KARNATAKA'S POWER SECTOR -- SOME REVELATIONS

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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**

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%

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.)

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**

DECISION-MAKING RE: LOAD SHEDDING

- (1) SUPPLY SCENARIO UP TO NEXT MONSOON (JUNE 15) (+ 15 DAYS SAFETY MARGIN) BY ADDING ESTIMATES OF IMPORTS (FROM OTHER STATES & CENTRE) TO GENERATION EXPECTED FROM STATIONS IN STATE

DECISION-MAKING RE: LOAD SHEDDING

- (2) TOTAL SUPPLY DIVIDED BY NUMBER OF DAYS TO NEXT JULY 1 = AVERAGE DAILY AVAILABILITY IN MU/DAY
- (3) DAILY AVAILABILITY VS DAILY REQT. (IN MU/DAY) EXPECTED TO NEXT YEAR JULY 1 = PREVIOUS YEAR'S AV. DAILY CONSUMPTION + 10% ANNUAL ESCALATION

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**

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**

WHAT SOURCE MIX FOR GENERATION?

- BEFORE 1985, 100% GENERATION FROM HYDRO
- AFTER 1985 --> RAICHUR THERMAL STATION
- AFTER 1993 --> DIESEL-BASED GENERATION ALSO
- HENCE, DECISION REQUIRED RE: HYDRO-THERMAL-DIESEL MIX

A STRATEGY FOR GENERATION

- STRATEGY FOR SOURCE MIX SHOULD BE FORMULATED:
  - CLEARLY AND TRANSPARENTLY
  - SUBJECTED TO PEER REVIEW
  - AND PREFERABLY COMPUTERIZED.
- DOES KARNATAKA HAVE A STRATEGY DOCUMENT?

KARNATAKA'S HYDEL RESERVOIRS

- RAIN-FED; NOT CONTINUOUSLY REPLENISHED BY PERENNIAL RIVERS
- INFLOW FROM SW MONSOON OCCURS IN A FEW MONTHS
- ONCE MONSOON IS OVER, NO POSSIBILITY OF FURTHER REPLENISHMENT UNTIL NEXT SW MONSOON
- HENCE, KARNATAKA'S HYDEL --> RENEWABLE RESOURCE ONLY ON A YEAR TO YEAR BASIS

HYDEL IS NON-RENEWABLE DEPLETABLE RESOURCE WITHIN ANY YEAR

- SO, WATER IN RESERVOIR HAS A COST BASED ON ELECTRICITY GENERATION FORGONE BY DISCHARGING WATER THROUGH TURBINES
- THUS, WATER IN RESERVOIR IS LIKE COAL FOR THERMAL POWER PLANTS

DIFFERENCES BETWEEN HYDEL & THERMAL POWER PLANTS

- (1) IF COAL-MINES & RAILWAYS COOPERATE, COAL SUPPLIES CAN BE PROCURED AT ANY TIME
- BUT, "PROCUREMENT" OF MONSOON WATER IS POSSIBLE ONLY ANNUALLY

DIFFERENCES BETWEEN HYDEL & THERMAL POWER PLANTS

- (2) HYDEL STATIONS CAN BE TURNED ON/OFF TO A GREATER EXTENT AND MORE OFTEN
- BUT COAL-BASED THERMAL PLANTS CANNOT BE TURNED DOWN WITH IMPUNITY
- HENCE, COAL-BASED THERMAL STATIONS --> BASE LOADS
- HYDRO STATIONS --> PEAK LOADS

REQUIRED --> AN INTEGRATED STRATEGY

- (1) MINIMIZING HYDRO DURING LOW-DEMAND MONTHS JUST AFTER SW MONSOON AND MAXIMIZING IT DURING HIGH-DEMAND PRE-MONSOON MONTHS
- POSSIBLE INSTRUMENT --> SEASON-OF-YEAR ELECTRICITY PRICING

REQUIRED --> AN INTEGRATED STRATEGY

- (2) MEASURES TO REDUCE EVAPORATION IN RESERVOIRS
- (3) EXPLOITATION OF STATE' SHARE OF CENTRAL POWER
- (4) MAINTENANCE SCHEDULES & COAL INVENTORY CONTROL FOR RAICHUR

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 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**

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%)**

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.

