Report of the
Workshop on Power Sector Reforms and Public Participation
on the 24th & 25th of August 2001 at the Indian Social Institute, Bangalore

Objective:

In recent years, several changes that have been taking place in the Power Sector. In Karnataka, we have had the entry of private firms into generation, the corporatisation of the Karnataka Electricity Board (KEB) to form the Karnataka Power Transmission Corporation Ltd. (KPTCL), and the planned separation of KPTCL into transmission and distribution companies while privatisation of distribution is now being considered. These are far-reaching and fundamental changes. During this process, many key decisions are being taken and legal precedence is being set. Hence, this period of transition is of critical importance for all concerned.

The Karnataka Electricity Regulatory Commission (KERC) was formed with a view to balance the interests and expectations of different actors in the power sector. In response to this, some actors -- power corporations, independent power producers (IPPs), consultants, etc.-- have been strengthening their capabilities as well as information and analytical bases to protect their interests. However, public-interest organisations need to sharpen their ability to take up the challenges thrown up by the regulatory process. Many individuals and organisations working for the protection of public interest have been engaged in analysis, political as well as legal actions, and regulatory interventions. However, these individuals and organisations sometimes suffer from a lack of adequate information, analytical tools, and human and financial resources. Hence, it was felt that consumer groups should improve their understanding, share their experiences and pool in their expertise.

The International Energy Initiative (IEI) - Bangalore and Prayas (Energy Group) – Pune therefore organised a workshop in Bangalore for Non-governmental organisations (NGOs) and consumer groups. The objectives of the Workshop were:

(1) to discuss the new regulatory régime in the power sector,
(2) to explain the need for regulation and the role that the public can/should play,
(3) to give the participants an overview of the work that has been done (or needs to be done) when attempting to intervene in the regulatory process,
(4) to describe some of the methods/analytical tools required,
(5) to discuss areas where public intervention can take place in the regulatory process.

Proceedings:

The Workshop started as scheduled (Annexure 1) on the 24th morning with an introduction of the participants. Professor Amulya Reddy welcomed the participants and summarised IEI's activities. Mr Shantanu Dixit gave a description of Prayas.

There were 21 representatives[a] from 17 different NGOs (Annexure 2) and one representative from KERC apart from the IEI and Prayas staff. The participants were from varies backgrounds and were involved with issues like consumer grievances (with respect to various utilities), environmental protection, rural development, and tribal welfare. Some of the representatives had interacted with KERC on the subject of tariff revision. Some were keen on understanding the implications of the power purchase agreements (PPAs) between the state utility (KPTCL) and IPPs.

The first presentation was on the History of the Power Sector by Mr Girish Sant (Annexure 3). He described the institutional structure of the sector over the years, major policies, the genesis of the capital crisis and the lessons that could be learnt from history. The dealings with IPPs, the World Bank model of power sector reforms and the current problems facing the power sector were also dealt with.

Professor Amulya Reddy then presented the Case for Regulation in the Power Sector (Annexure 4). It was argued that in view of the limitations of market forces (with respect to equity, increasing access, environmental soundness, etc.) and the withdrawal of the government from direct control of the State Electricity Boards, independent regulation was essential. The participants had several questions: -- whether or not it would be practically possible for KPTCL to take care of new connections at this juncture (when they are still unable to service the existing connections properly), why the state governments do not invest directly in electrification instead of withdrawing from the system, why they did not undertake the functions now invested in Regulatory Commissions, why investments were not in transmission lines instead of generation and whether or not KERC is bogged down with too many petty issues that prevent its addressing larger issues effectively, and why there should be multi-regulatory policies rather than a policy effecting all systems (communication, power, etc.).

After the lunch break, a Group Discussion was arranged to elicit the concerns of the participants on the problems of the Power Sector and the following issues were discussed:

1. T&D losses (technical and non-technical)
2. Subsidies (problems, how these can be overcome)
3. Practical problems in accessing information like – availability of documents (and where to search for them), availability of technical documents, dates and venues of public hearings, notifications, etc.
4. Flexibility
5. Performance vs tariffs
6. Debts for services (Who will be responsible for the pay back? Transfer scheme documents, etc.)
7. Establishment costs (-- too high?)
8. Legal aspects (Can the Government override the Regulatory Commission?)
9. Management problems of KPTCL (for instance, trade union problems cannot be dealt with by the RC)

[a] A few were present for only some of the sessions.

10. The KERC is not well-known enough (--Should they interact more with Consumer organisations?)
11. The state's role (-- it should still be strong)
12. The experience in other states
13. Privatisation could present problems too (for example those in the state of Orissa); reforms intended "unbundling" of the integrated generation-transmission-distribution system but are there checks to ensure that a single large private party does not purchase the "unbundled" segments
14. The need for public information centres/libraries with indexed information, web-sites and e-mail to provide the following:
    - Procedure regarding how to access information
    - Procedure regarding how to file petitions (formats of affidavits, evidence, etc.)
    - Lists of petitions, notices and orders, summaries of hearings
    - Schedules of hearings, dates for filing petitions, etc.
    - Timely updates of the information
15. The need for assistance in the process of intervention (preparation of petitions, obtaining data etc.)

In the afternoon, Mr Girish Sant and Mr Shantanu Dixit presented the Regulatory Process (Annexure 5) and also Case studies of intervention in Maharashtra (Annexure 6). The presentation on the Regulatory Process included salient features of the Karnataka Reform Act 1999 and the KERC regulations, as well as the process of tariff revision. Both the procedural aspects of tariff revision and the components of revenue requirement were described. The important cases of public intervention in Maharashtra's Power Sector were then described; these included cases where increases in tariffs/particular charges were questioned, cases where information was sought, and one case where the State Electricity Board's generation and plant dispatch were questioned.

At the last session that evening, Techno-Economic Issues in the Power Sector, Mr Sreekumar explained several terms commonly used in power sector literature with which some of the participants were not conversant (Annexure 7).

The deliberations on the 25th morning began with Ms Antonette D'Sa presenting Least-cost Planning for the Power Sector (Annexure 8). This involved estimating the cost per unit of all the available options – generation and conservation – to bridge the gap between availability and requirement. Examples of computing the cost of electricity generated (from a coal-based thermal plant) and of saving electricity (through the replacement of electric water-heaters by solar water heaters) were presented. It was shown that the least-cost "supply stairway" could be derived by ranking the options in increasing order of unit cost and by extension, the losses inherent in not selecting such a schedule.

In Paying for Power (Annexure 9), Professor Amulya Reddy spoke on guidelines for the implementation of tariff increases and how improved efficiency in the use of electricity can offset the increased unit cost of electricity.

There was then another open session during which the participants discussed a future course of action. Questions were raised about the steps to be taken, i.e. to operationalise the intervention talked about. It was decided that those interested would co-operate with one another to deal with the Power Sector problems, particularly when the opportunity to intervene in the regulatory process arose. Intervention was thought to be required in four areas, namely:

(a) least-cost principles in the choice of projects,
(b) the approach to problems (from suggestions for improvement to status reports on the results),
(c) electricity purchase from IPPs (because they historically had loaded costs and would not be front-runners in a least-cost schedule), and
(d) monitoring service quality from suppliers of electricity.

Meeting the Regulators:

The participants then had an opportunity to meet the regulators, represented by Mr Philipose Matthai, IAS, Chairman of KERC, Professor S.L.Rao, Retired Chairman of CERC and Mr Sridharan, IAS, Secretary of KERC.

Prof. Rao touched on several issues – that benefits of increased return on equity and depreciation allowances should be passed on to consumers, that the poor quality of supply (in terms of voltage and frequency) has resulted in huge costs to the economy that have not been quantified, that there should be a single grid code for the country, that tariffs should be based on plant availability, that there should be transparency in the procedures with detailed information being made available, and that the vacancies in the Central and State Electricity Regulatory Commissions should be filled sooner to ensure their continuity.

Mr Matthai spoke of the Regulatory Commission's role in bringing about a balance between the consumer and the utility on various issues related to power sector. He felt that the prevailing "mindset" of the regulators was said to be in favour of the government as most of them had spent their entire career in government service and the consumers had lost trust in the utilities' commitment to service. However, most cases in Karnataka had been decided in favour of the consumer. Further, the KERC did not have to endure any curbs from the government; in fact, they were very well provided for financially, ensuring their independence. There was the problem of the KERC's questions (or requests for data) being perceived by the utilities to be interference in their working; this would have to be dealt with by ensuring more transparency in the utilities' regular operations. But achieving the required results would require some time.

Mr Sridharan emphasised that the Regulatory Commission has to be accountable to the stakeholders in the power sector and has also to ensure that the utilities are accountable to the consumers. People should therefore equip themselves to intervene in the process of regulation on a case to case basis. KERC is interested in educating the consumers and in consumer grievance redressal. They feel that networking with

consumers would greatly benefit the regulatory process. For this purpose, KERC has a website with the relevant information on its functions.

The Workshop ended officially with tea. However, the participants from Bangalore met to begin an informal association of persons concerned with Power Sector issues.

