

POLICY ON HYDRO POWER DEVELOPMENT



**Government of India
Ministry of Power
(August, 1998)**

POLICY ON HYDRO POWER DEVELOPMENT

1. NEED FOR A HYDEL POLICY

Hydro power is a renewable economic, non polluting and environmentally benign source of energy. Hydro power stations have inherent ability for instantaneous starting, stopping, load variations etc. and help in improving reliability of power system. Hydro stations are the best choice for meeting the peak demand. The generation cost is not only inflation free but reduces with time. Hydroelectric projects have long useful life extending over 50 years and help in conserving scarce fossil fuels. They also help in opening of avenues for development of remote and backward areas.

Our country is endowed with enormous economically exploitable and viable hydro potential assessed to be about 84,000 MW at 60% load factor (1,48,700 MW installed capacity). In addition, 6781.81 MW in terms of installed capacity from small, mini and micro hydel schemes have been assessed. Also, 56 sites for pumped storage schemes with an aggregate installed capacity of 94,000 MW have been identified. However, only 15% of the hydroelectric potential has been harnessed so far and 7% is under various stages of development. Thus, 78% of the potential remains without any plan for exploitation.

Despite hydroelectric projects being recognised as the most economic and preferred source of electricity, share of hydro power has been declining steadily since 1963. The share of hydro power has been continuously declining during

the last three decades. The hydro share has declined from 44 per cent in 1970 to 25 per cent in 1998. The ideal hydro thermal mix should be in the ratio of 40:60. Because of an imbalance in the hydel thermal mix especially in the Eastern and Western regions, many thermal power stations are required to back down during off peak hours. The capacity of the thermal plants cannot be fully utilised resulting in a loss of about 4 to 5 per cent in the plant load factor. Even if the share of hydro power is to be maintained at the existing level of 25 per cent, the capacity addition during the 9th and 10th Plan would work out to 23,000 MW. If the share were to be enhanced to 30 per cent, it would require a further addition of 10, 000 MW of hydro capacity.

The constraints which have affected hydro development are technical (difficult investigation, inadequacies in tunnelling methods), financial (deficiencies in providing long term financing), tariff related issues and managerial weaknesses (poor contract management). The hydro projects are also affected by geological surprises (especially in the Himalayan region where underground tunnelling is required), inaccessibility of the area, problems due to delay in land acquisition, and resettlement of project affected families, law & order problem in militant infested areas.

2. Objectives

The programmed capacity addition from hydel projects during the 9th Plan is 9815 MW, of which Central Sector and State Sector will contribute 3455 MW and 5810 MW respectively and the balance 550 MW will be contributed by the Private Sector. Sanctioned and ongoing schemes under implementation will

enable a capacity addition of 5912 MW during the 10th Plan, of which 990 MW, 3872 MW and 1050 MW will be the contribution of Central, State and Private Sectors respectively. In addition, 12 projects (5615 MW) have been identified for advance action in the 9th Plan for benefits in the 10th Plan.

The Government of India has set the following objectives for accelerating the pace of hydro power development:-

(i) **Ensuring targeted capacity addition during 9th Plan :**

The 9th Plan programme envisages capacity addition of 9815 MW from hydel projects in the total capacity addition of 40245 MW. The Central Sector hydel projects would contribute 3455 MW, State Sector would add 5810 MW and Private Sector 550 MW. Keeping in view that the achievement in 8th Plan had been dismal, the Government is determined to ensure that no slippage is allowed to occur and the targeted capacity addition in the 9th Plan is achieved in full.

(ii) **Exploitation of vast hydroelectric potential at a faster pace:**

The Government would initiate advance action for taking up new hydro projects since the ongoing projects will contribute a very small percentage of the desired capacity addition envisioned for 10th Plan and beyond. Towards this end, Government would take up for execution all the CEA cleared projects, and take steps to update and obtain clearances for pending DPRs. Measures for vigorously starting survey and investigations for new green field sites would also be implemented shortly. In addition, Government is keen to restart and

activate the hydro projects which are either languishing for want of funds or are remaining dormant due to unresolved inter-State issues.

(iii) Promoting small and mini hydel projects

Small and mini hydel potential can provide a solution for the energy problems in remote and hilly areas where extension of grid system is comparatively uneconomical and also along the canal systems having sufficient drops. The small hydro potential could be developed economically by simple design of turbines, generators and the civil works. Small and mini hydel capacity aggregating to about 340 MW is in operation, and Government is determined to provide thrust for developing the assessed small hydel potential at a faster pace henceforth.

(iv) Strengthening the role of PSUs/SEBs for taking up new hydel projects:

In view of the poor response of the private sector so far in hydro development which may persist for some more years, the involvement of public sector in hydel projects would not only have to continue but will also have to be enlarged. There are categories of projects such as multi-purpose, projects involving inter-State issues, projects for peaking power and those involving rehabilitation and resettlement which may be taken up and implemented more easily in public sector. Similarly, mega hydro projects in the North and North Eastern region would also have to be executed by CPSUs in case the State or the private sector is not in position to implement these projects.

(v) **Increasing private investment:**

Even though public sector organisations would play a greater role in the development of new schemes, this alone would not be adequate to develop the vast remaining hydro potential since it will require huge investments which are difficult to be supported from the budget/plan assistance in view of competing demands from the various sectors. A greater private investment through IPPs and joint ventures would be encouraged in the coming years and required atmosphere, incentives and reliefs would be provided to stimulate and maintain a trend in this direction.

3. Policy Instruments

To achieve the above stated objectives for faster development of hydro potential, the Government proposes to take the following steps and measures: -

3.1 Funding

All the ongoing Central Sector hydroelectric projects namely Nathpa Jhakri (1500 MW), Tehri Stage I (1000 MW), Ranganadi Stage I (405 MW), Dulhasti (390 MW), Dhauliganga (280 MW), Doyang (75 MW) and Rangit (60 MW) would be provided with full budgetary support till completion. Government of India will also provide budgetary support for the new projects to be taken up by the CPSUs during the 9th Plan. The actual utilisation of the funds on the ongoing Central Sector hydel projects has been Rs.1616.87 crores in 1997-98 and the budget provision for 1998-99 has been increased to Rs.2070 crores. Therefore

the remaining three years of the 9th Plan would require about Rs.5896 crores on the ongoing Central Sector projects (excluding NEC projects). Having regard to the large capacity addition envisaged in the State Sector (5810 MW) it is necessary to (a) provide a mechanism for funding hydro projects by earmarking funds in the plan allocation of the State Governments by the Planning Commission; and (b) organising supplementary funding of hydel projects where more than 50 per cent of the expenditure has already been incurred.

The monitoring of all the ongoing projects will be intensified and a task force would be constituted for this purpose. The progress of important projects in the State and Central Sector would be reviewed at the level of Minister/Secretary(Power) and all measures will be taken so that there is no slippage in the schedule for completion of the ongoing projects.

3.2 Power Development Fund

The survey and investigation of hydro projects have been discontinued since long in the States due to paucity of funds. As a result, there are not enough projects right now that could be taken up in the next 2 to 3 years and get completed in the 10th Plan or early 11th Plan. It is necessary to carry out survey and investigations continuously and prepare a shelf of projects for execution over a decade and more.

In case fully investigated projects with Detailed Project Reports are offered to private developers, their response could be more favourable. If pre-construction activities and enabling works could be completed and these sites offered to

IPPs the chances of IPPs opting to invest in these projects would further improve. Further this would reduce the gestation period which would make investment in hydro projects more attractive.

The above approach is possible and successful only if a dedicated fund is available for this purpose.

It is proposed to levy a Power Development Cess at 10 paise per kwh of electricity consumed in the country. The levy of cess was recommended by the Sub Committee of the NDC Committee on Power which gave its report in January, 1994. The cess would be levied on the electricity billed by SEBs/ Electricity Departments/Bulk licensees/Distribution licensees. The State/UT Governments would be responsible for the collection of the cess. The amount would thereafter be credited to a "National Power Development Fund". It is expected that about Rs.3000 crores per annum can be realised by levying a cess of 10 paise per kwh.

It would be necessary to establish a legal and organisational frame work for levy of a cess. Electricity being a Concurrent Subject, the Central Government is empowered to legislate on all aspects of electricity including the levy of cess, the proceeds of which is to be utilised for power development. In order to levy a Power Development Cess, it would be necessary for Parliament to enact a legislation on the subject. The cess will be imposed on the consumption of electricity throughout the country. The State Electricity Boards will be the responsible agencies for the collection of cess. The proceeds of the cess will be shared with the State/UT Governments and the Central Government. Two-

thirds of the amount realised from the State/UT Government will be allocated to the respective government to be utilised for power development. This amount would be released from the National Power Development Fund for financing schemes/projects recommended by the State Government. The remaining one-third will be utilised by the Central Government for promoting hydel projects in the Central Sector and for investment in transmission lines for evacuation of power from mega hydel projects which will benefit more than one State.

