

**INDIAN POWER SECTOR REFORM FOR SUSTAINABLE DEVELOPMENT:
THE PUBLIC BENEFITS IMPERATIVE¹**

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1. The Crises of Indian Electricity Boards

Indian electricity boards have been trapped in the crises of capital, access/equity/distribution, environment and performance.

Capital Crisis: Severe financial losses have led to the total inability of utilities to self-finance improvements. Utilities also borrowed heavily and aggravated their losses. In the past, these losses used to be made good by government treasuries, but now, most treasuries are virtually "empty". The lack of internally generated funds and the inability of treasuries to provide funds have resulted in severe shortages of capital for expanding generating capacity. Governments (central and state) and utilities hoped to solve these capital-scarcity problems with an influx of private capital. It was believed that the indigenous private sector may not have the necessary capital. Also, the foreign exchange component of funds required by the power sector is large because very few developing countries have an indigenous electrical industry¹. Hence, *foreign* assistance/capital has been sought/invited. Since, multilateral and bilateral funding agencies cannot meet capital requirements², foreign *private* capital is being invited.

Access/Equity/Distribution Crisis: The benefits of electricity do not reach the whole population -- a significant percentage (particularly the rural poor) does not have connections and therefore access to electricity. Some consumer categories are given subsidies. Benefits are skewed in favour of certain sections (e.g., irrigation pumpset owners) and certain areas (e.g., urban areas).

Environmental Crisis: India is quite unusual among developing countries in that there is growing public concern about the environmental impacts of electricity generation. These concerns have focussed on pollution from coal-based thermal plants (particulates, acid rain, etc.), on the various problems of nuclear plants such as low-level radiation, disposal of high-level wastes, reactor safety and the NIMBY (Not in my backyard!) syndrome, and on the negative impacts of hydroelectric plants including the submergence of forests, the displacement of people and siltation. There are also concerns about global warming impacts.

Performance Crisis: The power sector has shown an inability to meet rising electricity consumption/ demand primarily because of declining technical performance. This decline has involves low plant-load factors, large T & D losses (technical and commercial), sub-standard voltages and frequencies, frequent load-shedding, brown-outs and black-outs, and large reserve margins. However, there have also been other problems such as uncertainties in future demand and in future supply, and diminishing scope for grid interconnections. The situation has also been complicated by the entry of new players (non-utility generators/consumers/regulators/conservationists/ environmentalists) and the declining monopoly of utilities in decision-making (which has moved closer to consumers).

2. World Bank Approach

Analysis: The World Bank which was a major funder of power projects carried out a study³ of 300 power projects between 1965 and 1983 and concluded that pursuit of electricity expansion was neither possible nor desirable for several reasons. It was believed that access

has been extended sufficiently and utility performance was declining because T & D losses are high. There is under-investment in distribution leading to bottlenecks. Demand forecasts can be 20% above consumption. Sometimes, over-investment in capacity leads to over-capacity and the utility cannot handle long-term capacity expansion.

Diagnosis of Sickness of Electricity Boards: The World Bank diagnosis of the sickness of electricity boards is that (1) they suffer from centralization and excessive size, leading to inflexibility, (2) they had a monopoly position resulting in they being exploitative and (3) they were publicly owned resulting in political interference and inefficiency.

World Bank's Top-down Cure: There must be much greater emphasis on restructuring and performance improvement than on capacity expansion (this view implies no further Bank funding for grid expansion). Simultaneously the three problems of centralization, monopoly and public ownership must be tackled through institutional change, financial reforms and management measures.

The institutional change required is **privatization** involving attraction of private capital into power sector because government does not have enough capital, attraction of foreign private capital into power sector because indigenous private sector may not have enough capital and sale of publicly owned utilities to the private sector. The objectives of privatization are to solve financial crises, to restore inflow of improved technology, to introduce profit-driven investment and management decisions, to eliminate political interference, to eliminate monopoly (and thereby introduce competition), to reduce size and to decentralize decision-making.

Financial reforms are necessary to make prices rise to marginal costs in order to raise level of efficiency of utilities and to attract private capital with a variety of incentives such as tax breaks, easy access to land, guarantees for repatriation of profits, power purchase agreements, and ensuring that future expansion is via low capital-intensity technologies (natural gas) to reduce gestation period.

Management measures include reduction of T & D losses, emphasis on maintenance, repair and distribution, review of reserve margins and engineering standards, reduction of demand, scrutiny of electricity-GDP coupling and emphasis of conservation and load management.