Immediate results:

After the scheduled sessions were over, the discussion on the association of the participants on Power Sector issues was continued. The immediate concern shown by this association was to intervene in one of the Power Purchase Agreements between the KPTCL and an IPP, currently open to public scrutiny and objection. Copies of the agreements had already been lent by IEI and the Nagarik Seva Samithi to some of the other participants. Shantanu Dixit explained the intervention procedure and arranged to send suggestions regarding the objections that could be raised. Antonette D'Sa circulated a set of items already sent informally to KERC. The group arranged to have further discussions.

As a result, two petitions have been filed before the KERC.

Annexure 1:

Schedule for the Workshop on "Power Sector Reforms & Public Participation in Karnataka"

	Timing	Session	
24th Aug.	9.45 to 10.00	Registration and tea	
	10.00 to 10.30	Welcome and introduction	IEI
	10.30 to 11.30	History and importance of the power sector	Prayas
	11.30 to 12.30	Case for regulation	IEI
	12.30 to 1.30 pm	Lunch	
	1.30 to 2.30	Discussion: Sharing concerns	Participants
	2.30 to 3.00	Tea	
	3.00 to 4.30	Regulatory process (tariff and other processes) Case study of intervention in Maharashtra	Prayas
	4.30 to 5.00	Tea	
	5.00 to 6.00	Techno-economic issues in the power sector	Prayas
25th Aug.	9.45 to 11.15	Least-cost planning in the power sector	IEI
		Paying for power (tariff policy, subsidy)	IEI
	11.15 to 11.45	Tea	
	11.45 to 1.15 pm	Feed-back and concluding comments	All
	1.15 to 2.15	Lunch	
	2.30 to 4.30	Interaction with Regulators	All
		Tea	

Annexure 2:
List of Participants for the IEI-Prayas Workshop on Power Sector Reforms and Public Participation in Karnataka (24th-25th August 2001):

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Regulators invited for the Discussion:

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Mr R.Sridharan, IAS,
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Professor S.L. Rao,
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Annexure 3: History and Importance of the Power Sector

Power Sector HISTORY

1. Pre-independence situation
2. Institutional evolution and structure
3. Major policies
4. Present infrastructure and crisis
5. Genesis of capital crisis
6. IPP process
7. World Bank model of reforms
8. Recent context

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1. Pre-independence situation

Small Private Companies

(licensees),

Urban based, used small

D.G. sets (1,700 MW)

2. Institutional evolution and structure

-> Bombay Plan & 1956 Industrial Policy Resolution

SEBs: Semi-autonomous, quasi-commercial

- Allowed to set tariff, no review mechanism

CEA: Depository of technical expertise

- Authority over licensees

Central Companies:

NTPC (1976), now 25% generation
PFC, Power Grid, Power Trading Corporation

3. Major policies

- Budgetary support between 15 to 20% of plan outlay (= Low interest loans)

- Self reliance

  Coal / Hydro, Indigenous Equipment (BHEL)

- Centralised supply and grid expansion

  Scares technical resources, Economy of scale, Non-uniformly located reserves

- Cross subsidy

  Difference in paying capacity
  Avoid burden on the government (form of tax)

4. Present infrastructure and the crisis

Installed Capacity : > 90,000 MW
Consumers : ~ 830 lakh
Villages electrified : 5 lakh
Houses electrified : 50 %

Consumption growth: 4 - 6 % p.a.

The Crisis

A) Performance

Poor power quality & plant utilisation,
high T&D losses, billing / recovery problems

B) Social

R&R problems, non electrified houses
inequity in benefits (also linked to larger policies)

C) Environment

Water and air quality
Even legal norms not followed

D) Capital

5. Genesis of capital crisis

Limited finances v/s enormous

(*claimed*) needs

- Need investment of Rs. 50,000 crore/ annum
- SEBs losses 10,000 cr.
- Inability to increase government support
- Limitations of foreign loans, equity
- Insufficient increase in tariff

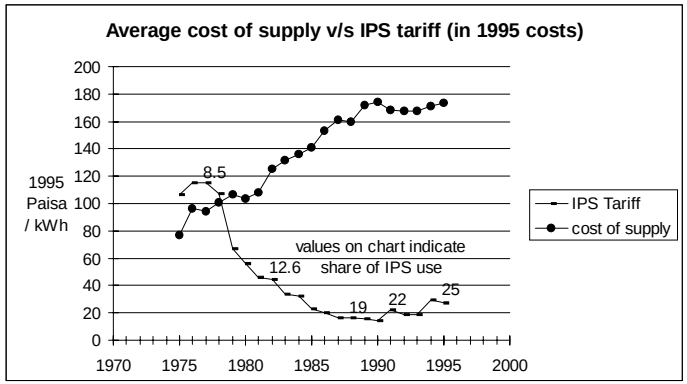
Major reasons for capital crisis

A) Performance crisis
B) IPS tariff policy
C) Inflated demand forecasts
D) Neglect of low cost options (centralised bias)

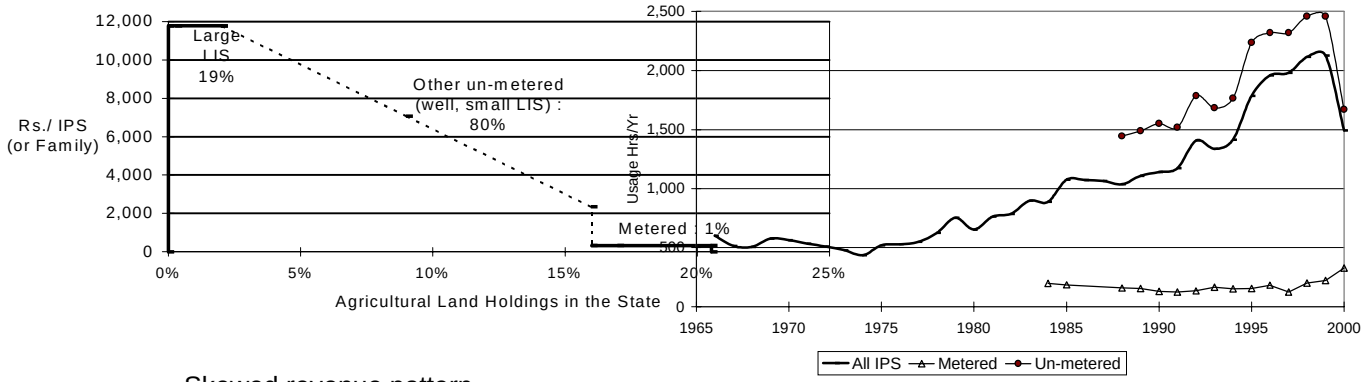
Leading to "Shortage Psychosis"

B) IPS tariff policy

Increasing consumption - declining revenue



Skewed subsidy distribution



Skewed revenue pattern

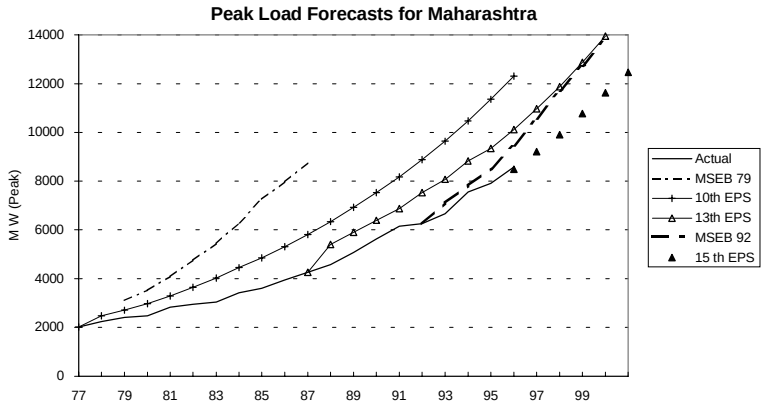
MP - 18,000 consumer giving 70% revenue

Orissa - about 100 consumer pay 35% revenue

Increasing unaccountability:

Claimed usage of Agri. pumps in Maharashtra

C) Inflated demand for capital



- Factors ignored by policymakers

  -

    - possible increase in plant performance (>norms)

- increasing captive generation
- demand sensitivity to tariff

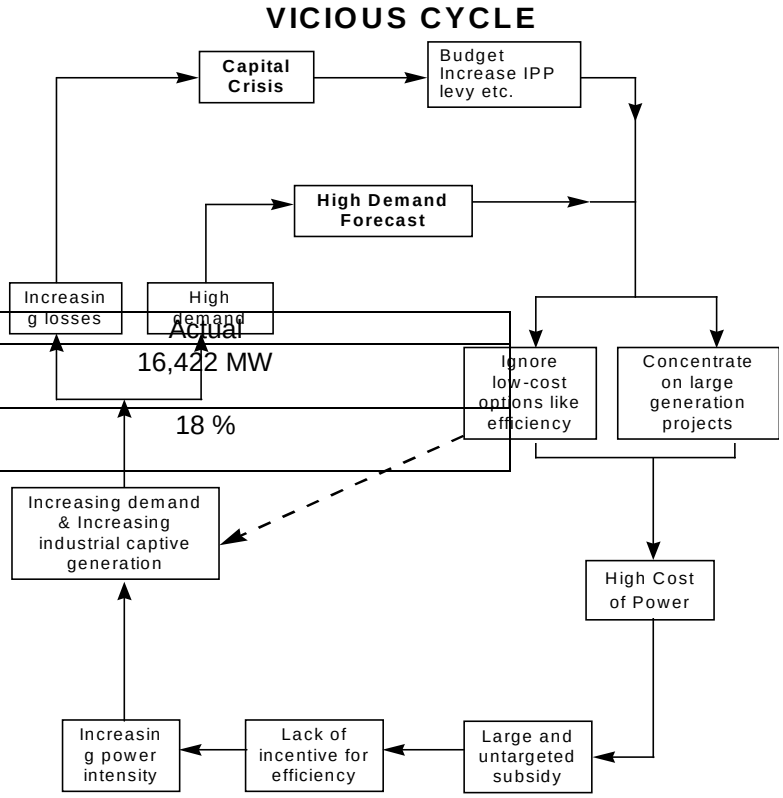
Example

Working Group for Eighth Plan -
48,000 MW addition needed

	Planned	Actual
Capacity Addition	30,538 MW	16,422 MW
Peak Deficit	20.7 %	18 %

⇒Over-projection of need to the extent of
Rs. 20,000 Crore / annum !