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 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)**

KARNATAKA'S POWER SECTOR: IMPORTANT POLICY MILESTONES

- (1) DECISION TO DE-METER IPS TO MEET METER SHORTAGE
- (2) TARIFF REVISION PROCESS RESULTING IN DIFFERENTIAL PRICING AND CROSS-SUBSIDY
- (a) ELECTRICITY TO IPS ON A HP BASIS (1981)
- (b) VIRTUALLY "FREE" ELECTRICITY (1990)

KARNATAKA'S POWER SECTOR: IMPORTANT POLICY MILESTONES

- (3) DECISION TO CAP SUPPLIES TO POWER-INTENSIVE HT USERS AND TO SHIFT KEB'S EMPHASIS TO ENERGIZATION OF IPS (1983-84)

ENERGIZATION OF IPS EQUATED TO GRID ELECTRIFICATION

- GRID ELECTRIFICATION --> ONLY ONE OPTTION FOR IPS
- MORE SUSTAINABLE OPTION --> ENERGIZATION VIA DECENTRALIZED SOURCES (WOOD GASIFIERS AND PV MODULES)

ENERGIZATION VS GRID ELECTRIFICATION

- UNFORTUNATELY, TIME WAS NOT RIPE FOR DISTINCTION BETWEEN ENERGIZATION AND GRID ELECTRIFICATION
- WOOD GASIFIERS BECAME PROVEN TECHNOLOGY ONLY A DECADE LATER
- PV MODULES WERE STILL TOO PROHIBITIVELY EXPENSIVE

(1983-84) ANTI-HT & PRO-IPS DECISION

- ADVANCED INTERESTS OF IPS-OWNING FARMERS AT EXPENSE OF LARGE INDUSTRY
- "CONSOLIDATING & STRENGTHENING POLITICAL POWER THROUGH ELECTRICAL POWER"

KARNATAKA'S POWER SECTOR: IMPORTANT TECHNICAL MILESTONES

- (1) ENDING OF COMPLETELY HYDRO SYSTEM IN 1985
- (2) RAICHUR CAME ON LINE WITH HIGHER COST ELECTRICITY
- (RELATIVE TO CHEAP HISTORICAL COSTS OF HYDRO POWER)
- THUS KEB'S AVERAGE COST ENTERED NEW REGIME

KARNATAKA'S POWER SECTOR: IMPORTANT TECHNICAL MILESTONES

- (3) INTRODUCTION OF DIESEL GENERATION --> STILL HIGHER COST-REGIME FOR KEB
- (4) WHAT WILL HAPPEN WHEN IPPs (COGENTRIX) ENTER PICTURE WITH STILL HIGHER COSTS?

SOURCE-MIX MILESTONES WITH PERFORMANCE IMPLICATIONS

- MU/MW AND PLF OF SYSTEM HAVE DECLINED
- COMPLICATIONS IN LOAD DISPATCH PROBLEM -- WHICH SOURCE TO USE FOR MATCHING DAILY/ANNUAL LOAD CURVE
- COMPUTERIZED SYSTEM FOR SUPPLY MANAGEMENT HAS NOT YET EVOLVED

SITUATION IS GOING TO GET EVEN MORE COMPLICATED

- WHEN IPPs COME INTO PICTURE AND ARE REWARDED IN PROPORTION TO PLF ABOVE CERTAIN MINIMUM PLF
- THEN, CHEAPER BASE-LOAD THERMAL PLANTS OF RAICHUR MAY HAVE TO BE BACKED DOWN

SITUATION IS GOING TO GET EVEN MORE COMPLICATED

- AND STILL CHEAPER PEAKING HYDRO PLANTS MAY HAVE TO BE IDLED
- IN ORDER TO PROVIDE PROFITS FOR EXPENSIVE COUNTER-GUARANTEED INDEPENDENT POWER PLANTS

WHO ARE THE WINNERS?

- (1) FARMERS OWNING IPS
- (2) POLITICIANS/POLITICAL PARTIES CHAMPIONING INTERESTS OF IPS-OWNING FARMERS
- (3) SOME SECTIONS OF KEB (GRID CONNECTIONS FOR IPS COULD BECOME LUCRATIVE)

WHO ARE THE WINNERS?