Two major assumptions underlie the World Bank cure: (1) private ownership leads *ipso facto* to competition and (2) private ownership leads *ipso facto* to arms-length relationship between industry and government, and therefore to elimination of political interference.

3. Reform/Restructuring in the Industrialized Countries

Since a wave of reform/restructuring has swept the industrialized countries, it is important to understand the dialectics and logic underlying the reform/restructuring of utilities in those countries. The starting point or baseline of utilities has been vertically integrated monopolies involving generation in mega-plants (~ 1,000 MW), transmission over extensive grids and distribution to end-users. Technologies for generation in smaller-scale (~100-250 MW)

plants for example gas turbines and advances in cogeneration led to the growth of smaller-scale independent power producers (IPPs) and cogenerators demanding the right to generate electricity. This led to legislation such as the Public Utilities Regulatory Policy Act (PURPA) according to which it became mandatory for the utility to off-take and purchase surplus electricity from IPPs and cogenerators at the avoided cost of generation to the utility. In addition, unrestricted access of cogenerators/IPPs to the utility-controlled grid required separation of generation from transmission. Disaggregation of distribution into bulk consumers and smaller distribution entities also took place. This meant that there should be a regulator to prescribe the rules and oversee the generation and transmission and distribution. Computerized dispatch on merit-order basis paved the way for consumers choosing their generators. And the final step involved full-scale deregulation leading to an electricity market with customers having right to purchase electricity from any generator.

There are two important features of the restructuring of the power sector in industrialized countries: (1) it was *technology-driven* wherein technological developments render "old" system inadequate for "new" possibilities, (2) the evolution from monopoly --> regulation --> deregulation is not driven by capital shortages, financial sickness of utilities or poor quality of electricity delivered. Thus the reform process in the industrialized countries is **irrelevant** to the developing countries where the arguments for power sector reform are virtually non-technical.

4. Case Study of Karnataka's Power Sector

IEI's 1998 Diagnosis: Contrary to conventional wisdom, IEI's study showed that the financial ills of the Karnataka Electricity Board (KEB) were **not** because of the subsidized electricity given to irrigation pump sets (IPS) of farmers at the state government's behest. In 1996, this subsidy was compensated by cross-subsidy primarily from industrial and commercial consumers and there was no net subsidy of consumers.

The individual constituents -- particularly, the consumption by IPS and the Transmission and Distribution (T & D) losses -- had to be guessed or fabricated every year. Some reductions in technical losses are possible with system improvements such as straightening lines, reducing low-voltage distribution, etc., but the real opportunities lie in reducing **commercial** T & D losses (theft, etc.). If the upper limit of **technical** T & D losses was about 20%, then the balance -- up to about 10% of Karnataka's electricity -- was **commercial** loss (the euphemism for theft). Commercial T&D losses were the fundamental reason for KEB being in the red. If these losses had been minimized, if not eliminated, and the resulting revenue brought into the coffers, KEB would have had a revenue surplus. KEB's balance sheets did not reveal information on the revenues that were **not** realized even though as much as 58% of the electricity purchased by KEB did not yield a revenue (the current percentage is about 60%) because its consumption was not metered. Karnataka's power sector used the fabricated IPS consumption to hide many of its technical and commercial shortcomings, in particular its commercial T & D losses. If theft is minimized, if not eliminated, the resulting extra revenue can lead to a surplus and to profits that can be used as an internal source of funds for improvement of the system and expansion of capacity.

Many of these observations from IEI's analysis were strongly protested against when they were published, but they have now become conventional wisdom repeated by the highest authorities in the power sector⁴.

IEI's Bottom-up Approach to Power Sector Reform: IEI's diagnosis of the ills of KEB leads to a **bottom-up** approach to the reform of its power sector. This alternative starts with the diagnosis and prescribes what is necessary to cure the ailment. The first reform is removal of the state government's control over the KEB without accountability. This requires **corporatization** of KEB, thus liberating it from stranglehold of government. However, making KEB a commercial entity may lead it to sacrifice social objectives in its pursuit of profits. It is essential, therefore, to regulate the corporatized body through an **independent regulatory body**. To ensure that such a body is not hijacked by vested interests, it must function in a **democratic** manner involving participation by government, all categories of consumers, potential consumers, and civil society. Efficient democratic functioning is not possible without **transparency** which in turn requires *right to information* so that information must be available and accessible to the public,. Thus, a bottom-up approach based on the diagnosis of KEB's ills suggests that the reform must involve (1) corporatization of KEB, (2) liberation from government, (3) an independent regulatory body and (4) transparent democratic functioning

The top-down World Bank prescription has these components of corporatization, liberation from government control and an independent regulatory body. Unfortunately, the other prescriptions such as removal of all subsidies, unbundling of generation⁵, transmission and distribution, and privatization of these functional entities *do not follow* from the diagnosis of the power sector. These other components have to be justified on other grounds such as ideology or propagated as a matter of faith or implemented regardless of objections.

