



Karnataka's Power Sector & Suggested Ways Forward

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1. Overview of the present system:

The main utilities in Karnataka's power sector are the Karnataka Power Corporation Ltd. (KPCL) -- the Public Sector generation utility, the Karnataka Power Transmission Corporation Ltd. (KPTCL)¹ -- the Public Sector transmission utility, and its four regional distribution utilities -- the Bangalore Electricity Supply Company (BESCOM), the Mangalore Electricity Supply Company (MESCOM), the Hubli Electricity Supply Company (HESCOM), and the Gulbarga Electricity Supply Company (GESCOM), currently in the Public Sector but expected to be privatised later.

Table 1 shows the trend in the total generation capacity of Karnataka's state utilities. This capacity has increased to 4,291 MW in 2002, comprising KPCL's 3,943 MW and VVNL's 348 MW. In addition, Karnataka's share of Central projects is currently 761 MW. The state also has an estimated industrial/commercial captive generating capacity of 3,021 MW, of which the 225 units with least 500 kW each had a capacity of 1,073 MW on 31st March 1999 [CEI-GoK, 2001].

Till 1985, the state's entire capacity had been hydroelectric, but with six 210 MW Units² of the coal-based Raichur Thermal Power Station (and a few diesel and wind-based plants), the hydro share of capacity has dropped to about 65%. (Figure 1) Further, only about 75% of the hydro capacity is available for utilisation; the remaining 25% constitutes (a) "non-firm" capacity (i.e. a part of the water stored in some hydro-reservoirs is also meant for irrigation), (b) unforeseen outages (necessitating a spinning reserve), and (c) maintenance protection reserve. As a result, in years of poor rainfall,³ hydel plants contribute only around 40% of the annual electricity generated. This also leads to increased dependence on the thermal plants whose operating costs per unit are necessarily higher.

Figure 2 shows the average annual load met by Karnataka's utilities (after the imposition of restrictions such as demand cuts and load shedding). The 16th Electric Power Survey⁴ of the Central Electricity Authority (CEA) has projected the utilities' peak demand requirements to be 7,740 MW and 10,460 MW for the years 2006-07 and 2011-12, respectively [CEA, 2001].

The consumers of electricity within the state include those whose electricity use is metered, namely high tension consumers (industrial, commercial, water-supply, railways and others), and low tension consumers (domestic, and other commercial, industrial and miscellaneous categories), and un-metered connections, namely, agricultural pumpsets,

¹ The State Electricity Board dealing with the transmission and distribution of electricity -- the Karnataka Electricity Board (KEB) -- was "unbundled" and corporatised in 1999. The resultant Karnataka Power Transmission Corporation Ltd. (KPTCL) retained charge of transmission and distribution, while a small generation company, Visveswaraya Vidyut Nigama Limited (VVNL), was given control of the few generation stations earlier controlled by the Board. KPTCL in turn was unbundled in June 2002, with the distribution segment split between the existing four main geographical zones.

² Unit VII is due to be commissioned in February 2003.

³ The monsoon rainfall in this region has usually followed the pattern of two "poor" years followed by one "good" year; the Linganamakki reservoir (source of the Sharavathi hydro projects) is usually filled once in six years, while the Supa and Mani dams (sources of the Nagihari and Varahi projects, respectively) have been completely filled only once (in 1994-95) since their construction.

⁴ The 15th Electric Power Survey had projected peak demand requirements of 7,202 MW and 9,453 MW in the years 2006-07 and 2011-12, respectively.

public lighting, bhagya jyothi connections for low income homes and KEB master unit substations (MUSS). Tables 2 and 3 indicate electricity use in each sector, and the category-wise number of connections serviced, respectively.

From the total annual electricity use of both metered and un-metered consumers, it can be observed that although there has been an increase in the aggregate electricity use, the high-tension category showed a slow increase, with the use/connection actually declining. This was due to a great extent to the industrial users shifting to captive generation. As shown in Table 4, the captive generation capacity at large industrial/commercial establishments rose to about 3,201 MW in March 1999, generating an estimated 2,668 GWh⁵ during 1998-99 [CEI-GOK, 2002]. As the electricity use from their captive sources rose to about 45% of their total requirements, their share of the utility supply dropped (from over 65% in the 1970s and 40% in the 1980s) to only around 20%.

In contrast, the (un-metered) agricultural sector appeared to display a rapid increase. (Figure 3) However, from the year 1998-99 onwards, the apportionment of un-metered electricity use between agricultural pumpsets and transmission and distribution (T&D) losses has been changed, so that the proportion of pump-set use is shown to have declined (from 42.2% of the energy available for sales in '97-98 to 30.9% in '98-99) and the corresponding distribution losses increased (from 18.6% to 30.2%). More importantly, agricultural pump-set use is now being estimated on the basis of sample metering at those transformer centres (TCs) catering chiefly to such users. The average of these readings has resulted in KPTCL's estimates of annual electricity use per pumpset: 6,397 kWh in 1998-99 and 6,217 kWh in 1999-2000⁶. However, regressing the total electricity use per TC on the number of pumpsets disaggregated by depth, showed that the consumption at bore-wells was more than twice that of open-wells [D'Sa and Reddy, 2000]. Therefore, the state average should be weighted by the number of pumpsets at bore (deep) wells and at open (shallow) wells – information that is not available accurately⁷. Similarly, the district-wise analysis showed that the electricity use per pumpset varied greatly with the geographic region; obviously, the state average should reflect regional weights. The sample data collection would also need to be far more complete⁸ to arrive at accurate estimates.

The electricity use computed per connection (as shown in Figure 4(a) to (f)) for two decades indicates an increasing trend in the use of the lower-use-domestic (lighting) category, in contrast to decreasing trends for the higher-use-domestic (lighting and heating) and high-tension (HT) categories. As noted earlier, the consumption per agricultural pumpset also appeared to be sharply increasing till 1998.

Transmission and distribution (T&D) losses include both technical and commercial losses, now generally considered to be over 20% and over 10%, respectively. Of these, the technical losses have been estimated for the transmission system (Table 5). There have also

⁵ These figures are not considered absolutely accurate by the Office of the Electrical Inspector as physical inspection is expected to be carried out only once in five years for units not connected to the grid.

⁶ Data for 1998-99 was obtained from 1,035 TCs, feeding 5,458 open-wells and 4,799 bore-wells, and for 1999-2000, from 1,214 TCs feeding 5,806 open-wells and 6,621 bore-wells.

⁷ This is because records on open-wells having been deepened to bore-wells are not available.

⁸ For example, 33.6% of the monthly readings were absent for the year 1998-99 so that only 612 of the 1,035 TCs had readings for at least 8 months of the year. Using this relatively "complete" subset and eliminating the outliers (defined as those readings outside $\mu \pm 2\sigma$), the regression coefficients for annual electricity use at open-wells and bore-wells yielded 2,475 kWh/year and 5,119 kWh/year, respectively.

been less rigorous estimates of the total losses in the T&D system (as shown in Figure 5 on T&D losses during 1998-99).

On the financial side, KPTCL's average 2000-01 tariff realisation is reported to be Rs 2.04/kWh, as compared with an average cost of supply of Rs 3.05/kWh⁹, according to its tariff amendment proposals. As a result of this, the subsidy released by the government for the electricity sector amounted to Rs 2,301 crores¹⁰, the highest received so far [KERC, 2002, p.110].

KPTCL's projected earning for the 2002-03, including a state government subsidy of Rs 1,764.24 crores, has been estimated at Rs 6,566.72 crores whereas the projected requirement was Rs 7,960.06. The category-wise realisation ranges from Rs 0.40/kWh, estimated for the agricultural LT category (said to account for 44% of electricity distributed), to Rs 5.66/kWh for the commercial sector (accounting for 4% of the electricity distributed). KPTCL therefore (in February 2002) proposed a tariff revision. Even with this revision, cross-subsidies have been retained so that, rather than varying with the cost of supply, the tariffs are higher for some categories where the supply cost is the lowest (e.g. the EHT industrial consumers) than for those for whom the supply costs are much higher (e.g. consumers along extended LT lines). However, the Karnataka Electricity Regulatory Commission (KERC) has, after its study of the situation, approved a lower revenue requirement¹¹, and increased the revenue availability through tariff collection at unauthorised connections and through reduction of distribution losses. (Table 6).

2. Karnataka Government's Power Policy

In its Policy Statement on restructuring and privatisation [GOK, 2001(b)], the Government of Karnataka has specifically mentioned three priorities:

- (a) Ensuring that the people of Karnataka have equitable access to basic and reasonably priced electricity services, with all households electrified by the year 2010;
- (b) providing adequate electricity to industry and commerce to achieve economic growth;
- (c) promoting the kind of energy use that will not damage the environment

The process of "reforming" the power sector was adopted in accordance with the Accelerated Power Development Program of the World Bank; the above priorities were supposed to guide the actions taken.

Karnataka's electricity Power Sector is unique among the states of India in that it was already split in 1970 between generation (through the Karnataka Power Corporation Ltd.) and transmission and distribution (controlled by the Karnataka Electricity Board)¹², long before the "un-bundling" of the State Power utilities commenced in other states¹³. However, since 1997, steps have been taken by the state government towards reform of the power sector.

⁹ This is the average obtained from the total cost ÷ total number of units supplied, as the category-wise cost of supply has not been calculated.

¹⁰ One crore = 10⁷

¹¹ A lower revenue requirement also lowers the subsidy receivable from the state government.

¹² A few generation stations were included with KEB.

¹³ Even so, co-ordination was maintained between generation and distribution, as the Load Dispatch Cell of KEB communicated the requirements necessitated by the diurnal fluctuation of demand to the generating stations of the KPCL and generation was stepped up or backed down accordingly.

Annexure 1 gives a detailed chronological list of the steps that have been taken in the state's reform process. These are summarised in the box below.

Summarised chronology of power sector reform in Karnataka State

• January 1997	Karnataka Govt. Energy Sector Policy Statement – referring to future privatisation of the distribution segments; Committee under the Chief Secretary of the State to select Consultants for recommendations on restructuring and privatisation
• May 1999	Karnataka Electricity Reform Ordinance promulgated
• July 1999	Corporatisation and unbundling of the State Electricity Board (KEB) into KPTCL and VVNL
• August 1999	Karnataka Electricity Reform Ordinance passed in the Legislature (Ordinance now an Act)
• October 1999	Karnataka Electricity Regulatory Commission (KERC) duly constituted
• January 2000	Steering Committee under the Chief Secretary to take decisions on Consultants for the privatisation
• October 2001	Consultants' report on strategy for distribution unbundling and privatisation
• June 2002	Distribution unbundled into four companies according to geographical zones

Improvements made since the reform process began:

- *Metering/improved measurement of electricity use in the agricultural sector:* As explained in Section 1, KPTCL has tried to obtain more accurate measurement of electricity use by irrigation pumpsets (ips) despite there being no individual meters for these consumers. Efforts are on to refine this estimation¹⁴ through monitoring of the electricity use at several transformer centres (TCs) catering chiefly to irrigation pumpsets in all the districts of the state.
- *Financial Restructuring Plan:* KPTCL has prepared a Financial Restructuring Plan with financial projections till the year 2004-05. This is a longer-term plan (in relation to the annual estimates prepared earlier); it has been sent to the Government of Karnataka for approval and there is now scope for alterations.
- *Public involvement in tariff revision:* For the first time, public opinion was invited for KPTCL's tariff proposals published in newspapers on the 28th/29th September 2000¹⁵. Based on its estimates of KPTCL's requirements and the needs of the consumers, KERC presented a modified version of changed tariffs in its first ever *Tariff Order – 2000* on 18th December 2000. Once again, in February 2002, KPTCL published its Tariff petition. KERC reviewed representations from various categories of consumers and after scrutinising the petitions filed against the utility's tariff revision, the Regulatory Commission revised the category-wise tariff schedule permissible, trying to raise tariffs to

¹⁴ The number of such metered TCs has increased from 1,026 in 1997-98 to 1,035 (servicing 10,257 ips) in 1998-99 and 1,214 (servicing 12,427 ips) in 1999-2000.