3.3 Basin-wise Development of Hydro Potential

The assessment of hydro potential in 845 identified conventional hydro projects and 56 pumped storage projects is on the basis of desk studies using toposheets and discharge data. Further, detailed studies to firm up the parameters of the projects as identified by CEA would be taken up on the basis of development of hydro potential in a basin as a whole for maximising benefits and prioritising execution of projects. These studies will be done in close co-ordination with CWC and Planning Commission and in harmony with development for other uses of water like irrigation, drinking water etc. While CEA would carry out these studies, CPSUs/other Central Government Organisations and State authorities would do the investigations and prepare the detailed project reports, by adopting an integrated approach towards planning and development of the various projects, evacuation arrangement and environmental impact assessment. This would enable an optimal harnessing of hydro potential in each river basin.

3.4 Advance Action for Capacity Addition in the 10th Plan and beyond

Government will take immediate steps to tie up funding, execution agencies and convey investment decision for schemes already accorded techno economic clearance of CEA. As far as Central Sector is concerned, NHPC would take up Chamera Stage II (300 MW), Parbati Stage-II (800 MW), and Kol Dam (800 MW) in HP; Teesta Stage V (510 MW) in Sikkim, Loktak Downstream (90 MW) in Manipur and NEEPCO will take up Tuivai (210 MW) in Mizoram, Lower Kopili (150 MW) in Assam, Kameng (600 MW) and Ranganadi Stage II (160 MW) in Arunachal Pradesh (after the consent of the State Govt. has been obtained). In addition THDC would take action to start activities on Tehri Stage II (1000 MW) and Koteshwar (400 MW) in UP. Similarly NJPC would also take up Rampur Project (535 MW) in HP. These projects would require budgetary support of about Rs.2000 crores in the 9th Plan.

3.5 Survey & Investigations

As a long term strategy efforts will be made to ensure that DPRs which are under various stages of processing for accord of TEC by CEA are finalised and cleared so that a start could be made on these projects in the next one or two years. Survey and investigation of the potential hydro sites on an advanced scientific basis would be essential requirement for the future. The progress on this front has been dismal given the funds constraint and outdated technology. The funding agencies like World Bank and ADB have shown their interest towards funding the survey and investigation activities for hydroelectric projects. Concerted efforts would be made towards availing the funds quickly. This

would not only help in preparation of the bankable DPRs for large hydroelectric projects but would also bring in advanced technology by involving reputed international consultants. The Central organisations like CWC, Brahmaputra Board, NEEPCO and NHPC, besides SEBs would be provided with funding support from the proposed Power Development Fund for the purpose of carrying out survey and investigations and preparation of bankable DPRs.

Since the private sector has so far been hesitant and cautious to invest in hydro projects, it is proposed that new projects will initially be taken up by CPSUs/SEBs for investigations, updation of DPRs, obtaining the necessary clearances and pre-construction activities. After these stages, the projects could be offered to the private sector for execution either on 'stand alone' basis or for joint venture participation with the CPSU/SEB. The expenditure incurred by CPSUs/SEBs on these activities would be adjusted in the project cost to be recovered from the executing agency to be decided at a later stage. The Government expects that more private investment would be possible with this approach. In case for a particular project no such private investment is forthcoming, it will be executed entirely by the concerned CPSU/SEB which initiated its development.

3.6 Inter-State Projects

A substantial hydel power potential has remained locked up and many mega hydel projects could not be taken up for implementation, even though these projects are well recognised as attractive and viable, because of unresolved Inter-State issues. Govt. of India recognises the need for evolving an approach

to ensure that the available hydro-electric potential is fully utilised without prejudice to the rights of the riparian States as determined by the Awards of the Tribunals/Agreements arrived at among the party States for a given river basin with regard to water sharing. The selection and design of project would be based on integrated basin wise studies, so as to arrive at an optimal decision and care will be taken that such projects do not in any way prejudice the claims of basin states or affect benefits from the existing projects. A consensus would be evolved amongst the basin states regarding the location of such project, basic parameters involved and mechanism through which each project would be constructed and operated. As far as possible, there would be preference to take up simple run-of-the-river schemes that do not involve any major storage or consumptive uses.

3.7 Renovation, Modernisation & Uprating

Renovation, Modernisation & Uprating of old hydro power plants is being accorded priority as it is a faster and cheaper way of capacity addition than installing new capacity. As per recommendations of National Committee set up in 1987 and based on the subsequent reviews, 55 hydro schemes with an aggregate capacity of 9653 MW were identified for RM&U. Out of these, 20 hydro schemes have been completed providing a benefit of 971.5 MW and work on 27 schemes is in progress. In order to provide a greater thrust for RM&U, Government would set up a Standing Committee, to identify the new schemes and for tying up technology, funding and executing agencies.

3.8 Promoting Small and Mini Hydel Projects

The Ministry of Non-Conventional Energy Sources (MNES) deals with all matters related to Small Hydel Projects (up to 3 MW capacity). These projects are being provided with the following incentives.

- (i) Incentives for detailed survey & investigation and preparation of DPR.
- (ii) Incentives during the execution of the project in the form of capital/ interest subsidy.
- (iii) Special incentives for execution of small hydro projects in the North Eastern Region by the Government departments/SEBs/State agencies.
- (iv) Financial support for renovation, modernisation and uprating of old small hydro power stations.

The Small Hydel Projects are site specific and depending on the hydrology, typically the plant load factor varies from 40 to 60%. The Small Hydel Projects upto 25 MW will also be transferred to MNES in order to provide greater thrust for its development. Government of India proposes to provide soft loans to these projects (up to 25 MW) through IREDA/PFC/REC and other financial institutions and Ministry of Non-conventional Energy Sources would announce a suitable package of financial incentives for the accelerated development of Small Hydel Projects upto 25 MW station capacity. The State Government and Central and State Hydro Corporations like NHPC/NEEPCO etc. would be

encouraged to take up a cluster of small/mini hydel schemes on Build, Operate and Transfer basis, and other suitable arrangements.

3.9 Simplified Procedures for Transfer of Clearances

As stated in the foregoing, the CPSUs and the private sector would need to play a greater role in hydro development. The immediate requirement would be to transfer the clearances already accorded to non-starting hydro projects in the State Sector in favour of CPSU/IPP/Joint Venture of IPP and CPSU. Government would evolve a simple procedure so that the transfer of CEA's techno economic clearance would be facile as only updation of project estimate would be examined by CEA. In the case of Environment and Forest clearances these could be transferred to CPSU/IPP etc. within a prescribed time limit on acceptance of conditionalities stipulated in the MOEF clearances accorded for execution in the State Sector by the above executing agencies. Another inhibiting factor discouraging IPPs is the need for notification of the scheme as per Section 29 of ES Act in newspaper and Gazette afresh even if this was done earlier for execution by SEBs. Government intends to do away with this requirement. The simplified procedure as proposed would be an encouraging factor for IPP to evince greater interest in hydro development. Government would initiate action right away towards this end.

3.10 Rationalisation of Hydro Tariff

The tariff formulation and norms for hydro projects as per existing Government notification are viewed by CPSUs and IPPs as unfavourable compared to those

for thermal projects and the IPPs tend to prefer thermal projects for investment. There is a need to reformulate the principles on the basis of which tariff is determined for hydel generation. The objective is to fix a rate which will be reasonable to the consumer, to ensure adequate internal resources to repay the loan and also to provide a reasonable rate of return on investment. Recognising the difficulties in execution of hydro projects, the Government has decided to rationalise the existing hydro tariff norms, improve the incentives for better operation and evolve a solution to the contentious issue of computing the completion cost in the face of geological uncertainties and surprises and natural incidents of rock slide etc.

In January 1995, the Government issued a notification providing for a two part tariff for hydel generation stations. The first part of the tariff, denominated as capacity charges covers (a) interest on loan capital; and (b) depreciation reckoned at an annual amount not exceeding 1/12 of the loan amount and limited to the actual loan liability of the year as per approved financial package. The second part of the tariff denominated as energy charges covers (a) return on equity calculated at 16% (b) O&M charges; (c) tax on income; and (d) any other variable charge.