5. The Epidemic of Power Sector Reforms in India

The reform process started with the October 1991 amendment of the Electricity (Supply) Act to allow the private sector entry into generation. At the urging of the World Bank, Orissa was the first state to enact in 1995 comprehensive power sector reform involving (a) an independent regulatory commission, (b) unbundling of the State Electricity Board into separate generation, transmission and distribution entities, and (c) eventual privatisation particularly of distribution. This World Bank pattern of power sector reform has since been followed by Andhra Pradesh, Haryana, Rajasthan, Uttar Pradesh and Karnataka. A conference of Chief Ministers in late 1996 came up with a "Common Minimum National Action for Power" involving (a) establishment of independent regulatory commissions, (b) rationalisation of tariffs and (c) private sector participation in distribution. A Central Regulatory Commission Bill was initiated in 1998 and the CERC has since started functioning.

Thus far, there has not been a specification of the criteria that should be used to judge the success or failure of the reforms/restructuring that is being pushed through. Obviously, the criteria should include (1) the **efficiency** of transmission and distribution measured by the quantified technical losses, (2) the **quality** of service as measured by the continuity, voltage and frequency of supply, (3) the **price** of electricity, (4) the **ability to minimize if not**

eliminate theft as measured by the commercial losses, (5) the **financial health** of the electricity board (or its successor entities), (6) the **reduction if not elimination of control by the state government and the politician-bureaucrat nexus** over the electricity board (or its successor entities), (7) the **degree of independence** of the regulatory authority monitored by the **extent of transparent democratic functioning**.

Even more serious is the fact that, to date, there has not been an evaluation of the success of these reforms. For instance, there is no evidence in India that privatization has prevented or reduced theft -- the Orissa experiment has not had enough time and the Noida experience of the RPG group is complicated by the large fraction of industrial/ commercial establishments.

6. Immediate Steps required in Indian Power Sector Reform

The most important step is to effective and creative management to reduce theft and increase revenues. The revenues along with performance-tied grants from government and multi- and bi-lateral agencies can be used to improve technical performance involving reduction of T&D losses and improvement of power quality (frequency, voltage, continuity). An emphasis on demand management (peak reduction, load-curve smoothing, end-use efficiency improvement) is also required. Advantage must also be taken of cost-effective cogeneration and decentralized generation. Corporatization and liberation from government control are urgently required along with consumer-oriented and market-driven development of the power sector. An independent regulatory authority must be established with transparent democratic functioning. Supply expansion to meet demand-supply gap must be resorted to after efficiency improvement and decentralized generation. Price reform and subsidy-reduction cannot be implemented without improving quality and continuity of supply because higher prices require better quality and improved end-use efficiency.

7. Public Benefits and Sustainable Development

Power Sector Reform is a necessary, but not sufficient, condition: Power sector reform based on corporatization may ensure profits and economic growth, and it may turn the Electricity Boards around into profitable bodies. But market-driven reform will not take care of crucial public benefits -- access, environmental soundness, self-reliance/empowerment and the long-term. Power sector reform has to be buttressed with a public benefits dimension/imperative

Public Benefits and Sustainable Development: Left alone, a corporatised and market-driven power sector will pursue economic growth rather than public benefits. A public benefits imperative requires the perspective of sustainable development (rather than mere economic growth). Sustainable development is a process of economic growth with the following features: economic efficiency, equity through widening access and giving growth a basic-needs orientation, environmental soundness, empowerment and concern for the long-term

Sustainable Development implies the New Energy Paradigm: What human beings -- as individuals and as societies -- want is not energy *per se* but energy services to satisfy basic needs, improve the quality of life, increase production and advance development.