¹⁵ KPTCL lodged its *Expected Revenue from Charges (ERC)* on the 6th July 2000 and filed its final tariff-revision proposals on 20th September 2000 (after two revisions).

the cost of supply, where possible, and reducing the additional amount that the subsidising categories pay over the cost of supply. KERC's *Tariff Order 2002* was published on the 5th May 2002. The existing, proposed¹⁶ and KERC-approved rates are shown in Table 7. Another of such revisions¹⁷ is due in early 2003.

- *T&D loss assessment*: The system transmission and distribution (T&D) losses had not been measured earlier; they were derived as the remainder after subtracting the category-wise electricity use (both metered and un-metered) from the total electricity purchased/generated. Consultants¹⁸ have been hired to assess these losses on the basis of sample measurements. Estimates have been made by KPTCL of the expenditure required to reduce the technical losses from 26% to 14% and also to provide for transmission from additional generating stations to increased load centres.
- *Environmental assessment*: Consultants¹⁹ have also been hired for conducting environmental assessments of the possible impacts of restructuring and new power projects in the state. Sources of 8,300 MW of additional thermal/hydroelectric capacity by the year 2010, have been identified (Table 8a), so that projects from among these can be selected according to the estimated requirement. The corresponding costs and emissions in various scenarios (Table 8b) – with/without T&D reduction, and with/without demand side management (DSM) and rural energy technologies (RETs), have also been predicted (Table 8c).

¹⁶ However, the State government has held back the revision for the agricultural LT category.

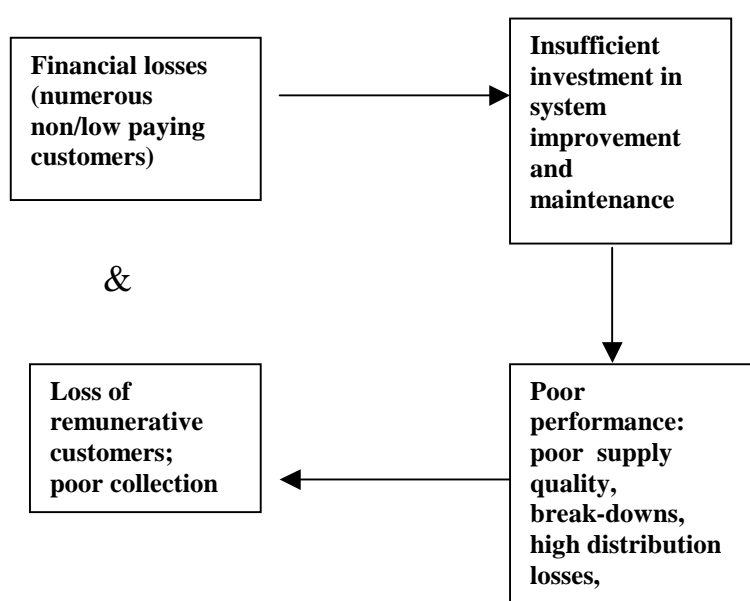
¹⁷ Since this report was prepared, another tariff revision has been sought (December 2002) and is being debated.

¹⁸ These include Mecon Ltd., a Government of India Enterprise of engineering consultants.

¹⁹ These include a consortium of Mecon Ltd. and Knight Piésold.

3. Problems

As in the case of several other SEBs, the Karnataka utilities have been beset by problems, chiefly with respect to financial and technical performance. Some of these have been mutually reinforcing. For example, revenue losses due to low-paying categories, inadequate collection (including theft) and high T&D losses have resulted in low investment over the years in transmission facilities (both new capacity and maintenance), and this has in turn led to poor performance in terms of reliability (for example numerous break-downs) and supply quality (low voltage and frequency). This poor quality has led to the loss of the remunerative customer segment (as several industrial and commercial customers have turned away from the grid to captive generation), thereby lowering the utility's average revenue realisation.



The efforts at “reforming” the power sector made so far, i.e., unbundling and corporatisation of utilities, have not addressed the serious problems of inadequate electrification, particularly in rural areas, as well as inadequate maintenance and high T&D losses, poor quality of supply, lack of environmental protection, etc. Plans for privatisation of the utilities are now being made. However, there are still several unanswered questions, such as:

- Electrification of homes – particularly in the rural areas -- constitutes the first priority of the state’s power sector policy. Thus far, the state has subsidised not only the capital costs of grid extension but also the running costs of supply. Who would incur these costs with privatisation?
 - A greater degree of cross-subsidisation would not be commercially feasible, as the higher paying categories (commercial and industrial) would shift to captive sources.
 - If the government is to continue incurring these costs, how is it to raise funds for this expenditure? If the option were taxes on the profits of commercial suppliers of electricity, the suppliers would try to pass these on to consumers. This may not work with the commercial and industrial consumers, as just explained, and perhaps not even

with those who cannot resort to captive generation (such as domestic consumers), as their protests could be politically unacceptable. Ultimately, suppliers/distributors could withdraw from the business of electricity supply, as in the case of one of the distribution companies in another state²⁰.

- Given the problems inherent in the present transmission and distribution systems due to lack of investment and maintenance over the years, any improvement would necessitate investment that private parties would not incur without assurance of commensurate increases in rates/tariffs receivable. For instance, 26,921 transformers (from 25 to 500 kVA) failed in 1999-2000, involving a replacement cost of Rs 104.81 crores (apart from the costs of removal and replacement and the inconvenience caused by the supply interruption). The total costs of bringing about a reduction of T&D losses from 26% to 14% are obviously much higher; one estimate of this is Rs 13,500 crores [Guptha, 2001].
- The costs of generation at new power plants are higher than that at most of the existing plants (as there are several hydroelectric plants in Karnataka). Depending on the scenario envisaged – with expected T&D losses, growth rates of capacity and the inclusion of DSM and renewables as variables (as shown in Table 8b), the costs of meeting the projected requirements till the year 2010 have been estimated between Rs 25,400 crores and Rs 34,500 crores (as shown in Table 8c). Tariffs would have to be raised to recover the costs of supply. If even the present tariffs are not collectible, the financial position of the new distributors would be even worse than that of the existing utilities.
- Increased generation will not suffice if the corresponding transmission facilities are not installed. IPPs are currently only interested in generation because the tariffs agreed upon guarantee a high rate of return. If power cannot be evacuated, this emphasis on generation will serve no purpose. Hence, policies/regulation are required to ensure appropriate evacuation of power.
- Co-ordination between electricity generators and several distributors to the final consumers -- an essential with electricity – would have to be ensured by an independent systems operator/regulator. Such a position has not yet been created. (This task is currently fulfilled by the Load Despatch Cell that has been communicating with the generating company's stations and the transmitting/distributing company's load centres).
- How would public benefits such as equity (extending access to economically backward areas), environmental protection, etc., be expanded/ ensured in future? Expansion of such benefits, particularly with the reduction in governmental involvement envisaged would need specific policies/measures.
- Who would have the authority for pricing policies -- for generation, transmission and sale to the final consumers? Would it be the regulatory authority or the government, and if the former, can it be overruled by the latter? (Consider, for instance, the case of agricultural pump-sets that have been exempted from energy payments or have not been penalised for not paying the charges levied).
- Would privatisation actually improve operational efficiency? Efficiency is supposed to be spurred by competition between competing suppliers, but these could actually collude to obtain higher prices. Furthermore, other countries have achieved efficiency even with the power sector being under Government control (for example, the French EdF) and there has been resistance to privatisation.

²⁰ The distribution company (distcom) controlled by the private firm AES Transpower withdrew from business due to the problem of tariff collection [GoO, 2001].

4. Suggested Way Forward

The power sector system with the flows (of directives/policies, electricity/electricity services, payment, information, etc.) between the various entities has been schematically represented in Figure 6. In India, power is a Concurrent subject, i.e., a subject under the jurisdiction of both the Central and State governments; policy direction has therefore been allowed both from the Central government and State-government through its Energy Department. The state government can define its goals and then formulate policies and levy taxes towards achieving these goals.

Since the Karnataka Electricity Reform Act of 1999, the State Electricity Regulatory Commission has come into existence with the purpose of giving directives to the generators, transmitter, distributors and energy service companies. These directives are supposed to be binding. The Commission can also seek information from these entities who are obliged to provide it.

Generators sell electricity to the transmitter (and possibly to large consumers). The transmitter, in turn, sells to the distributors. The distributors sell electricity to various categories of consumers; they can also purchase electricity from those with captive generation facilities or have this electricity banked and wheeled to these or others, at later periods. Energy Service Companies (ESCOs) have a negligible role today but could in future contribute by providing efficiency improvement services to consumers.

We have also included people who are not usually considered when discussing the power system. These are the people without domestic connections; these unconnected homes are (or should be) potential future customers and should therefore be an integral part of the reckoning.

Finally, the Judiciary has been included although it is not a part of the Power System, as organisations and individuals have the constitutional right to appeal and the Judiciary in turn can give its judgements on any justiciable subject.

Each organisation or group has its roles to play (or tasks to perform) that, if accomplished, can contribute towards the economical and sustainable operation of the power system, as follows:

Karnataka State Government's Energy Department

Role/tasks:

- With corporatisation of utilities and formation of a regulatory commission, government involvement in the actual functioning of the utilities could cease.
- However, *setting goals* – particularly with regard to social needs – should continue to be the government's task.
- Once goals have been chosen, the government would have to *formulate appropriate policies to achieve these goals*. Extending electricity to all homes could be an important goal, but to reach this goal, a variety of policies could be required, for example, subsidies for rural electrification, not necessarily through grid extension but even from decentralised schemes, depending on the unit costs of these alternatives.
- *Appropriate legislation* should be enacted to ensure that policies can be carried through.

- *Tariff approval (jointly with the KERC)* may also be required.

Results expected:

- The policies formulated should *enable the goals to be achieved* (or at least move in the correct direction).
- There should be appropriate *allocation of funds* (obtained through taxes, levies, etc.) towards fulfilling those policies.
- *Feedback of information* from the various departments would lead to *suitable modification of policies, if required*.

Karnataka Electricity Regulatory Commission (KERC):

Role/tasks:

- KERC has been assigned an entire gamut of functions in the Karnataka Electricity Reform Act 1999. In particular, it has a *monitoring/regulatory role* for the state's power sector.
- The regulator has to *set standards* (for example, for the quality of supply), for each segment of the unbundled power sector -- the generators, the transmitter, and the distributors (G,T,D).
- It should then *monitor the activities* of the G,T,D according to standards set.
- The *(life-cycle) costs of alternative generation and conservation/DSM options* appropriate to the region need to be estimated, along with the *potential of each* towards meeting the supply-demand gap.
- *Region-wise and category-wise costs of supply* should be estimated, for comparison with the tariffs sought by the G,T,D.
- The Regulator should also *obtain information* from the various power sector entities and be willing to provide it when sought, to facilitate transparency in the functioning of the system.

Results expected:

- There would be *regulated functioning of the power system* according to the norms/standards set.
- The *quality of electricity services* would improve.
- There would be *accountability of the various G,T,D*.
- *Least-cost demand & supply scenarios* for the state – an indicative state-level power sector IRP -- would be drawn up.
- *Rational tariffs* (when sought by G,T,D) would be approved and ordered (perhaps jointly with the government).
- There would be *transparency of operation* in the power sector, i.e. relevant information available to the public.
- With *regular feedback* through reports, regulations could be appropriately modified, if necessary.