Hydro projects provide valuable peak power and have inherent capability for instantaneous starting and stoppage based on variation of load. The peaking power stations generally operate at a very low load level. Recognising the value of peak power to the system and resultant improvement in operation of thermal stations, it is proposed to allow a premium on the sale rate for hydro generation during peak period. The formulation of peak tariff and the premium to be allowed would be decided by the Central Electricity Regulatory Commission and the State Electricity

Regulatory Commissions. Under the present notification, the rate for incentive for secondary energy has to be fixed at a rate mutually agreed between the State Electricity Board and the generating company. However, the maximum payment on this account is restricted to an amount not exceeding 10% return on equity. In order to provide an additional incentive for attracting investment in hydel projects, it is proposed to allow the sale rate for secondary energy at the same rate which is applicable for a primary energy.

Recognising the problems in operation of hydro power stations in the initial years especially in project with silt laden water, the normative availability factor is proposed to be reduced from 90% to 85%.

3.11 Estimates on Completion Cost (Geological Risks)

During the implementation of hydro power projects specially underground power stations, there is a likelihood of coming across geological surprises which are not anticipated at the time of preparation of Detailed Project Report. This results in increase in capital cost. The developer would need to be compensated for this kind of eventualities.

In the existing tariff notification for hydro projects, there is no provision for increase in project cost arising due to geological risks. A realistic estimate of completion cost has to take into account the geological and hydrological risks, cost escalation and natural occurrences of land slides, rock falls etc. In such cases, the developer will be allowed to submit his proposal for the enhanced cost to the Government. Expert Committee would be constituted at the State and Central level who would

evaluate and recommend the cost increases for acceptance by the Government. The expert committee at the State Government level would recommend the cost increase proposal upto certain percentage and beyond that the cost increase would be recommended by the expert committee at the Central Government level.

3.12 Promoting Hydel Projects with Joint Ventures

With a view to bring in additional private investment in the hydel sector there would be a greater emphasis to take up schemes through the joint ventures between the PSUs/SEBs and the domestic and foreign private enterprises. The joint venture company will be an independent legal entity to be registered under the Companies Act and would act as an independent developer. The joint venture agreement between the two partners will bring clearly the extent of participation by each partner and sharing of risks relating to implementation and operation of the project. It will also provide for arrangement in such cases where the joint venture partner would not be associated with the operation and maintenance of the project. While the selection of a joint venture partner would be in accordance with the policy of the Government, there would be an option for the PSU to either select the joint venture partner together with their financial and equipment package or to select a joint venture partner wherein the EPC contract is decided by both the partners after they have formed the joint venture company. The associated transmission line connected with the scheme will be constructed by the Powergrid Corporation of India. The power from joint venture hydel projects will be purchased by the Power Trading Corporation (PTC) proposed to be formed with equity participation from Government/CPSUs/Financial Institutions. The security for payment of power purchased from the joint venture projects would be through a

LC to be provided by the SEBS and recourse to the State's share of Central Plan Allocation and other devolution. This security package would enable to raise finances for these projects. As far as the new schemes to be developed under the joint venture route are concerned, the power sharing formula as applicable to the Central Sector Projects shall not apply and joint venture company would be totally guided by the commercial interest. The State Government (home State/ States) will be compensated by way of 12% free power as per the present policy applicable for Central Sector hydel projects.

3.13 Selection of Developer and Techno Economic Clearance of CEA

As per Government notification of September, 1996, all the schemes estimated to involve a capital expenditure above Rs.100 crores are to be submitted to CEA for techno economic clearance and in respect of schemes prepared by a generating company and selected through a process of competitive bidding by the competent Government or Governments, the exemption from CEA's techno-economic clearance is applicable if the capital cost is Rs.1000 crores or less.

Considering the capital intensive nature of hydel projects especially those of medium size being executed in the State Sector, it is proposed to increase the limit for exemption of CEA clearance from the present Rs.100 crores to Rs.250 crores if the projects are taken in the MOU route. In case of projects through competitive bidding the existing limit of Rs.1000 crores for CEA techno economic clearance will continue. However, irrespective of the capital cost or capacity, all hydel projects having inter-State aspect will require a mandatory clearance from the CEA. Keeping in view the need for transparency and cost

assessment by an accepted mechanism as well as the uncertainties that are inevitable in the development and execution of hydel projects, the Government proposes to allow the selection of developer through MOU route for the hydel projects upto 100 MW instead of the existing limit of Rs.100 crores. However, these projects would require CEA techno economic clearance if their capital cost exceeds Rs.250 crores. This would enable more developers to evince interest in medium size hydro projects due to ease of execution and resource raising and due to exemption in obtaining clearances.

3.13 Govt. Support for Land Acquisition, Resettlement & Rehabilitation, Catchment Area Development

The acquisition of requisite Government, forest and private land involves cumbersome procedure and difficult negotiations with land owners to part with the land. Demands for employment in lieu of the land cost, land for land at places of land owners choice etc. has resulted in contractual problems for several projects. There is, therefore, a need that project authorities are insulated from the problems arising out of land acquisition and R&R. It will be the responsibility of the State Govt. to acquire the land (Government/Private/Forest) for the project and also negotiate at its own terms with land owners as per the policy adopted by respective State Governments. Similarly, all the issues of resettlement and rehabilitation associated with projects have to be addressed by the State Govt. The State Governments. may consider to form Authorities to address the problems of land acquisition and R&R for all infrastructure projects. In case of mega projects the project specific Authorities may be created not only for land acquisition and RR but for comprehensive development of the area including

catchment area. The project developer may not be involved in execution and implementation of works by these Authorities, but will be required to contribute for funding their plans. All such costs incurred by the developer shall be considered as cost to the project and allowed to be passed through tariff.

**HYDRO POWER SCENARIO
OF INDIA
AT A GLANCE**

INDEX

Sl. No.	Contents	Page No.
1	Growth and Share of Hydro Power	1
2	Planwise Growth and Share of Hydro Power	2
3	Growth of Hydro Installed Capacity vis-a-vis Total Installed Capacity	2
4	Planwise Hydro Capacity Targets/Achievements	3
5	Hydro Power Potential in India Region/Statewise	4
6	Sector/Statewise installed capacity as on 31.3.98	9
7	River/Basinwise Distribution of Hydro Power Potential	10
8	River/Basinwise Development of Hydro Power Potential	11
9	Sanctioned and Ongoing Hydroelectric Schemes for Benefits during 9th Plan	14
10	Sanctioned/Ongoing Hydroelectric Schemes for benefits during 10th Plan	18
11	Advanced Action Schemes for 10th Plan and beyond under Central Sector	19
12	Hydroelectric Schemes Cleared/Appraised by CEA and awaiting investment decision	20

