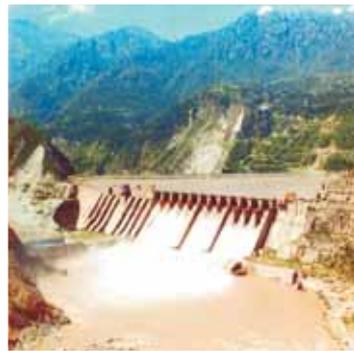
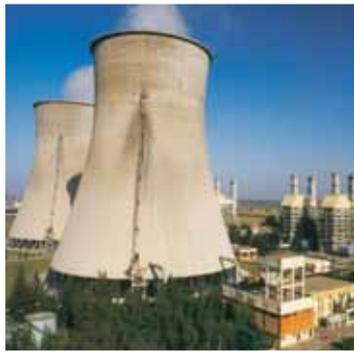


INDIAN POWER SECTOR

Challenges & Investment Opportunities



सत्यमेव जयते

Ministry of Power
Government of India

Website : www.powermin.gov.in

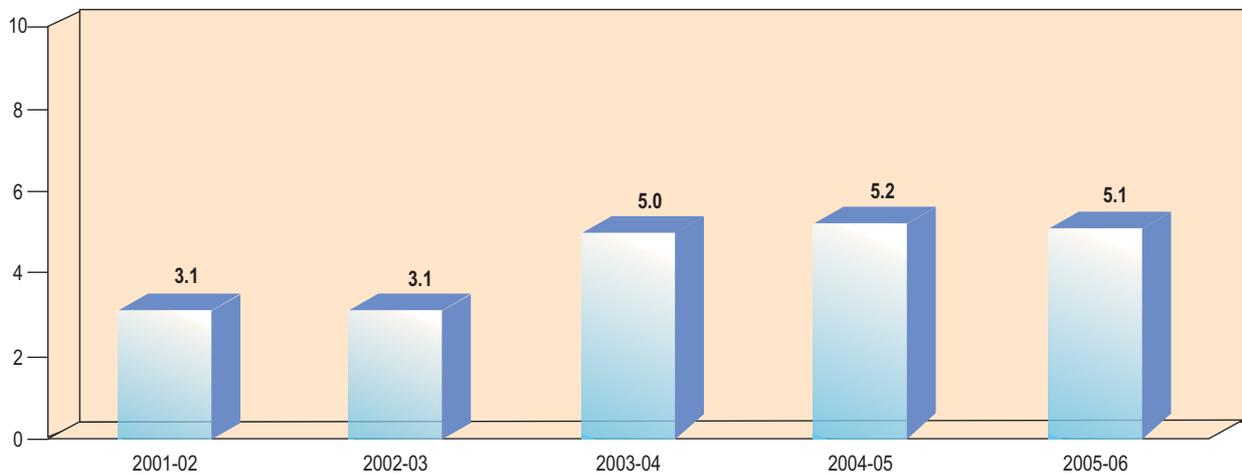
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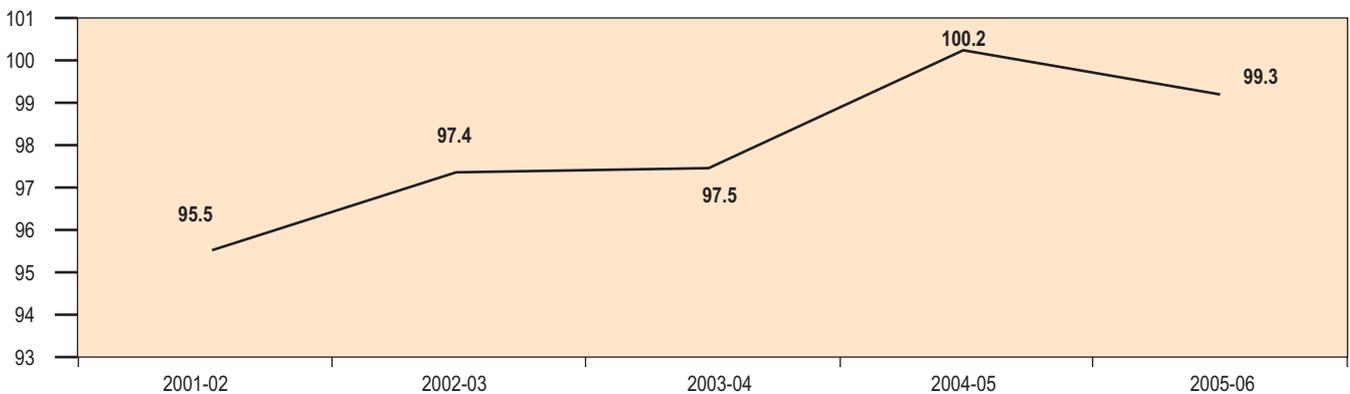
I. INTRODUCTION

Growth of the Indian economy is targeted to be over 8%. Energy has to play critical role in sustainable development of the economy. According to sectoral analysis for achieving growth of such a magnitude, electricity, gas and water supply sector put together should also grow by 8%. As per Economic Survey 2005-06, the average growth in the economy have been estimated to be 7% in first four years ending 2005-06. Year wise actual growth of GDP in real terms was to the tune of 4.2% during 2002-03, 8.5% during 2003-04, 7.5 % during 2004-05 advance estimates project the growth of economy to the tune of 8.1% during 2005-06. Electricity generation growth which was around 3.1% towards the end of IX Plan (2001-02) has increased to over 5.1% during the last three Years of Tenth Plan. The year wise details are given below:

Growth of Generation



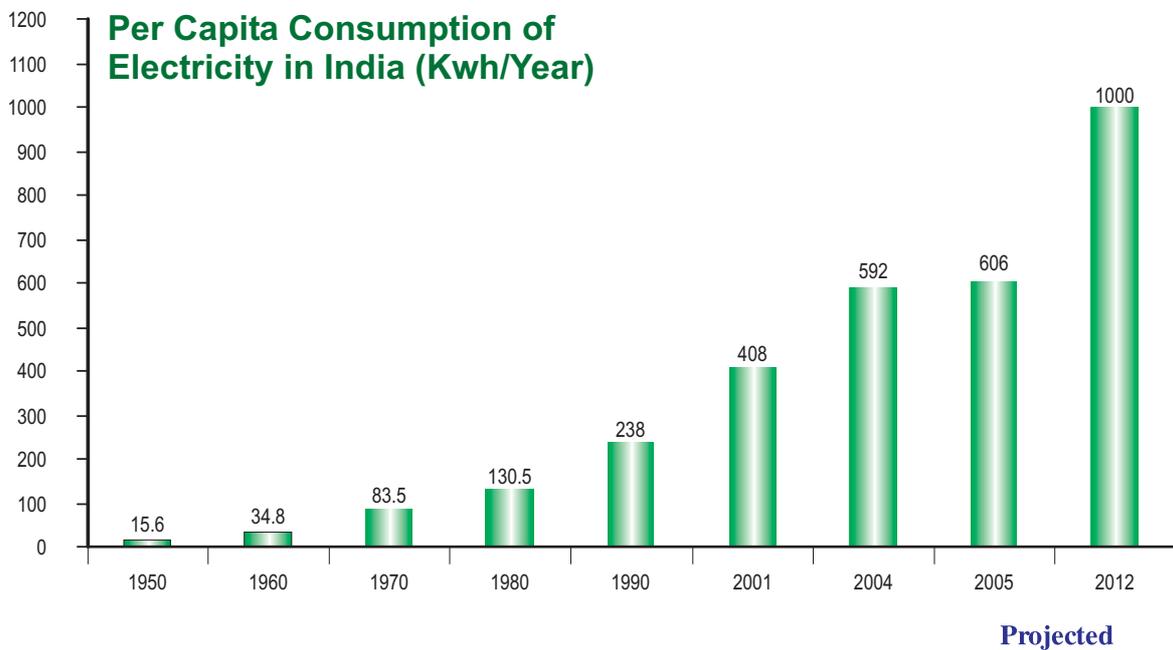
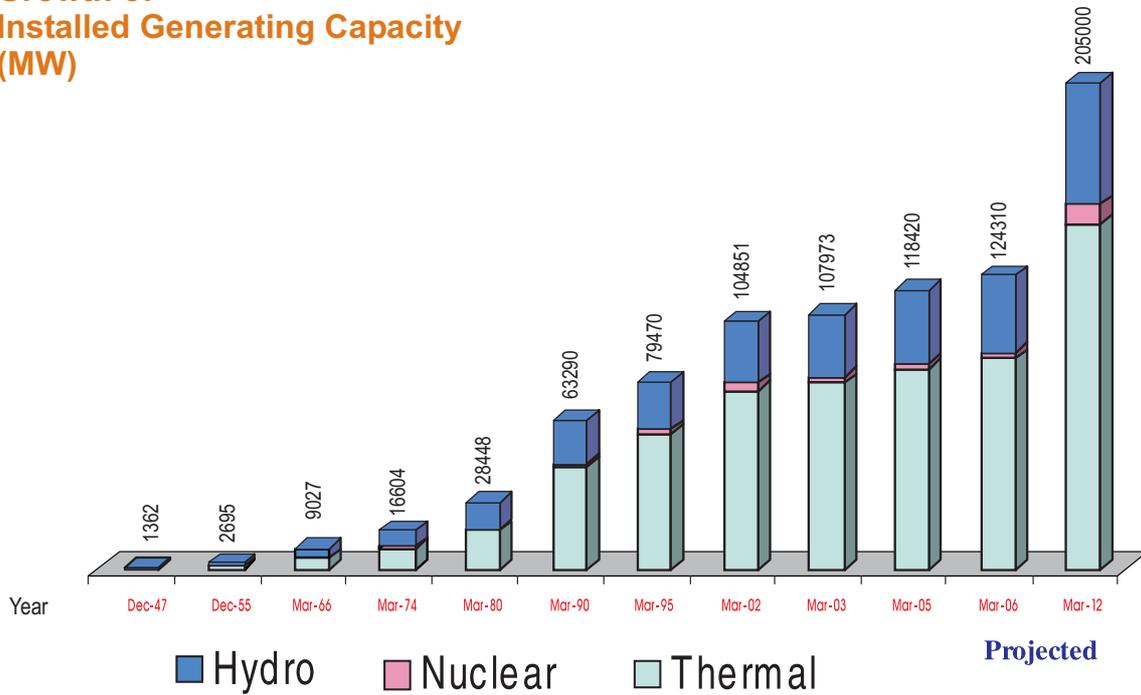
Electricity Generation as % of Target



2. Since independence, there has been sizeable growth in the power sector. Generating capacity in the country which was only 1362 MW has increased to 124 GW today. Despite, rapid increase in population over period of

time, per capita consumption has increased from 15 Kwh to 606 Kwh during the same period. Growth profile in respect of installed capacity and per capita electricity consumption is given in figures presented below :

Growth of Installed Generating Capacity (MW)



3. The power supply position is characterized by shortages both in terms of demand met during peak time and overall energy supply. The peaking shortage is much more in every region and it is about 12% on all India basis. The energy shortages on regional basis are varying in magnitude and overall shortage on all India basis is about 7%. To meet the growing demand and shortages encountered in various regions, generation capacity is required to be doubled in 10 years between 2006-2016, so that the total demand both in terms of peak and energy can be met.



Gas Based Power Station - Auraiya

II. POWER SECTOR PERFORMANCE

(a) **Generation:**

- After United States, China, Japan, Russia, and Canada, India ranks Sixth in terms Electricity Generation. Power generation in 2004-05 was 587.365 billion Kwh. During 2005-06, the electricity generation was over 617 BU, which is about 99.3% of the target, a growth of 5.1% over previous year.
- As per Mid Term Appraisal of the Tenth Plan, capacity addition projected was about 36,000 MW. Against this, the likely achievement is expected to be around 34,000 MW, which would be almost equal to the total capacity addition achieved during Eighth and Ninth Plan put together. In addition, about 5000 MW captive power is being attempted to be connected to the grid