Karnataka Power Corporation Ltd. (KPCL):

Role/tasks:

- As the main generator of the state, its chief task should be *cost-effective generation*.

- Cost-effective generation could be achieved through *investment in the most efficient options*, based on a *cost comparison* between the available options.
- Cost-effective generation could also be achieved through *improved utilisation of and performance at the existing plants* (e.g. higher PLFs) and through planning for the *seasonally optimum utilisation* of thermal and hydel capacity.
- KPCL could collaborate with KPTCL (say, through some investment in the transmission facilities) to *improve evacuation facilities*.

Results expected:

- There would be *cost-effective increases in capacity* (from different sources).
- *Plant utilisation* would be better and *electricity generation would increase*.
- There would be *more efficient evacuation of electricity*.

Independent Power Producers (IPPs):

Role/tasks:

- There should be *least-cost analysis of options for investments*.
- There could be *investment in renewable energy services*, such as mini- and micro-hydro and biomass-based schemes.
- IPPs could collaborate with KPTCL (say, through some investment in the transmission facilities) to *improve evacuation facilities*.

Results expected:

- There would be *cost-effective increases in capacity* (from different sources) and *electricity generation*.
- There could be *more efficient evacuation of power*.

Karnataka Power Transmission Corporation Ltd. (KPTCL) and the distribution companies (BESCOM, HESCOM, MESCOM, and GESCOM):

Role/tasks:

- KPTCL -- unbundled to form a transmission company and four distribution companies – has *the task of transmitting and distributing electricity to consumers all over the state*.
- They should (jointly with KERC & consultants) be able to *accurately estimate (if not actually measure) the T&D losses* being incurred for each region/category.
- They should (jointly with the generators and with loans/government subsidies) *invest in system improvement for reduction in technical T&D losses*.
- They should *reduce commercial distribution losses*.
- They should *improve the quality of supply* (in terms of voltage, frequency, etc.)

Results expected:

- There would be *reduction of commercial and technical T&D losses*. Commercial losses, said to account for 10% of the T&D losses, could be reduced through improved management and vigilance. Technical losses would be reduced through investment in system improvement (e.g. transformer replacement) and system extension (e.g. new lines).

- Reduction in T&D losses would lead to increased electricity delivered and thereby *increased sales*.
- Simultaneously, *better supply quality* (voltage, frequency, reliability, etc.) through system improvement could lead to *justifiably increased tariffs*.
- *Enhanced revenue* (due to increased sales and raised tariffs) could result in *increased investment in system improvement*. (This could continue with better evacuation leading to further revenue increases and ploughing back of this into system improvement).

ESCOs:

Role/tasks:

- They should *identify efficiency/DSM opportunities*.
- ESCOs should *fill in the gap* between energy efficiency/DSM requirements and the commitments of the existing utilities.
- They should *develop implementation packages* (with manufacturers, financing, logistics, etc.) to manage such DSM projects.

Results expected:

- Consumers would have access to *comparatively cost-effective* and *environmentally-friendly energy services*.

Karnataka Renewable Energy Development Ltd. (KREDL):

Role/tasks:

- KREDL should *estimate the potential* of all the *renewable sources of energy relevant to the region*.
- The *costs per unit* of generating electricity from these should be estimated, in different circumstances.
- Based on the potential and costs estimated, *appropriate niches* should be identified.
- *Feasibility studies for new technologies* should be carried out.
- *Financing schemes* should be provided to encourage renewables in these niches.

Results expected:

- There would be an increase in energy services from *comparatively cost-effective* and *environmentally-friendly renewable sources*.

Consumer groups/NGOs:

Role/tasks:

- *Consumer interests* should be represented.
- There should be *participation* of consumers so as to affect decisions.

Results expected:

- Consumer participation would result in greater *accountability of utilities* and *consumer difficulties being addressed*.

- “*Externalities*” to the concerned utilities (such as polluting emissions) would be included in the consideration.

5. Summary of tasks and expected results:

Stakeholders:	Role/tasks:	Results expected:
Government (Energy Department)	<ul style="list-style-type: none"> → Setting goals; → formulating appropriate policies and strategies; → legislation; → (joint) rational tariff approval; 	<ul style="list-style-type: none"> → Policies that enable goals to be achieved; → suitable allocation of funds; → feedback from different departments/entities -> modified policies
Karnataka Electricity Regulatory Commission (KERC)	<ul style="list-style-type: none"> → Regulation – setting standards (for supply/services) & monitoring of the activities of the generators, transmitters, distributors (G,T,D) according to standards set; → assessment of the costs and potential of demand & supply options; → assessment/approval of tariffs sought by G,T,D; → seeking and providing information regarding the power sector; 	<ul style="list-style-type: none"> → Regulated functioning of the power system; → improved quality of electricity services; → accountability of G,T,D; → state-level IRP & least-cost options of meeting electricity service requirement; → rational tariffs approved and ordered; → transparency of activities; → feedback from different departments/entities -> modified regulations;
Karnataka Power Corporation Limited (KPCL)	<ul style="list-style-type: none"> → Main generator -> Investment in least-cost options (generation from various sources); → more efficient utilisation of existing capacity → collaboration with the transmitter for effective evacuation of power; 	<ul style="list-style-type: none"> → Investments -> increased generation capacity; → better plant utilisation -> (price reduction ?) → more efficient evacuation of power (shared investment in new T&D facilities?)
Independent Power Producers (IPPs)	<ul style="list-style-type: none"> → Least-cost analysis (among available options) 	<ul style="list-style-type: none"> → Increased investments

(including green producers)	<ul style="list-style-type: none"> → investment in least-cost options → collaboration with the transmitters for effective evacuation of power; 	<ul style="list-style-type: none"> → increased generation capacity → efficient generation -> (price reduction ?) → more efficient evacuation of power (shared investment in new T&D facilities?)
Karnataka Power Transmission Corporation Limited (KPTCL) & Distribution Subsidiaries	<ul style="list-style-type: none"> → T&D → system improvement (increased investment) → improved management/vigilance; → more effective transmission/distribution of electricity; 	<ul style="list-style-type: none"> → Reduction of technical losses → reduction of commercial distribution losses → lower cost/unit of supply → increased revenue -> more system improvement → better supply quality → (justifiably) increased tariffs and revenue -> ploughed back into further system enhancement → more efficient evacuation of power (shared investment in new T&D facilities)
Karnataka Renewable Energy Development Ltd. (KREDL)	<ul style="list-style-type: none"> → estimate renewable energy potential; → estimate costs of such sources; → conduct feasibility studies & → identify appropriate niches; → finance feasible schemes; 	<ul style="list-style-type: none"> → Cost-effective renewable sources tapped
Energy Service Companies (ESCOs) – including green services	<ul style="list-style-type: none"> → Identify cost-effective DSM/efficiency projects → develop implementation packages 	<ul style="list-style-type: none"> → Less expensive energy services → more environmental-friendly energy services
The public (through NGOs and consumer groups)	<ul style="list-style-type: none"> → Representing diverse consumer interests → participation in power sector processes 	<ul style="list-style-type: none"> → Consumer difficulties addressed → “externalities” included → transparency & accountability ensured

Table 1: Karnataka's Installed Capacity (at Utilities) and Electricity Availability

Year	Utilities' Installed Capacity (MW)	Peak Load (Maximum # Demand) (MW)	Energy available for sale (MU)	Energy supply in the state (MU)	Exports@ (MU)	Total energy supplied (MU)	System Loss as per KEB (%)
1970-71	877.50	628	4,821	2,947	1,091.22	4,038	13.89
1971-72	966.60	695	4,925	3,406	754.27	4,160	14.88
1972-73	966.60	741	4,620	3,501	425.04	3,926	14.75
1973-74	966.60	783	4,883	3,644	399.44	4,043	16.18
1974-75	966.60	825	4,990	3,748	392.35	4,140	16.00
1975-76	966.60	963	5,782	4,396	405.70	4,801	15.78
1976-77	1,055.70	947	5,942	4,464	295.00	4,759	15.75
1977-78	1,144.80	968	5,563	3,961	333.00	4,294	22.36
1978-79	1,144.80	1,136	6,892	4,906	505.00	5,411	21.82
1979-80	1,334.80	1,153	6,699	4,858	457.00	5,315	20.21
1980-81	1,469.80	1,134	7,399	5,189	411.00	5,600	21.84
1981-82	1,739.80	1,367	8,182	6,032	351.00	6,383	21.03
1982-83	1,874.80	1,601	8,440	6,116	411.00	6,527	21.74
1983-84	2,009.80	1,658	8,650	6,251	345.00	6,596	21.75
1984-85	2,219.80	1,799	9,761	7,277	195.00	7,472	22.00
1985-86	2,529.80	1,895	9,844	7,192	416.39	7,608	21.80
1986-87	2,529.80	2,007	10,583	7,733	535.45	8,269	22.85
1987-88	2,529.80	1,998	10,995	8,185	592.67	8,778	21.34
1988-89	2,529.80	2,231	12,223	9,445	346.45	9,791	20.74
1989-90	2,644.80	2,409	14,004	11,089	46.17	11,136	20.48
1990-91	2,759.80	2,422	15,130	12,182	0.00	12,182	19.48
1991-92	2,969.80	2,619	15,498	12,539	28.18	12,567	18.91
1992-93	3,011.20	2,643	15,951	12,998	5.82	13,004	18.70
1993-94	3,260.05	3,002	17,197	14,044	0.72	14,045	18.60
1994-95	3,470.05	3,155	19,542	15,906	1.27	15,907	18.60
1995-96	3,491.67	3,164	19,612	15,983	1.01	15,984	18.50
1996-97	3,522.97	3,246	18,639	15,192	2.72	15,194	18.48
1997-98	3,578.97	3,641	21,594	17,582	4.02	17,586	18.56
1998-99	3,915.97	3,893	22,714	15,903	7.05	15,910	30.24
1999-00	4,291.37	4,066	26,117	16,151	13.00	16,164	38.16
2000-01	4,291.37	4,464	27,700	17,867	22.45	17889	35.50
2001-02	4,291.37		28,406	18,902			33.50

Sources of data:

Till 1986 - "Power Supply in Karnataka - Statistical Profile (1969-86)", for 1986-95: Annual Administration Reports (KEB),

and for 1995-96 onwards: Annual Accounts (KEB/KPTCL) and ERC Filing.

Please note:

The installed capacity does not include Karnataka's share of Central projects.

The "maximum load" is as given in the KEB Reports.

@ Prior to 1965-66, there were no inter-state transmission lines and no imports and exports.