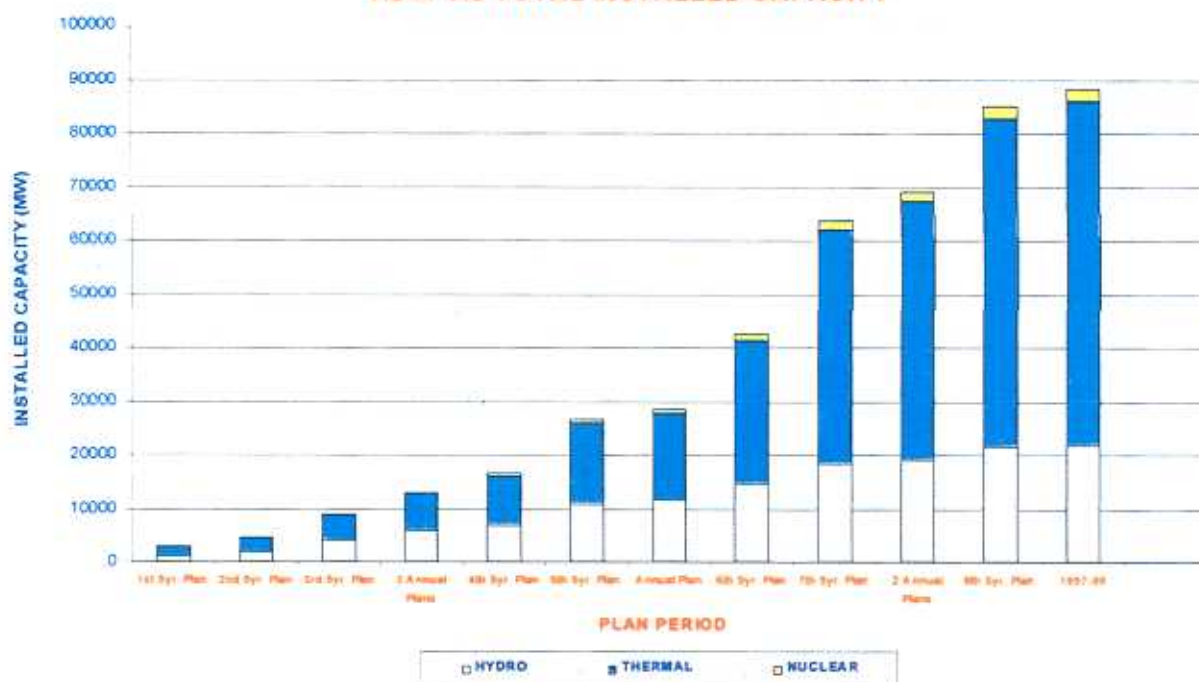
GROWTH AND SHARE OF HYDRO POWER

YEAR	INSTALLED CAPACITY (MW)		HYDRO SHARE (%)
	TOTAL	HYDRO	
1947	1361.76	508.13	37.31
1950	1712.52	559.29	32.66
1951	1835.43	575.18	31.34
1952	2061.76	715.18	34.69
1953	2305.19	731.18	31.72
1954	2494.00	793.35	31.81
1955	2694.82	939.48	34.86
1956	2886.14	1061.44	36.78
1957-58	3223.11	1213.92	37.66
1958-59	3511.59	1361.44	38.77
1959-60	3873.17	1530.15	39.51
1960-61	4653.05	1916.66	41.19
1961-62	5218.82	2419.10	46.35
1962-63	5801.19	2936.35	50.62
1963-64	6576.94	3167.02	48.15
1964-65	7396.67	3388.73	45.81
1965-66	9027.02	4123.74	45.68
1966-67	10092.17	4757.22	47.14
1967-68	11888.16	5486.92	46.15
1968-69	12957.27	5906.91	45.59
1969-70	14102.45	6134.70	43.50
1970-71	14708.95	6383.23	43.40
1971-72	15254.37	6611.61	43.34
1972-73	16281.71	6785.41	41.68
1973-74	16663.56	6965.30	41.80
1974-75	18316.68	7529.24	41.11
1975-76	20117.06	8463.60	42.07
1976-77	21468.50	9024.90	42.04
1977-78	23668.71	10020.22	42.34
1978-79	26680.06	10833.07	40.60
1979-80	28447.83	11383.97	40.02
1980-81	30213.68	11791.22	39.03
1981-82	32345.09	12172.81	37.63
1982-83	35363.27	13055.86	36.92
1983-84	39338.86	13855.56	35.22
1984-85	42584.72	14460.02	33.96
1985-86	46769.03	15471.60	33.08
1986-87	49265.86	16195.64	32.87
1987-88	54155.17	17265.33	31.88
1988-89	59040.38	17798.05	30.15
1989-90	63636.34	18307.63	28.77
1990-91	66086.33	18753.42	28.38
1991-92	69065.39	19194.62	27.79
1992-93	72319.46	19568.76	27.06
1993-94	76718.21	20365.91	26.55
1994-95	81164.41	20829.04	25.66
1995-96	83287.96	20976.00	25.18
1996-97	85019.31	21644.80	25.46
1997-98	88266.86	21891.08	24.80

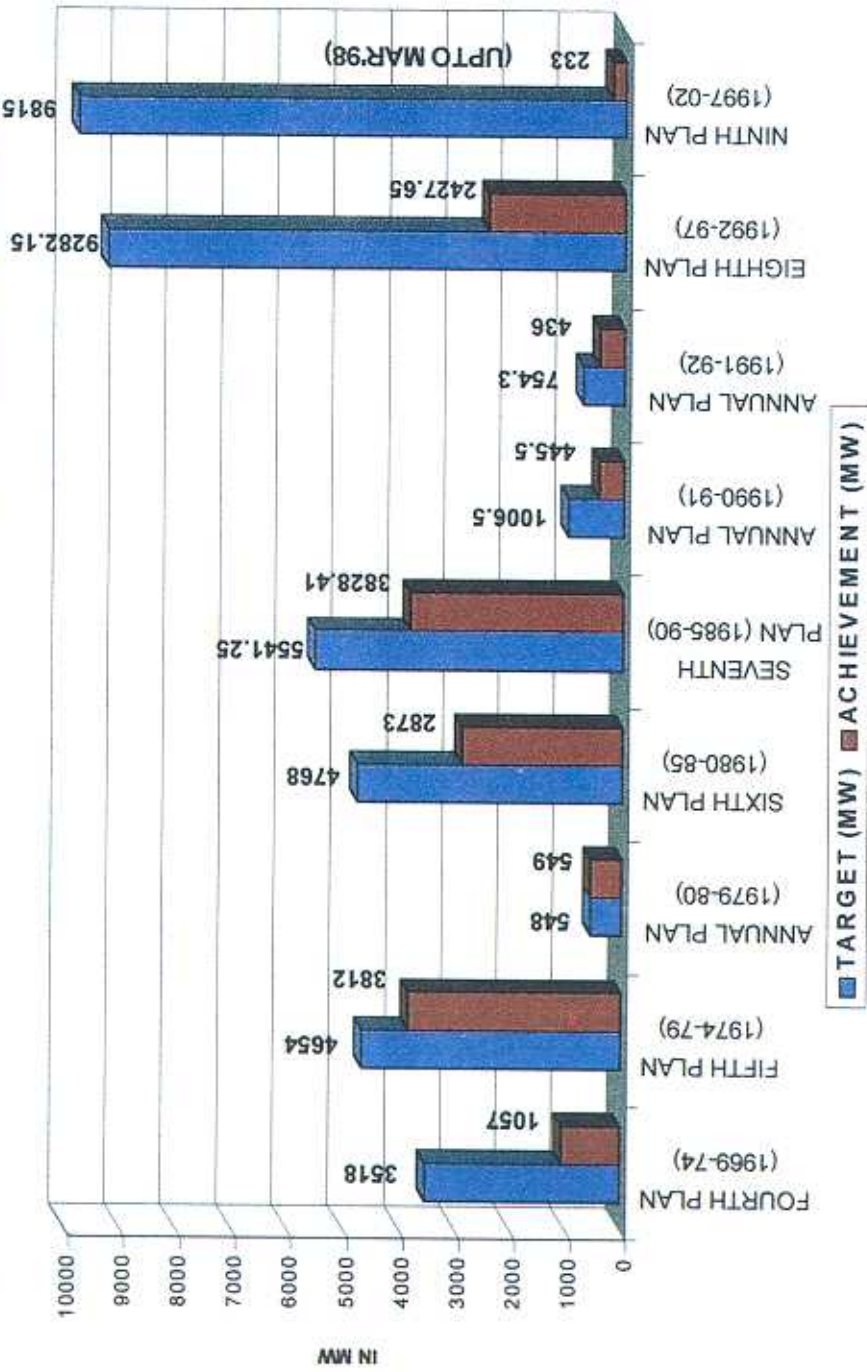
PLANWISE GROWTH AND SHARE OF HYDRO POWER

Plan Period	Installed Capacity in MW			
	Hydro	Thermal	Nuclear	Total
1st Five Year Plan (1951-56)	1061.44	1824.70	0	2886.14
2nd Five Year Plan (1956-61)	1916.66	2736.39	0	4653.05
3rd Five Year Plan (1961-66)	4123.74	4903.28	0	9027.02
3 Annual Plans (1966-69)	5906.91	7050.36	0	12957.27
4th Five Year Plan (1969-74)	6965.30	9058.26	640	16663.56
5th Five Year Plan (1974-79)	10833.07	15206.99	640	26680.06
Annual Plan (1979-80)	11383.97	16423.86	640	28447.83
6th Five Year Plan (1980-85)	14460.02	27029.70	1095	42584.72
7th Five Year Plan (1985-90)	18307.63	43763.71	1565	63636.34
2 Annual Plans (1990-92)	19194.62	48085.77	1785	69065.39
8th Five Year Plan (1992-97)	21644.80	61149.51	2225	85019.31
1997-98	21891.08	64150.78	2225	88266.86

GROWTH OF HYDRO INSTALLED CAPACITY VIS-A-VIS TOTAL INSTALLED CAPACITY



PLANWISE HYDRO CAPACITY TARGETS / ACHIEVEMENTS



HYDRO POWER POTENTIAL IN INDIA

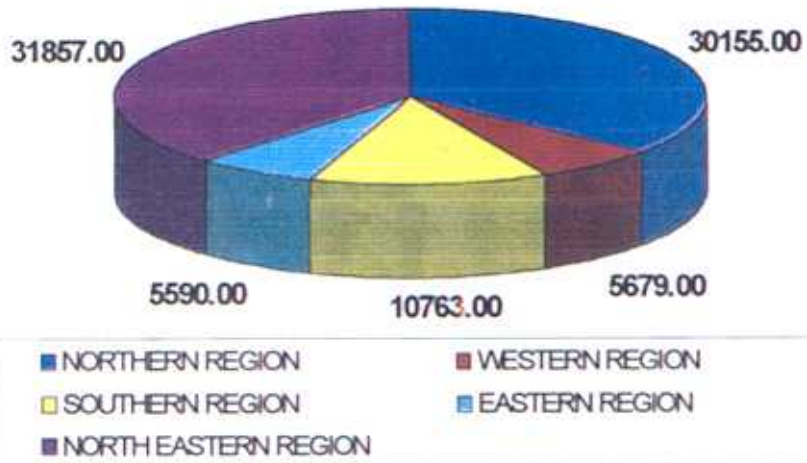
REGION/ STATE WISE (AT 60% LOAD FACTOR)