D) Neglect of low cost options
Energy efficiency
Load management
(flattening of load curve)



6. **IPP Process and it's impact**

National and international context

- Capital crisis for sector, 1991 forex crisis
- Dwindling capacity additions in OECD countries

Assured and high returns in foreign exchange ➔profit > 3 times allowed in USA

Factors limiting IPPs

- SEBs creditworthiness (*same that caused capital crisis & led to need for IPPs!*)
- Fuel issues,
- Clearances (Over 50)

Government Response: More Concessions **...**

- Fast track status, Increased profitability,
- Imported fuel allowed, Liquid fuel projects,
- State and GoI (Counter) guarantee → Escrow
- Increase in CEA clearance limits → removal of same

Status of IPPs

Presently only 3,255 MW operational
Expected by 2005 ~ 10,000 MW

i.e. ~ 9-10 % of Capacity v/s 15-18% of Revenue

IPP Process and it's impact …

Implications: Unjustified payments (higher tariff), Locking in of projects / government budget
Little action on key issues (T&D loss, billing/recovery)

Lessons from History

- Centralised bias,
- Short term view
- Ad-hock decision-making
- Postponing of hard decisions
- Narrow political interest supersede economic rational
  - Lack of accountability
  - Failure of regulation

➢ Lack of Professionalism
➢ IPPs viewed as opportunity
  - to maintain control over the sector
  - while continuation of milk skimming

A case of system sabotage

7. World Bank model of reforms

Three Main Reform Components

- Un-bundling
- Private ownership
- Independent regulation

- Physical flow of power remains same
- Financial flows change
- Disco will buy power from Transco
- Transco will buy power from Gencos
- Transco and Disco will be "Licensees
- RC will issue "Licenses"
- Transco - > Demand - Supply , Dispatch

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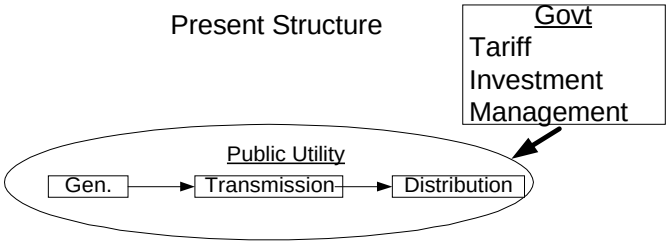
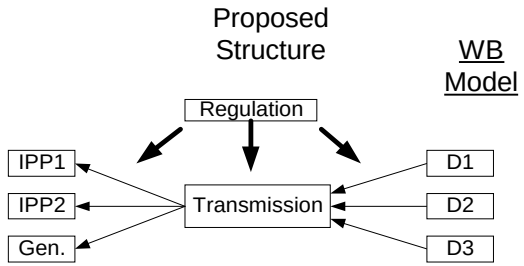
- Disco - Distribution Company
- Transco - Transmission Company
- Genco - Generation Company





Key aspects / Conceptual expectation

Competition

- Generation - Competitive bidding
- Bench Marking performance
- Fear of existence and incentive for good performance

Accountability

- Financial Accountability
- Performance accountability to RC

Insulation from Government interference

- RC a non political body, to take key decisions
- Limited authority to government
- Legal Contracts

8. Recent context

1. Fast increasing Captive generation
2. Low growth in demand
3. Inability to rapidly reduce T&D losses & increase tariffs

- **Electricity Bill 2001**

Annexure 4: The Case for Regulation in the Power Sector

1. ERCs - the offspring of Power Sector Reform

2. Features of the Pre-reform Power Sector
   - Government control -- EBs are run like departments of government
   - Administered prices that do not reflect marginal costs (what it would cost to deliver the next kWh)
   - Subsidies and cross-subsidies
   - Large T & D losses -- technical and commercial
   - Theft -- consumption w/o payment and delivery w/o revenue
   - Capital crisis -- no surplus to finance expansion and improvement

3. Command-and-control set-up to Market

4. Corporatization for Efficiency (commercial and technical)

5. Corporatization and Regulation
   - Withdrawal of the State from direct control of EBs
   - Power and Limits of Market
   - Regulation to overcome limits of market
   - Corporatization and Regulation -- two sides of the same coin

6. Immediate problems of ERCs -- Tariff Revision and Complaints

7. Unfortunately, ERCs are trapped in Narrow Agenda in which the urgent takes precedence over the important

8. Required -- a larger perspective for ERCs

- Public Benefits
  - Sectoral efficiency via IRP
  - Increasing access via obligation to serve yet-unconnected
  - Environmental soundness via RETs and EIs
  - Long-term health of the power sector via R&D
  - Empowerment of consumers
- Minimize growth of in-house capacity and maximize utilization of civil society
- Process must be synergistic -- hence, transparency and participatory
- Accountability

9. ERCs and Sudevelopment
   - Sudevelopment = Economic Efficiency + Equity + Empowerment + Environmental Soundness
   - ERCs must make Power Sector contribute to Sudevelopment

Annexure 5: The Regulatory Process

Regulatory Process

By

Prayas (Energy Group)

Workshop on Power Sector Reforms
and Public Participation in Karnataka

IEI - Prayas (Bangalore, Aug. 2001)

Importance of Regulatory Process

We See Regulation as:

"Ways and means employed by the society to ensure that rational decisions (from society's point of view) are made."

Reforms =>

Implicit Regulation (Government ownership and direct control) to

Explicit, Arms-Length (from Government) Regulation

Structure of the Presentation

- Salient Features of
  - Karnataka Reform Act, 1999
  - KERC Regulations
- Process of Tariff Revision
  - Procedural Aspects
  - Substantive Aspects

Building Blocks of Regulatory Process

- Karnataka Electricity Reform Act, 1999
- KERC General and Conduct of Proceedings Regulations, 2000
- KERC Licensing Regulations, 2000
- KERC Tariff Regulations, 2000
- Guidelines for Load Forecast and Power Purchase

Karnataka Reform Act, 1999

- Establishment of Three Member Regulatory Commission (RC)
- Functions of the RC
  - Issue License
  - Regulate Power Purchase
  - Regulate Tariff
  - Set Standards of Performance / Service to Consumers
  - Promote Demand Side Management
  - Promote efficiency, economy and safety

Reform Act 1999 …2

- RC Advisory Committee - Nine to Fifteen Members
- Designated RC Officer to Represent Consumer Interests
- All Decisions and Orders to be Public
- Unless Specified, All Hearings and Proceedings Open to Public
-) No Confidential Information to be Made Public
- Appeals in the High Court- Issues Relating to Law

Reform Act 1999 3

- Tariff
  - To Reflect Cost of Supply and Commercial Principles
  - Can Differentiate Considering Paying Capacity and Need for Cross-Subsidy
  - Uniform Tariff Across State
  - Tariff Order Within 90 Days

Conduct of Proceedings Regulations, 2000

- Defines Procedural Aspects of KERC's Functioning
  - How to file a petition and How it will Progress?
- Regulation 33 - Allows Inspection and Copies of RC's Records
- Regulation 35 - Allows Anybody to Attend Hearings / Proceedings
- Regulation 18 - Authorizes Registered Society as Consumer Forum

Licensing Regulations, 2000

- Public Hearings after 45 Days Notice
- Objectives of Licensing Scheme
  - Quality Power at Lowest Rates and Consumer Responsiveness
  - Transparency in Activities of Licensee
  - Provision of Universal Service
- Draft Transmission and Supply License

Licensing Regulations, 2000

- Importance of License Terms & Conditions
  - ✔ Annual Investment Approval by RC
  - ✔ Consumer Service Obligations
  - ? What Happens When License Expires ?

