KARNATAKA'S POWER SECTOR: SOME REVELATIONS

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COMMON BELIEFS RE: KARNATAKA'S POWER SECTOR

- IPS consumption excessive -- 1/3 to 1/2 of total
- T & D losses are relatively smaller -- about 1/5
- Major power and energy shortages
- IPP’s mega-projects will solve problems

COMMON BELIEFS RE: KARNATAKA'S POWER SECTOR (CONTINUED)

- Subsidies are cause of KEB's financial problems
- No solution of generation and distribution possible through public sector
- KEB's employees are inefficient
- Generation performance has deteriorated

KEB'S 1994-95 METERED CONSUMPTION

- ONLY 42% OF THE GENERATION IS METERED
- ONLY HT, LT, COMMERCIAL, AEH AND DOMESTIC LIGHTS AND FANS ARE METERED

KEB'S 1994-95 NON-METERED CONSUMPTION

- **TOTAL NON-METERED CONSUMPTION = AVAILABILITY - TOTAL METERED CONSUMPTION**
- **AS MUCH 58% OF THE GENERATION IS NOT METERED**
- **IPS, BHAGYA JYOTI (BJ), PUBLIC LIGHTING (PL) AND MUSS ARE NOT METERED**

KEB'S 1994-95 NON-METERED CONSUMPTION

- **ONLY *SUM* OF CONSUMPTION BY IPS, T & D, BHAGYA JYOTI (BJ), PUBLIC LIGHTING (PL) AND MUSS IS KNOWN**
- **INDIVIDUAL COMPONENTS OF SUM MUST BE GUESSED OR ALLOCATED**
- **IN PARTICULAR, IPS AND T & D MUST BE GUESSED**

IPS CONSUMPTION (1994-95)

- **IPS CONSUMPTION = NUMBER OF IPS X CONSUMPTION/IPS/YEAR**
- **IPS CONSUMPTION (KEB) = 960,165 IPS X 7,600 KWH/IPS/YEAR = 7,297 MUS = 37.3% OF AVAILABILITY**
- **IPS CONSUMPTION (IEI) = 960,165 IPS X 5,250 KWH/IPS/YEAR = 5,040 MUS = 25.8% OF AVAILABILITY**

IPS CONSUMPTION AS PER IEI

- **BOREWELLS -- 12,000 KWH/IPS/YEAR**
- **OPEN WELLS -- 2,000 KWH/IPS/YEAR**
- **CANAL BEDS -- 5,000 KWH/IPS/YEAR**
- **IN 1994-95, 64% OPEN WELLS + 31% BOREWELLS + 5% CANAL BED IPS**
- **WEIGHTED AVERAGE = 5,250 KWH/IPS/YEAR**

IPS CONSUMPTION AS PER KEB (IEI'S GUESS)

- **BOREWELLS -- 10,400 KWH/IPS/YEAR**
- **OPEN WELLS -- 2,000 KWH/IPS/YEAR**
- **BETWEEN 1991-96, 33% OPEN WELLS + 67% BOREWELLS**
- **WEIGHTED AVERAGE = 7,610 KWH/IPS/YEAR**

T & D LOSSES

- **KEB'S OVER-ESTIMATION OF IPS CONSUMPTION --> KEB'S UNDER-ESTIMATION OF ITS T & D LOSSES**
- **KEB'S ESTIMATION OF 1984-94 T & D LOSSES --> *SUSPECT* BECAUSE T & D LOSSES DECREASING WITH LT LOADS INCREASING**

T & D LOSSES (CONTINUED)

- T & D LOSSES (KEB) = 3,635 MUS = 18.6% OF AVAILABILITY
- T & D LOSSES (IEI) = 5,946 MUS = 30.4% OF AVAILABILITY

T & D LOSSES (CONTINUED)