- (4) MANUFACTURERS & SUPPLIERS OF CAPTIVE GENSETS, UPSs, BACK-UP SUPPLIES, VOLTAGE STABILIZERS, ETC.
- (5) KARNATAKA'S POWER SECTOR (IPS PACKAGE USED TO HIDE TECHNICAL & COMMERCIAL SHORTCOMINGS (E.G., THEFT)

IMPLICATIONS OF "SHORTAGES" AND "CRISES"

- FERTILE GROUND FOR MALPRACTICES IN PROVISION OF CONNECTIONS, CONNECTED LOAD AND (LEGAL AND ILLEGAL) ELECTRICITY CONSUMPTION)
- THEY "JUSTIFY" INVITATIONS TO PRIVATE POWER WITH ALL ASSOCIATED BENEFITS INCLUDING JUNKETS

IMPLICATIONS OF "SHORTAGES" AND "CRISES"

- **UNSUBSTANTIATED "CONSPIRACY THEORY" --> LOAD-SHEDDING (EVEN THOUGH SUPPLY CAN MANAGE DEMAND) JUST TO CREATE A FAVOURABLE CASE FOR MEGA-PROJECTS**

IS THERE A FARMER-POLITICIAN NEXUS RE: ELECTRICITY

- **SOME POLITICIANS/POLITICAL PARTIES**
- **(a) HAVE PLEASED IPS-OWNING FARMERS & OBTAINED SUPPORT OF VOTE-BANKS UNDER AEGIS OF THESE FARMERS**
- **(b) HAVE EVEN ENSURED THAT GOVERNMENT IS NOT FULLY COMPENSATING SUBSIDY TO IPS OWNERS**

GOVERNMENT HAS PROMOTED INTERESTS OF IPS-OWNERS

- GOVT HAS ARRANGED THROUGH TARIFF REVISIONS TO GET SOME USERS (HT, LT, COMMERCIAL AND TO A SMALL EXTENT AEH USERS) TO PAY THE BILL FOR "FREE" ELECTRICITY THAT IT HAS ORDERED FOR IPS

WHO ARE THE LOSERS?

- (1) **HT, LT AND COMMERCIAL CONSUMERS** --> CROSS-SUBSIDIZE "FREE RIDERS" AND/OR SUFFER BECAUSE THEIR DEMAND CANNOT BE MET
- THEY ARE DIRECT LOSERS WITH HIGH TARIFFS AND SEVERE ENERGY & POWER CUTS FORCING THEM TO EITHER CUT PRODUCTION/SERVICES OR INSTALL CAPTIVE POWER GENERATION.

WHO ARE THE LOSERS?

- (2) **AEH USERS** PROVIDE A MINOR AMOUNT OF CROSS-SUBSIDY
- (3) **NON-AEH HOUSEHOLDS** MAY RECEIVE A VERY SMALL AMOUNT OF CROSS-SUBSIDY, BUT ALL HOUSEHOLDS HAVE NOT BEEN ELECTRIFIED.

NON-ELECTRIFICATION OF POOR HOUSEHOLDS

- ROUGHLY HALF THE POPULATION OF THE STATE (IN 1990) DID NOT BENEFIT DIRECTLY FROM ELECTRICITY.
- THUS, POWER SECTOR HAS BEEN EXPANDED IN THE NAME OF THE POOR, BUT IT HAS BYPASSED THE POOR
- OBVIOUSLY, UNELECTRIFIED HOUSEHOLDS LACK A POLITICAL LOBBY AND LEADERS TO PRESS FOR ELECTRIFICATION OF THEIR HOMES.

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**
- **(b) NO LONG-TERM PROJECTS WILL HAVE ANY IMMEDIATE IMPACT**

GOOD NEWS

- **KARNATAKA POWER SECTOR WAS NOT IN A CRISIS IN 1994-95**
- **AND PERHAPS NOT EVEN NOW**
- **A NUMBER OF IMMEDIATE MEASURES CAN REMEDY THE SITUATION**

SOME IMMEDIATE REMEDIES

- (A) REDUCE OUTFLOWS ON IPS --> DEBTS --> T & D --> ARREARS
- (B) INCREASE INFLOWS ON GRANTS FROM GOVERNMENT --> WHEELING

REDUCTION OF OUTFLOWS ON IPS

- **REQUIRES TARIFF REVISION.**
- **FARMERS MAY PREFER PRICED RELIABLE ELECTRICITY TO "FREE" UNRELIABLE ELECTRICITY**
- **BUT CREDIBILITY PROBLEM: FARMERS ARE UNLIKELY TO BELIEVE THAT KEB CAN EVER DELIVER RELIABLE ELECTRICITY**