Table 2: Total (category-wise) electricity sales by the distributing utility – KEB (since 1999, KPTCL)

Year	<-- Domestic --> Lighting~ Ltg & htg (A.E.H.)		Commercial Ltg & htg	Industrial L.T. @	Indust.&oth H.T. #	Public Lighting	Irrigation pumpsets ^	Water Works *	Licenseses Bulk Sup. (H.T.)	Others - temp.sup. (L.T.)	Railway Traction	Total Energy Sales
1970-71	163.83	52.64	88.54	239.46	2,009.01	53.37	178.91	115.39	45.58			2,946.73
1971-72	175.23	89.78	72.15	320.14	2,346.92	60.14	202.13	86.00	53.50			3,405.99
1972-73	152.13	122.21	67.10	305.10	2,395.18	61.00	237.30	106.28	54.39			3,500.69
1973-74	171.24	121.34	68.46	332.77	2,461.86	76.15	256.58	98.77	56.79			3,643.96
1974-75	185.62	170.75	79.87	409.24	2,346.05	67.45	291.11	151.35	46.45			3,747.89
1975-76	195.32	202.83	112.69	350.23	2,973.15	59.28	307.54	168.15	26.48			4,395.67
1976-77	202.60	221.80	93.64	326.52	3,034.48	46.81	396.14	97.64	33.11	11.37		4,464.11
1977-78	219.56	237.49	103.51	350.42	2,523.54	48.41	356.61	85.07	19.75	16.42		3,960.78
1978-79	237.04	267.67	99.57	425.25	3,448.32	56.27	334.16		19.43	18.57		4,906.28
1979-80	254.21	342.62	121.43	460.12	3,211.39	69.48	360.91		19.08	18.99		4,858.23
1980-81	278.54	417.80	132.71	489.38	3,374.34	70.99	384.36		22.09	18.47		5,188.68
1981-82	280.22	508.60	143.39	504.93	4,050.17	77.02	425.53		24.22	17.54		6,031.62
1982-83	331.31	649.57	161.19	620.71	3,698.67	86.62	525.61		27.58	15.03		6,116.29
1983-84	422.00	643.00	165.00	459.00	3,499.00	99.00	936.00		28.00			6,251.00
1984-85	567.00	910.00	196.00	698.00	4,165.00	104.00	607.00		30.00			7,277.00
1985-86	627.00	934.00	181.00	668.00	3,413.00	114.00	1,221.00		34.00			7,192.00
1986-87	550.25	907.11	180.38	614.53	3,065.11	135.28	2,225.10		41.51	13.92		7,733.19
1987-88	602.00	854.00	197.00	556.00	3,316.00	140.00	2,477.00		43.00			8,185.00
1988-89	641.69	878.89	197.86	692.19	3,974.66	143.27	2,848.59		47.09	20.67		9,444.89
1989-90	711.89	975.90	225.35	773.02	4,651.95	145.55	3,535.76		58.78	11.20		11,089.40
1990-91	769.77	1,032.93	244.32	774.10	4,706.20	148.24	4,434.40		62.22	9.76		12,181.93
1991-92	819.45	1,109.49	280.35	799.61	4,726.78	150.57	4,584.99		57.73	9.97		12,538.93
1992-93	891.25	1,158.57	287.85	787.55	4,167.35	152.87	5,340.47	131.52	60.75	13.44	6.85	12,998.47
1993-94	995.71	1,196.67	305.80	857.86	4,034.35	154.86	5,659.93	135.63	48.05	14.13	14.04	13,417.03
1994-95	1,206.84	1,295.75	386.64	930.33	4,462.00	157.21	7,297.93	149.94			19.33	15,905.96
1995-96	1,315.37	1,339.00	421.74	967.16	4,213.09	158.46	7,363.00	156.65		18.31	30.62	15,983.39
1996-97	1,459.70	1,437.69	428.33	981.66	3,598.21	158.71	6,913.21	165.07		20.77	28.40	15,191.73
1997-98	1,626.22	1,543.94	510.44	1,096.22	3,269.22	159.54	9,117.17	198.05	10.85	24.27	26.44	17,582.37
1998-99	1,726.12	1,616.21	579.64	1,181.36	3,327.99	160.69	7,008.34	216.02	31.09	27.58	27.57	15,902.61

99-2000	1,848.00	1,787.00	531.00	1,278.00	3,312.00	432.00	6,314.00	292.00	173.00	144.00	29.00	16,151.00
2000-01	1,996.32	1,913.15	606.34	1,345.12	3,500.96	323.34	7,353.37	468.58	182.50	154.58	31.00	17,875.26
2001-02	2,378.12	2,054.67	692.60	1,436.86	3,854.42	360.15	7,194.34	535.29	199.81	162.28	33.71	18,902.25

Sources of data:

"Power Supply in Karnataka - Statistical Profile (1969-86), Annual Administration Reports and Annual Accounts, KEB (1987-1998), KPTCL's ERC for the years 2001-02 and 2002-03 and Tariff filing with KERC.

Please note:

~ From 1979-80, domestic lighting includes the usage of "bhagya jyothi" installations along with the lights & fans category;

@ L.T. includes industrial heating & motive power and, from '78-79 to '82-83, usage of all water supply installations also;

from '82-83 to '91-92, the electricity usage of water-supply installations in the urban areas (municipalities) is included;

H.T. comprises all the H.T. uses (except the Railways) industrial, commercial, public water-supply and irrigation schemes;

* From 1978-82, water-supply usage has been included under industrial L.T., and from '82-83 to '91-92, distributed between

Industrial L.T. and Irrigation Pumpsets

^ from 1982-83 to 1991-92, Irrigation pumpset (L.T. usage) includes the electricity usage of water-supply installations of villages and town panchayats.

Table 3: Total (category-wise) connections serviced by KEB (since 1999, KPTCL)

Year	<----- Domestic ----->			Commercial	Industrial Power		Public	Irrigation	Water
	Bhagya jyothi	Lights & fans	Ltg.& htg. (A.E.H.)	Lighting & Heating	L.T. Power	H.T. Power	Lighting No.- pts.	Pumpsets^	Works
1970-71		747,810	37,261	84,284	38,251	465	183,931	130,820	948
1971-72		819,168	44,630	103,283	40,915	550	219,733	149,622	1,011
1972-73		892,163	55,132	113,879	42,815	622	254,123	168,587	1,117
1973-74		969,842	64,687	133,681	45,786	687	279,668	187,665	1,285
1974-75		1,038,422	78,937	149,958	49,118	754	291,645	205,644	1,414
1975-76		1,103,204	93,724	161,799	51,814	841	299,933	222,545	1,500
1976-77		1,156,706	107,433	174,361	55,007	913	308,389	240,106	1,660
1977-78		1,213,991	121,547	186,877	57,666	952	316,877	259,272	1,811
1978-79		1,287,576	138,571	200,638	60,744	1,004	325,998	275,036	1,945
1979-80	15,958	1,384,061	161,340	215,828	66,405	1,161	337,558	290,308	2,174
1980-81	34,817	1,493,178	190,021	233,582	74,329	1,209	348,022	308,719	2,560
1981-82	55,326	1,609,194	225,579	247,589	82,457	1,365	361,531	332,416	2,834
1982-83	101,325	1,741,425	268,775	239,406	114,335	1,430	373,206	358,113	3,144
1983-84	151,038	1,851,343	355,813	347,627	136,459	1,479	389,336	395,801	3,723
1984-85	200,833	2,023,646	420,631	369,205	147,136	1,530	413,115	441,214	4,347
1985-86	226,404	2,204,526	468,527	394,694	159,340	1,673	549,871	489,551	5,533
1986-87	275,635	2,384,805	511,692	420,907	172,123	1,756	564,898	537,408	7,365
1987-88	308,607	2,568,718	563,891	446,643	184,988	1,831	579,513	586,491	8,799
1988-89	332,503	2,754,073	611,755	472,941	197,568	1,920	591,994	632,121	10,296
1989-90	352,957	2,943,296	661,919	498,943	210,021	2,005	605,278	673,907	12,019
1990-91	369,810	3,136,148	715,062	523,397	221,948	2,098	612,623	744,045	14,054
1991-92	395,794	3,338,086	772,771	549,125	232,543	2,191	622,713	816,924	16,011
1992-93	581,925	3,540,515	833,207	574,986	241,854	2,275	630,249	869,461	18,276
1993-94	763,434	3,741,311	895,039	603,727	251,269	2,358	636,742	917,326	21,234
1994-95	945,934	3,934,677	962,534	634,556	262,965	2,471		960,165	23,861
1995-96	1,109,627	4,116,149	1,030,389	668,230	275,673	2,562	647,244	1,001,209	26,781
1996-97	1,228,082	4,290,160	1,100,739	698,340	287,742	2,649	650,967	1,035,240	29,871
1997-98	1,376,705	4,499,448	1,175,248	733,820	299,064	2,794	654,009	1,067,032	33,567
1998-99	1,517,468	4,698,202	1,242,169	769,384	309,050	3,040	657,042	1,125,933	37,041

1999-00	1,665,859	4,891,096	1,303,430	804,410	319,703	3,203	*	1,165,465	41,223
2000-01	1,823,845	5,139,293	1,375,582	848,268	332,569	3,769	*	1,246,810	46,073
2001-02	1,963,845	5,376,639	1,454,411	890,532	344,797	4,271		1,286,810	51,345

Sources of data:

"Power Supply in Karnataka - Statistical Profile (1969-86),
Annual Administration Reports and Annual Accounts, KEB (several issues),
KPTCL's ERC Filing before the KERC, 2001 and 2002.

^ The number of irrigation pumpset-installations includes those of the Hukkeri Rural Electric Co-operative Society Ltd.

* The number of public lighting installations has not yet been obtained for these years.

Table 4: Large-scale Captive Generation in Karnataka

Year	Captive capacity (MVA)	Electricity generated for captive use (GWh)@	Electricity purchased from the utilities# (GWh)	Proportion of the total electricity use of the sector purchased from the utility (%) \$	Proportion of KPTCL's total electricity distribution accounted for by large HT units (%)
1996-97	2,684	2,641	3,598	57.7	23.7
1997-98	2,906	2,668	3,269	55.1	18.6
1998-99	3,201	2,668	3,328	55.5	20.9

@ These are estimates from the Office of the Chief Electrical Inspector of the Government of Karnataka (as explained in the text).

This is the total electricity sold to the HT category.

\$ Many of these purchasers do not have captive generation, hence the proportion is much lower for those with such facilities.

Sources of data: For columns 2 and 3, information from the Office of the Chief Electrical Inspector to the Government, 2001, and for columns 4 and 6, KPTCL Annual Reports, 1997-98 to '98-99.

Table 5: Estimated transmission losses

Loss computation year		1998-1999			1999-2000			2000-2001		
Peak demand in MW		3820.00			3985.00			4464.00		
Total Energy for the year in MU		22736.00			26116.00			27701.00		
Peak power losses and Energy Losses	Voltage class	Peak power losses in MWs	Energy losses		Peak power losses in MWs	Energy losses		Peak power losses in MWs	Energy losses	
			in mu	% losses		in GWh	% losses		in GWh	% losses
	400KV	29.27	135.19	0.59	34.53	186.38	0.71	32.94	161.35	0.58
	220KV	183.08	845.13	3.72	215.63	1164.00	4.46	196.98	964.74	3.48
	110KV	47.71	220.23	0.97	40.59	219.10	0.84	44.99	220.34	0.80
	66KV	68.46	316.02	1.39	77.45	418.10	1.60	79.26	388.19	1.40
	33 KV	141.39	652.68	2.87	87.35	471.53	1.81	123.34	604.07	2.18
Transformer Losses (MU)	35.18	162.41	0.71	19.59	171.60	0.66	20.58	180.27	0.65	
Total peak power and energy losses in transmission system		505.09	2331.66	10.26	475.14	2630.71	10.07	498.09	2518.96	9.09

Source of data: Note on the Capital Investment on required for Karnataka's Transmission and Distribution System for the period 2001-02 to 2011-12 [Gupta, P.S.J., 2001].

