministry of Power Central Electricity Authority	Department of Energy		
REGULATION	Central Electricity Regulatory Commission (National Grid Code; inter-state transmission and sale of power, incl. tariff)	State Electricity Regulatory Commission (intra-state transmission and sale of power, incl. distribution tariff for final consumer)		
GENERATION	Central Sector Undertakings (Thermal, Hydro & Nuclear)	State Electricity Boards (SEBs)	Govt. Owned Gencos	Private Gencos (IPPs)
TRANSMISSION	Central Transmission Utility (Power Grid Corporation of India Ltd.)		State Transmission Utilities (Govt. Owned Transcos)	
DISTRIBUTION			Govt. Owned Discoms	Private Discoms

Note for Charts A2 & A3: Diamond legends in red are discoms which have been privatised. The legend names in bold are those states/utilies that have qualified for the APDRP incentive scheme.

Appendix Chart A3: Cross plot of revenue gap vs. gap reduction



Appendix Chart A4: Change in demand composition