• **Benchmarks for setting up of power projects.**

Coal Based

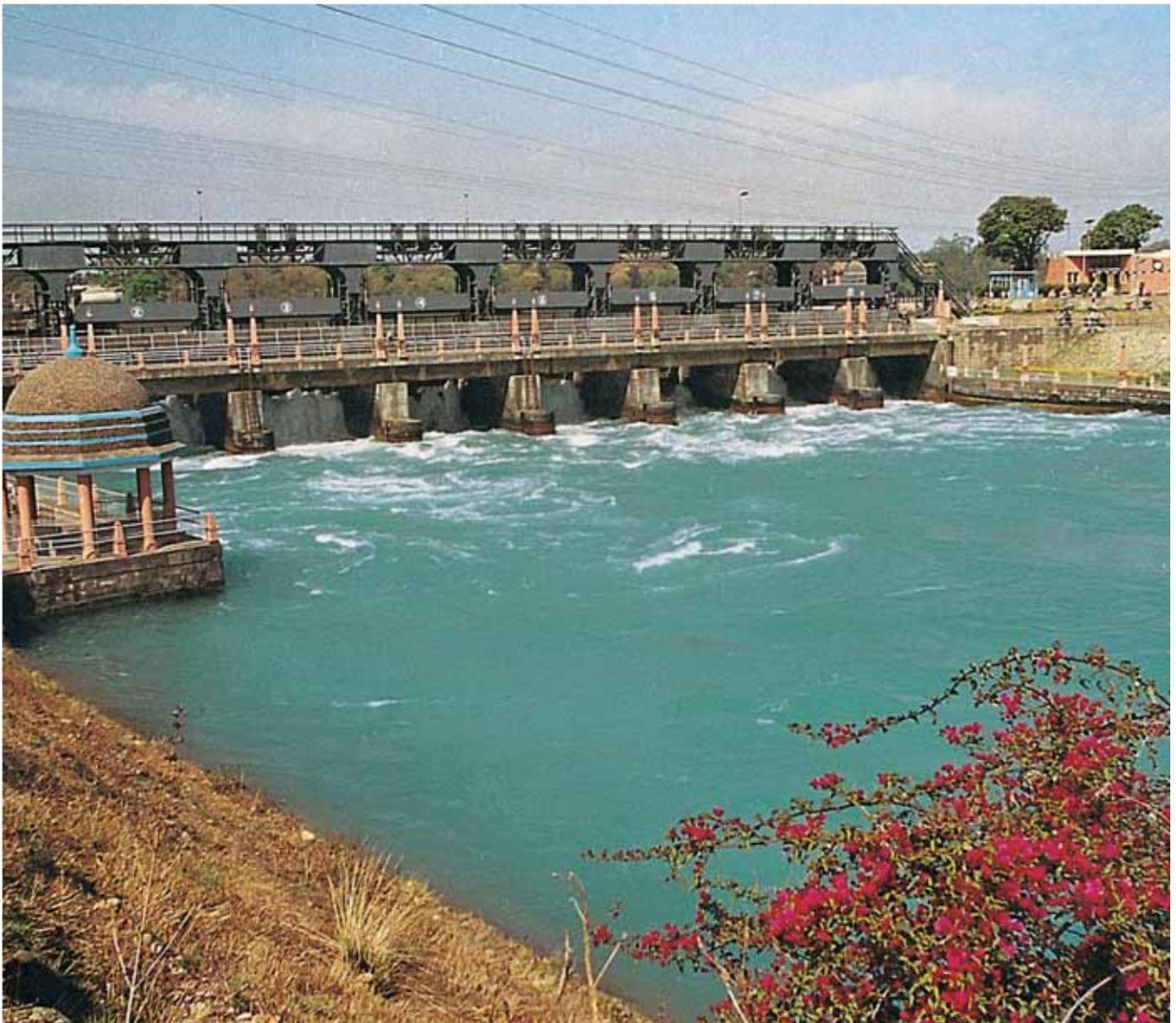
- ♦ The Average lead time for the 500 MW unit reduced from 49 months to 38 months. The Ramagundam STPS-III of NTPC commissioned in 37 months
- ♦ The Average lead time for the 210/250 MW units reduced form 32 months to 28 months. The Raichur TPS unit of KCPL commissioned in 26 months.

Gas Based

- ♦ Average lead time for gas based project has come down from 24 months to 20 months. Ramgarh CCPP open cycle commissioned in 15 months.

Hydro Based

- ♦ Average lead time of new Hydro project is likely to be 60 months. Chamera II (3x100 MW) of NHPC commissioned in 49 months.
- The Plant Load Factor (PLF) is an important measure of the operational efficiency of thermal power plants. The PLF of the overall system has improved significantly from 64.6% in 1998-99 to 74.8 in 2004-05 . Thus, implying a secular improvement in the efficiency of generation.
- There has been a quantum increase in the investment in the power sector. In the beginning of the X Plan (April, 2002), about 24,000 MW worth projects with the estimated cost of \$20,568 million were under execution. 46 projects of these (14,300 MW) have been completed. Besides, at present, 83 generation power projects totaling above 41,559 MW with a total estimated cost of \$43,832 million are under execution. Out of these projects, 45 projects totaling 23,783 MW with a total estimated cost of \$22,125 million pertain to thermal and 32 totaling 13,806 MW with a total estimated cost of \$15,100 million pertain to hydro projects and remaining 6 projects



Harnessing the Water Resources

pertain to nuclear segment. The sector-wise details are given in table below:-

PROJECTS UNDER CONSTRUCTION

| At the beginning of X Plan | | | As on March 2006 | |
|----------------------------|--------------------------|------------------------------|------------------|------------------------------|
| | Installed Capacity MW | Estimated Cost million \$ | Capacity MW | Estimated Cost million \$ |
| Thermal | | | | |
| Central | 4630 | 4150 | 9920 | 9498 |
| State | 2090 | 1750 | 7406 | 6318 |
| Private | 2312 | 2318 | 6457 | 6309 |
| Total | 9032 | 8218 | 23783 | 22125 |
| Hydro | | | | |
| Central | 5465 | 3357 | 8423 | 9778 |
| State | 4721 | 2592 | 3791 | 4705 |
| Private | 700 | 573 | 1592 | 618 |
| Total | 10886 | 6523 | 13806 | 15100 |
| Nuclear | | | | |
| Central | 3960 | 5826 | 3970 | 6607 |
| Total | 3960 | 5826 | 3970 | 6607 |
| Central | 14055 | 1333 | 22313 | 25882 |
| State | 6811 | 4343 | 11197 | 11023 |
| Private | 3012 | 2891 | 7149 | 6927 |
| Total | 23878 | 20568 | 41559 | 43832 |

- Based on demand projections and also on preparedness, tentatively, we are aiming at developing over 62,000 MW of capacity during the 11th Plan period. The following table presents the breakup of these capacities into thermal, hydro, nuclear etc.

| | | |
|------------------------------|---|------------------|
| Hydro | - | 15,000 MW |
| Nuclear | - | 3,000 MW |
| Thermal (Coal* + Lignite) | - | 38,000 MW |
| Gas/LNG | - | 6,000 MW |
| Non-conventional Sources | - | 5,000 MW |
| TOTAL: | - | 67,000 MW |

* About 8,000 MW on imported/blended coal.

(b) Transmission:

- Indian power system is demarcated into five independent regional grids viz. Northern, Eastern, Western, Southern, and North-eastern Regions. All the regional grids, except Eastern and North-eastern Regions, operate independently with only a limited exchange of power across the regions.
- The length of 400 KV (765 KV / operated at 400 KV) and HVDC bi-pole transmission lines in the country is of the order of 56,000 circuit kilometers and 6000 circuit kilometers respectively and the transformation capacity in 400 KV substations is 66 GVA and HVDC capacity is 8 GW.



- Inter-regional connectivity has been planned with hybrid systems consisting of HVDC, Ultra High Voltage AC (765 KV) and Extra High Voltage AC (400 KV) lines. The present inter-regional capacity is 9,500 MW and projects in hand indicate that this capacity would be enhanced to 17,000 MW by 2007. This capacity is further slated to grow to 37,000 MW in 2012.

(c) Distribution sector reforms:

With the advent of economic liberalization in 1991, the power sector was the focus of attention for attracting private investment specially FDI in generation. Eight fast track projects were even offered counter guarantees for payment by the Central Government in addition to the guarantees of the State Governments. By 1995-96, 57,000 MW of projects were proposed by potential developers and 27,000 MW had received techno-economic clearance from the Central Electricity Authority. These were all MOU based projects with negotiated costs and tariffs. In the absence of a transparent process of bidding, many of these had high costs. Due to lack of adequate payment security mechanisms, combined in some cases with public perceptions of high cost in tariffs, most of these projects did not get implemented. Since 1990 till date only 9922 MW of generation has come in the private sector.