- T & D LOSSES = TECHNICAL LOSSES + COMMERCIAL LOSSES (= THEFT)
- IF TECHNICAL LOSSES = 20% THEN COMMERCIAL LOSSES (= THEFT) = 10%

DEMAND

- Over half KEB's consumption is ***unmetered***
- KEB exaggerates IPS consumption
- KEB under-reports T & D losses
- Theft (so-called commercial T & D losses) is substantial

DAILY LOAD CURVE

- **DAILY LOAD CURVE --> MORNING PEAK (MP) + EVENING PEAK (EP) WITH MP < EP**
- **IF EP IS MET, THERE SHOULD BE NO TROUBLE WITH MP**
- **THEN, WHY SOMETIMES KEB LOAD SHEDDING IN MORNING BUT NOT IN EVENING**

DAILY LOAD CURVE

- **KEB DOES NOT KNOW WHAT MAKES UP ITS DEMAND AT ANY TIME OF DAY**
- **KEB DOES NOT HOW MUCH DEMAND DUE TO ELECTRICAL DEVICES (MOTORS, WATER HEATERS, LIGHTS, ETC.)**

KARNATAKA'S AVAILABLE CAPACITY 1994-95

- **INSTALLED CAPACITY = 3,485 MW**
- **LESS NON-FIRM CAPACITY (IRRIGATION REQUIREMENTS) 0F 8.72% = 3,181 MW**
- **LESS UNFORESEEN OUTAGES (SPINNING RESERVE) OF 5.47% = 3,007 MW**
- **LESS MAINTENANCE PROTECTION OF 11.47% = 2,662 MW**

KARNATAKA'S AVAILABLE CAPACITY 1994-95

- **NON-AVAILABLE CAPACITY = 823 MW**
- **RESERVE MARGIN = 23.61%**
- **FIRM AVAILABLE CAPACITY = INSTALLED CAPACITY - NON-AVAILABLE CAPACITY = 3,485 MW - 823 MW = 2,662 MW**

TOTAL AVAILABLE OR FIRM CAPACITY

- **STATE'S AVAILABLE OR FIRM CAPACITY = 2,662 MW**
- **STATE'S SHARE OF CENTRAL CAPACITY = 510 MW**
- **TOTAL AVAILABLE OR FIRM CAPACITY = 3,172 MW**

1994-95 AVAILABLE CAPACITY VS HIGHEST PEAK DEMAND

- **TOTAL FIRM CAPACITY = 3,172 MW**
- **HIGHEST PEAK DEMAND = 3,155 MW**
- **BUT IN 1994-95, NO RESTRICTION ON DEMAND & NO ENERGY OR POWER CUTS**
- **HENCE, NO SHORTAGE OF FIRM (AND INSTALLED) CAPACITY**

1994-95 AVAILABLE ENERGY VS TRUE ENERGY REQUIREMENT

- **FIRM NET ENERGY AVAILABLE = 20,124 GWH**
- **TRUE ENERGY REQUIREMENT = 19,740 GWH**
- **BUT, IN 1994-95 --> NO SUPPRESSION OF DEMAND**
- **HENCE, NO ENERGY SHORTAGE**

ABSENCE OF POWER & ENERGY SHORTAGES IN 1994-95

- **OPERATIONAL HOURS OF HYDRO STATIONS SHOWED:**
- **PLANNED OUTAGES = 10.5%**
- **FORCED OUTAGES = 3.4%**
- **IDLE HOURS = 6.2%**
- **SO, HYDRO STATIONS IDLED WHEN FIRM CAPACITY > DEMAND**

ABSENCE OF POWER SHORTAGE IN 1994-95

- **PEAK DEMAND CAME CLOSE TO THE FIRM CAPACITY (> 2,850 MW) ONLY FOR LESS THAN 31 HOURS (0.36%) IN THE YEAR**
- **VERY FAR CRY FROM THE CONSTANT CLAIM OF POWER CRISES**

WAS THERE A SUPPLY-DEMAND "CRISIS" IN 1994-95?