As on March 98

REGION/STATE	POTENTIAL ASSESSED (MW)	POTENTIAL DEVELOPED (MW)	POTENTIAL UNDER DEVELOPMENT (MW)	BALANCE POTENTIAL	
				(MW)	(%)
NORTHERN REGION					
JAMMU & KASHMIR	7487.00	480.17	407.17	6599.66	88.15
HIMACHAL PRADESH	11647.00	2007.07	525.33	9114.60	78.26
PUNJAB	922.00	454.67	375.00	92.33	10.01
HARYANA	64.00	51.67	11.67	0.66	1.03
RAJASTHAN	291.00	192.67	8.00	90.33	31.04
UTTAR PRADESH	9744.00	1127.00	1117.67	7499.33	78.96
SUB -TOTAL	30155.00	4313.25	2444.84	23396.91	77.59
WESTERN REGION					
MADHYA PRADESH	2774.00	579.50	1211.05	983.45	35.45
GUJARAT	409.00	138.67	110.67	159.66	39.04
MAHARASHTRA	2460.00	1108.00	197.67	1154.33	46.92
GOA	36.00	0.00	0.00	36.00	100.00
SUB-TOTAL	5679.00	1826.17	1519.39	2336.44	41.09
SOUTHERN REGION					
ANDHRA PRADESH	2909.00	1392.92	43.70	1472.38	50.61
KARNATAKA	4347.00	2072.83	557.00	1717.17	39.50
KERALA	2301.00	1068.67	276.13	956.20	41.56
TAMIL NADU	1206.00	944.67	69.33	192.00	15.92
SUB-TOTAL	10763.00	5479.09	946.16	4337.75	40.30
EASTERN REGION					
BIHAR	538.00	119.95	211.00	207.05	38.49
ORISSA	1983.00	722.17	387.28	873.55	44.05
WEST BENGAL	1786.00	91.33	9.83	1684.84	94.34
SIKKIM	1283.00	28.83	33.67	1220.50	95.13
SUB-TOTAL	5590.00	962.28	641.78	3985.94	71.30
NORTHERN EASTERN REGION					
MEGHALAYA	1070.00	121.67	0.00	948.33	88.63
TRIPURA	9.00	8.50	0.00	0.50	5.56
MANIPUR	1176.00	73.17	5.33	1097.50	93.32
ASSAM	351.00	111.67	90.83	148.50	42.31
NAGALAND	1040.00	0.00	81.88	958.12	92.13
ARUNACHAL PRADESH	26756.00	16.50	108.33	26631.17	99.53
MIZORAM	1455.00	1.00	6.00	1448.00	99.52
SUB-TOTAL	31857.00	332.51	292.37	31232.12	98.04
ALL INDIA	84044.00	12913.30	5844.54	65286.16	77.68

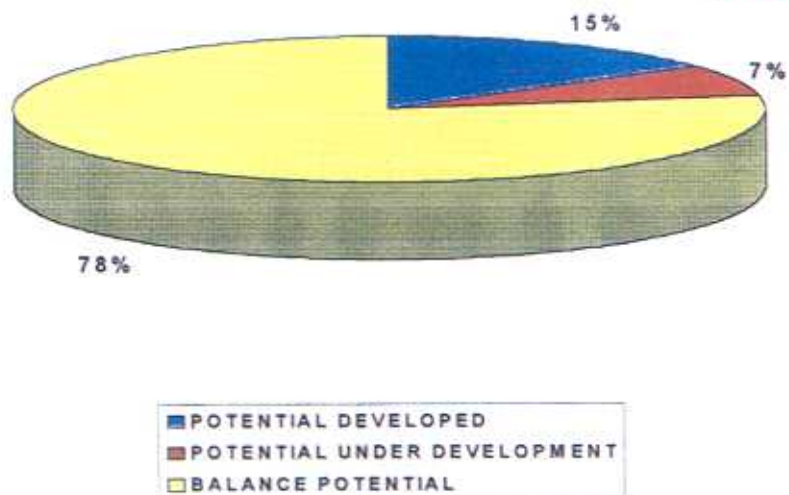
REGIONWISE HYDRO POWER POTENTIAL ASSESSMENT (MW AT 60 % LOAD FACTOR)

TOTAL POTENTIAL : 84044 MW



DEVELOPMENT OF HYDRO POWER IN INDIA (AT 60 % LOAD FACTOR)

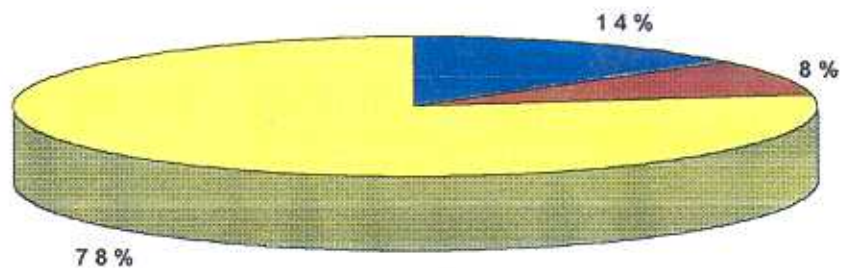
AS ON MARCH 98



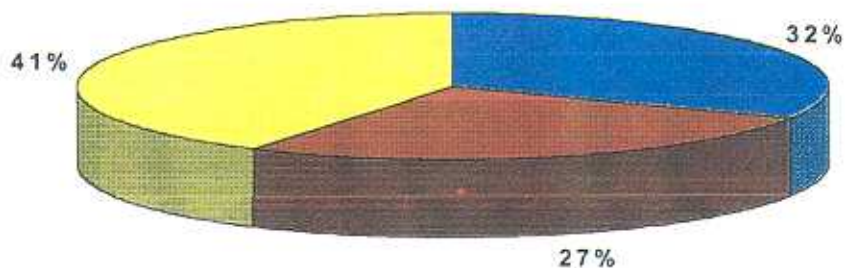
REGIONWISE DEVELOPMENT OF HYDRO POWER (AT 60 % LOAD FACTOR)

AS ON MARCH 98

NORTHERN REGION (TOTAL POTENTIAL - 30155 MW)



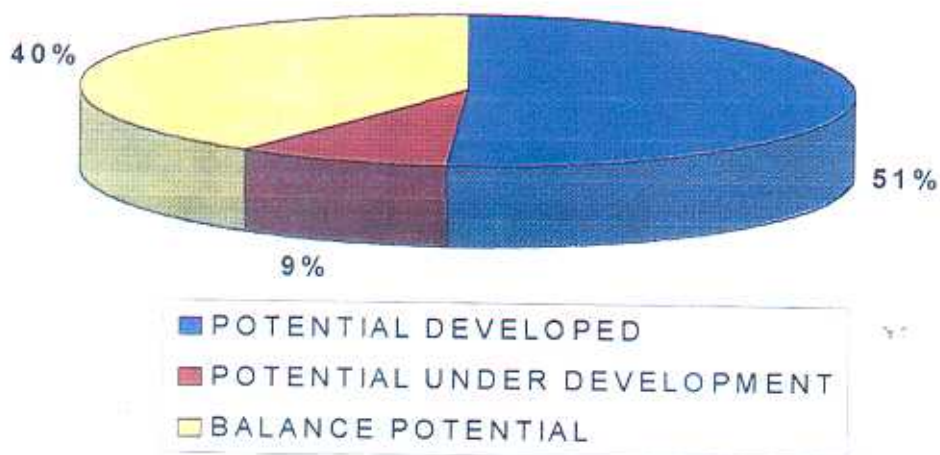
WESTERN REGION (TOTAL POTENTIAL - 5679 MW)