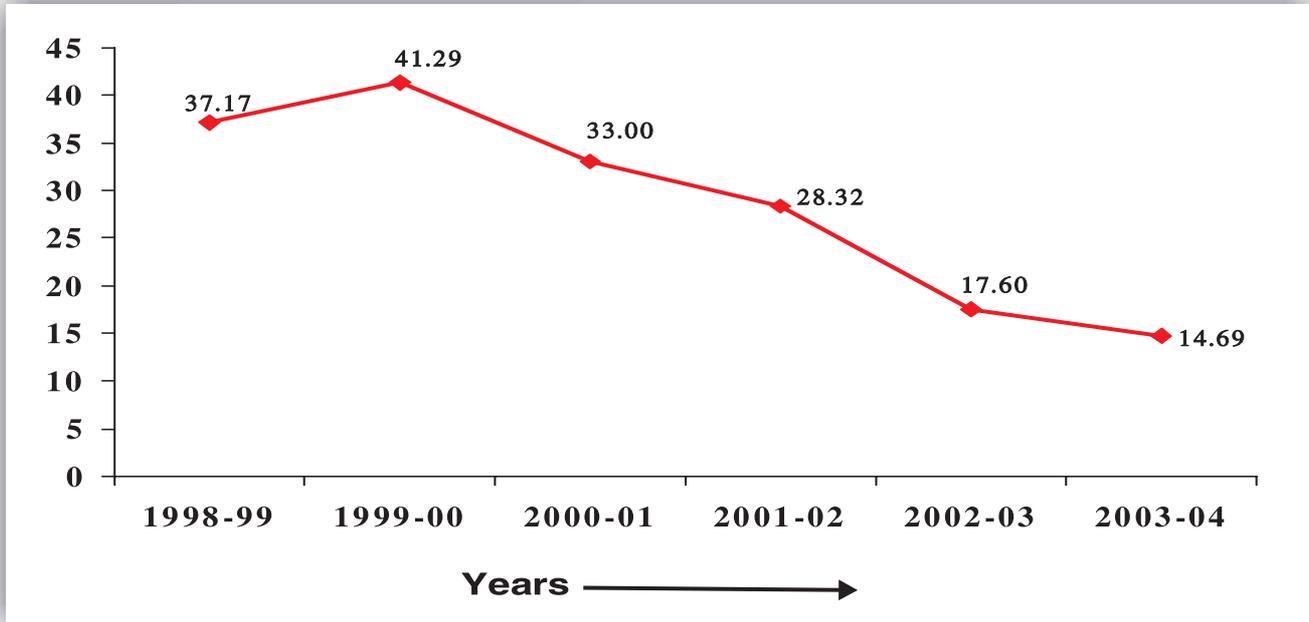
The decade of the 1990s also saw the gradual deterioration of the financial health of State Electricity Boards. Towards the latter half of 1990s, it was apparent that the deterioration in the finances of the State Electricity Boards was becoming unsustainable. Restoration of the financial health of the State Electricity Boards / State Utilities was recognized as the most critical challenge facing the sector. In this context it became clear that the distribution sector needed urgent attention if the trend of deteriorating financial health had to be reversed. The reversal would need a combination of the following key measures:-

- i) Control of theft of electricity
- ii) Reduction in the cost of supply through reduction in technical losses.
- iii) Better management and lowering the cost of generation
- iv) Payment of user charge and Tariff rationalization

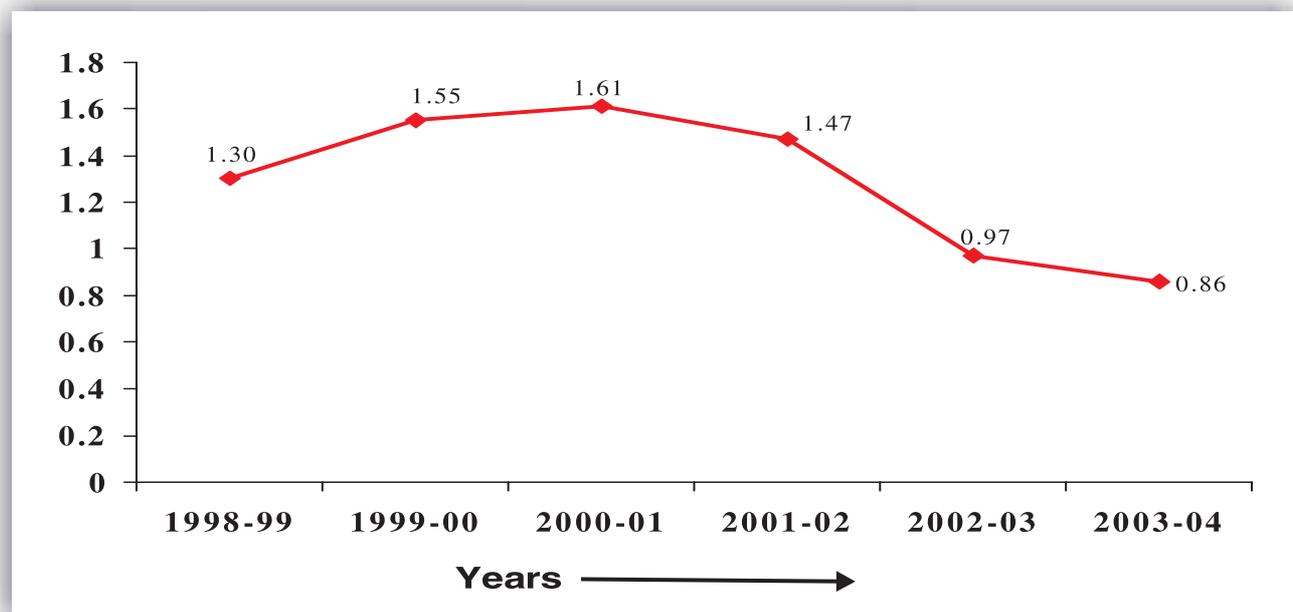
Attention over the last few years has been focused on each of these aimed at distribution sector reform. There has been significant progress. Notwithstanding encouraging initial results, the task ahead is quite difficult. Momentum achieved needs to be sustained with the requisite regulatory intervention and political consensus and will, which is being created.

The following briefly summarizes the reversal of ever-increasing losses:

Commercial Losses of State Utilities as % of Turnover (Without Subsidy)