Tariff Regulations, 2000

- Formats of Annual Filings of Expected Revenue (ER) and Tariff Filing (TF)
- Requires 30 days Notice and Inviting of Public Comments on ER and TF

Guidelines for Load Forecast and Power Purchase, 2000

- Licensee to Submit a 10 Year Load Forecast and Power Procurement Plan Annually
- For Additional Capacity Licensee Should Seek Approval of the RC for Procurement Process, Which Should be Transparent and Competitive as Specified by the RC
- RC May Invite Public Comments at Any Stage

Intervention Opportunities

- License Conditions and Their Implementation
- Annual Expected Revenue Filing
- Investment Approval
- Load Forecast & Power Procurement Approval
- Tariff Revision

Procedural Aspects of Tariff Revision

- Filing of Tariff Revision Application
- Technical Validation of the Application
- Public Notice Inviting Comments
- Utility Replies to Public Comments
- Public Hearings
- Tariff Order

Process to be Completed in 90 Days

Substantive Aspects of Tariff Revision

$(S_{Ind.} * T_{Ind.}) + (S_{Dom.} * T_{Dom.}) + \ldots\ldots\ldots + \text{Misc. Revenue}$

=

Expected Revenue = Revenue Requirement

Components of Revenue Requirement

Component	KPTCL Proposal	KERC Approval	%
Power Purchase	4254	3695	69%
Interest & Finance	443	443	8%
Depreciation	299	299	6%
Employee Cost	856	821	15%
O & M	134	134	2%
Other Expenses	20		
Surplus / Profit			
Total	6006	5392	

Determinants of Key RR Components

- Power Purchase Cost
  - Long Term PPAs
  - Merit Order Dispatch (buy least cost power first)
- Interest & Finance + Depreciation
  - Result of capital investments (to be approved by RC)

Annexure 6: Case Studies of Intervention in Maharashtra

Case Study of Regulatory Intervention in Maharashtra's Power Sector

Prayas

Structure of Presentation

- Overview of cases
- Salient points of important cases
- Lessons & Precautions

Overview of cases - in last two years

Utility	**8**		
Tariff	4	MSEB 1998, 00-01 *, FOCA *, Mula Coop	
Dispute	2	Tata-BSES, MSEB-DPC *	
PPAs	2	MSEB-Cogen PPAs *	
Govt Subsidy	**1**	*	
Industry	**12**		
Own Tariff	7	Bulk discount, billing Dmd	
NTPC direct Supply	4	Steel export industry	
Supply conditions	1	With AGP *	
NGOs	**6**		
Transparency	2	Prayas	MSEB data, PPA documents
PPA invalidity	1	Prayas	Reliance PPA being void
Government role	1	MGP	Restraining government
Supply conditions	1	AGP	Challanging MSEB comm. Circulers
MSEB efficiency	1	Individua	Challanging MSEB plant dispatch
Political Party	**1**		
PPA invalidity	1	JD (s)	Reliance PPA being void

Salient points of important cases

- MSEB tariff 1999-00 & 2000-01, Prayas case for data / information
- Mumbai Grahak Panchayat - Government role in tariff
- Government - Seeking permission for subsidy disbursement schedule
- Prayas - Obtaining copies of ALL contracts, clearances related to IPPs
- Prayas - PPA invalidity
- Akhil-Bharatiya Grahak Panchayat - New connection charges, commercial circulars
- Mr. Paranjpe - Plant dispatch, MSEB generation, load shedding

MSEB Tariff 1999-00 / 00-01, Prayas Case

- Issues Raised
  - Estimation, Reduction of T & D losses
  - Merit Order Dispatch - buy least cost power first
  - Hidden Revenue - misc. income, wheeling charges etc.
  - Double Counting of Expenses - write-off and agricultural concessions
  - Correctness of Demand projections (increase tariff / need for IPPs)
  - Heat Rate - fuel cost, transit loss
  - Costs of unregulated activities - DPC shares
  - Bill adjustments (B-80)

MSEB Tariff 1999-00 / 2000-01, Prayas..2

- Decision
  - Survey based estimation, target reduction of T&D losses
  - Merit order dispatch -> DPC put last in order
  - Hidden revenue, double counting revealed
  - Demand projections brought down
  - Heat rate reduced, transit loss disallowed
  - Costs of unregulated activities - DPC shares - disallowed
  - Bill adjustments (B-80) - *MSEB internal processes started*
  - Energy Audit - major thrust of commission, sub-regional audit data demanded - *MSEB internal processes started*
  - Meter reading, billing, recovery - low efficiency revealed (reporting, checks in place) + *MSEB internal processes*

MSEB Tariff 1999-00 / 2000-01, Prayas..3

- Results
  - Consumer groups coming together
  - SEB had to reveal lot of information, data - answer pointed questions / criticism. Media pressure
  - Key parameters of SEB efficiency being monitored
    - Energy Audit, Billing problems, recovery, Least cost dispatch, metering plan, etc.
  - Technical sessions (& all proceedings) opened to public, press

⇒Opened way for further analysis / intervention

✕Old PPA, Investment control remained untouched

Mumbai Grahak Panchayat - Govt. role in tariff

Background: minister talked about likely tariff, directed MSEB to waive arrears of some consumers without announcing corresponding reimbursement

Issue: Government / MSEB cannot announce concessions in tariff (without government giving subsidy from budget),
  - restrain minister, SEB & start contempt process

Order: Government and SEB warned

Result: Government became cautious - some financial discipline, RC's authority accepted

Government - Seeking permission for subsidy

Background: Government announced subsidy - but was not disbursing it. Advisory Committee discussed the matter -> suggested RC to start action against Govt.

Issue: Govt. approached RC seeking permission for subsidy disbursement (and made provision in budget)

Order: Proposed disbursement schedule allowed

Result: Govt. financial accountability increased, timely payment being monitored by RC, public

Prayas - Obtaining copies of ALL contracts, clearances related to IPPs

Background: Prayas analysis showed large tariff increase due to IPPs, questionable status of several IPPs, govt. continued offering sops (at cost of consumers)

Issue: MSEB should submit to MERC all PPAs, clearances, related contracts, tariff models etc. of all IPPs and make them available to Prayas & public

Order 1: MSEB committed to give all documents but gave only limited set.

⇒ Some PPAs were clearly invalid

Prayas - Obtaining copies …2

MSEB was reminded to give documents - it gave additional documents. But not ALL documents demanded - as DPC objected, claimed confidentiality under the PPA clause

Contempt Petition: against MSEB for not giving documents - in defiance of RC order

Issues: MSEB was contractually bound to claim confidentiality, MERC's jurisdiction was examined

Order 2: MERC overruled MSEB's plea and asked it to give all documents to Prayas (including DPC loan documents, fuel purchase/ transport, O&M & **...**

Prayas - Obtaining copies …3

… construction contracts, equity undertaking, etc.)

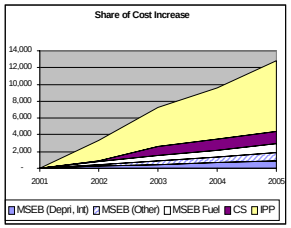
DPC raised objection to MSEB following the order…..may move high court

Result: A lot more transparency has been achieved

=> Paved way for staying wrong acts of MSEB in this regard

Prayas analysis indicated tariff shock due to excessive IPP contracts.

Consumers would have to pay ~ Rs. 7,000 crore more in just three years



- Else government budget would be affected (budget for education+health = ~ Rs 700 Cr / yr)
- IPP issue is more important than all other issues
- Up to 60% incremental cost due to IPP contracts
- Need for urgent attention - else tariff will be pre-determined

Prayas - PPA invalidity

Background: Examination of documents submitted clearly showed that Reliance had not obtained requisite permission from MERC for amending PPA.

Issue: Plea was to declare PPA null and void and direct MSEB to bring all PPAs to MERC. Similar issue was also raised by Janta Dal (s)

Order: said PPA was effectively declared void, MSEB was asked to bring all PPAs for public scrutiny

⇒Several Co-gen PPAs came under public scrutiny. Only IPP contract that remained binding was that of DPC

Akhil-Bharatiya Grahak Panchayat - New connection charges, commercial circulars

Issue: MSEB's commercial circulars (including connection charges) needed approval of MERC, charges were seen as too high

- Joint petition by Consumer Organisation and one Industry association

Order: MERC gave a stay on the revised charges, asked MSEB to get commercial circulars approved along with tariff proposal

Mr. Paranjpe - Plant dispatch, MSEB generation, load shedding

Issue: MSEB was not running plants to its full capacity, leading to need for load shedding, and purchase of power from DPC

Process:

- Load dispatch, claimed load shedding (up to 2,000 MW) and power plant performance were publicly scrutinized
- Additional gen. opportunities examined, MSEB likely to revise its plant availability (performance) claims, MSEB defended its honest intent

Order: Awaited

Lessons & Precautions

- Strong intervention by NGOs / consumer bodies can lead to significant benefits
- **We need to ……**
  - Be realistic about expectations and constraints
    - Legal, Techno-economic, Administrative/ Managerial
  - Ask key questions
  - Ensure due process is followed
  - Be consistent and persistent
  - Seek wider support
    - Other groups (unions, farmers & industry organisations etc.) & Media.