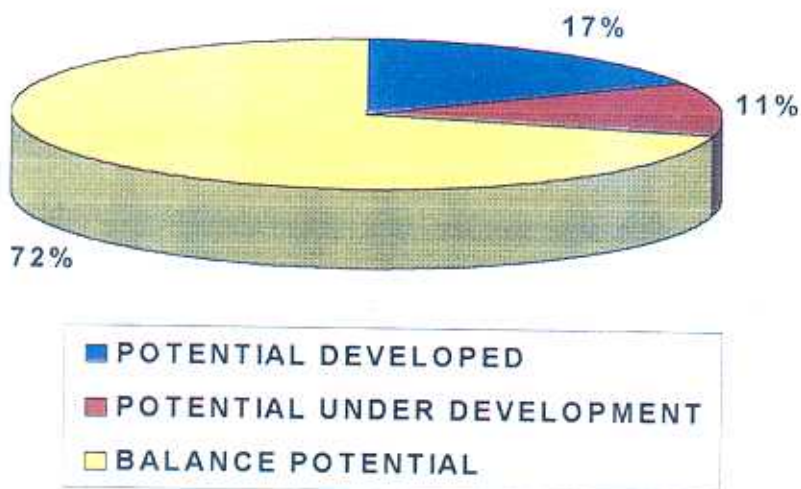
REGIONWISE DEVELOPMENT OF HYDRO POWER (AT 60 % LOAD FACTOR)

AS ON MARCH 98

SOUTHERN REGION (TOTAL POTENTIAL - 10763 MW)



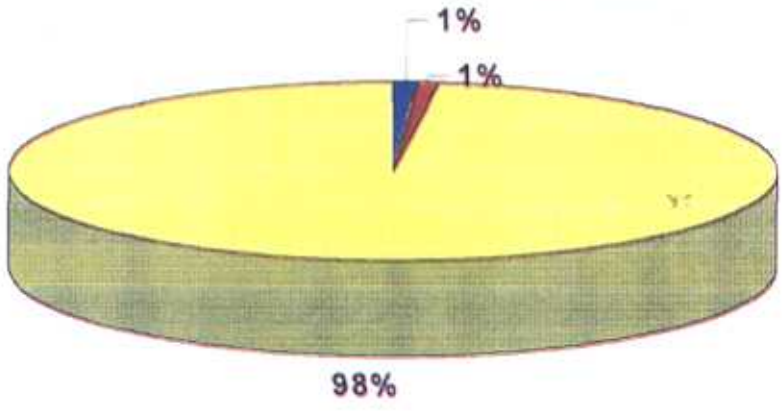
EASTERN REGION (TOTAL POTENTIAL - 5590 MW)



REGIONWISE DEVELOPMENT OF HYDRO POWER (AT 60 % LOAD FACTOR)

AS ON MARCH 98

NORTH EASTERN REGION (TOTAL POTENTIAL - 31857 MW)

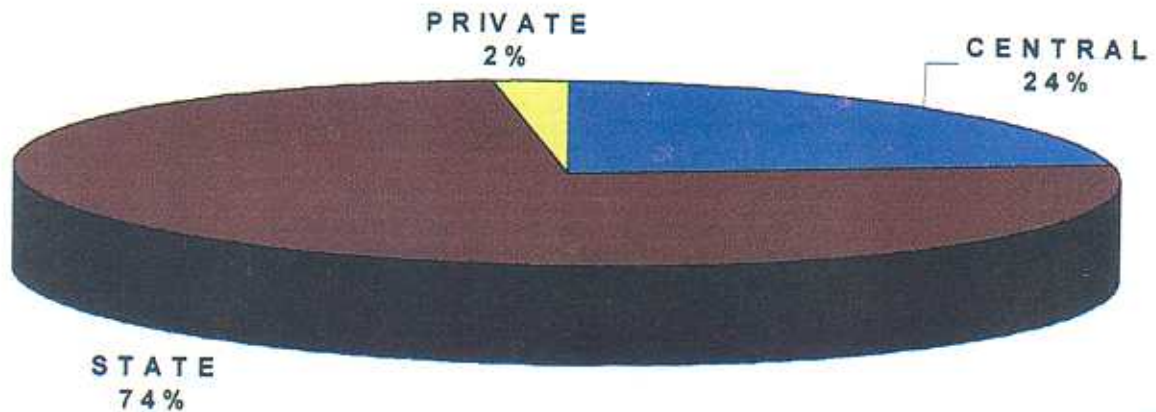


- POTENTIAL DEVELOPED
- POTENTIAL UNDER DEVELOPMENT
- BALANCE POTENTIAL

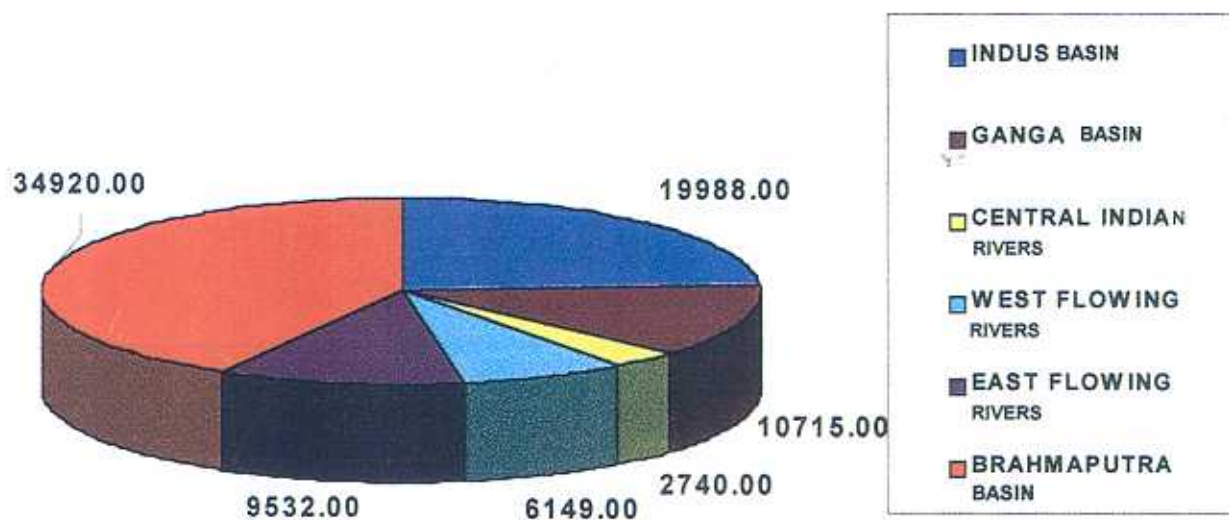
SECTOR / STATEWISE INSTALLED CAPACITY AS ON 31.3.98

SECTOR / STATE	INSTALLED CAPACITY (MW)	SECTOR / STATE	INSTALLED CAPACITY (MW)
CENTRAL SECTOR			
BBMB	2704.50	RSEB	430.00
NHPC	2115.00	UPSEB	1483.85
DVC	144.00	GEB	485.00
NEEPCO	250.00	MPEB	820.00
SUB TOTAL	5213.50	MSEB	1310.30
		APSEB	2698.75
PRIVATE SECTOR		KEB & KPCL	2449.40
TATA(MAHARASHTRA)	426.00	KSEB	1683.50
KARNATKA	18.00	TNEB	1942.95
SUB TOTAL	444.00	BSEB	174.90
		OSEB	1237.50
STATE SECTOR		SIKKIM	24.00
HSEB	48.00	WBSEB	119.00
HPSEB	289.95	ARUNACHAL PRADESH	10.50
J&K	181.75	MEGHALAYA	185.20
PSEB	541.00	TRIPURA	15.00
		SUB TOTAL	16130.55
GRAND TOTAL 21788.05*			
* Figures do not include projects of capacity less than 3 MW			

SECTORWISE DISTRIBUTION OF INSTALLED CAPACITY (AS ON 31.3.98)



**RIVER/ BASIN WISE DISTRIBUTION OF
HYDRO POWER POTENTIAL
(AT 60 % LOAD FACTOR)
(TOTAL POTENTIAL = 84044 MW)**



RIVER / BASIN WISE DEVELOPMENT OF HYDRO POWER POTENTIAL (AT 60 % LOAD FACTOR)

As on March 98

INDUS BASIN

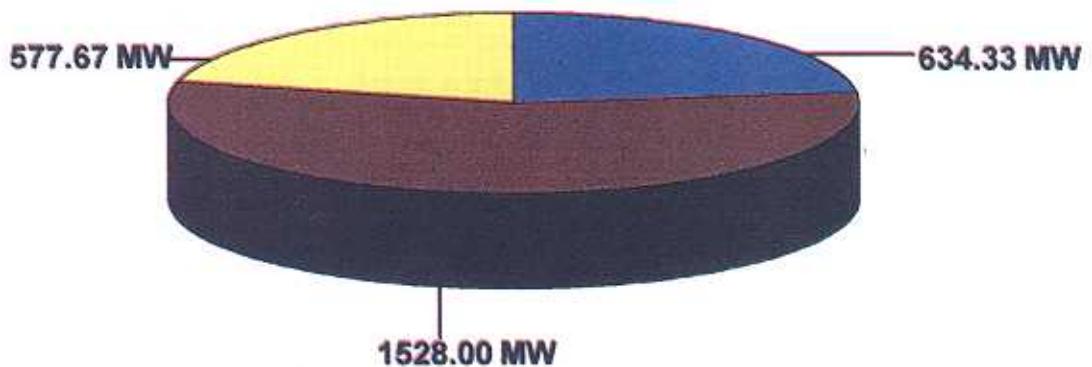
(TOTAL POTENTIAL = 19988 MW)