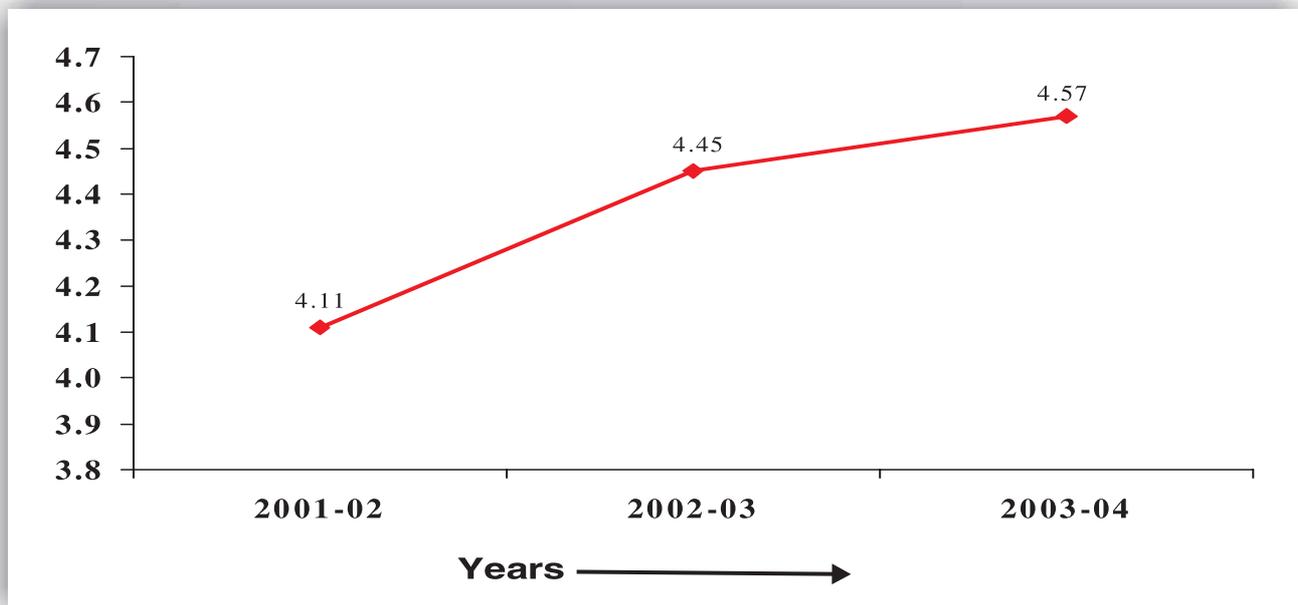


Revenue Gap (Cents/kWh) Difference between Average Cost of Supply (ACS) and Average Revenue Realised (ARR)



Tariff Rationalisation and Improved Collection Efficiency

Average Revenue Realised (ARR) (Cents/kWh)



A coal based power station - Simbadri

III. REFORM INITIATIVES

a) The Electricity Act

The Electricity Act, 2003 has created a new paradigm for the development of power sector in the country. It has abolished the monopoly of the State Electricity Boards created through the Electricity (Supply) Act, 1948 and has created a new competitive framework for the development of the power sector in the country with focus on the consumers and safeguarding of their interests by independent Regulatory Commissions. The Act has eliminated / reduced entry barriers in the entire chain of the electricity supply business.

It marks the culmination of the process beginning in the mid nineties of States enacting their own Reform Acts and the enactment of the Electricity Regulatory Commission Act of 1998 which brought into place the Central Electricity Regulatory Commission and authorized the States to create SERC if they wished to do so.

The key features of the Act are:

- Independent Regulatory Commissions in the States as well as in the Centre
- Freeing up of thermal generation from the requirement of any prior clearances
- Full freedom for setting up captive power plants including group captive power plants
- Open access in transmission; creation of an all-India market
- Private investment in transmission through licensing by Regulatory Commissions. This is in addition to full freedom for building dedicated transmission lines
- Open access in distribution to be introduced in phases with consumers above 1 MW getting the right of open access, latest by January, 2009
- Enabling provision for more than one distribution licenses in the same area.
- Prescription of performance standards for distribution licensees and its enforcement by Regulatory Commissions.
- Multi-year tariff framework for performance based regulation to incentivise efficiency gains.
- Competitively bid generation tariffs to be accepted by Regulatory Commissions. Power purchase costs of customers availing of open access to be market determined.
- An Appellate Tribunal for quick disposal of appeals against decisions of State Regulatory Commissions / CERC.

Under the Act, most of the rules have been prescribed. Open access in transmission has become a reality.



b) National Electricity Policy

The National Electricity Policy has been notified. The salient features of the Electricity Policy are as follows:

- Access to Electricity Available for all households in next five years.
- Availability of Power Demand to be fully met by 2012. Energy and peaking shortages to be overcome and spinning reserve of 5% to be available at the national level.
- Supply of Reliable and Quality Power of specified standards at reasonable rates.
- Per capita availability of electricity to be increased to over 1000 units by 2012.
- Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.
- Full development of hydro potential of the country.
- Choice of fuel for thermal generation to be based on economics of generation and supply of electricity.
- Development of National Grid.
- Availability based tariff (ABT) to be extended to State level.
- All India transmission tariff sensitive to distance and direction to be introduced by CERC.

c) Tariff Policy

The National Tariff Policy has been notified. The salient features of the Electricity Policy are as follows:

- Tariff of Generation and Transmission Projects in Private Sector determined through competitive bidding to be accepted by Regulatory Commission.
- Reduction of cross subsidy to (+) (-) 20% of average tariff in next five years.
- Facilitating Open Access in Distribution; clear formulation on cross subsidy surcharge.
- Transmission Tariff framework to be sensitive to distance and direction.
- Strict Implementation of Performance Standards.
- Time-bound introduction of Multi Year Tariff.



Barrage of Hydro Power Station - Uri

IV. LONG TERM PERSPECTIVE PLANNING

Capacity addition requirement in line with growth in economy

To meet the ever increasing requirements of the economy, electricity generation capacity has to be increased at sustained manner at the rate of over 7% per annum. As shown in the table given below, even if we presume modest growth of 7% by the end of 15th Plan, the total capacity requirement would be well over 7,62,000 MW. In case, 9% growth rate is anticipated in the economy, assuming one to one correspondence, the required capacity by the end of the 15th Plan would be over 12 lakhs MW.

Private participation in power sector

| Year/By end of Plan | Generation in BU with growth assumption of | | | Capacity in MW with growth assumption of | | |
|--|--|------|------|--|--------|---------|
| | 7% | 8% | 9% | 7% | 8% | 9% |
| Reference year 2006-07(10 th Plan) | 700 | 700 | 700 | 140500 | 140500 | 140500 |
| 2011-12(11 th Plan) | 982 | 1029 | 1077 | 197060 | 206440 | 216180 |
| 2016-17(12 th Plan) | 1377 | 1511 | 1657 | 276385 | 303330 | 332615 |
| 2021-22(13 th Plan) | 1931 | 2221 | 2550 | 387645 | 445690 | 511770 |
| 2026-27(14 TH Plan) | 2709 | 3263 | 3923 | 543690 | 654865 | 787420 |
| 2031-32(15 th Plan) | 3799 | 4793 | 6036 | 762555 | 962210 | 1211540 |

Projections of per capita consumption of electricity under different growth scenario

| Year | Projected population (Million)* | Growth per capita consumption of electricity under different scenario | | |
|--------------------------------|---------------------------------|---|------|------|
| | | 7% | 8% | 9% |
| 2006-07(10 th Plan) | 1114 | 628 | 628 | 628 |
| 2011-12(11 th Plan) | 1197 | 820 | 859 | 900 |
| 2016-17(12 th Plan) | 1275 | 1080 | 1185 | 1299 |
| 2021-22(13 th Plan) | 1347 | 1434 | 1649 | 1893 |
| 2026-27(14 TH Plan) | 1411 | 1920 | 2313 | 2781 |
| 2031-32(15 th Plan) | 1468 | 2588 | 3265 | 4111 |

*Projections have been worked out based on the information of Registrar General of India as quoted in Economic Survey 2004-05

V. DEVELOPMENT OF ULTRA MEGA PROJECTS

The Government of India has envisaged in its Mission, Power to All by 2012. Achievement of this target requires development of large capacity projects.