Development requires, therefore, an increasing level of energy services to meet basic needs more fully, to improve the quality of life and increase production. Thus the level of energy services must be taken as the measure of development, rather than the magnitude of energy consumption and supply. Environmental soundness has to be achieved by exploiting end-use efficiency measures, renewable sources and "clean" centralized sources of energy. Self-reliance and empowerment of rural communities by promoting decentralized sources for rural areas. Self-reliance also requires the initiation and strengthening of technological capability in energy analysis, planning and implementation. Economic efficiency by increasing energy services through a rationally determined and efficiently achieved mix of end-use efficiency measures, decentralized renewable sources and "clean" centralized sources of energy. Economic efficiency also requires that the issues of policy, institutions, financing, management, etc, involved in the implementation of such a mix be tackled. Concern for the long-term by fostering and developing emerging technologies of end-use efficiency improvement and of renewable sources and promoting their dissemination.

8. Power Sector Reforms with Public Benefits for Sustainable Development

Economic efficiency through competition: Since competition enforces an external measure of performance, it is in general more conducive to efficiency than a monopoly situation which can only provide an internal standard. Competition is required between old generators and new independent power producers (IPPs) to supply wholesale power to distributors. All generators (including IPPs) must have open access to grid (as a necessary condition for competition); otherwise, new IPPs will be denied access to the grid. Competition is required between generators and distributors to supply power to large consumers. Competition is required between the expansion of supply to consumers from distributors and the improvement of the efficiency with which they use the supply. energy service companies (ESCOs) can compete with distributors to provide these efficiency improvement.

Equity through widening of access to electricity and protection of interests of economically weaker consumers: Increasing the coverage of electricity (not necessarily *grid* electricity) with an **obligation to serve** so that the whole population (even the poor segment outside market) enjoys the benefits of electricity. Protection of segment which is a captive market to electricity distributors. Protection of the whole market against monopolistic power of generators, grid transmitters and distributors. Reducing, if not removing, the urban-rural and regional disparities with regard to the benefits of electricity

Environmental protection through environmentally sounder technologies: Transition to "cleaner" technologies of generation from fossil-fuels. Transition to renewable non-fossil-fuel sources. Non-fossil fuel obligation (NFFO). Fossil-fuel Levy. Improvement of the efficiency of production and use of energy. efficiency improvement through retro-fitting. efficiency improvement through choice of efficient devices and technologies

Self-reliance/empowerment through growth of decentralized sources for rural areas: Decentralized electricity generation via biogas /producer-gas/micro=turbines from biomass-based sources. Utilization of wind, small hydel and photo-voltaic sources

*Concern for the long-term through current energy decisions being part of long-term strategy:
Emphasis on Research and Development*

9. Regulation-assisted Market to ensure Public Benefits

The good news is the power of the market -- the market is an excellent allocator of manpower, capital, technology and resources. The bad news is the limits of the market -- it is not concerned with equity/distributional justice, self-reliance/empowerment, environmental soundness and the long-term.

Even with regard to economic efficiency, there are limits to competition in the electricity sector because vertical integration of generation-transmission-distribution is a necessity of the system which promotes therefore a natural monopoly. Faulty capital allocations and stranded investments (for example, nuclear power) tend to restrict competition in electricity sector. End-use efficiency is opposed by market (because profit maximization requires sales maximization which means unaided market will not promote conservation). Private sector uses higher discount rates than public sector; hence, bias against capital-intensive projects. Higher discount rates means higher prices, and therefore political hurdle. Establishing and maintaining competition requires large state intervention (competition requires regulator)

With regard to equity, the market ignores those outside the market. It is also biased in favour of those with strong market power and towards rich regions and urban areas. In the matter of environmental soundness, the market considers environmental impacts as externalities and the market discount rate biased against the long term. With respect to empowerment, the market not concerned about strengthening self-reliance and empowering communities. Also, the market is biased against long-term investments on R & D and infrastructure. The bottom-line is that the market alone cannot ensure that electricity systems will advance public benefits and sustainable development.

The invisible hand (market) needs help from the visible hand (regulation). Regulation is required to increase access to electricity, to protect captive segment of market (single commodity-two segment market with competitive and monopolistic segments), to protect those outside market, to lay down rules (absolute competition = no rules), to establish level playing field, no competition without regulation, removal of government from market and ownership change by themselves won't produce competition, private monopolies need heavier regulation, to specify type and length of contracts (long contracts are good for planning, and short contracts are good for competition) between generators, distributors and large consumers

10. Privatization from the perspective of sustainable development

Private Ownership does not necessarily create competition: The transmission grid does not lend itself to replication, or even duplication; hence, a single transmission grid and no competition is the natural situation. Similarly, the distribution system does not lend itself to

replication/ duplication except in very small areas such as villages; hence, there is a bias towards a single distribution system with no competition. It is only in generation that there can be competition but even here there will only be a small number of generators (not the "infinity" required by an ideal market), i.e., a duopoly or oligopoly . It is inevitable that there are tendencies to dominate market and to collude. Hence, withdrawal of government from market and change from public to private ownership will not result automatically in competition