Lessons & Precautions

- **We need to avoid … …**
  - Verbal arguments, emotive approach
  - Alleging ill-intent

Annexure 7: Techno-Economic Issues in the Power Secto

Techno-economic Primer

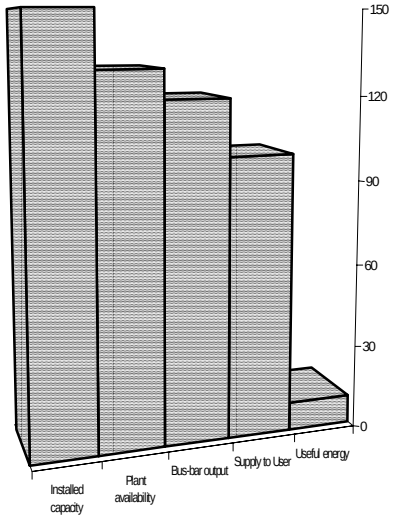
1) High quality source

- High conversion efficiency and convenience

- Large cost and low efficiency at generation

  150 W plant needed to support 100 W light bulb

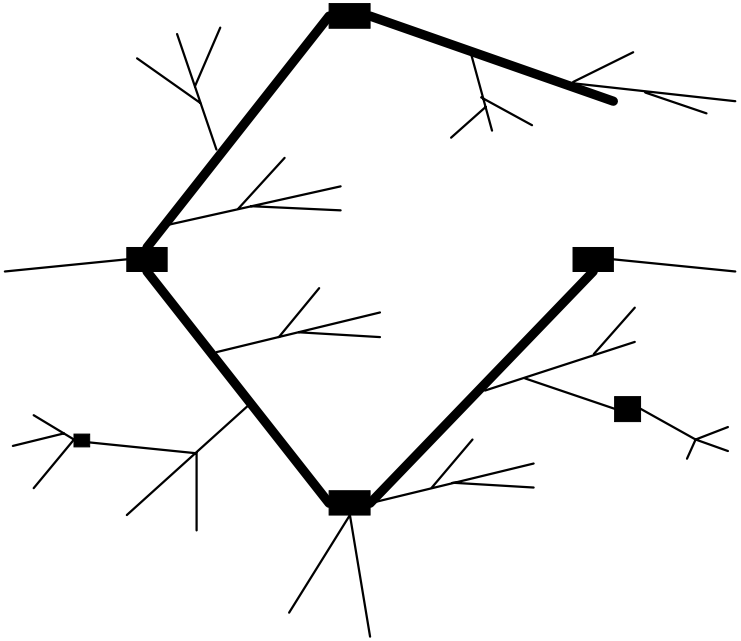
  ➔Investment of Rs.6,000



A 100 W bulb usage of 4 hrs/day

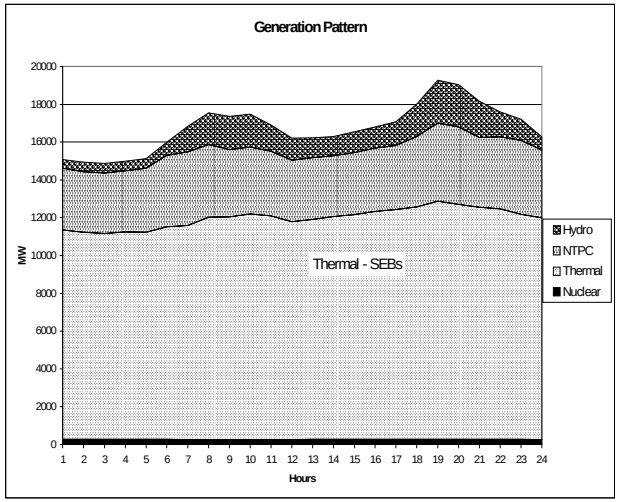
Energy billed → 148 unit / year
Coal consumption → 152 Kg / year

2) Grid Operation



- **Implications**

  - Generation to follow demand

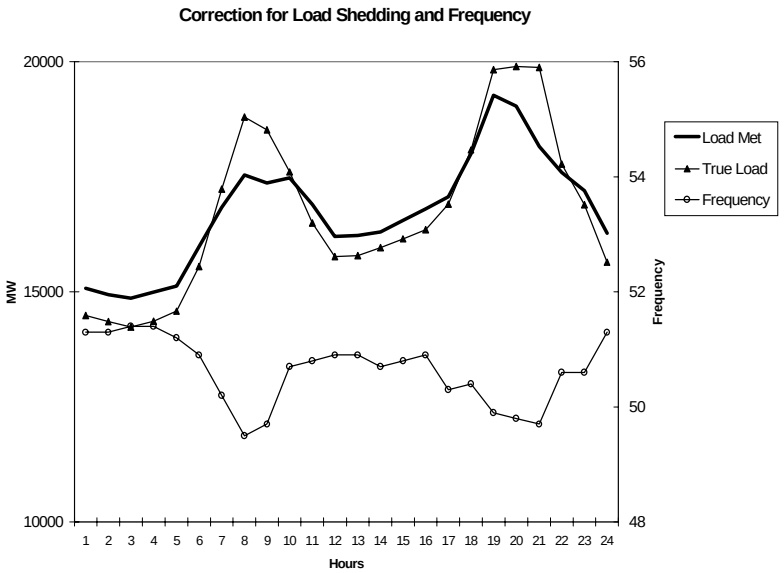


- Need for central dispatch
  Increase or decrease is possible to an extent

- Frequency: an indicator of demand-supply situation

- Load shedding
  Frequency relays,
  Manual load shedding (planned, un-planned)

- Effect of Frequency and load shedding



(Load shedding is assumed, due to lack of data)

3) Types of Generation Plants

- Operating Principle

Steam - Coal, Nuclear, Industrial Co-generation
Gas turbine - GT (similar to Aircraft engines)
I.C. Engines - D G Sets
Direct motion - hydel plants, wind turbines
Others - Photo-voltaic

- Characteristics of different plants

Peaking v/s Base Load Plants
Technical reasons and economics

Availability, Auxiliary consumption
=> net reliable plant out-put (atbus-bar)

Type	Typical Size(MW)	Construction time	Efficiency	Initial Cost cr. Rs/MW	Backing down*	Startup-time
Coal	200-750	3-5 year	38%	3.5 - 4.5	75%	4 hours
Hydel PSS	KW – 200	3-7 year	85% 70%	Variable	Up to 5%	Few minutes
Gas Turbine Open cycle CCGT	 12-240 3 x OC	 2 year 3 year	 32% 48%	 2.5 3.5 - 4	 50% 50%	 Few minutes
DG sets	0.5-20	< 1 year	~ 30%	1.5 or 3 #	50%	-- " --
Wind	0.25-1	6 months	---	~ 3.5	Variable	None
Nuclear	250-1000	6 –10 year	---	6 - 8 @	80%	Few days

Notes

* : Backing down : generation level considered acceptable in normal operation.

: The lower cost refers to the high speed engine (running on Diesel) and higher cost refers to Low Speed engines running on lower quality oils.

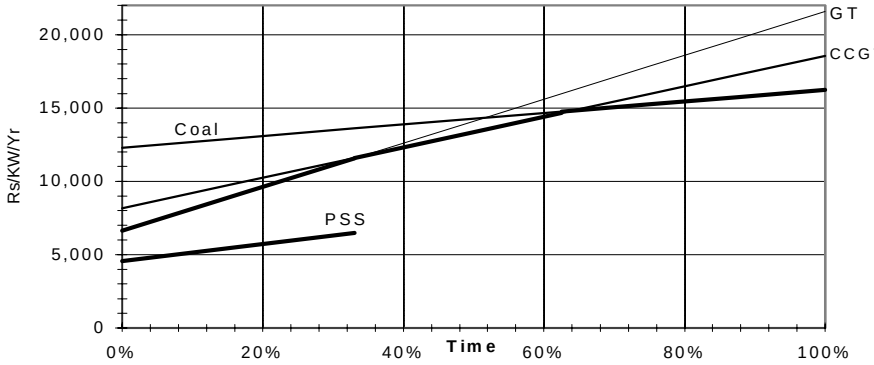
@ : Cost of nuclear plants is difficult to estimate due to the secrecy followed by the GoI. But these plants are considered highly un-economical in most developed countries.