Table 6: KPTCL's Projected Revenue for 2002-03
(in Rs crores)

	As proposed by KPTCL (after revision of its tariff petition)	As per KERC's tariff order (May '02)
Revenue from the sale of electricity	4,740.37	4,740.37
Miscellaneous revenue	62.11	62.11
Additional revenue at existing tariffs -- through regularisation of unauthorised installations	81.01	81.01
Revenue from additional sales to metered categories through reduction of T&D losses (to 28%)		279.25
Subsidy from the government	1,363.24	1,363.24
Total revenue receivable	6,246.73	6,525.98
Revenue expenditure requirement	7,566.78	7,273.03
Revenue gap before tariff revision	1,320.05	747.05
Tariff revision impact	1,393.34	761.86
Revenue surplus/deficit (-) expected after tariff revision	73.29	14.81

Source of data: KERC's Tariff Order 2002

Table 7: Tariffs -Existing, Proposed by KPTCL (February 2002) and recommended by KERC (May 2002)

Type of installation	Existing tariff (since 2000)	Tariff rate (incl. FEC) (Rs)	Proposed tariff - 2002 (KPTCL)	Tariff rate (incl. FEC) (Rs)	Recommended tariff – 2002 (KERC)	Tariff rate (incl. FEC) (Rs)
LT categories:						
<i>Bhagya/kutir jyothi</i> LT-1(a)	Fixed charges/month (capital loan recovery)		Fixed charges/month		Fixed charges/month	
	Energy charges (per inst./month) till 18 kWh /month, then domestic lighting rates	10	Energy charges (per point/month) Per extra point	30 20	Energy charges (per point/month) Per extra point	30 10
Domestic lighting LT-1(b)	Fixed charges per kW or part thereof of sanctioned load for 2 months	20	Fixed charges of Rs 20 per kW or part thereof of sanctioned load for 2 months, such that a minimum of	40	Merged with LT-2(a)	
	Energy charges per kWh till 60 kWh in 2 months	1.50	Energy charges per kWh till 60 kWh in 2 months	3.10		
	Energy charges per kWh from 61 to 200 kWh in 2 months	2.30	Energy charges per kWh from 61 to 200 kWh in 2 months	3.50		
	Above 200 kWh/ 2 months, with AEH		Above 200 kWh/ 2 months, with AEH			
Domestic lighting and heating LT- 2(a) (AEH)	Fixed charges @ Rs 20/kW/month, minimum Rs 60	60	Fixed charges @ Rs 30/kW/month, minimum Rs 60, (for the usual 3 kW=)	90	Fixed charges for the first kW = Rs 20, + Rs 30/kW thereafter (for the usual 3kW=)	80
	Energy charges per kWh till 100 kWh/month	2.30	Energy charges per kWh till 100 kWh	3.50	Energy charges per kWh till 30 kWh	1.75
					Energy charges per kWh from 31 to 100 kWh	2.80
	Energy charges per kWh from 101 to 200 kWh	2.80	Energy charges per kWh from 101 to 400 kWh	4.05	Energy charges per kWh from 101 to 200 kWh	3.50
	Energy charges per kWh from 201 to 300 kWh	3.25			Energy charges per kWh from 201 to 300 kWh	4.00
	Energy charges per kWh from 301 to 400 kWh	3.75			Energy charges per kWh from 301 to 400 kWh	4.25
	Energy charges per kWh above 400 kWh	4.50	Energy charges per kWh above 400 kWh	4.50	Energy charges per kWh above 400 kWh	4.50
Private professional & unaided educational inst. LT-2(b)	Fixed charges Rs 30/kWh, minimum Rs 60	60	Fixed charges Rs 30/kWh, min. Rs 60	60	Fixed charges Rs 30/kWh, min.Rs 60	60
	Energy charges per kWh till 100 kWh	3.75	Energy charges per kWh till 100 kWh	4.05	Energy charges per kWh till 100 kWh	3.85
	Energy charges per kWh from 101 to 200 kWh	4.25	Energy charges per kWh from 101 to 400 kWh	4.50	Energy charges per kWh from 101 to 200 kWh	4.35

	Energy charges per kWh from 201 to 400 kWh	4.50			Energy charges per kWh from 201 to 400 kWh	4.60
	Energy charges per kWh above 400 kWh	4.95	Energy charges per kWh above 400 kWh	4.95	Energy charges per kWh above 400 kWh	4.95
Commercial LT-3	Fixed charges Rs 35/kW (no minimum)		Fixed charges Rs 70/kW for the first kW or part thereof; Rs 35/kW for addn. kW, min. of Rs 70/month	70	Fixed charges Rs 35/kW for the first kW or part thereof;	35
	Energy charges per kWh till 50 kWh	4.40	Energy charges per kWh till 50 kWh	4.55	Energy charges per kWh till 50 kWh	4.55
	Energy charges per kWh above 50 kWh	5.25	Energy charges per kWh above 50 kWh	5.40	Energy charges per kWh above 50 kWh	5.40
Ipsets incl. nurseries, coconut & sugarcane growers (< 10 HP) Non-IT assesseees LT-4(a)	Rs/HP per annum till meters are fixed	540	Rs/HP per annum till meters are fixed	900	General: Un-metered: Rs/HP per annum till meters are fixed	720
	For the metered segment: energy charge/kWh subject to a minimum of Rs 300/HP/annum	0.50	For the metered segment: energy charge/kWh subject to a minimum of Rs 900/HP/annum	0.80	For the metered segment: energy charge/kWh Fixed charge/HP/annum	0.40 240
					Connected to urban feeders not subject to rostering: Unmetered: Rs/HP per annum till meters are fixed For the metered segment: energy charge/kWh Fixed charge/HP/annum	1,200 0.40 480
Ipsets of income tax assesseees LT-4(b)	Rs/HP per annum till meters are fixed	900	Rs/HP per annum till meters are fixed	2,400	Rs/HP per annum till meters are fixed	1,500
	For the metered segment: energy charge/kWh subject to a minimum of Rs 600/HP/annum	1.35	For the metered segment: energy charge/kWh subject to a minimum of Rs 2,400/HP/annum	3.00	For the metered segment: energy charge/kWh Fixed charge/HP/annum	1.00 480
Ipsets above 10HP LT-4(c)	Energy charge/kWh subject to a minimum of Rs 800/HP/annum	1.35	Energy charge/kWh subject to a minimum of Rs 1,500/HP/annum	2.35	Energy charge/kWh s.t. minimum of Rs 840/HP/annum	1.75
Ipsets at private hort. nurseries, tea/coffee pln. LT-4(d)	Energy charge/kWh subject to a minimum of Rs 600/HP/annum	2.00	Energy charge/kWh subject to a minimum of Rs 1,500/HP/annum	2.75	Energy charge/kWh s.t. minimum of Rs 840/HP/annum	1.75

Industrial lighting, heating & motive power LT-5	Fixed charges/HP: < 5 HP	25	Fixed charges/HP: < 5 HP	25	Fixed charges/HP: < 5 HP	25
	5 HP – <40 HP	30	5 HP – 40 HP	30	5 HP – <40 HP	30
	40 HP – <67 HP	40	40 HP – 67 HP	40	40 HP – <67 HP	40
	> 67 HP	100	> 67 HP	80	> 67 HP	100
	Demand-based tariff/kW:		Demand-based tariff/kW:		Demand-based tariff/kW of billing demand (optional):	
	>5 HP - <40 HP	60	>5 HP - <40 HP	60	>5 HP - <40 HP	50
	40 HP - <67 HP	80	40 HP - <67 HP	80	40 HP - <67 HP	70
	67 HP & above	175	67 HP & above	175	67 HP & above	150
	Energy charges (Rs/kWh):		Energy charges (Rs/kWh):		Energy charges (Rs/kWh):	
	for < 200 kWh	2.50	for < 500 kWh	3.00	till 500 kWh	3.00
	201 – 1,000 kWh	3.00	501 – 1,000 kWh	3.50	501 – 1,000 kWh	3.50
	1,001 – 4,000 kWh	3.25	> 1,001 kWh	3.75	> 1,000 kWh	3.75
	> 4,001 kWh	3.50				
Water supply, sewerage, streetlights of panchayats, municipal corporatns, etc. LT-6(a): Rural	Water supply metered					
	Fixed charges: per HP/annum	180	Fixed charges: per HP/annum	600	Fixed charges: per HP/annum	420
	per kW/annum	240				
	Energy charges/kWh	2.00	Energy charges/kWh	4.00	Energy charges/kWh	3.00
	Public lighting metered:					
	Fixed charges: per HP/annum	180	Fixed charges: per kW/annum	420	Fixed charges: per kW/annum	600
	per kW/annum	240				
	Energy charges/kWh	1.20	Energy charges/kWh	3.75	Energy charges/kWh	3.00
	Public lighting un-metered:					
	Fixed charges/kW/annum	6,000	Fixed charges/kW/annum	16,800	Fixed charges/kW/Annum	14,400
LT-6(b): Urban	Water supply metered					
	Fixed charges: per HP/annum	360	Fixed charges: per HP/annum	600	Fixed charges: per HP/annum	420
	per kW/annum	480				
	Energy charges/kWh	2.75	Energy charges/kWh	4.00	Energy charges/kWh	3.00
	Public lighting metered:					
	Fixed charges: per HP/annum	360	Fixed charges: per kW/annum	600	Fixed charges: per kW/annum	600
	per kW/annum	480				
	Energy charges/kWh	2.00	Energy charges/kWh	3.75	Energy charges/kWh	3.00
	Public lighting un-metered:					
	Fixed charges/kW/annum	9,600	Fixed charges/kW/annum	16,800	Fixed charges/kW/Annum	14,400
Temporary	Energy charges per kWh, s.t. min. = Rs 125/kW/week	6.00	Energy charges per kWh, s.t. min. = Rs150/kW/week	6.00	Approved	
	For > 67 HP, + addn. fixed charge/HP/month	200	For > 67 HP, + addn. fixed charge/HP/month	200		

Type of installation	Existing tariff (since 2000)	Tariff rate (incl. FEC) (Rs)	Proposed tariff - 2002 (KPTCL)	Tariff rate (incl. FEC) (Rs)	Recommended tariff – 2002 (KERC)	Tariff rate (incl. FEC) (Rs)
HT categories:						
Water supply & sewerage installns. HT-1	Demand charges per kVA/month	150	Demand charges per kVA/month	180	Demand charges per kVA/month	180
	Energy charges per kWh	2.80	Energy charges per kWh	3.75	Energy charges per kWh	3.00
Industrial /non-industrial, non-commercial HT-2(a)	Demand charges per kVA/month	150	Demand charges per kVA/month	180	Demand charges per kVA of billing demand/month	180
	Energy charges per kWh till 1 lakh kWh	3.50	Energy charges per kWh till 1 lakh kWh	3.85	Energy charges per kWh till 1 lakh kWh	3.50
	Energy charges per kWh for > 1 lakh kWh	4.00	Energy charges per kWh for 1 to 2 lakh kWh	4.25	Energy charges per kWh for > 1 lakh kWh	4.00
			Energy charges per kWh for > 2 lakh kWh	4.05		
Commercial HT-2(b)	Demand charges per kVA/month	180	Demand charges per kVA/month	180	Demand charges per kVA/month	200
	Energy charges per kWh till 2 lakh kWh	4.25	Energy charges per kWh till 2 lakh kWh	4.35	Energy charges per kWh till 2 lakh kWh	4.25
	Energy charges per kWh for > 2 lakh kWh	4.55	Energy charges per kWh 2 – 3 lakh kWh	4.65	Energy charges per kWh for > 2 lakh kWh	4.55
			Energy charges per kWh for > 3 lakh kWh	4.55		
Lift irrigation, schemes/soc. HT-3(a)	Demand charges	Nil	Demand charges	Nil	Demand charges	Nil
	Energy charges per kWh for all units, min, Rs800/HP/annum	1.35	Energy charges per kWh for all units, min, Rs 1,500/HP/annum	2.25	Energy charges per kWh for all units, min, Rs 1,000/HP/annum	0.80
Private/govt. horticulture, plantations, etc. HT-3(b)					Demand charges	Nil
					Energy charges per kWh for all units, min, Rs 1,000/HP/annum	2.50
Bulk supply (Hukkeri Co-op) HT-4	Energy charges per kWh	0.58	Energy charges per kWh	2.40	Energy charges per kWh	0.75
Temporary supply HT-7	Merged with LT-temporary; Above 67 HP load: Fixed charges: /HP/month Energy: Rs/kWh	200 6.00	No increase			
Railway traction HT-6	Merged with industries: Demand charges per kVA/month	150				

	Energy charges per kWh	3.50				
Residential apartments HT-5	Demand charges per kVA/month of contract demand	73	Demand charges per kVA/month of contract demand	75	Demand charges per kVA/month of contract demand	100
	Energy charges/kWh	3.10	Energy charges/kWh	3.80	Energy charges/kWh	3.10

There are also rebates for some categories of consumers, namely, high voltage consumers, domestic consumers using solar water heaters, domestic consumers in rural areas with load shedding of > 6 hours/day, and sick industries.