Private ownership and Exploitation: Private companies may exploit captive segment of market by raising prices

Private monopolies/oligopolies and regulation: Private monopolies/oligopolies need heavier regulation. Hence, no privatization without regulation

Privatization and High Discount Rates: Private capital uses high discount rates leading to reduction of total investment and less capital-intensive short-gestation projects

Private ownership and Performance: Private ownership is neither only nor even central issue in improving performance

Privatization and Foreign Capital: Is privatization a recipe for foreign capital to earn substantial and secure profits from ownership of large segments of electricity sector?

11. A sustainable-development-oriented approach to the electricity systems of developing countries

What is required is economic efficiency: If economic efficiency can be ensured without competition, so be it; if competition can ensure this efficiency, well and good; if privatization is also necessary, then privatization must take place.

What is required is equity: If the widening of access and protection of non-market segments or weaker market segments are required, then regulation has to provide this protection.

What is required is environmental soundness: If environmental externalities have to be internalized to protect the environment, then this protection must be provided by regulation. If environmental protection can be achieved by lowering the discount rate to take care of the long term, then this lowering must be made.

What is required is self-reliance/empowerment: If self-reliance is to be strengthened and communities, empowered, then specific steps must be taken in this direction.

What is required is concern over the long-term: If the market is biased against long-term investments on R & D and infrastructure, then this bias has to be corrected.

12. Looking forward to a Power Sector ensuring Public Benefits and advancing Sustainable Development

Restructuring of existing Institutions and Introduction of New Institutions: Breaking up monopoly generator into $n > 1$ generators. Permitting IPPs and DECENTs (grid-connected and stand-alone). Guaranteeing grid access to IPPs or separation of grid transmission from generation and ensuring open transmission access to any generator. reation of ESCOS to compete with utilities to supply efficiency improvements to consumers

Promotion of Competition through creation/ maintenance of LPFs: LPF between FIPPS and RIPPS. LPF between IPPS and $n > 1$ Generators. LPF between Centralized and Grid-connected DECENTS. LPF between Grid-based Distributors and Stand-alone DECENTS. PF between Efficiency Improvements and Distributors

Widening Access and Promoting Equity: Making it an obligation for generators and grid transmitters to supply distributors adequately to meet needs of small consumers. Guaranteeing access to small consumers. Preventing politically influential "free riders" (for example, irrigation pumpset owners). Making it an obligation for rural areas to be electrified through the grid-based distribution and/or Stand-alone DECENTs

Integrated Resource Planning: IRP is necessary to identify a socially-beneficial mix of Centralized, Grid-connected DECENTS, Stand-alone DECENTs and Efficiency Improvements. Such a mix will suggest what LPFs must be established and what are the rules of the game that must be prescribed

Research and Development and Demonstration: IRP will identify the technologies of centralized, grid-connected decentralized and stand-alone decentralized generation and of end-use efficiency improvements that can benefit from research and development and demonstration. These technologies must be assisted to go through the learning process

Environmental Protection: Internalizing the externalities. Correcting for the bias of the market discount rate against the long term

Pricing: Making electricity prices move towards true long-term marginal costs of generation + transmission + distribution. Ensuring in the transition that consumer expenditures do not increase by making efficiency improvements and reduced consumption offset increasing prices. Monitoring prices to ensure that they are not increased to skim profits.

Protecting State-inspired Stranded Investments: Several massive state-sponsored investments in the electricity sector (e.g., nuclear power stations) have been stranded by newer technologies (e.g., gas turbines, cogeneration, etc.). Since they cannot withstand market forces, they have to provided a "safety net" and a transition to survival.

Actors involved in Regulation:

- Established Generators
- Old and new IPPs

- DECENTs (Grid-connected and Stand-alone)
- Transmission grid
- Distributors
- ESCOS
- Consumers (Large and Small) of various categories (including politically influential "free riders" such as irrigation pumpset owners)
- Unconnected
- Environmental organizations (Governmental and non-governmental)
- Planners involved in *Integrated Resource Planning*
- Research and Development organizations
- Regulator

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1. India is an exception because of its Bharat Heavy Electricals Limited
 2. Churchill and Saunders World Bank analysis at Montreal WEC
 3. Mason, Gelling and Munasinghe
 4. Kumaramangalam
 5. This was already done in Karnataka with the separation of KPCL and KEB.