Plant Availability v/s Plant Load Factor

4) Economics of Generating Plants

- Fixed Costs: loan repayment, profit on equity, insurance, fixed O&M etc.
- Variable Costs: fuel cost, variable O&M

Screening Curve for Plant Selection(PLF v/s Annual cost)



Time = PLF

Low PLF = Peaking Plants (PSS, GT)
High cost in Rs/unit

High PLF = Base Load Plants (Coal)
Low cost in Rs/unit

Peaking plants → peak power → high cost power

→ Lower the need for peaking plants (flatter the load curve) lower is the tariff

5) Comparing cost of different plants

- Factors
  - Initial cost
  - Construction time (interest during construction IDC)
  - Auxiliary consumption
  - Plant availability

- Fuel cost per unit (efficiency, fuel cost escalation)
- Life
- Associated T&D costs (location, size)

- Corrections
  - Output taken at Bus-bar (net of auxiliary)
  - capacity taken is net of availability
  - Cost includes IDC and T&D investments (at the time of commissioning)
  - T&D losses to be subtracted from the output

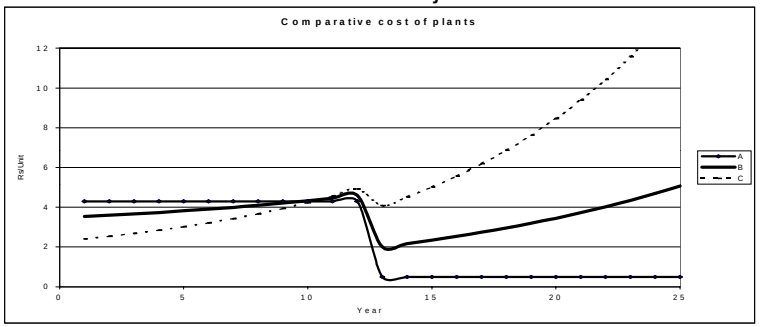
Example:

Plants A, B, C are for same duty, say base load.
Corrections mentioned in (i) are applied to get following costs
Fixed cost becomes nil after 12 years for all plants

	A	**B**	**C**
1. Fixed cost	3.8	2.73	1.25
2. Variable cost	0.5	0.74	1.05
Escalation in (2)	0%	8%	11%

Which plant to choose ? **A or B or C**

Tariff Projection



- Discount Rate

  Used to calculate Net Present Value (for all years)

  Levalised tariff (constant tariff having same NPV)

  For discount rate = 15%

  All plants have same NPV

  Levalised Tariff = 3.66 Rs/u

  For discount rate = 10%

  B is 10% costlier than A

  C is 25% costlier than A

6) Dispatch Logic

Plants are installed → Fixed cost is given

Aim is to minimise operating cost

- Least variable cost is put in operation

  Called “Merit order operation”, except what is reserved for peaking duty

- Role of proper grid code, commercial arrangements

  Western Region experience

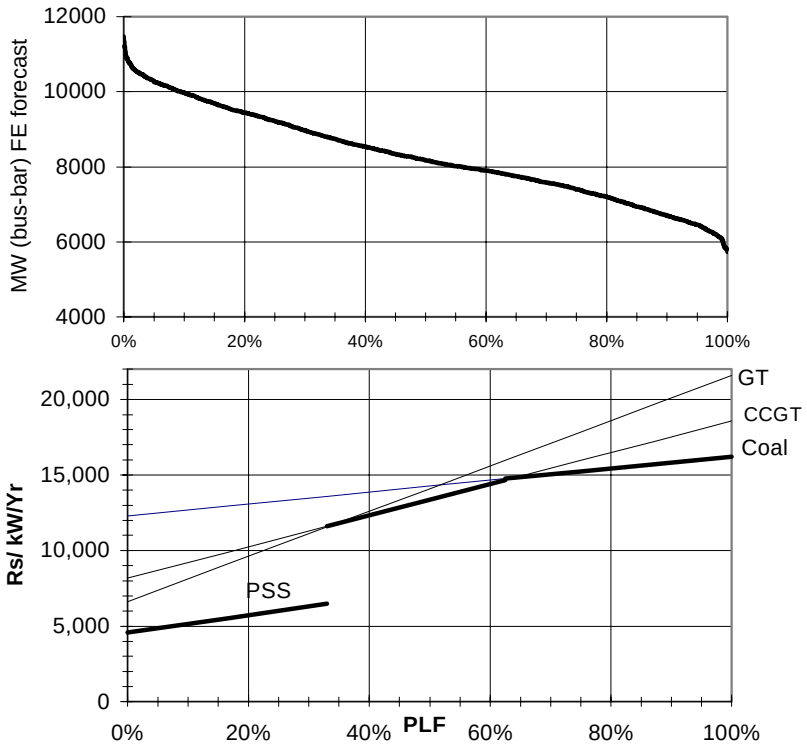
  MSEB – TEC

  MPEB buying Captive

7) Long Term Planning

Aim is to minimise the fixed as well as operating costs

a) Demand Projection (energy and peak)
b) Load Duration Curve is plotted



Required Capacity of
Peaking, Intermediate and Base load plants is decided

c) Loss of Load Probability (LOLP) = reliability
   Tariff very sensitive to LOLP (in 0 to 10% range)
d) Detailed computer models (A/S plan, Elfin)

8) Market Approach to planning / operation

a) Increasing suspicion about centralized planning

   Wrong projections of demand, limited cross-checks etc.

b) UK model: Planning as well as dispatch left to market

- No guarantees
  - Anyone can set-up power plant
  - Consumers free to buy from any plant (after paying transmission charges)
- IPPs can try for long term contract and offer rest of the power on spot market
- Futures trading of Power
- Intermediaries emerging (like share brokers)
- It is yet evolving, spot prices have been easy to manipulate
- Advantages are significant
- Most popular model – several countries moving towards this

  Called "Pool system" with "Retail Wheeling"

9) Tariff Concepts

- Components of Tariff
  Average Tariff = All costs / energy sold
  Costs include:
  Cost of generation (or energy purchase)
  T&D costs
  billing & recovery
  profits

Energy sold = Generation – Aux. consumption – T&D loss – Theft
Generation / T&D costs
Fixed cost reduces over time (as loan is repaid)
High cost initially, declines later (initial losses, profits later)

Generation cost forms about 50 to 60% of tariff

- Tariff Principles

- Cost+ = Fair cost (loan repayment, interest, O&M, fuel etc.) + return on investments
- Chinese mixed model: historical power + new commercial power
- Long range marginal cost - What would be the cost of additional supply
- Market driven

All have certain corrections such as cross subsidy and Life-line tariff

Conclusion

Important Items for Consumers

Good performance of Gen. plants

Low T&D losses (and theft), good recovery

Economic Dispatch

Long Term Planning

Correct demand forecasts

Right choice of power plants

Triangle of "Reliability – Quality – Cost"

Techno-econmic Primer

Convenient but costly affair

From thermodynamic point of view, electricity is a high quality energy. It can be easily transported over large distance, it can be easily and efficiently converted in different kinds of energy (such as motion, sound, light, and heat). But generation of electricity is not very efficient. Usually fifty to sixty percent of energy content of the fuel goes waste through the stacks and waste heat. Similarly, electricity use is free of pollution at the site of use. But at the site of electricity generation there are a lot of social and environmental impacts. Figure 1 * shows the typical conversion efficiencies of end use appliances that use electricity.

Electricity is a convenience form of energy. But the systems are very capital intensive. For providing reliable power to a 100 Watt lamp (that is expected to be used in the evening, which happens to be the peak demand) a generation plant of * Watts and associated supply lines have to be installed. The cost of this is about Rs *. Figure 2 shows the different kinds of losses that typically occur in the process from generation to final use of electricity. These include, non-availability of generation plant (due to reasons such as maintenance), losses during process of generation, transmission and distribution (T&D) losses, and finally losses in the power using appliance.

Annexure 8: Least-cost Planning in the Power Sector

Least-Cost Planning for Electricity

Antonette D'Sa

International Energy Initiative

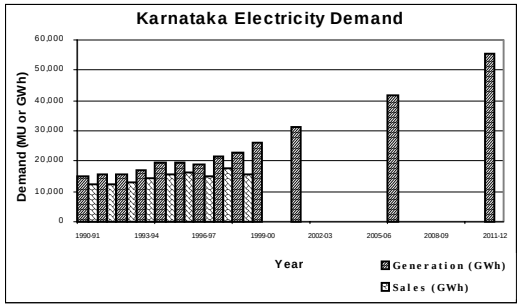
Workshop on

Power Sector Reform and Public Participation

24th - 25th August 2001

TRENDS IN ELECTRICITY GENERATION & USE

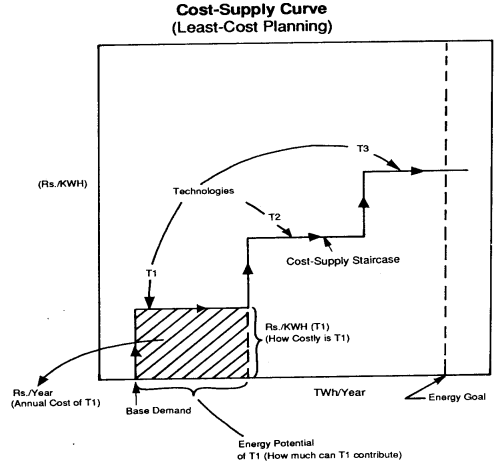
FUTURE REQUIREMENT ESTIMATED BY CEA



2002-03 to 2011-12
CEA's 15th EPS

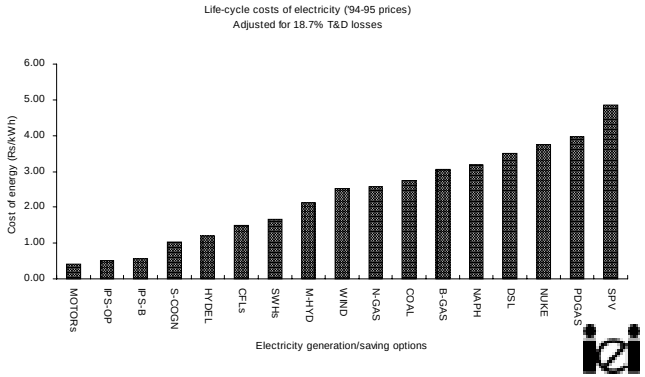
TO BRIDGE THE GAP BETWEEN AVAILABILITY←→ REQUIREMENT:

- **INCREASE GENERATION through**
  - **NEW PLANTS (more capacity)**
  - **BETTER UTILISATION (of existing capacity)**
- **REDUCE REQUIREMENT through IMPROVED EFFICIENCY OF:**
  - **ELECTRICITY USE**
    - **better devices (e.g. CFLs)**
    - **alternative energy sources (e.g. SWHs)**
  - **ENERGY SUPPLY**
    - **reduce technical T&D losses**
    - **reduce commercial distribution losses**



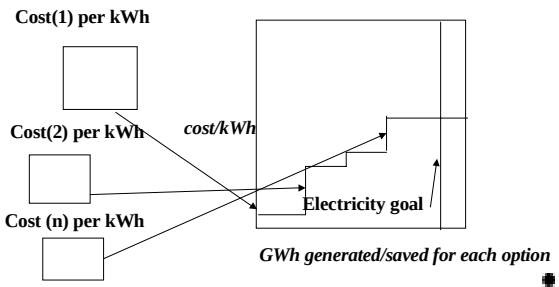
FOR THE LEAST-COST PATH:

-> ESTIMATE THE COST/UNIT (Rs/kWh) of each SUPPLY OR EFFICIENCY OPTION
-> RANK options in ORDER OF INCREASING Rs/kWh

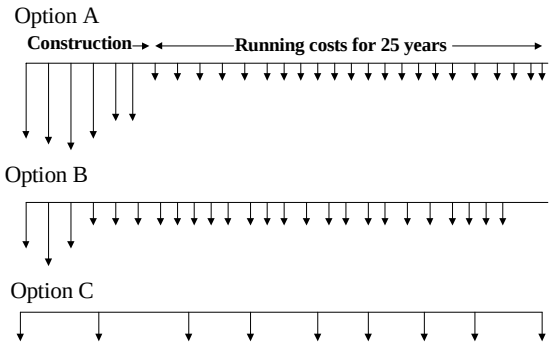


LEAST COST PATH (continued)

-> ESTIMATE POTENTIAL of generation or saving (kWh)
-> SELECT ALL OPTIONS TILL GOAL (million kWh)



OPTIONS HAVE DIFFERENT COST PROFILES:



COMPARISON OF ANNUALISED LIFE-CYCLE COSTS (ALC) OF THE AVAILABLE OPTIONS:

where:
ALC = ANNUAL VALUE OF ALL ACTUAL COSTS
= [INITIAL COSTS + RECURRING COSTS] INCURRED DURING THE WORKING LIFE OF THE PLANT OR DEVICE

(The financing costs -- like return on equity and interest on debt -- are *not* included).

FUTURE VALUE OF INVESTMENT
at interest rate = i

|<---------- n years ---------->|

C_0 ?

$C_0 \times (1 + i)^n = C_n$

CONVERSELY, PRESENT VALUE OF COSTS:

|<----------|

C_n

$C_0 = C_n / (1 + i)^n$

SIMILARLY,
Commencement of construction

|<------ n years of construction --------->|

C_0 ---------->Commissioning

$C_n = C_0 \times (1 + i)^n$

FOR LIFE-CYCLE COSTS -- FORMULAE USED:

IF COST C HAS TO BE "ANNUALISED",

i.e., IF C MUST BE EQUIVALENT TO EQUAL ANNUAL AMOUNTS =A, FOR N YEARS AT i % INTEREST, THEN:

$$A = \left[\frac{i}{1 - \{1/(1+i)^N\}}\right] \times C$$

where

$\left[\frac{i}{1 - \{1/(1+i)^n\}}\right]$ **is known as the "annuity" or "capital recovery factor".**

CONVERSELY, *FOR THE "PRESENT VALUE" OF ANNUAL PAYMENTS*, i.e., FOR A PRESENT AMOUNT C EQUIVALENT TO A STREAM OF EQUAL ANNUAL PAYMENTS A, FOR N YEARS AT i % INTEREST, THEN:

$$C = A \times \frac{[1 - \{1/(1+i)^N\}]}{i}$$

FOR COMPARATIVE COSTING - REMEMBER:

- THE *SAME UNIT* (KW OR KWH) GENERATED OR SAVED SHOULD BE COMPARED IN ALL CASES
- ALL COSTS MUST PERTAIN TO THE *SAME REFERENCE YEAR*
- THE *TIME VALUE OF MONEY* SHOULD BE CONSIDERED
- THE *SAME INTEREST (DISCOUNT) RATE* MUST BE USED FOR COMPARISON OF DISCOUNTED CASH FLOWS OF OPTIONS
- THE *CONSTRUCTION (TIME) LAG* BETWEEN COSTS INCURRED AND BENEFITS RECEIVED (PLANT COMMISSIONING) MUST BE REFLECTED IN THE COSTS
- A KWH GENERATED OR SAVED MUST BE *COMPARED AT THE USERS' END* (i.e. LOSSES INCURRED ON T&D MUST BE PROVIDED FOR)

For the Costs/kWh delivered:

Generation:

- **1. Initial (Capital costs):**
  - Civil construction
  - Plant, machinery
- **2. Recurring (fixed and variable) costs:**
  - Fuel costs (varying with generation)
  - Operation (salaries, etc.)
  - Maintenance (repairs)

Transmission & distribution

STEPS TO ESTIMATE THE *COST PER kWh DELIVERED:*

1 ESTIMATE THE ANNUAL GENERATION OF ELECTRICITY PER KW = kWh/kW/year

2 COMPUTE THE INITIAL (CAPITAL) COST OF (1), CONSISTING OF:

(a) ANNUALISED INITIAL COSTS PER KW (at the time when generation begins), i.e.

EFFECTIVE COST AT COMMISSIONING ÷ CAPACITY = EFFECTIVE COST PER KW (Rs/kW)

=> EFFECTIVE COST PER KW x CRF

$$= (\text{Rs/kW}) \times \left[\frac{i}{1 - \{1/(1+i)^n\}}\right] = \text{ANNUALISED COST}$$

=> ANNUALISED COST (in 2) ÷ GENERATION/YEAR (in 1) = (Rs/kW/year) ÷ (kWh/kW/year) = Rs/kWh

TO ESTIMATE THE *COST PER kWh DELIVERED (continued)*

(b) COMPUTE ALL RECURRING COSTS:

For example: FUEL COSTS PER kWh

= [Requirement/kWh x cost/unit of fuel]

= [{(kj/kWh)÷(kj/kg)} x {Rs/kg}] = Rs/kWh

Similarly, compute other costs per kWh

=> TOTAL COSTS PER kWh AT GENERATION = SUM OF ALL COSTS IN (a)+(b)

3 EQUIVALENT COSTS AT THE CONSUMPTION POINTS

= COST/kWh from (2) INFLATED BY THE T&D LOSSES (till the specified consumption point)

$$= \text{Rs/kWh} \times \left[\frac{1}{1 - (1 + \text{T\&D proportion})}\right]$$

Example (of computing the cost of delivering a kWh generated):
COST PER kWh FROM A COAL-BASED THERMAL POWER PLANT
Discount rate assumed = 10%
DATA:
CAPITAL COSTS:
CAPITAL COSTS = Rs 613 crores comprising annual costs of Rs 76.63 cr, Rs 229.88, Rs 229.88, Rs 76.63
CAPACITY = 210 MW
RECURRING COSTS:
PLANT LIFE = 25 years
UTILISATION = 68.493%
AUXILIARY USE = 9.5%
(CONTINUED)

DATA (continued)
STATION HEAT RATE = 2,500 kcal/kWh
CALORIFIC VALUE OF COAL = 4,200 kcal/kg
PRICE OF COAL = Rs 1,925/tonne
FURNACE OIL REQUIREMENT = 3.5 millilitres/kWh
PRICE OF OIL = Rs 8,000/kilolitre

ANNUAL O&M COSTS = 2.5% of capital
WORKING CAPITAL norms:
coal stock = 1.5 months
furnace oil stock = 2 mths
O&M of 1 month
spares @ 1% of capital cost

COMPUTATION:

GROSS GENERATION/kW/year @ 68.493%
= 1 kW x 0.685 x (8,760 hours/year)
= 6,000 kWh/year

NET GENERATION/kW/year
= GROSS GENERATION LESS 9.5% AUXILIARY USE
= [6,000 X (1 – 0.095)]
= 5,430 kWh/year

FOR THE CAPITAL COSTS:

ANNUAL EXPENDITURE (Rs cr.)	compounding to commissioning date @ 10%/year	EFFECTIVE CAPITAL COST (Rs cr.)
76.63	x $(1 + 0.10)^3$	101.99
229.88	x $(1 + 0.10)^2$	278.15
229.88	x $(1 + 0.10)^1$	252.86
76.63	x $(1 + 0.10)^0$	76.63
613.02		709.62

EFFECTIVE CAPITAL COST/kW
= Rs (709.62 x 10^7) / (210 x 10^3) kW
= Rs 33,792 per kW
(continued)

(Continued)

Annuity factor for 25 years, @ 10% = $\frac{[\ 0.10\ ]}{[1 - \{1/(1 + 0.10)^{25}\}]}$ = 0.1102

EFFECTIVE ANNUALISED CAPITAL COST/kW

= Rs 33,792 x 0.1102

= Rs 3,723/kW/year

EFFECTIVE CAPITAL COST PER kWh

= Rs 3,723/kW ÷ 5,430

= Rs 0.69/kWh (approx.)