Source: Information collated from KPTCL's Tariff Petition and KERC's Tariff Order 2002.

Table 8a: Potential Power Sources (Mecon-KP, 2002)

SUMMARY OF POTENTIAL POWER SOURCES

TYPE OF GENERATION	ENERGY SOURCE	APPROX. POTENTIAL - CAPACITY- MW		TOTAL CAPACITY (MW)
		UPTO 2005	FROM 2005 UPTO 2010	
1) SOURCES LOCATED IN STATE	A) HYDEL	605	1440	2045
	B) THERMAL			
	• COAL	710	1733	2443
	• GAS	301	1485	1786
	• LIQUID FUEL	28	32	60
	• REFINERY RESIDUE	-	448	448
SUB-TOTAL		1644	5138	6782
2) SOURCES LOCATED OUTSIDE STATE (SHARE / PURCHASE)		918	600	1518
GRAND TOTAL		2562	5738	8300

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Table 8b: Scenarios for the Environmental Assessment of New Power Sector Projects (Mecon-KP, 2002)

ATMOSPHERIC & WASTE IMPACTS						
SCENARIOS ASSUMED FOR THE STUDY						
SCENARIO	GROWTH RATE	TARIFF	CAPACITY ADDITION	T&D LOSS	DSM	RET
I	LOW	NO CHANGE	ONLY THOSE IN PIPELINE. CONSTRAINED DUE TO FINANCIAL PROBLEM	TO REMAIN AT 26%	NOT CONSIDERED	NOT CONSIDERED
II	AS PER REFORM POLICY	TO REFLECT COST OF SUPPLY	NO CONSTRAINT	TO REDUCE TO 14%	NOT CONSIDERED	NOT CONSIDERED
III	AS PER REFORM POLICY	TO REFLECT COST OF SUPPLY	NO CONSTRAINT	TO REMAIN AT 26%	NOT CONSIDERED	NOT CONSIDERED
IV	AS PER REFORM POLICY	TO REFLECT COST OF SUPPLY	NO CONSTRAINT	TO REMAIN AT 26%	NOT CONSIDERED	CONSIDERED
V	AS PER REFORM POLICY	TO REFLECT COST OF SUPPLY	NO CONSTRAINT	TO REDUCE TO 14%	CONSIDERED	CONSIDERED

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Table 8c: Potential costs and emissions in various scenarios (Mecon-KP, 2002)

PREDICTION UPTO 2010
(FOR EMISSION)

Scenario	PV of total cost (B Rs.)	Cumulative CO ₂ (Mt)	PV of SO ₂ (kt)	PV of NO _x (kt)	PV of TSP (kt)	Cum. ash (Mt)	LOLP by 2010
I	263	172	724	733	49	17	40%
II	254 – 294 (274)	183 – 198 (190)	754 – 794 (774)	794 – 836 (815)	50 – 55 (52.5)	25 – 27 (26)	<5%
III	296 – 340 (318)	198 – 230 (214)	776 – 849 (812.5)	807 – 842 (824.5)	52 – 57 (54.5)	26 – 28 (27)	<5%
IV	300 – 345 (322)	195 – 221 (208)	766 – 809 (787.5)	798 – 807 (802.5)	51 – 54 (52.5)	25.45 – 27 (26)	<5%
V	254 – 275 (264.5)	173 – 194 (183.5)	735 – 781 (758)	742 – 781 (761.5)	50 – 53 (51.5)	25 – 26.45 (25.5)	<5%

Figure 1: Trends in utility electricity generating capacity
 (Drawn on the basis of the reports of KEB and KPCL for the relevant years)

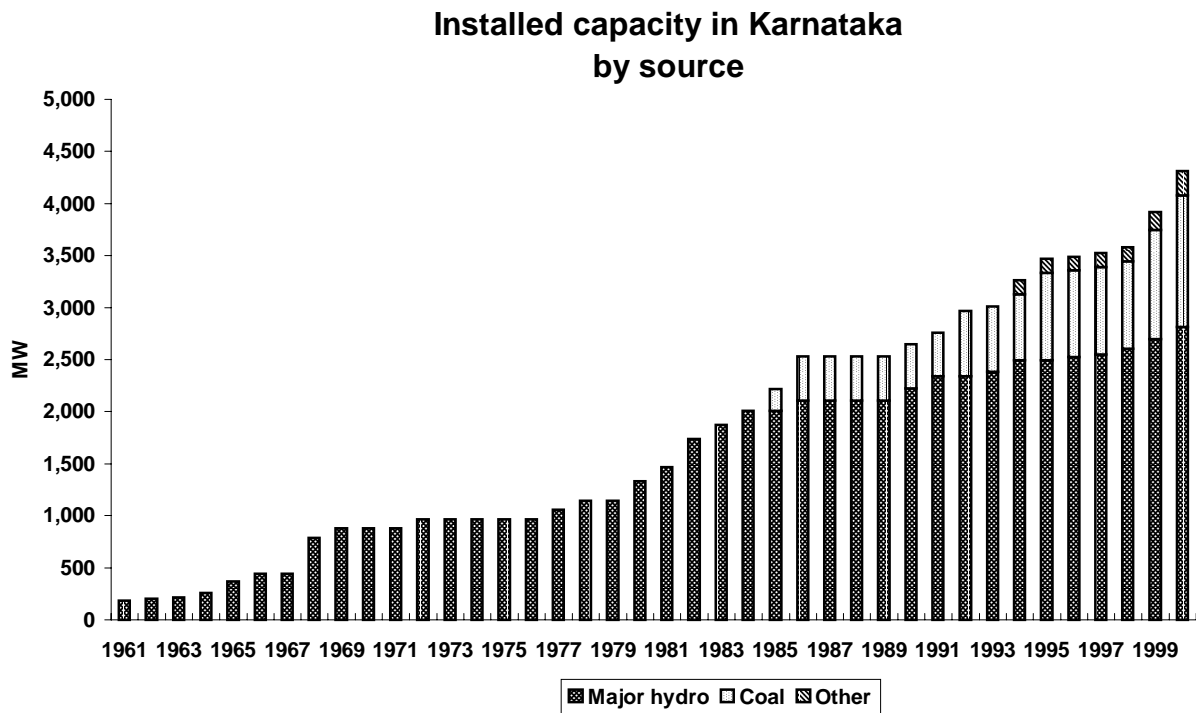
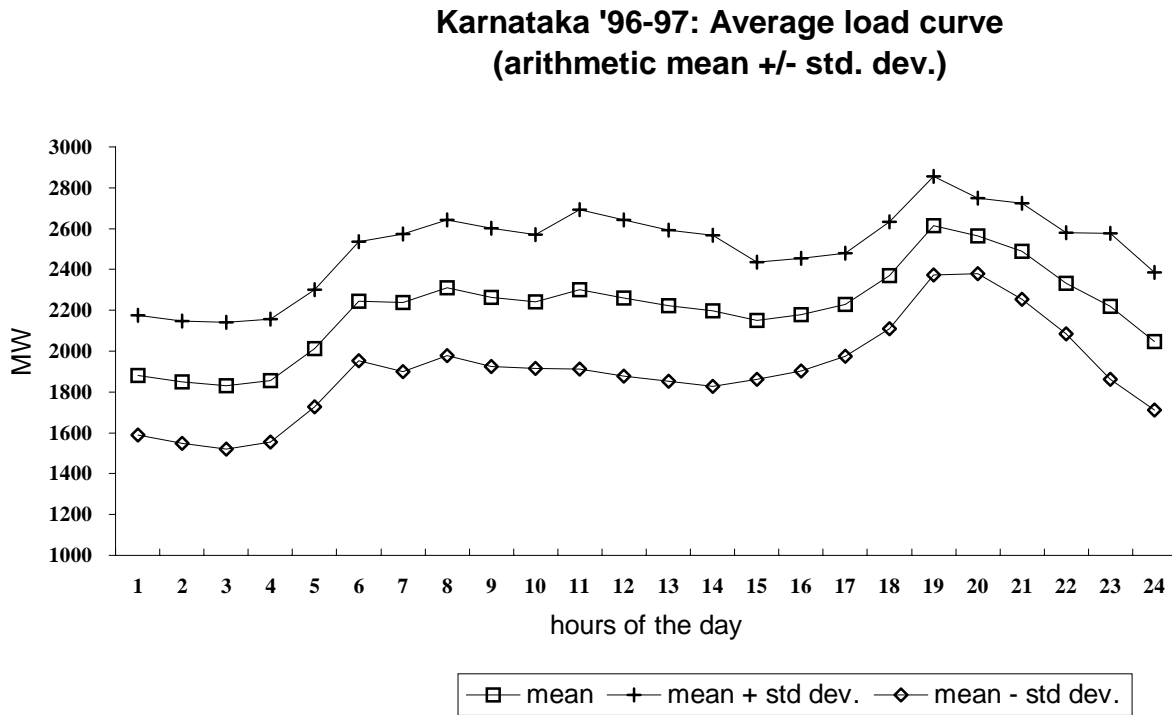


Figure 2: Annual load met by the utilities (1996-97)
 (Drawn on the basis of the data collected from the ledgers of the Load Despatch Cell, KEB, 1997)



**Annual load-duration-curve of Karnataka
 for the year April'96 to March'97**

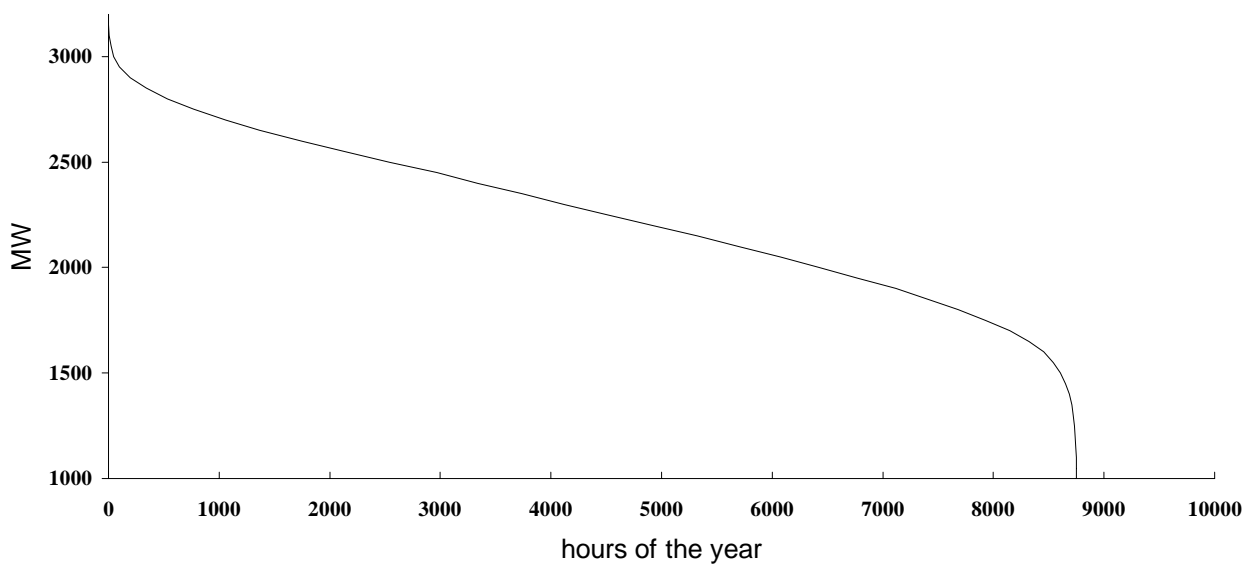


Figure 3: Electricity use (metered/un-metered) from the utilities
 (Drawn on the basis of the data from the Annual Reports, KEB, relevant years)