- There was no energy or power crisis in 1994-95 because
  - Demand < Firm Capacity
  - Energy Requirement < Availbility
  - Hydro Stations were idled for 6% of the time
  - Peak Demand approached Firm Capacity for less than 1% of the time

1994-95 CAPTIVE GENERATION SETS

- **TOTAL CAPACITY OF CAPTIVE GENERATION SETS > 1,000 MW = ABOUT ONE-THIRD OF CENTRALIZED INSTALLED CAPACITY**
- **BUT, THEY REMAIN IDLE FOR AS MUCH AS 73% OF THE TIME**

HARNESSING OF CAPTIVE GENERATION SETS

- **IF THEY ARE CONNECTED TO THE GRID OR TO SELECTED LOADS,**
- **THEN A LARGE FRACTION OF THEIR CAPACITY CAN BECOME AVAILABLE TO THE STATE.**
- **THUS, A MAJOR GENERATION RESOURCE HAS NOT BEEN HARNESSED**

PERFORMANCE OF GENERATING STATIONS

- **MU/MW WAS ABOUT 4.7 IN THE 1960s AND 1970s BUT DROPPED AFTER 1980 TO 3.9**
- **AND PLF WAS OVER 60% BEFORE THE 1980s BUT REDUCED TO 30-50% AFTER 1980**

GENERATION PERFORMANCE DETERIORATION?

- **DECLINE OF MU/MW & PLF OF HYDRO STATIONS NOT DUE TO THE INEFFICIENCY OF THE GENERATING STATIONS**
- **SUPPLY (GENERATION) HAS TO BE ADJUSTED TO DEMAND**
- **PLANT PERFORMANCE IS BETTER JUDGED BY THE AVAILABILITY OF STATIONS**

SUPPLY

- Karnataka Power Sector has no strategy for dispatching present source mix (hydro, thermal and diesel and imports)

DIFFERENTIAL PRICING OF ELECTRICITY

- **MAXIMUM PRICE --> RS.5.09/KWH (TEMPORARY CONNECTIONS)**
- **MINIMUM PRICE --> RS.0.02/KWH (IPS)**
- **WEIGHTED AVERAGE PRICE --> RS.1.06/KWH**
- **FAR LOWER THAN THE COST OF GENERATION IN A NEW PLANT SUCH AS RAICHUR V AND VI**

NET REVENUE FOR EACH USER CATEGORY

- **NET REVENUE = REVENUE REALIZED - EXPENDITURE INCURRED**
- **HT, COMMERCIAL, LT & AEH --> PROVIDE CROSS-SUBSIDY**
- **RECEIVERS OF SUBSIDIES --> MAINLY IP SETS (RS.6,900/IPS)**
- **NON-AEH AND BJ --> TRIVIAL SUBSIDY**
- **RS.16/NON-AEH HH AND RS.234/BJ HH**

SUBSIDIES NOT RESPONSIBLE FOR KEB'S FINANCIAL PROBLEMS

- **IPS LOSSES --> MORE THAN COMPENSATED BY SURPLUSES FROM HT, COMMERCIAL AND LT CONSUMERS**
- **CROSS-SUBSIDY FROM HT, COMMERCIAL, LT & AEH (RS.878.2 CRORES) > OUTFLOW OF SUBSIDY (RS.689.2 CRORES)**
- **IPS SUBSIDY --> RS.666.5 CRORES**
- **KEB SHOULD HAVE HAD AN EXCESS OF RS.196.4 CRORES.**

IPS SUBSIDY NOT BEING REIMBURSED TO KEB

- **GOVERNMENT GAVE KEB ONLY RS.269.3 CRORES (40%) GRANTS, ETC. VS SUBSIDY OF RS.666.5 CRORES ON IPS**

ARREARS & REPAYMENTS

- **ARREARS HAVE INCREASED BY RS.66.2 CRORES**
- **REPAYMENTS OF LOANS --> RS.415.2 CRORES = ABOUT 2.25 TIMES EARNINGS FROM BONDS, ETC. (RS.184.7 CRORES)**
- **KEB MUST NOT REDUCE ITS NET REPAYMENTS, OR DEBT TRAP**