REDUCTION OF OUTFLOWS ON IPS

- DEMONSTRATION PROJECTS FOLLOWED BY PILOT EXPERIMENTS
- TO PROVE THAT PRICED AND METERED RELIABLE ELECTRICITY BENEFITS FARMERS MORE THAN UNRELIABLE "FREE" UNMETERED ELECTRICITY

REVISION OF TARIFFS

- PRESENT TARIFF COMMITTEE
  - (A) IS SUBORDINATE TO GOVERNMENT
  - (B) DOES NOT HOLD PUBLIC HEARINGS
  - (C) PROCEDURES ARE NOT OPEN AND TRANSPARENT

REVISION OF TARIFFS

- **REQUIRED A DIFFERENT TYPE OF TARIFF COMMITTEE IS NECESSARY WITH**
- **(a) REPRESENTATION OF VARIOUS USER GROUPS -- HT, LT, COMMERCIAL, DOMESTIC, ETC.**
- **(b) INDEPENDENCE FROM GOVERNMENT**

REDUCTION OF OUTFLOWS ON DEBTS

- REQUIRES A HIGHER EQUITY-DEBT RATIO
- GOVERNMENT DECISION TO CAPITALIZE PART OF THE KEB'S DEBT

REDUCTION OF COMMERCIAL T & D LOSSES (THEFT)

- (1) UNWISE TO LEGITIMIZE DERELICTION OF DUTY AND ROBBERY OF PUBLIC REVENUES
- (2) ESSENTIAL TO CREATE A FAVOURABLE ENVIRONMENT
- (3) INSTITUTIONAL CHANGES MAY BE REQUIRED

A FAVOURABLE ENVIRONMENT

- IN WHICH TYPICAL EMPLOYEE OF KEB TENDS TO BE HONEST
- (1) A COMPONENT OF REWARD FOR HONESTY (INCENTIVES FOR BILLING AND COLLECTION WITH AN APPROPRIATE COMMISSION)
- (2) SEVERE PUNISHMENT FOR DISHONESTY BASED PERHAPS ON CRIMINAL PROCEEDINGS.

POSSIBLE INSTITUTIONAL CHANGES

- EMPLOYEE-OWNED DISTRIBUTION COMPANIES
- DISTRIBUTION COOPERATIVES INVOLVING CONSUMERS
- PRIVATE-SECTOR DISTRIBUTION COMPANIES
- (PERHAPS IN THAT ORDER)

REDUCTION OF ARREARS

- MANY OF OUTSTANDINGS ARE FROM MAJOR PUBLIC-SECTOR UNDERTAKINGS DEBTS OF KEB ARE TO OTHER PUBLIC-SECTOR UNDERTAKINGS LIKE KPCL
- HENCE, GOVERNMENT-MODERATED CONFERENCE OF POWER-SECTOR DEBTORS AND CREDITORS

INCREASE OF INFLOWS ON GRANTS

- GOVERNMENT MUST BE SCRUPULOUS ABOUT REIMBURSING LOSSES THAT IT INITIATES THROUGH ITS TARIFF INSTRUCTIONS
- FINANCIAL DISCIPLINE ON THE PART OF GOVERNMENT.

INCREASE OF WHEELING REVENUES

- POWER CAN BE TAPPED FROM CAPACITY OF CAPTIVE GENERATION SETS NOW BEING USED AT A LOW PLF
- PUBLIC UTILITIES REGULATORY POLICY ACT (PURPA) IN USA HAS MADE IT MANDATORY FOR UTILITY TO BUY-BACK DECENTRALIZED ELECTRICITY GENERATION AT AVOIDED COSTS.

HOUSEHOLD-LEVEL COGENERATION IN USA

- A HOUSEHOLD CAN RUN A SMALL 7.5 HP ENGINE-GENSET
- USE THE WASTE HEAT FOR HEATING THE HOME IN COLD WEATHER
- MAKE THE GENERATED ELECTRICITY RUN THE HOUSE METER BACKWARDS
- ALL WITH THE APPROVAL AND BLESSING OF THE UTILITY.