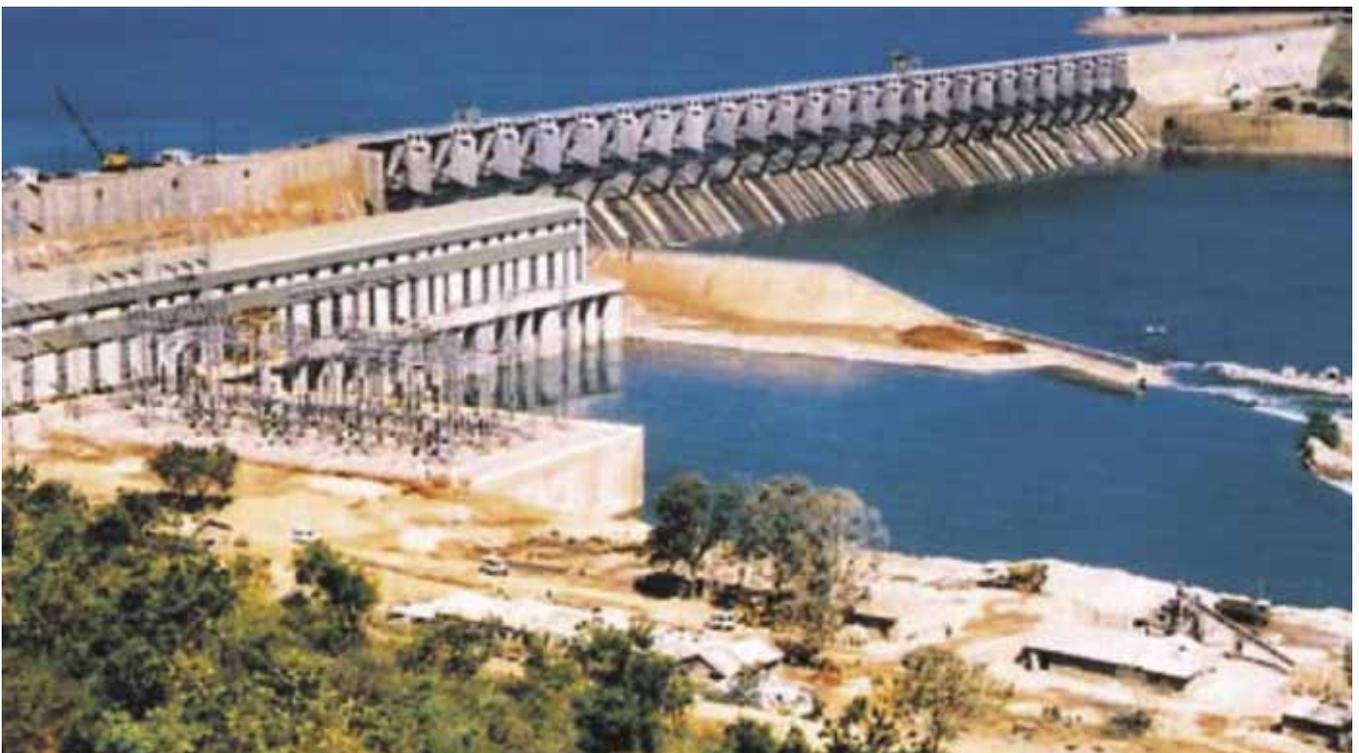
Section-63 of the Electricity Act, 2003 provides that the Regulatory Commissions shall adopt the tariff if it is determined through transparent process of bidding in accordance with the guidelines issued by the Central Government. This aims at moving away from cost-plus support for tariff determination and it is expected to further encourage private sector investment. Guidelines for competitive bidding for determination of tariff for procurement of power by distribution licensees were issued on 19th January, 2005. The policy stipulates that all future requirement of power needs to be procured competitively by distribution licensees except in cases of expansion of existing projects and where regulators will need to resort to tariff determination based on norms.

Recognizing the fact that economies of scale leading to cheaper power can be secured through development of large size power projects, Ministry of Power, CEA, and Power Finance Corporation are working together for development of five ultra mega power projects under tariff based competitive bidding route. These projects will be awarded to developers on Build, Own, Operate (BOO) basis. The Ultra Mega Power Projects each with a capacity of 4000 MW, would also have scope for further expansion. The size of these projects being large, they will meet the power needs of a number of states through transmission of power on regional and national basis.

Role of Ministry of Power

Ministry of Power is playing an important role as a facilitator to coordinate with concerned Ministries/ agencies and State Govts. for ensuring:

- Coal block allotment/ coal linkage
- Environment/ forest clearances
- Required support from State Government and its agencies



Storage of water for electricity generation

- financial closure by Financial Institutions
- To facilitate PPA and proper payment security mechanism with State Govt./ State Utilities.
- Monitoring the progress of Shell Companies w.r.t. predetermined timelines.

These Ultra Mega Power Projects will add 20,000 MW at five locations within a span of 7-8 years and help in achievement of the targets for capacity addition.

In order to enhance investors' confidence, reduce risk perception and get good response to competitive bidding, 5 Shell Companies have been set up as wholly owned subsidiaries of Power Finance Corporation Ltd. (a Govt. of India Undertaking) to facilitate tie-up of inputs, linkages and clearances for these projects. These companies will undertake preliminary studies and obtain necessary clearances and tie-ups including water, land and power selling arrangements etc. prior to award of these projects to successful bidders by way of selection of developers through a tariff based ICB. The Shell Companies shall also facilitate the process of obtaining environmental clearance.



Taking electricity to rural masses

In the first phase, two projects at coal pit heads based on indigenous coal and three projects at coastal locations based on imported coal have been identified for development.

Five wholly owned subsidiaries have been established by Power Finance Corporation Ltd. for taking up developmental work. These are :-

- 1) Sasan Power Limited for pit head project at Sasan (Madhya Pradesh)
- 2) Akaltara Power Limited for pit head project at Akaltara (Chhatisgarh)
- 3) Coastal Gujarat Power Limited for imported coal based project at Mundra (Gujarat)
- 4) Coastal Karnataka Power Limited for imported coal based project in Karnataka
- 5) Coastal Maharashtra Mega Power Limited for imported coal based project in Maharashtra
- 6) Two more projects, a pit head site in Orissa and a coastal site in Andhra Pradesh are being explored.

Role of Shell Companies

- a. Appointment of Consultant to undertake preparation of bankable Project Report
- b. Initiate land acquisition proceedings
- c. Allocation of fuel linkages/ fuel blocks for pit-head projects
- d. Allocation of water by State Government
- e. Appointment of Consultant for International Competitive Bidding (ICB) document preparation and evaluation.
- f. Obtain various approvals and statutory clearances.