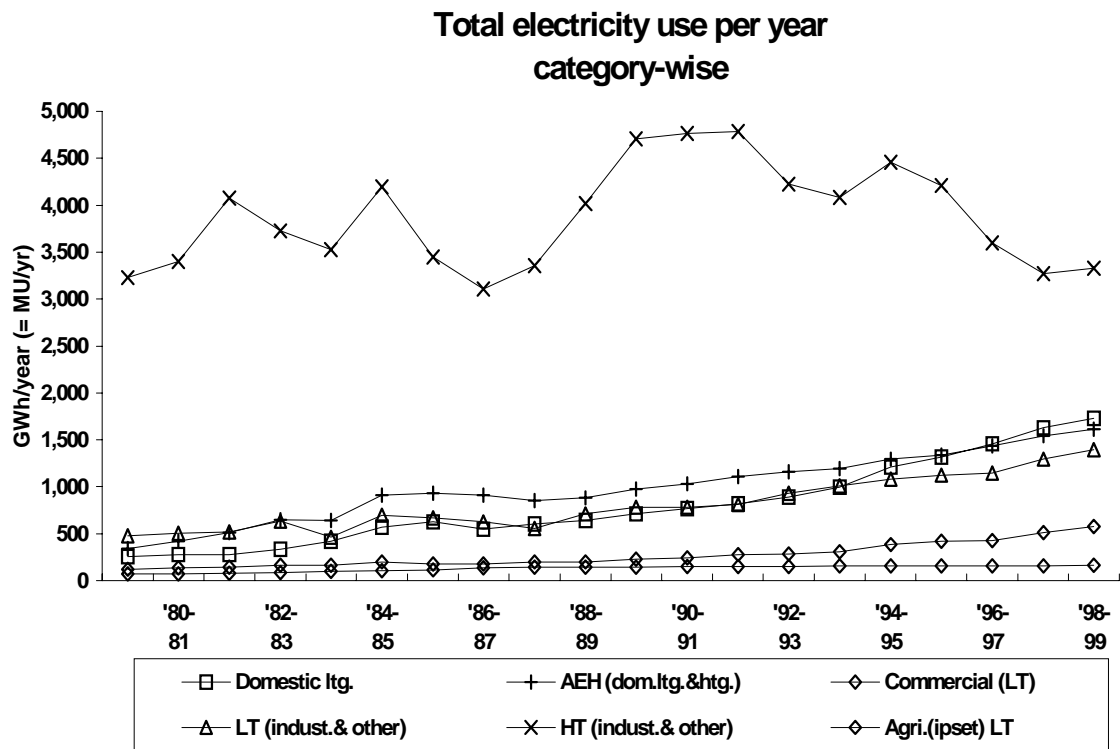


Figure 4(a) – (d): Category-wise electricity use/connection
 (Drawn on the basis of the data from the Annual Reports, KEB, relevant years)

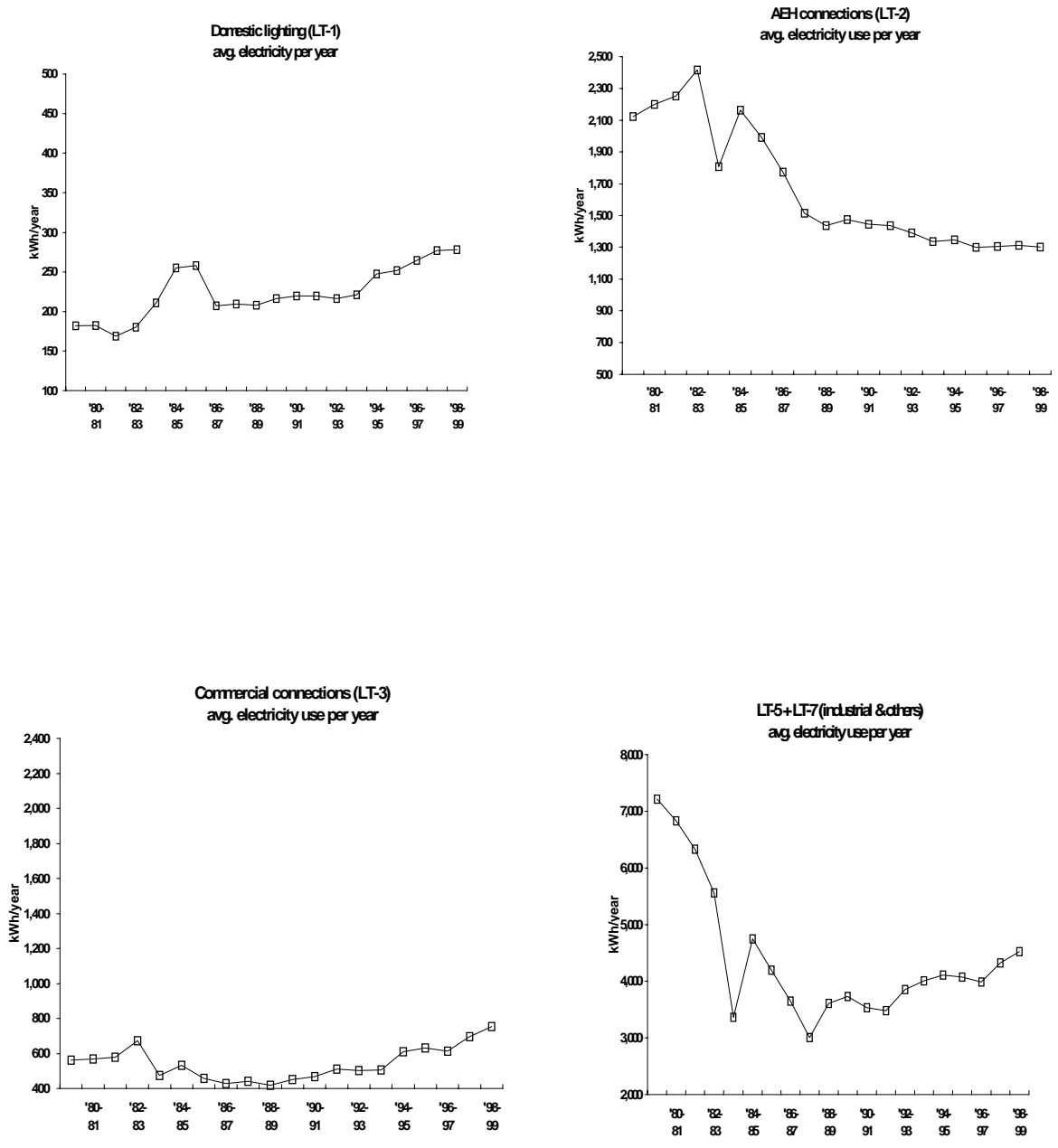


Figure 4(e) – (f):

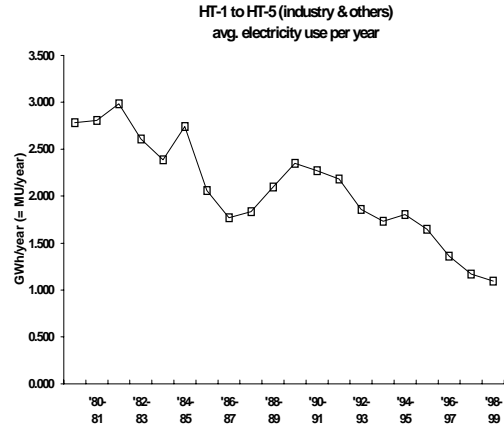
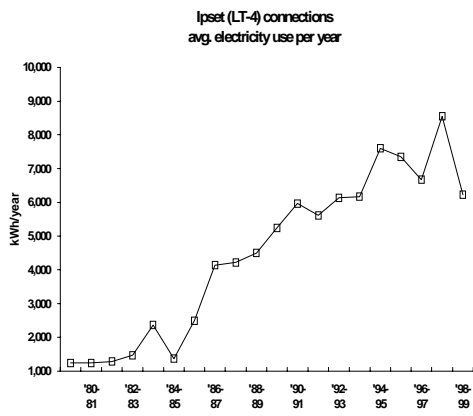


Figure 5: Estimated T&D Losses (1998-99)
 (Drawn on the basis of the estimates given by KPTCL to KERC, 2000)