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 TOTAL 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

A WAY FORWARD

- **REALISTIC & SMALL MEASURES ON DEMAND & SUPPLY SIDES**
- **ALSO A VISION OF A SUSTAINABLE FUTURE**

DEMAND-SIDE MEASURES

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

DAILY PEAK SHAVING

- FLAT DAILY DEMAND CURVE WITHOUT PEAKS IS IDEAL
- HENCE, STEPS ARE REQUIRED TO MOVE TOWARDS SUCH A CURVE
- TIME-OF-THE-DAY METERING
- DIFFERENTIAL TARIFFS (HIGHER ELECTRICITY PRICES TO DISCOURAGE UTILIZATION OF ELECTRICITY DURING PEAK HOURS)

SEASONAL PEAK SHAVING

- **SEASON-OF-YEAR ELECTRICITY PRICING (LOWER PRICES IN THE LOW-DEMAND MONTHS JUST AFTER THE SOUTH-WEST MONSOON, AND HIGHER PRICES IN THE HIGH-DEMAND PRE-MONSOON MONTHS)**

EFFICIENT LIGHTING

- REDUCING THE EVENING PEAK ARISING FROM THE LIGHTING LOAD
- NEW LIGHTING DEVICES (E.G., COMPACT FLUORESCENT LAMPS)

EFFICIENT LIGHTING

- CFLs HAVE HIGHER INITIAL COSTS, BUT CONSUME ONLY ABOUT 25% OF THE ELECTRICITY USED BY CONVENTIONAL LAMPS, AND ALSO LAST MUCH LONGER.
- CFLs ARE NOW BEING MANUFACTURED IN INDIA BY A NUMBER OF FIRMS.

SOLAR WATER HEATERS

- TO REDUCE THE MORNING PEAK DUE TO WATER HEATING FOR BATHING SWH IN HOMES & APARTMENT BUILDINGS, AS WELL AS IN HOSPITALS, HOTELS, RESTAURANTS, CANTEENS, AND OTHER ESTABLISHMENTS
- A 100 LITRE/DAY CAPACITY SWH CAN SAVE ABOUT 1,000 UNITS/YEAR

SOLAR WATER HEATERS

- IF 250,000 HOUSES/APARTMENTS ARE FITTED WITH 100 LITRE/DAY SWH, SAVING IN PEAK CAPACITY WOULD BE ABOUT 270 MW
- (C.F., ONE KAIGA-TYPE NUCLEAR REACTOR IS 235 MW).

EFFICIENT IPS

- FRICTIONLESS FOOT-VALVES & HDPE-PIPING INSTEAD OF GI DELIVERY PIPES CAN SAVE ABOUT 35% OF ENERGY
- IF 250,000 IPS ARE FITTED WITH HDPE PIPES, RESULTANT SAVING WILL BE ABOUT 780 MUS ANNUALLY (CORRESPONDING TO ABOUT 320 MW).

EFFICIENT MOTORS

- INDUSTRY ACCOUNTS FOR ABOUT 30% OF THE CONSUMPTION
- ABOUT 70% OF THE ENERGY USED IN INDUSTRY GOES FOR DRIVES, PUMPS, COMPRESSORS, ETC.,
- ABOUT 25-35% OF THE ENERGY CAN BE SAVED WITH EFFICIENT MOTORS
- IF 10% OF THE MOTORS ARE IMPROVED, SAVING CAN BE AS MUCH AS ABOUT 410 MUS (ABOUT 110 MW)

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

ENVIRONMENTALLY SOUND HYDROELECTRIC PROJECTS

- STILL CONSIDERABLE HYDROELECTRIC POTENTIAL LEFT IN STATE
- OVER 1,600 MW CAN BE OBTAINED FROM "ENVIRONMENTALLY BENIGN" PROJECTS

REDUCING T & D TECHNICAL LOSSES

- CONSIDERABLE REDUCTION POSSIBLE IN TECHNICAL T & D LOSSES
  - (a) STRAIGHTENING OF OTHERWISE HIGGLEDY-PIGGLEDY LINES
  - (b) MINIMIZING OF THE LOW-TENSION LINES, ETC.

CAPTIVE GENERATION

- WITH SUITABLE INCENTIVES (WHEELING), A LARGE FRACTION OF INVESTMENT CAN BE HARNESSED BY GRID
- IF ONLY 25% OF THE 1,100 MW CAPTIVE GENERATION INSTALLED CAPACITY IS AVAILABLE TO THE GRID --> 270 MW.

SUGAR COGENERATION

- IF BAGASSE LEFT AFTER EXTRACTING THE SUGARCANE JUICE IS BURNED IN HIGH-PRESSURE BOILERS, SURPLUS ELECTRICITY CAN BE PRODUCED. ROUGHLY ABOUT 10 MW OF SURPLUS ELECTRICITY CAN BE PRODUCED PER SUGAR FACTORY
- HENCE, ABOUT 200 MW IN KARNATAKA
- KEB SHOULD OFFER WHEELING ARRANGEMENTS AND LONG-TERM GUARANTEES TO OFF-TAKE THE SURPLUS POWER.