- g. Tie-ups for off-take/sale of power
- h. Initiate action for development of the power evacuation system and grid tolerance considering the addition of capacity by these projects.

Payment Security

Post Electricity Act, 2003, industry structure has undergone several changes. The payment security mechanism for off-take of power from these projects would be as follows :-

- Revolving letter of credit (LC) by distribution licensees.
- Agreement on Escrow account establishing irrevocable claims on receivables of utilities at the time of PPA itself.
- In case of default, direct supply to HT consumers as per provision of Electricity Act, 2003. Open access in Transmission is already operational. Open access in Distribution being introduced by Regulatory Commissions. Act mandates it latest by January, 2009.



Jhanor Gandhar - a gas based power station

Roadmap for Bidding Process

| | Tentative Schedule |
|--|--------------------|
| 1. Notice for Expression of Interest | 31.01.2006 |
| 2. Bidders Conference for Sasan/Mundra | 21.02.2006 |
| 3. Submission of Expression of Interest | 28.02.2006 |
| 4. Issue of RFQ Documents | 31.03.2006 |
| 5. Submission of Bids (RFQ) | 14.05.2006 |
| 6. Issue of RFP Documents | 01.07.2006 |
| 7. Submission of Bids (RFP) | 30.09.2006 |
| 8. Selection of Developer/ Transfer of SPV | 31.12.2006 |

It is proposed to transfer these SPVs to the successful bidders at the end of the bidding process, on payment of development costs incurred by each SPV.

Salient Features of The Plant

- Super critical environment friendly technology
- Unit size of 800 MW (some flexibility in size, provided energy efficiency is comparable to such super critical technologies)
- Integrated power project with dedicated captive coal blocks.
- Coal transportation through Marry Go Round (MGR) system.
- High voltage transmission of 765 KV



Water Reservoir of a Hydro Power Plant

Bidders' Conference

- Bidders' Conference for Sasan & Mundra inaugurated by Union Minister of Power at New Delhi on February 21, 2006.
- The Conference attended by about 35 companies including several overseas bidders.
- Suggestions received have been incorporated in the Bidding Documents
- Once the agencies are qualified, tariff should be the only consideration for selection.
- Experience of development of power projects alone should not be an essential requirement, otherwise competition would be restricted.
- Government should ensure coal block allotment and substantial progress on environment clearance.
- To cover the development risk, the successful bidder shall provide a development security (Performance Bond).

Expression of Interest for Sasan and Mundra Projects

- EoI for Sasan, MP and Mundra, Gujarat have been very encouraging. About 30 to 33 companies globally participated in each project.
- Some of the global players are :
Korea Electric Power Co., Mitsui & Co. Tokyo, Tronoh Alco Combine (Malaysia), Duncan Macneil, London, Khanjee Holding (US) Inc. Texas, Sumitomo Corporation

- The domestic players include all major Groups in power sector such as :
Aditya Birla Power Company Ltd., Essar Power Ltd., GMR Energy Ltd., GVK Consortium, Secunderabad, Jayprakash Associate, Larsen & Turbo Limited, Reliance Energy Limited, Tata Power Limited, Torrent Private Limited including Public sectors like NTPC and NLC etc.

EOI for other projects

- EOI for Girye, Maharashtra has been received on 31st March, 2006. 22 leading national and international companies have shown interest for participating in this project.
- EOI for Tadri, Karnataka has been issued on 10th March, 2006 and expected submission date is 10th April, 2006.
- EOI for Orissa & Andhra Pradesh Ultra Mega Power Projects expected date of issue is 15th April, 2006.

Request for Qualification (RFQ) for Sasan and Mundra

- The document for RFQ has been issued for Sasan and Mundra on 31st March, 2006. The expected date of submission for the same is 15th May, 2006.

Investment Opportunity

The Ultra Mega Projects being developed based on super critical technology would entail substantial investment to the tune of Rs.15,000 crores or USD 3000mln for each project. With the prevailing debt-equity ratio of 70:30, it requires large equity of the order of Rs.4500 crores or USD 900mln which may come through domestic sources or FDI rout. It was indicated by the financial institutions that for good and credible developers and for power projects offering cheaper tariff, debt funding may not be a constraint at all. A long term Bond market and take out financing would be useful and render better tariff. The sectoral capping and the group exposure capping for the purpose of debt financing, as notified by the RBI, expected to be revisited and properly enhanced exclusively for these Ultra Mega Projects. Development of these large projects would have to have the involvement of large private business groups, who either on their own or through consortiums from within and outside could take up implementation of these projects.

Involvement of Financial Institutions (FIs)

To keep the financial institutions update about the developments in setting up of Ultra Mega Projects, FIs are being involved at various stages including the selection of consultants and final evaluation of the bids for selection of developer.

Major policy issues including selection of consultants are decided in consultation with the Inter Institutional Committee consists of

- Representatives of FIs (MD SBI, MD IDFC and ED IDBI)
- Member(Thermal), CEA
- Director (Projects), PFC,

Final Bid Evaluation for Selection of Developer will be decided by Apex Evaluation Committee consists of

- Chairperson/CEO of the lead FI,
- Chairperson, CEA
- CMD, PFC
- Representative of the power purchasers.