(WORKING CAPITAL CAN ALSO BE INCLUDED HERE AS PART OF THE TOTAL CAPITAL COST).

FOR THE RECURRING COSTS:

FUEL:

NET COAL REQUIREMENT

=Station heat rate ÷ calorific value of coal used

= 2,500 kcal/kWh / 4,200 kcal/kg = 0.5952 kg/kWh

GROSS COAL REQUIREMENT (including auxiliary use)

= {1 /(1 - 0.095)} x 0.5952 kg/kWh = 0.6577 kg/kWh

COAL COST PER kWh = Rs 1.925/kg x 0.6577 kg/kWh

= Rs 1.27/kWh

Similarly,

GROSS OIL REQUIREMENT (including auxiliary use)

= {1 /(1 - 0.095)} x 3.5 ml/kWh = 3.87/kWh

OIL COST PER kWh = Rs 8.00/litre X 3.87/1000 litre/kWh

= Rs 0.03/kWh

TOTAL FUEL COSTS = Rs (1.27 + 0.03)/kWh

= Rs 1.30/kWh

TOTAL ANNUAL O&M COSTS = 2.5% of total capital costs

= 0.025 x 33,792 /kW = Rs 844.8/kW

ANNUAL O&M COSTS/ kWh = Rs 844.8/kW / 5,430 kWh/kW

= Rs 0.16/kWh

WORKING CAPITAL COMPUTED AT THE GIVEN NORMS

= Rs (859 + 28 + 70 + 338 + 50)/kW = Rs 1,346/kW

WORKING CAPITAL contribution to costs

= Rs (1346 x 0.1102) /kW/year

Or Rs 148/kW / 5,430 kWh/kW = Rs 0.03/kWh

[Other costs such as ash-disposal costs were not available].

TOTAL COSTS PER kWh

= Rs (0.69 + 1.30 + 0.16 + 0.03)

= Rs 2.17/kWh (approximately)

(The financing costs -- such as return on equity, interest on debt, are *not* included among these life-cycle investment costs).

INCLUDING T&D LOSSES OF 30%,

=> THE COST OF DELIVERING ELECTRICITY

= Rs 2.17 ÷ (1 – 30/100) = 2.17 ÷ 0.70

= Rs 3.10/kWh

STEPS TO ESTIMATE THE *COST PER kWh SAVED*:

1. ESTIMATE THE ANNUAL SAVING OF ELECTRICITY (kWh/device/year)

2. COMPUTE THE COST OF (1):

ANNUALISE INITIAL COSTS (at the time when saving begins):

$$\text{ANNUALISED COST} = (\text{Rs/device}) \times \frac{i}{1 - \{1/(1+i)^n\}}$$

= Rs/device/year

3. COST PER kWh = (Rs/device/year) ÷ (kWh/device/year)

= Rs/kWh

Example (of computing the cost of saving a kWh):

COST PER kWh SAVED THROUGH REPLACEMENT OF A DOMESTIC ELECTRIC WATER-HEATER WITH A SOLAR WATER-HEATER (SWH)

Discount rate assumed = 10%

DATA:

COST OF 100 litre SWH (+ ACCESSORIES) = Rs 16,000 (approximately)

WORKING LIFE = 25 years

ANNUAL O&M COSTS (assumed) = 0.5%/year

AVOIDED USE OF ELECTRICITY = 330 days, 3 kWh/day (average)

COMPUTATION:

Annuity factor for 25 years, @ 10% = $\frac{0.10}{[1 - \{1/(1 + 0.10)^{25}\}]} = 0.1102$

ANNUALISED COST OF SWH = Rs 16,000 x 0.1102
= Rs 1,763

ANNUAL O&M COSTS = 0.005 x 16,000 = Rs 80

=> TOTAL ANNUAL COSTS = Rs 1,843

ANNUAL SAVING OF ELECTRICITY = 3 kWh x 330
= 990 kWh

=> COST OF (DELIVERED) ELECTRICITY SAVED
= Rs 1,843 / 990 kWh
= Rs 1.86 per kWh

COSTS ESTIMATED FOR (ONE/MORE OF) THE FOLLOWING GENERATION/CONSERVATION OPTIONS IN KARNATAKA:

GENERATION PLANTS (based on)
NUCLEAR
COAL
(LARGE) HYDROELECTRIC
MINI-HYDROELECTRIC
NATURAL GAS (not based in Karnataka)
BIOGAS-DIESEL
PRODUCER GAS-DIESEL
DIESEL
WIND

COGENERATION:
SUGAR FACTORIES

CONSERVATION (through):
SOLAR WATER HEATERS
RETROFITTED IRRIGATION PUMPSETS
RETROFITTED MOTORS
REPLACEMENT OF INCANDESCENT BULBS WITH COMPACT FLUORESCENT LAMPS

Annexure 9: Paying for Power

PAYING FOR POWER

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Workshop on Power Sector Reform and Public Participation
24th – 25th August 2001

1. Approach to Tariff Reform
   - Bridging Revenue-Expenditure Gaps
     - Match revenue to expenditure is only logic
     - Ad hoc arbitrary pushing to maximum
     - R = Sum(Ri) = Sum(Ci x Ti) = Sum (Ei) = E
     - Constraints
       - Minimal increase in IPS tariff
       - Industry tariff cannot exceed cost of captive power
   - Prices to reflect Present Costs
     - Present costs = Operating Costs (because of depreciated capital)
     - Costs = Costs at last tariff increase + Cost increase
     - True costs = Present costs - Costs of inefficiency
     - Costs of inefficiency = Costs of generation inefficiency + costs of avoidable + costs of avoidable T&D + Theft
     - Costs of inefficiency must not be passed on to consumers
   - Prices to reflect Future Costs
     - Future costs = LRMC
     - Which new projects?
     - Least-cost (not arbitrary) basis

- Saving (EUEI) is an option

2. Guidelines for implementation
   - Consumer's Concern -- *expenditures* rather than *prices* and *tariffs*
   - Expenditures can be held constant (or even decreased) under tariff increases! How?
   - Improvement of equipment efficiency => lower electricity consumption => compensation for higher tariff
   - If consumption = 100 units/ month => bill = Rs 200/month @ Rs 2.00/unit
   - If improved device uses 75 units/month, then consumer could pay Rs 200/75 = Rs 2.67/unit *without* increasing expenditure
   - Tariff increase only *after* efficiency improvement
3. Tariff Increases With Efficiency Improvement
   - How to ensure that there will be no expenditure increase with tariff increase
   - New tariff P_a (after efficiency improvement) must not be greater than $[(P_b \times Q_b) / (Q_a)]$ where P_b = tariff before increase, and Q_b and Q_a = consumption before and after efficiency improvement and tariff increase
4. Poor Quality Electricity Causes Extra Expenditures
   - Consumers incur extra expenditures to prevent/rectify damage to equipment caused by poor quality electricity (low voltage, low frequency, irregular supply)
   - Suppliers get away with this damage only because there is no competition to steal their customers
5. Avoiding Adding Insult (Tariff Increases) To Injury (Poor Quality Electricity)
   - But they may not be able to get away with a superimposed tariff increase
   - Hence, there must be improvement In power quality *before* tariff increase
6. Tariff Increases For Reliable Electricity
   - Most consumers would be prepared to pay higher tariff for *reliable* electricity rather than incur extra expenditure from subsidized *unreliable* electricity
   - But *before* tariff is increased (for reliable electricity), demonstration projects should reveal improvement of supply quality and prove benefits to consumers.
7. Subsidies To The Power Sector
   - Subsidies promote waste and discourage efficiency

- There should be no net subsidies to power sector
- Cross-subsidies (from one consumer category to another) permissible

8. Discouraging Consumers From Wasting Electricity
    - Two options: tariff increases versus efficient equipment
    - If consumers' demand is inelastic (i.e., does not decrease even after price increases), tariff increase may not reduce electricity demand
    - Improving equipment efficiency is better than mere tariff increases
9. Better To Subsidize Efficient Equipment Than Subsidize Electricity
    - Some consumers may be unable to pay first cost of efficient equipment
    - Financing schemes to lower/defer first costs for promotion of improved equipment and reduction in energy demand
    - Subsidy (with sunset clause) should be restricted to emerging technologies