BIOMASS-BASED RURAL ENERGY AND WATER SUPPLY UTILITIES (REWSUs)

- KARNATAKA HAS PIONEERED IN DEMONSTRATING BIOMASS-BASED RURAL ENERGY AND WATER SUPPLY UTILITIES (REWSUS)
- DECENTRALIZED ELECTRICITY FOR LIGHTING & DOMESTIC WATER CAN RELIEVE GRID OF BURDEN OF SUPPLYING VILLAGES

BIOMASS-BASED RURAL ENERGY AND WATER SUPPLY UTILITIES (REWSUs)

- IN THE FUTURE, VILLAGES CAN USE FUTURISTIC BIOMASS-BASED ELECTRICITY-GENERATION TECHNOLOGIES (E.G., FUEL CELLS) TO EXPORT BASE-LOAD ELECTRICITY WITH GRID TRANSMISSION FROM VILLAGES TO CITIES

SMALL HYDEL

- THERE IS CONSIDERABLE POTENTIAL FOR SMALL HYDEL
- AS MUCH AS 200 MW IN KARNATAKA

WIND

- CONSIDERABLE SCOPE FOR WIND TURBINES
- ESTIMATES OF A POTENTIAL FOR 50 MW

PHOTOVOLTAICS

- ULTIMATELY, A NICHE FOR PHOTOVOLTAICS FOR IRRIGATION AND SYSTEMS FOR ISOLATED HOMESTEADS

NON-CONVENTIONAL SOURCES

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 & NES

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

A NEW ENERGY PARADIGM

- SOLUTION FOR THE LONG TERM
- EMPHASIS MUST SHIFT FROM ENERGY CONSUMPTION TO ENERGY SERVICES AS AN INDEX OF DEVELOPMENT
- WHAT HUMAN BEINGS WANT IS NOT ENERGY PER SE (KWH, KILOCALORIES) BUT SERVICES THAT ENERGY PROVIDES (HEAT FOR COOKING, ILLUMINATION, WARMTH, MOBILITY, ETC.)

SHIFT FROM ENERGY CONSUMPTION TO ENERGY SERVICES

- NOT A SEMANTIC TRICK
- ENERGY SERVICES CAN BE INCREASED BY INCREASING ENERGY SUPPLIES AND ENERGY CONSUMPTION OR/AND BY IMPROVING EFFICIENCY
- WHICH IS A BETTER OPTION DEPENDS UPON THE RELATIVE COSTS, CONVENIENCE ETC.

IMPORTANCE OF DECENTS & EUEIs

- DECENTS & EUEIs MUST BE BROUGHT INTO THE SCOPE OF INCREASING ENERGY SERVICES
- DISCUSSION MUST NOT BE RESTRICTED TO EXPANSION OF ENERGY SUPPLIES.

ENERGY "FUNDAMENTALISM"

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

LEAST-COST PLANNING

- RATIONAL APPROACH IS TO IDENTIFY A LEAST-COST MIX OF THESE THREE POTENTIAL CONTRIBUTIONS TO THE EXPANSION OF ENERGY SERVICES

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

EACH OF MEASURES MAY NOT CONTRIBUTE MORE THAN TENS OR HUNDREDS OF MEGAWATTS

BUT WHOLE PACKAGE CAN YIELD AS MUCH AS, IF NOT MORE THAN, ONE OF THE MEGA-PROJECTS BEING TALKED ABOUT.

METHODOLOGY OF IDENTIFYING THIS LEAST-COST MIX

- BASED ON INTEGRATED RESOURCE PLANNING (IRP)
- REGULATORY COMMISSIONS HAD MADE IRP MANDATORY FOR 40 OUT OF 50 STATES IN THE USA

LEAST-COST ELECTRICITY PLANNING

- FIRST EXERCISE FOR KARNATAKA WAS DONE IN 1991.
- IEI IS REFINING THIS EXERCISE
- HOPEFULLY, THIS UPDATED EFFORT WILL NOT BE IGNORED AS THE FIRST ONE WAS.

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

THE MORAL:
LOOK AFTER THE PEOPLE
AND ELECTRICITY WILL
LOOK AFTER ITSELF!