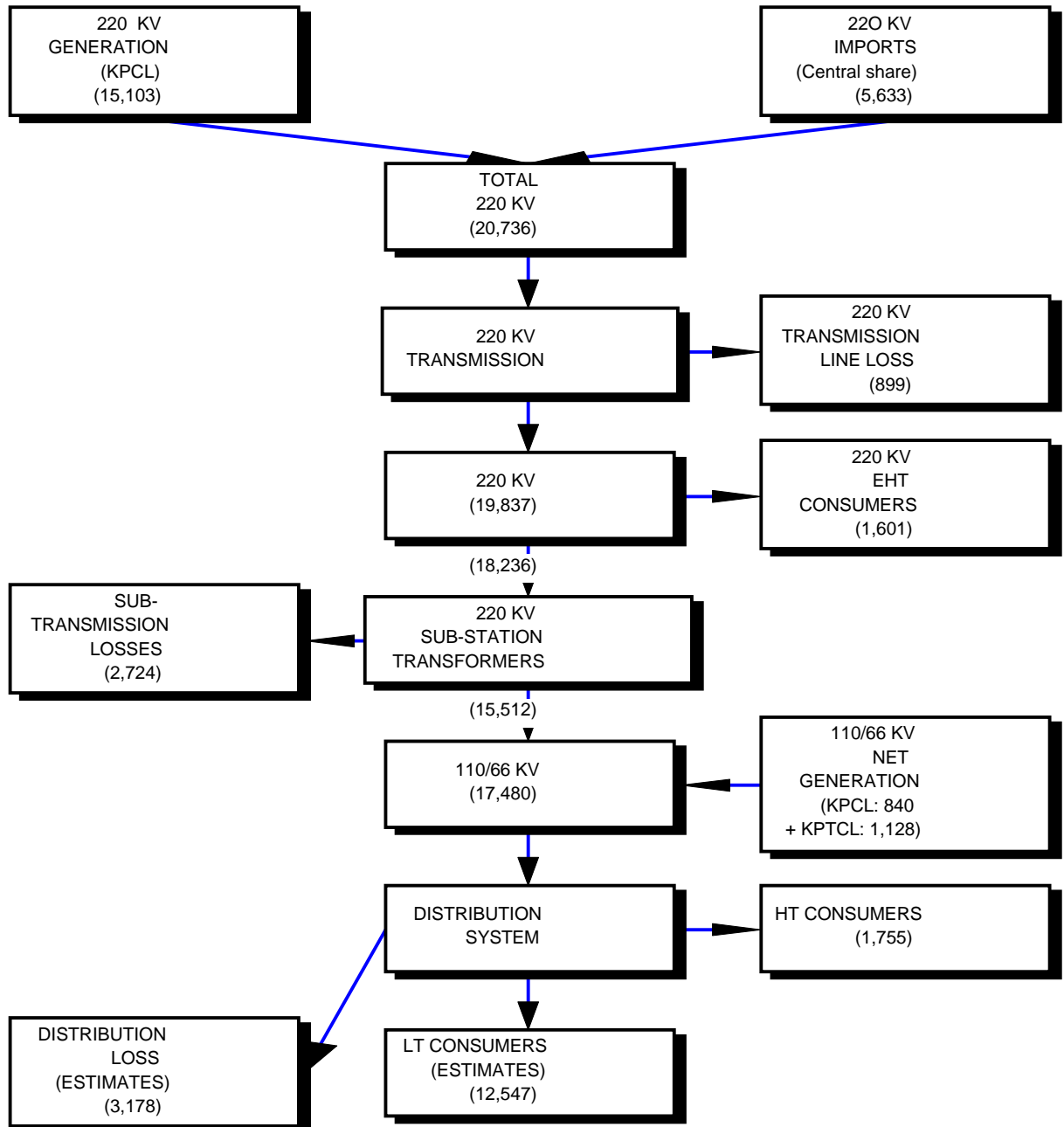
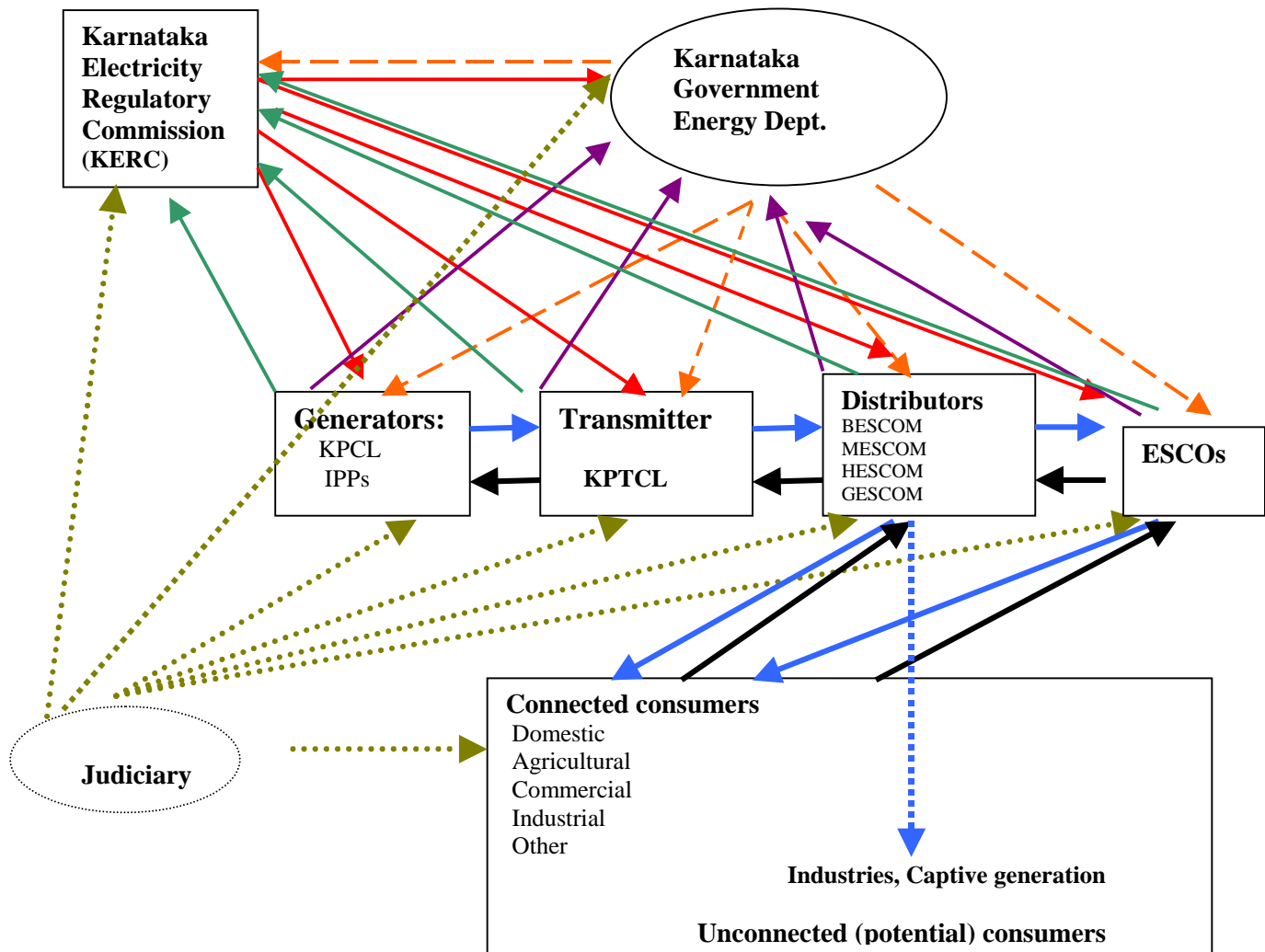










Figure 6: Representation of the State’s Power Sector (stakeholders and activities)



Legends:

-  Directives (from the Regulator)
-  Policies (from the Government)
-  Information (from the operators to the Regulator)
-  Electricity/Energy Service
-  Payment
-  Wheeling facilities (two-way supply of electricity)
-  Taxes and levies (paid to the Government)
-  Judgements (from the Courts)

Annexure:***Chronology of Reforms in Karnataka's Power Sector***

The following list recounts the recent (i.e. post 1991 National liberalisation) reform – restructuring and other system improvement -- efforts in the power sector of Karnataka through the proceedings of the Government of Karnataka:

- An Energy Sector Policy Statement was issued vide a Government Order (No.DE 99 PPC 96) dated 30th January 1997, in which it was stated that “in order to improve the operational efficiency in distribution and to enhance customer service quality, the State Government plans to privatise the restructured distribution operations of the KEB. . . . Privatisation would be implemented after the independent Regulatory Commission has become fully operational.”
- A Government Order (No.DE 99 PPC 96) dated 31st January 1997 constituted a committee under the Chairmanship of the Chief Secretary to the Government of Karnataka to float tenders for selection of consultants, evaluate the bids received and appoint consultants and thereafter guide the consultants and monitor their performance.
- The Karnataka Electricity Reform Act passed in 1999²¹ contained provision for, among others, the following:
 - the establishment of the Karnataka Electricity Regulatory Commission (KERC) within 90 days;
 - the conditions of appointment, terms of office, etc. of the members of the Commission;
 - the proceedings, powers and functions of the Commission including among others,
 - a) “to regulate the purchase, distribution, supply and utilisation of electricity, the quality of service, the tariff and charges payable, keeping in view the interest of the consumer as well as the consideration that the supply and distribution cannot be maintained unless the charges for the electricity supplied are adequately levied . . . “ *Part III, Section 11 (1) (a)*
 - b) “to promote efficiency, economy and safety in the use of electricity, in the State, including and in particular, in regard to quality, continuity and reliability of service, the standard of performance by the units engaged in the electricity supply industry in the State, the efficient utilisation and conservation of energy, appropriate demand side management and reduction of wastes and losses in the use of electricity . . . “
 - c) to issue licenses
 - d) to regulate the working of the licensees, . . . ,
 - (f) “to aid and advise, in matters concerning electricity generation, transmission, distribution and supply in the State”, . . . ,
 - (j) “to set appropriate codes of conduct and standards for the electricity industry in the State and standards of service to the consumers by licensees”, . . . ,

²¹ The Karnataka State Government first published the Karnataka Electricity Reform Ordinance in the Karnataka Gazette Extraordinary on 3rd May 1999, and subsequently promulgated it as the Karnataka Electricity Reform Act on 20th August 1999.

and so on.

- the general powers of the State Government to issue policy directives on matters concerning electricity in the State “*provided that such policy directives shall be consistent with the objectives sought to be achieved . . . and accordingly shall not adversely affect or interfere with the functions and powers of the Commission, including but not limited to the determination of the structure of tariffs for supply of electricity to various classes of consumers*”
- restructuring of the electricity industry in the State involving separation and rationalisation of the generation, transmission and distribution functions,
- the reorganisation and corporatisation of the KEB, transfer of KEB’s functions to successor entities (including the licensing and transfer of distribution functions to licensees authorised by the Commission, etc.)
- provision for Advisory Committees, Consumer Consultation, Disclosure of Information, Standard of Performance, etc.
- The Government Order (No.DE 4 PSR 99) dated 16th July 1999 accorded approval was for the incorporation of new Government companies known as the Karnataka Power Transmission Corporation Limited (KPTCL) for handling the transmission and distribution functions of KEB, and Visvesvaraya Vidyuth Nigama Limited (VVNL) for handling KEB’s existing generating stations with its associated units.
- In the Government Notification (No.DE 3 PSR 99) dated 28th August 1999, the Karnataka Electricity Regulatory Commission (KERC) was established under the provisions of the Karnataka Electricity Reform Act, 1999.
- In the Government Notification (No.DE 11 PSR 99) dated 11th October 1999, the Commission has been duly constituted.
- The Government has also taken steps to privatise the distribution operations of the KEB, as envisaged in its Power Sector Policy Statement dated 30.1.1997 and the provisions of the Karnataka Electricity Reform Act, 1999. In its Order (No.DE 17 PSR 99) dated 27th January 2000 it has accorded approval for the following:
 1. To take steps for inviting private sector participation in power distribution in the State by following the three stages bidding as detailed below:
 - i. Request for Qualification (REQ),
 - ii. Request for Proposals in which bidders will also furnish the price bid, and
 - iii. Negotiation on terms and conditions, and conclusion of contracts.
 2. The competitive bidding process will follow the delineation of the jurisdiction of each distribution company and preparation of detailed documentation.
 3. Bidding for the proposed joint venture entities would be limited to those companies which are evaluated to have the required technical, financial and managerial capabilities in the field, following the first stage of bidding which will be to invite Requests for Qualification (RFQ).
 4. To hold an Investors’ Conference inviting domestic and foreign companies during August 2000 in order to promote the Privatisation proposal.
 5. To invite suitable consultants to prepare the proposals relating to financial restructuring, delineation of distribution entities and preparation of bid documents as well as assistance in the whole process, and to meet the cost of these consultants from the State Government Funds.

The Consultants will be required to develop evaluation criteria, which are transparent and appropriate.

6. To authorise the Steering Committee under the Chairmanship of the Chief Secretary to Government of Karnataka (constituted in the Government Order No.DE 99 PPC 96 dated 31.1.1997) to take all the decisions relating to Terms of Reference of Consultants, selection and appointment of Consultants, obtaining of Consultants' reports and payment of Consultancy fees.
- Distribution unbundling and privatisation: A consortium of consultants hired to work out a Privatisation Strategy for the state's distribution system presented their first report in July 2001 concluding that only some urban pockets (constituting 33% of the load and 5% of the geographical spread) would be viable for private investors. This meant that the state government would continue to shoulder the burden of the remaining un-remunerative areas or else delay privatisation entirely [CMS Cameron McKenna, *et al.*, 2001]. The revised strategy presented in October 2001 suggested dividing the entire state according to the existing zones (each with a mix of consumer categories), but with the state government still retaining the risks of tariffs, collection and commercial losses, at least for a transition period.
 - With effect from the 1st June 2002, KPTCL's distribution segment was split geographically into four distribution companies (Distcoms) on the basis of the existing zones, (with the erstwhile Bangalore-Metropolitan and Bangalore-Rural zones combined). The resulting companies – the Bangalore Electricity Supply Company (BESCOM), the Mangalore Electricity Supply Company (MESCOM), the Hubli Electricity Supply Company (HESCOM), and Gulbarga Electricity Supply Company (GESCOM), are currently state-owned but likely to be privatised.

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