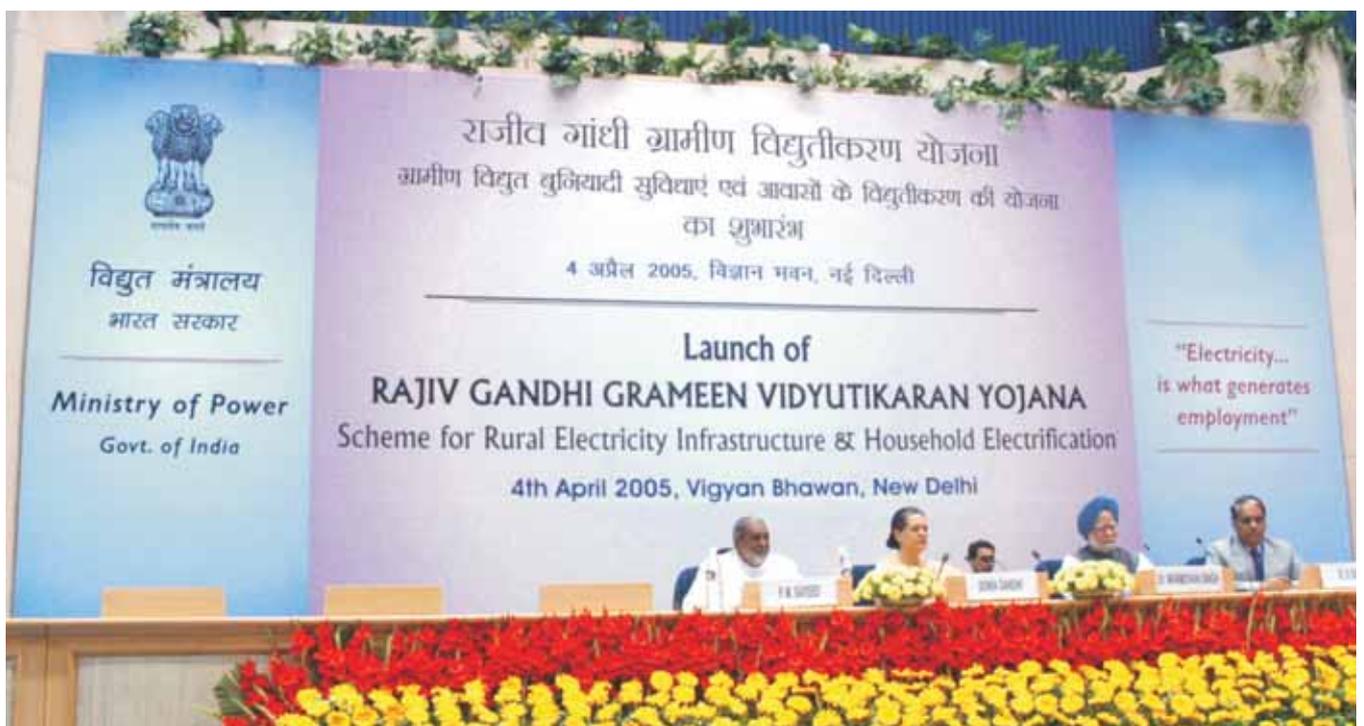
VI. Energy Conservation

Indian Electricity Sector provides enormous opportunities for energy service companies and also for those who manufacture energy efficient equipment, gadgets and devices. On the basis of a comprehensive study, it has been established that energy efficiency projects, when appropriately implemented, could lead to a saving of as much as 23% of energy consumption.

Government of India enacted a legislation namely “Energy Conservation Act, 2001”. Bureau of Energy Efficiency (BEE), a very important organizational instrument, envisaged under the Act, has been put in place. Several lines of actions have been initiated by the Bureau of Energy Efficiency in the areas of energy conservation in industry, in domestic sector, in commercial establishments and in agriculture. This has led to creation of opportunities for organizations which could conceptualize energy efficiency projects and implement them. Manufacturers of a number of energy efficiency equipment and gadgets have started expanding their capacity.

VII. Rural Electrification- Rajiv Gandhi Grameen Vidyutikaran Yojana

56% of rural India does not have access to electricity. The Government is committed to provide power in these areas by 2009 and ensure availability of power for all by 2012. This is a great challenge. At the same time, this provides great opportunities for developers and investors. The Electricity Act, 2003 has made special provisions for not only de-licensing generation of power, but even de-licensing distribution of power and systems which promote de-centralized distributed generation and supply. In order that this challenge is converted into opportunities for development and growth, the Government of India has put in place a very ambitious programme, namely Rajiv Gandhi Grameen Vidyutikaran Yojana to create a sound Rural Electricity Infrastructure.

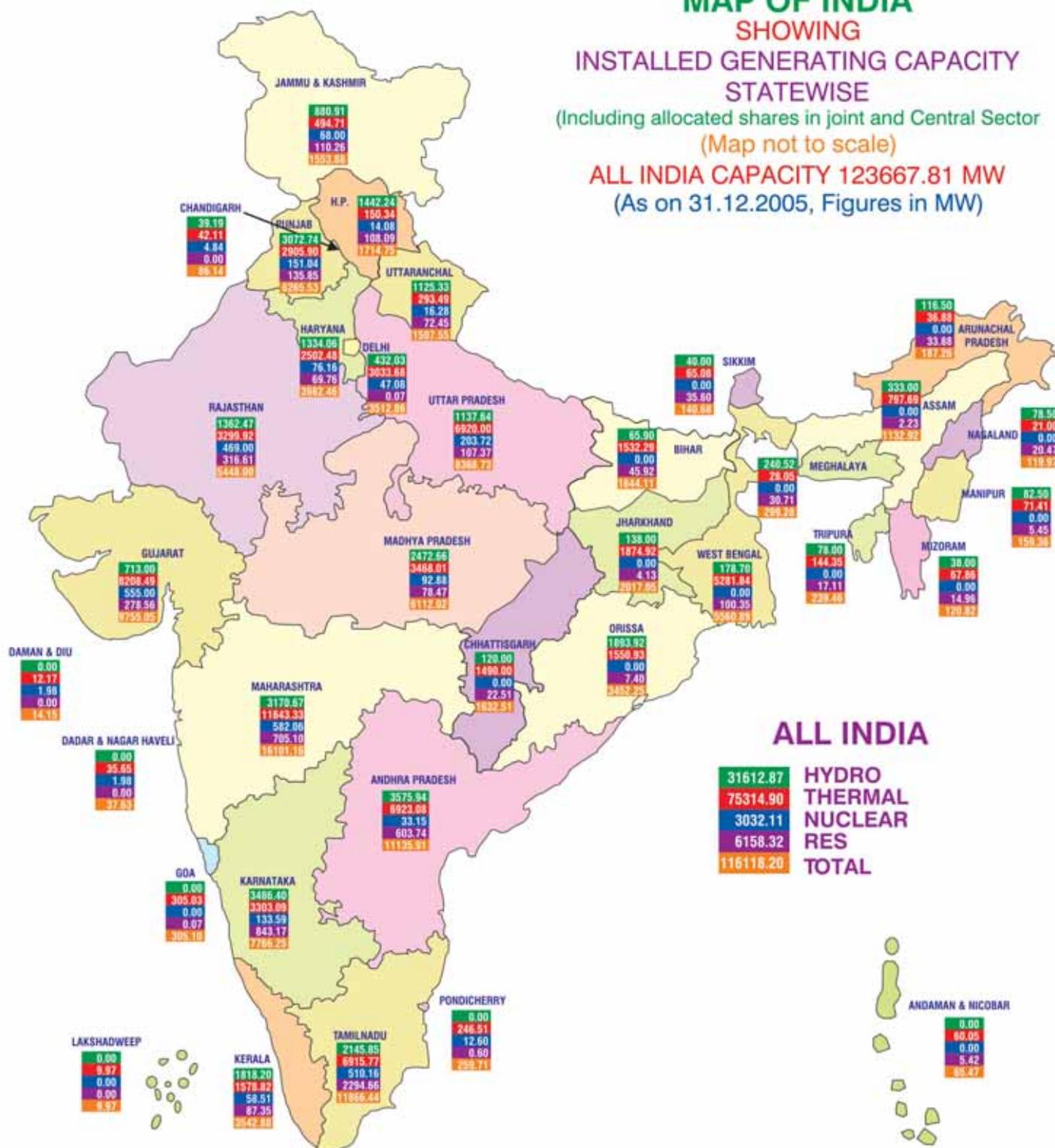




MAP OF INDIA SHOWING INSTALLED GENERATING CAPACITY STATEWISE

(Including allocated shares in joint and Central Sector
(Map not to scale))

ALL INDIA CAPACITY 123667.81 MW
(As on 31.12.2005, Figures in MW)



ALL INDIA

| | |
|-----------|---------|
| 31612.87 | HYDRO |
| 75314.90 | THERMAL |
| 3032.11 | NUCLEAR |
| 6158.32 | RES |
| 116118.20 | TOTAL |