■ POTENTIAL DEVELOPED ■ POTENTIAL UNDER DEVELOPMENT ■ BALANCE

CENTRAL INDIAN RIVERS

(TOTAL POTENTIAL = 2740 MW)

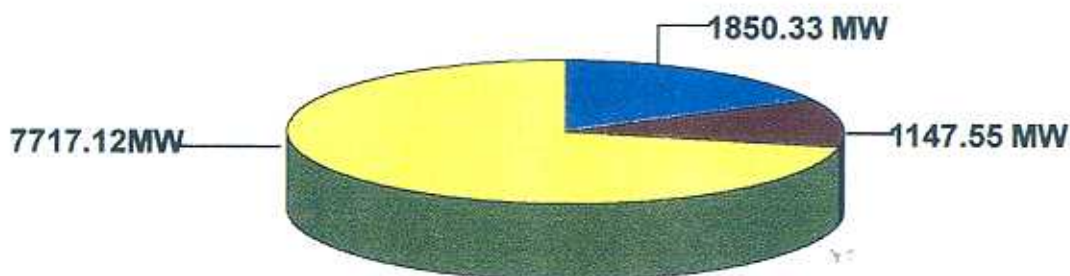


■ POTENTIAL DEVELOPED ■ POTENTIAL UNDER DEVELOPMENT ■ BALANCE

RIVER / BASIN WISE DEVELOPMENT OF HYDRO POWER POTENTIAL (AT 60 % LOAD FACTOR)

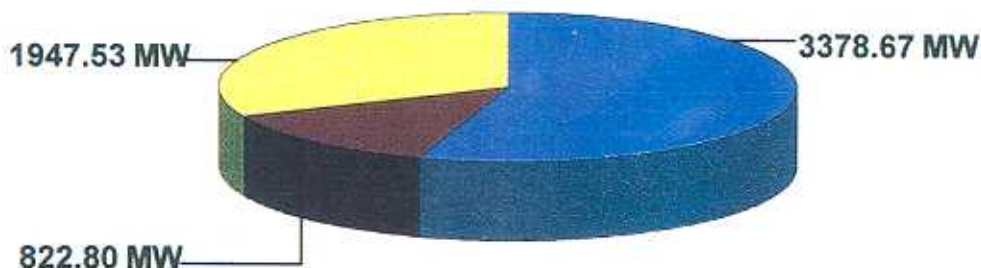
As on March 98

GANGA BASIN (TOTAL POTENTIAL = 10715 MW)



■ POTENTIAL DEVELOPED ■ POTENTIAL UNDER DEVELOPMENT ■ BALANCE

WEST FLOWING RIVERS (TOTAL POTENTIAL = 6149 MW)

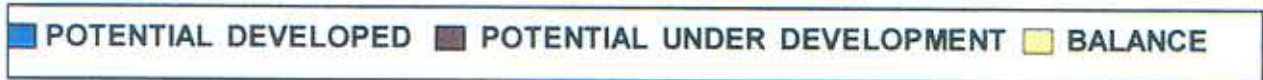
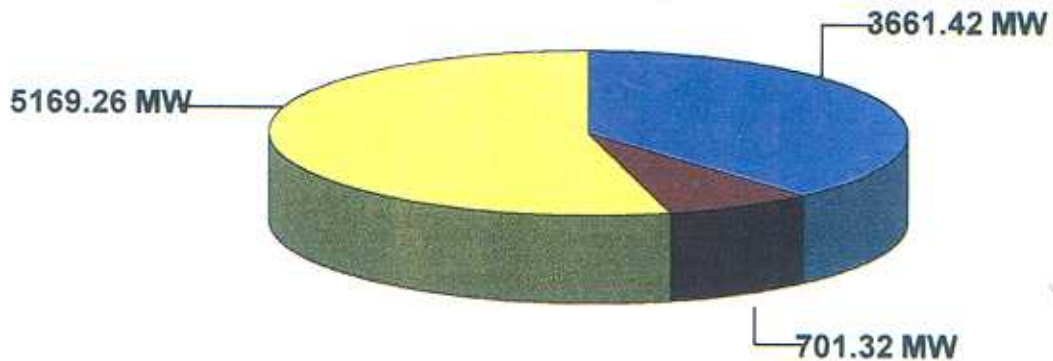


■ POTENTIAL DEVELOPED ■ POTENTIAL UNDER DEVELOPMENT ■ BALANCE

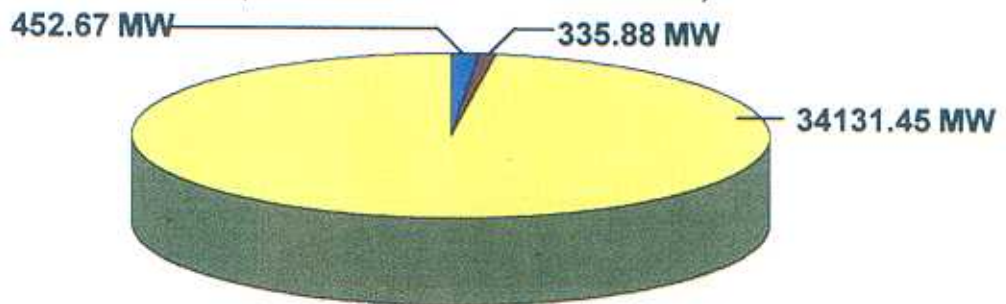
RIVER / BASIN WISE DEVELOPMENT OF HYDRO POWER POTENTIAL (AT 60 % LOAD FACTOR)

As on March 98

EAST FLOWING RIVERS (TOTAL POTENTIAL = 9532 MW)



BRAHMAPUTRA BASIN (TOTAL POTENTIAL = 34920 MW)



SANCTIONED AND ONGOING HYDROELECTRIC SCHEMES FOR BENEFITS DURING 9TH PLAN

(As on 31.3.1998)

Sl. No.	Scheme	State	Installed Capacity (MW)	Benefits 9th Plan (MW)	Latest anticipated cost (Rs.Cr.)	Expenditure upto 3/98 (Rs.Cr.)
CENTRAL SECTOR						
1	Nathpa Jhakri	HP	1500	1500	7217.05	2700.56 (2/98)
2	Dulhasti	J&K	390	390	3559.77	1866.56
3	Tehri Stage I	UP	1000	1000	4657.00	1642.45
4	Rangit-III	Sikkim	60	60	361.86	268.42
5	Ranganadi	Ar. Pradesh	405	405	1024.10	666.29
6	Doyang	Nagaland	75	75	557.87	407.36
7	Kopili Stage II	Assam	25	25	63.00	
Total (Central Sector)			3455	3455	17440.65	7551.64
STATE SECTOR						
1	Dadupur	Haryana	6	6	32.25	0.01
2	W.Y.C.-II	Haryana	16	16	81.00	18.45
3	Gharvi	HP	22.5	22.5	94.64	43.89
4	Sewa-III	J&K	9	6	50.00	35.54
5	Uppersindh-II	J&K	70	70	302.00	261.85
6	Pahalgoan	J&K	3	3	N.A.	N.A.
7	Uppersindh-III	J&K	35	35	42.27	24.24 (3/97)
8	Thein Dam	Punjab	600	600	2976.00	2660.10

9	Kata Pathar HE	UP	19	19	47.50	0.00
10	Sobla	UP	6	6	15.98	13.57 (3/97)
11	Jakhm	Rajasthan	5	5	24.94	0.62 (3/96)
12	Kadana PSS Extn.	Gujarat	120	60	142.48	119.48
13	Bansagar Ton 2.3	MP	90	90	895.44	655.85
14	Bansagar Ton 4	MP	20	20	80.93	2.84
15	Rajghat	MP	45	45	131.26	98.39
16	Sardar Sarovar	MP	1450	650	3248.77	1595.95
17	Dudhganga	Maha.	24	24	49.11	42.69
18	Ghatghar PSS	Maha.	250	250	620.78	43.16
19	Koyna Stage-IV	Maha.	1000	1000	1113.97	1000.58
20	Warna	Maha.	16	16	30.93	27.12
21	Srisaillam LBPH	A.Pradesh	900	900	2324.55	1523.98
22	Singur	A.Pradesh	15	15	40.58	25.36
23	Sarapadi	Karnataka	90	90	369.45	1.82 (11/97)
24	Bhadra RBC	Karnataka	6	6	21.29	4.31 (3/97)
25	Brindawan	Karnataka	12	12	51.24	5.11
26	Kalinadi-II	Karnataka	270	270	571.00	477.76
27	Saravathy Tail Race	Karnataka	240	240	408.57	169.32
28	Kakkad	Kerala	50	50	145.99	122.26
29	Peppara	Kerala	3	3	5.80	5.60
30	Kuttiadi Extn.	Kerala	50	50	113.71	76.00