HUGE SAVINGS POSSIBLE ON COMMERCIAL T & D LOSSES

- **ABOUT RS.190 CRORES SAVINGS ARE POSSIBLE ON COMMERCIAL T & D LOSSES**
- **THESE LOSSES MAKE KEB'S NET REVENUE NEGATIVE**
- **BY AVOIDING THEM, KEB CAN BECOME FINANCIALLY VIABLE**
- **INCREASING THE REVENUE FROM IPS WILL GREATLY IMPROVE VIABILITY.**

T & D LOSSES HAVE MAJOR FINANCIAL IMPLICATIONS

- **T & D LOSSES NOT EXPLICIT IN KEB BALANCE SHEETS**
- **MONETARY VALUE OF T & D LOSSES = (ELECTRICITY LOST BETWEEN AVAILABLE ENERGY AND ENERGY SUPPLIED) X (AVERAGE EXPENDITURE PER KWH OF AVAILABLE ENERGY)**
- **TECHNICAL T & D LOSSES CANNOT BE REDUCED BELOW AN UNAVOIDABLE MINIMUM (SAY 20%)**

IS KEB EXTRAVAGANT?

- **PURCHASE OF POWER --> 50% OF KEB'S COSTS**
- **COSTS OF PURCHASING POWER INCREASED AFTER 1990-91**
- **WILL INCREASE EVEN MORE AFTER NEW EXPENSIVE PLANTS COME ON STREAM**

COSTS INCURRED BY KEB ON ITS EMPLOYEES

- **SALARIES, ETC. --> ONLY ABOUT 20% OF THE TOTAL COSTS**
- **COST PER EMPLOYEE ROSE IN STEP WITH WPI UNTIL ABOUT 1983-84**
- **THEN ROSE MORE RAPIDLY THAN WPI PARTICULARLY AFTER 1988-89**

PRODUCTIVITY OF KEB'S EMPLOYEES

- **OUTPUT HAS INCREASED BETWEEN 1972-73 AND 1993-94**
- **CONNECTIONS/EMPLOYEE --> FROM 42 TO 128 (3.04 TIMES)**
- **CONNECTED LOAD/EMPLOYEE --> FROM 49 KW TO 179 KW (3.65 TIMES)**
- **ENERGY SUPPLIED/EMPLOYEE --> FROM 108,000 KWH TO 256,000 KWH (2.37 TIMES)**

CAUSE(S) OF KEB'S FINANCIAL MESS

- Cross-subsidy > Subsidy to IPS -- subsidies ***not*** root cause of KEB's financial problems
- HT + LT + AEH categories cross-subsidize IPS (and trivially BJ and non-AEH)
- Net Surplus Revenue (Cross-subsidy - Subsidy to IPS) < T & D Losses; hence, ***T & D losses*** are responsible for KEB's financial problems

CAUSE(S) OF KEB'S FINANCIAL MESS

- KEB's costs are 50% power purchase and 20% salaries
- KEB's salaries have risen in step with WPI up to about 1983-84
- Productivity of KEB's employees has risen from 1972-73 to 1993-94
- KEB's power purchase costs have jumped with every new source

WHO ARE THE WINNERS?

- Farmers owning IPS
- Politicians/Parties championing these farmers
- Some individuals in KEB make IPS connections a lucrative proposition
- Manufacturers/suppliers of equipment to overcome defective supply

WHO ELSE ARE THE WINNERS?

- KEB blames IPS for its technical & commercial shortcomings
- “Shortages” facilitates malpractices
- Decision-makers use “shortages” to justify their power-expansion policies (foreign private power, trips, etc.)

WHO ARE THE LOSERS?

- HT, LT and Commercial consumers providing cross-subsidy and suffering cuts, load-shedding and/or defective supply
- Non-AEH households
- Unelectrified households

SHAPE OF THINGS TO COME

- ***Worst Case Scenario I***: To honour PPAs, cheap hydro and/or thermal plants will have to be backed down/ idled, but even that may not be enough
- ***Worst Case Scenario II***: Industry will de-link from KEB when tariffs exceed costs of captive generation -- KEB will be left with no- or low-tariff customers

WHAT IS A CRISIS IN THE POWER SECTOR?

- A "NO-SOLUTION REGIME"
- A SITUATION IN WHICH
  - –(a) NO IMMEDIATE MEASURES WILL REMEDY THE SITUATION AND

THE WAY FORWARD

- Package of Realistic & Small Measures: 11 Institutional + 5 DSM + 8 SSM
- Institutional Measures will rescue KEB and KPC
- DSM+SSM package will provide about 1,600 MW

INSTITUTIONAL MEASURES -- REDUCTION OF KEB OUTFLOWS

- reduction of IPS subsidies
- reduction of KEB's debts
- reduction of commercial T & D losses (theft)
- reduction of arrears

INSTITUTIONAL MEASURES -- INCREASE OF INFLOWS TO KEB

- grants from government to reimburse IPS subsidies,
- (b) an increase of wheeling revenues
- (c) season-of-year pricing so that the electricity price is higher in high-demand pre-monsoon months and lower in the post-monsoon months

INSTITUTIONAL MEASURES -- IMPROVEMENT OF THE DATABASE

- the census of IPS in open wells, borewells and canal beds,
- the annual consumption of IPS in open wells, borewells and canal beds by metering transformers serving IPS clusters and/or IPS
- the technical component of T & D losses
- annual auditing of electricity consumption by major consumers

INSTITUTIONAL MEASURES -- LOAD MANAGEMENT METHODOLOGY

- the rationale for, and the extent of, load shedding and
- load dispatch from hydroelectric-thermal-diesel generation mix.

ENERGY "FUNDAMENTALISM"

- EXCLUSIVE FOCUS ON CONVENTIONAL/FUTURISTIC CENTRALIZED TECHNOLOGIES
- OR NON-CONVENTIONAL RENEWABLE/DECENTRALIZED TECHNOLOGIES
- OR ENERGY SAVING OPTIONS THROUGH EFFICIENCY IMPROVEMENTS

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ROLE OF DECENTRALIZED RENEWABLES & END-USE EFFICIENCY IMPROVEMENTS

- DECENTS & EUEIs, SINGLY OR TOGETHER, CANNOT MEET ENERGY REQUIREMENTS
- CENTRALIZED SOURCES ARE ESSENTIAL
- BUT INCORPORATION OF DECENTS & EUEIs IN SUPPLY MIX REDUCES MAGNITUDE OF CENTRALIZED SOURCES REQUIRED

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DEMAND-SIDE MEASURES

- (1) PEAK SHAVING
- (2) EFFICIENT LIGHTING
- (3) SOLAR WATER HEATERS
- (4) EFFICIENT IPS
- (5) EFFICIENT MOTORS

SOLAR WATER HEATERS

- **100 LITRES/DAY UNIT FOR 4-PERSON FAMILY --> RS 10,000 + AVERAGE OF RS 1,500 FOR EXTRA PIPING**
- **REPLACES 2 KW ELECTRIC GEYSER USED FOR 2.2 HOURS/DAY**
- **1,320 KWH/YEAR (RS. 1,980/YEAR AT RS.1.50/KWH) SAVING = 5.8 YEARS PAYBACK**

LAWS RE: SWHs IN ISRAEL

- **"No new building in which there is a system or installations for supplying hot water shall be built unless the system is a solar installation"**

LAWS RE: SWHs IN JERUSALEM

- "If the roof is large enough for a number of solar boilers equal to the number of apartments in the building, an apartment owner may, without the consent of the other apartment owners, install in a reasonable place on the roof of the cooperative house which is common property, a boiler for the solar heating of water, and to install in a reasonable manner the installations relating thereto and the pipes for transporting the water to his/her apartment (provided certain provisions are fulfilled".