31	Malankara	Kerala	10.5	7	41.57	2.26
32	Poringalkuthu-4	Kerala	16	16	36.69	34.78
33	Lower Periyar	Kerala	180	120	273.00	288.39 (1/98)
34	Sathanur Dam	Tamil Nadu	7.5	7.5	28.65	23.66
35	Lower Bhawani	Tamil Nadu	8	8	31.93	30.10
36	Kundah-5 Extn	Tamil Nadu	30	30	98.12	68.01
37	Chandil LBC	Bihar	8	8	32.49	22.00
38	North Koel	Bihar	24	24	47.34	35.00
39	Eastern Gandak	Bihar	15	5	66.00	61.74 (6/97)
40	Balimela-II	Orissa	150	120	277.57	14.05 (3/97)
41	Bargarh	Orissa	9	9	34.80	0.10
42	Potteru Small	Orissa	6	6	18.83	16.27
43	Upper Indravati	Orissa	600	600	1107.10	775.27
44	Teesta Canal Fall	W.B.	67.5	67.5	527.69	466.75
45	Rolep-HE	Sikkim	9	9	35.13	0.14 (12/97)
46	Rathongchu	Sikkim	30	10	135.00	12.16 (3/97)
47	Nuranang	Ar. Pradesh	6	6	36.00	33.95
48	Umian Umtru-V	Meghalaya	18	18	45.00	0.00
49	Dhansiri	Assam	20	20	71.89	37.07 (12/97)
50	Lower Borpani (KL)	Assam	100	100	288.37	118.37 (12/97)
51	Serlui-B	Mizoram	9	9	100.00	7.22 (12/97)
52	Likim-Ro	Nagaland	24	24	156.00	92.31 (3/97)

53	Kalpong	A&N Islands	5.2	5.2	49.37	5.30
	Total (State Sector)		6795.2	5808.7	17570.97	11200.75
	PRIVATE SECTOR					
1	Baspa-II	H.P.	300	300	949.23	283.83
2	Uhi-III	H.P.	100	100	713.00	N.A
3	Dhamwari Sunda	H.P.	70	70	384.93	N.A
4	Maheshwar	M.P.	400	80	1582.27	136.49 (12/97)
	Total		870	550	3629.43	420.32

Y:

**SANCTIONED/ ONGOING HYDROELECTRIC SCHEMES
FOR BENEFITS DURING 10TH PLAN**

S. No.	Scheme	State	Installed Capacity	Benefit 10th Plan (MW)	Estimated Cost (Rs Cr.)	Expendr. upto 3/98 (Rs. Cr.)
Central Sector						
1	Dhauliganga-I	U.P	280	280	1881.49	64.14
2	Koel Karo	Bihar	710	710	2377.87	21.53
Total (C.S)			990	990	4259.36	85.67
State Sector						
3	Larji	H.P	126	126	667.04	63.77
4	Kishan Ganga	J&K	330	330	1650.00	NA
5	Lakhwar Vyasi	UP	420	420	1446.00	211.55
6	Indira Sagar	MP	1000	750	2325.70	727.56
7	Sardar Sarovar	MP	1450	800	3248.77	1595.95
8	Bedthi	Ktk	210	210	380.75	6.70
9	Dandeli	Ktk	60	60	162.59	2.40
10	Puyankutti	Kerala	240	240	590.00	5.30
11	Purulia PSS	W.B	900	900	3198.90	29.19
12	Rammam St. I	W.B	36	36	77.00	0.90
Total (S.S)			4772	3872	13746.75	2643.32
Private Sector						
13	Srinagar	UP	330	330	1270.63	100.00 (3/97)
14	Vishnu Prayag	UP	400	400	1614.66	NA
15	Maheshwar	MP	400	320	1582.27	136.49 (12/97)
Total (P.S)			1130	1050	4467.56	236.49
Grand Total (CS+SS+PS)			6892	5912	22473.67	2965.48

**ADVANCED ACTION SCHEMES FOR 10TH PLAN AND
BEYOND UNDER CENTRAL SECTOR**

S.No.	Project	Capacity (MW)
NHPC		
1.	Chamera II (HP)	300
2.	Teesta-V (Sikkim)	510
3.	Parbati II (HP)	800
4.	Kol Dam (HP)	800
5.	Loktak D/S (Manipur)	90
THDC		
6.	Koteshwar (UP)	400
7.	THDC Stage II (PSP) (UP)	1000
NJPC		
8.	Rampur (HP)	535
NEEPCO		
9.	Tuirial (Mizoram)	60
10.	Tuivai (Mizoram)	210
11.	Lower Kopili (Assam)	150
12.	Kameng (Ar. Pradesh)*	600
13.	Ranganadi St-II (Ar. Pradesh)*	160

* Consent of state Government to be obtained

**HYDROELECTRIC SCHEMES CLEARED / APPRAISED BY CEA AND
AWAITING INVESTMENT DECISION
FOR BENEFITS BEYOND 9TH PLAN
(Costing more than Rs.100 Crores)**

Sl. No.	NAME OF PROJECT	STATE	DISTRICT	CAPACITY (NO.xMW)	ESTIMATED COST (Rs. Crs.)	BENEFITS DURING 9TH PLAN AND BEYOND (MW)
NORTHERN REGION						
1.	Chamera St. II	H.P.	Chamba	3x100	1460.31	300
2.	Tehri St. II	U.P.	Tehri Garhwal	4x250	531.02	1000
3.	Koteshwar	U.P.	Tehri Garhwal	4x100	342.53	400
4.	Kol Dam	H.P.	Bilaspur	4x200	932.85	800
5.	Sawalkot	J&K	Doda	3x200	1550.35	600
6.	Baglihar	J&K	Doda	3x150	1046.51	450
7.	Parbati St. II	H.P.	Kullu	4x200	2151.78	800
8.	SYL Canal	Punjab	Ropar	2x18+2x7	101.28	50
9.	Parnaj	J&K	Poonch	3x12.5	177.93	37.5
	TOTAL (N.R.)					4437.5
WESTERN REGION						
10.	Marhikheda (Mohini Sagar)	M.P.	Shivpuri	2x20	106.94	40
11.	Omkareshwar	M.P.	Khandwa	8x65	1216.95	520
	TOTAL (W.R.)					560
SOUTHERN REGION						
12.	Priyadarshini (Jurala)	A.P.	Mehboob Nagar	6x36.9	387.07	221.4
13.	Nagarjuna Sagar TPD	A.P.	Guntur	2x25	357.63	50
14.	Adirapally	Ker.	Trisur	2x80	230.48	160
	TOTAL (S.R.)					431.4

	EASTERN REGION					
15.	Teesta St. III	Sik.	North Sikkim	6x200	1566.65	1200
16.	Teesta St. V	Sik.	North Sikkim	3x170	1925.44	510
17.	Farakka Barrage	W.B.	Murshidabad	5x25	601.69	125
	TOTAL (E.R.)					1835
	NORTH EASTERN REGION					
18.	Kameng	Ar. Pr.	Kameng	4x150	1112.87	600
19.	Dhaleshwari	Miz.	Aizwal	3x40	154.06	120
20.	Loktak Downstream	Manipur	Tamenglong	3x30	424.95	90
21.	Tulvai	Miz.	Aizwal	3x70	659.27	210
	TOTAL (N.E.R.)					1020
	TOTAL ALL INDIA					8313.9

Note :

- 1) Malana H.E. Project (2x43 MW)(H.P.) was cleared by CEA in April 93 for execution under State Sector. The scheme has now been cleared on 27.7.98 for execution in Private Sector at an estimated cost of Rs 340.91 crores.
- 2) Palamaneri (3x47.5 MW) (U.P.) and Lohari Nagpala (3x94 MW) (U.P.) were accorded techno-economic approval by C.E.A. in 08/80 and 03/81 respectively. The reports of these projects are under revision by Govt. of UP with proposed capacities of 4x100 MW & 4x130 MW respectively.
- 3) Hibra (3x77 MW) in Himachal Pradesh cleared by CEA in May' 94 in State Sector has now been proposed for execution in the private sector.