DEMAND SIDE MEASURES

DEMAND SIDE MEASURE	SAVING OF ENERGY (GWH)	SAVING OF POWER (MW)
CFLs - DOMESTIC	210	130
CFLs - COMMERCIAL	50	10
SOLAR WATER HEATERS	250	270
IMPROVED IPS	780	320
IMPROVED MOTORS	410	110
TOTAL SAVING	1700	840

SUPPLY-SIDE MEASURES

- (1) ENVIRONMENTALLY SOUND HYDROELECTRIC PROJECTS
- (2) REDUCING T & D TECHNICAL LOSSES
- (3) CAPTIVE GENERATION
- (4) SUGAR COGENERATION
- (5) COGENERATION IN OTHER INDUSTRIES

SUPPLY-SIDE MEASURES

- (6) BIOMASS-BASED RURAL ENERGY & WATER SUPPLY UTILITIES (REWSUS)
- (7) SMALL HYDEL
- (8) WIND
- (9) PHOTOVOLTAICS

SUPPLY-SIDE MEASURES

SOURCE	GENERATION ENERGY (GWH)	GENERATION POWER (MW)
SMALL HYDEL	460	200
SUGAR COGEN	900	200
WIND	100	50
CAPTIVE GENSETS	1200	270
TOTAL	2660	720

ALTERNATIVE OPTIONS: DSM & SSM

OPTION	ENERGY (MU)	POWER (MW)
DSM	1,700	840
NES	2,660	720
TOTAL	4,360	1,560

REAL LONG-TERM SOLUTION

- shifting to the New Energy Paradigm (NEP)
  - emphasis on energy services (rather than energy consumption)
  - Integrated Resource Planning (IRP).

GOAL --> SUSTAINABLE ENERGY

Realistic and Small Measures

PLUS

New Energy Paradigm
(Mind-set/Approach)

KARNATAKA'S POWER SECTOR: SUMMARY OF RECOMENDATIONS

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DEMAND

- Quantify consumption of ***all*** KEB consumer categories (particularly IPS consumption, Technical and Commercial T & D losses & Theft)
- Energy Audit of HT & LT

SUPPLY

- Ensure that investments on supply expansion are backed by appropriate investments on T & D
- Ensure adequate funds for system improvement to reduce T & D losses

SUPPLY

- Develop **annual** strategy (preferably computerized) for dispatching different sources of supply (hydro, thermal and diesel and imports)

SUPPLY-DEMAND MATCHING

- Publish hourly demand values on an annual basis to determine relationship between demand and firm capacity and between energy requirement and availability

SUPPLY-DEMAND MATCHING

- Publish information on Captive Generation Sets (installed capacity and utilization)
- Incorporate Captive Generation Sets in supply mix

SUPPLY-DEMAND MATCHING

- Obtain disaggregated data on operational hours of power plants (planned and forced outages and idle hours)
- Avoid PPAs that force cheap hydro and/or thermal plants to be backed down/idled

TARIFFS

- Ensure that tariffs do not exceed costs of captive generation to prevent industry from de-linking from KEB and KEB being left with no- or low-tariff customers
- Revise tariffs so that net revenues are positive

TARIFFS

- Give IPS choice between cheap unreliable power and priced reliable power
- Implement tariff increases with improvements of efficiency because consumers are concerned with expenditures rather than with tariffs

TARIFFS

- Since KEB's power purchase costs (over 50% of KEB's expenditures) have jumped with every new source, estimate impact of new projects on power purchase costs
- Ensure that T & D losses are monetized and appear in balance-sheets

ESSENTIAL RESTRUCTURING TO RESCUE KEB

- Independent autonomous regulation
- If government obliges power sector to serve social goals (of access, affordability, etc.), it must compensate for any resulting losses

ESSENTIAL RESTRUCTURING TO RESCUE KEB

- Corporatization to liberate KEB from government and make KEB run on commercial lines
- Independent private power generation
- Transparent democratic functioning

DECISION-MAKING RE: LOAD SHEDDING

- **July 1 = Next monsoon (June 15) + a safety margin of 15 days**
- **Generation that can be expected up to July 1 from each station (hydro, thermal, etc.) in the state + Estimates of imports from other states and Central stations = Grand Total**
- **Average daily availability (MU/day) = Grand total / Number of days left to the next July 1**

DECISION-MAKING RE: LOAD SHEDDING (CONTD.)

- Expected daily requirement (MU/day) = Previous year's average daily consumption + a 10% annual escalation

DECISION-MAKING RE: LOAD SHEDDING (CONTD.)

- If the expected daily requirement > the daily availability, then Load Shedding
- If the expected daily requirement < the daily availability, then no Load Shedding

FOLLOWING RESTRUCTURING COMPONENTS ARE NOT ESSENTIAL

- Removal of **all** subsidies
- Privatization of (i.e., divesting) generation facilities
- Privatization of Transmission
- Privatizating (i.e., handing over) distribution to private sector

INSTITUTIONAL MEASURES TO RESCUE KEB

- INCLUDE FOLLOWING ELEMENTS BEING URGED BY THE WORLD BANK
- (1) AN INDEPENDENT AUTONOMOUS REGULATORY AGENCY
- (2) TARIFF REVISION SO THAT THE NET REVENUES ARE POSITIVE
- (3) CORPORATIZATION SO THAT KEB RUNS ON COMMERCIAL LINES
- (4) INVOLVEMENT OF INDEPENDENT PRIVATE POWER GENERATORS

IS TOTAL RESTRUCTURING PACKAGE OF WB ESSENTIAL FOR SEB REVIVAL?

- NO! REVIVAL DOES NOT APPEAR TO REQUIRE
- (1) REMOVAL OF ALL SUBSIDIES TO USERS
- (2) PRIVATIZATION OF ALL GENERATION
- (3) PRIVATIZATION OF T & D
- (4) LEAVING UTILITIES TO THE MARKET WITHOUT IMPOSING ON THEM OBLIGATION TO SERVE THE COMMUNITY

INTEGRATED RESOURCE PLANNING (IRP)

- It is as suicidal to have ***gross*** excess capacity as to have ***major*** shortages
- Emphasize energy services (rather than energy consumption)

INTEGRATED RESOURCE PLANNING (IRP)

- Evolve a Least-Cost Mix (Package) of Centralized and Decentralized Generation and Efficiency Improvements (equivalent to Supply Expansion)
- Integrated Resource Planning is essential

ELECTRICITY IS CRUCIAL

- **(1) A WAY OF IMPROVING THE QUALITY OF LIFE**
- **(2) AN INPUT TO INDUSTRIALIZATION AND AGRICULTURAL DEVELOPMENT**
- **(3) A PROVIDER OF SERVICES**

THE POWER SECTOR IS TOO IMPORTANT

- **TO BE LEFT TO ELECTRICAL ENGINEERS AND ELECTRICITY ORGANIZATIONS (KEB, KPC, ENERGY MINISTRY, ETC.)**
- **EDUCATION, SCIENCE AND TECHNOLOGY INSTITUTIONS, LEGISLATORS, MEDIA, PUBLIC INTEREST GROUPS, NGOS, USER GROUPS FROM INDUSTRY, COMMERCE, ETC., VILLAGE-LEVEL INSTITUTIONS MUST BE ALSO BE INVOLVED**