

17

STANDING COMMITTEE ON ENERGY

(2015-16)

SIXTEENTH LOK SABHA

MINISTRY OF POWER

Hydro-power, a sustainable, clean and green alternative

SEVENTEENTH REPORT



**LOK SABHA SECRETARIAT
NEW DELHI**

May, 2016/Vaishaka, 1938 (Saka)

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STANDING COMMITTEE ON ENERGY
(2015-16)**

(SIXTEENTH LOK SABHA)

MINISTRY OF POWER

Hydro-power, a sustainable, clean and green alternative

Presented to Lok Sabha on 06.05.2016

Laid in Rajya Sabha on 06.05.2016



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NEW DELHI**

May, 2016/Vaisakha, 1938 (Saka)

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**COMPOSITION OF THE STANDING COMMITTEE ON ENERGY
(2015-16)**

LOK SABHA

Dr. Kirit Somaiya - Chairman

2. Shri Om Birla
3. Shri M. Chandrakasi
4. Shri Ashwini Kumar Choubey
5. Shri Harish Chandra alias Harish Dwivedi
6. Shri Deepender Singh Hooda
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19. Shri Devender Singh alias Bhole Singh®
20. Shri Purno Agitok Sangma*
21. Shri Malyadri Sriram
22. Shri Bhanu Pratap Singh Verma

RAJYA SABHA

23. Shri V.P. Singh Badnore
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27. Shri S.Muthukaruppan
28. Dr. K.P. Ramalingam
29. Shri Ananda Bhaskar Rapolu
30. Dr. Anil Kumar Sahani
31. Shri Javed Ali Khan
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SECRETARIAT

- | | |
|---------------------------|----------------------------|
| 1. Shri K. Vijayakrishnan | Additional Secretary |
| 2. Shri N.K. Pandey | Director |
| 3. Shri Manish Kumar | Senior Executive Assistant |

@ Nominated as Member of the Committee w.e.f. 13th April, 2016, consequent upon vacancy caused by the death of Shri P.A. Sangama on 4th March, 2016.

* Expired on 4th March, 2016.

INTRODUCTION

I, the Chairperson, Standing Committee on Energy having been authorized by the Committee to present the Report on their behalf, present this Fifteenth Report on 'Hydro-power, a sustainable, clean and green alternative' relating to the Ministry of Power.

2. The Committee had a briefing on the subject by the representatives of the Ministry of Power on 16th November, 2015. The Committee, with a view to examining the subject in detail, had evidence of the representatives of the Ministry of Power on 11th January, 2016. Further, the Committee, to gain clarity in regard to financial issues relating to the hydro power sector, took evidence of the representatives of the Ministry of Power on 25th January, 2016. The Committee, thereafter, took evidence of the representatives of the Ministry of Power, the Ministry of New and Renewable Energy, the Ministry of Environment, Forest and Climate Change, and Border Roads Organization, jointly on 11th February, 2016.

3. The Committee wish to express their thanks to the representatives of these Ministries/Organizations for appearing before the Committee and furnishing the desired information on the issues relating to the subject.

4. The Report was considered and adopted by the Committee at their sitting held on 27th April, 2016.

5. The Committee place on record their appreciation for the valuable assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

6. For facility of reference and convenience, the observations and recommendations of the Committee have been printed in bold letters in Part-II of the Report.

NEW DELHI
05th May, 2016
Vaisakha 15, 1938 (Saka)

DR. KIRIT SOMAIYA
Chairperson,
Standing Committee on Energy

REPORT

PART-I

NARRATION ANALYSIS

I. INTRODUCTORY

1.2 Hydro power is clean, green, sustainable and also a cheap source of power in the long run. Amongst the renewable sources of energy, hydro power has been recognized as the most preferred source of energy due to its inherent benefits. Thermal power generation stations are dependent on fossil fuels, which are limited and may not last long, whereas hydro power is a renewable source of energy. Inadequate availability of coal is already causing lot of concerns while non-availability of gas has already caused thousands of MW capacity equivalents of power stations to be non-operational, at least at present. While hydro power has a long gestation period and needs huge upfront capital cost, it is a much longer life and is free from fuel cost which significantly makes it cheaper in the long run. The Bhakra Nangal Plant, which is about 40 years old, has an operating cost of meager 10 paisa per unit. Moreover, hydro power stations, unlike conventional thermal power stations, do not emit pollutants in to the environment.

1.3 Hydro power, in the recent times, has gained greater importance due to the planning of 1.75 lakh MW capacity of power in the country from renewable sources, including wind and solar. Since these renewable sources of energy are intermittent in nature, it will require balancing power which can swiftly start up and stop down to provide grid stability. Hydro power possesses this quality.

1.4 Hydro projects generate employment for local people in remote hilly and backward areas and also provide incidental benefits of development of road/ rail, telecommunications,

electrification, industrialization and improvement of the quality of life in backward areas which lead to overall development of the area. Further, hydro power projects help in the utilization of water resources for other purposes like irrigation, flood moderation, navigation, pisci-culture, water supply etc.

1.5 At present, hydro power only upto capacity of 25 MW is termed as renewable energy source in the country and is under the purview of the Ministry of New and Renewable Energy, while larger capacity hydro projects are still included in conventional energy sources and looked after by the Ministry of Power. Basically, there are three types of hydro power projects: run of the river – it channels flowing water from a river through a canal or penstock to spin a turbine and has little or no storage facility; Storage hydro power – dam is used to store water and when released electricity is produced; and Pumped Storage hydro power - works like a battery and it stores energy by pumping water uphill to a reservoir at higher elevation from a second reservoir at a lower elevation.

1.6 It has been assessed that the country has hydro power potential to the tune of 1,45,320 MW. Besides this, an additional potential to the tune of 96,524 MW has been discovered in the form of Pumped Storage Schemes. Against this backdrop, at present, only 42,433 MW capacity of hydro power is being harnessed. It is a matter of great concern that despite having various positives, the hydro sector has not got the due attention of the Government and the valuable resource remains unutilized. The share of hydro power in the total energy mix of the country has been falling consistently, from 51% in the year 1962-63 to about 15% at present. The

North-Eastern Region, where most of the hydro power potential lies, has the least installed hydro power capacity.

1.7 The inherent complexities of hydro power – long gestation period, requirement of huge land area, large upfront capital and being site-specific – have further been aggravated by lack of finances and incentives, lack of transparency in allocation of projects, lack of coordination among agencies for grant of various clearances and in providing support to these projects. So far, rapid augmentation of thermal power generation capacities in the country has been compensating the slow pace of hydro power sector to some extent. However, due to fuel constraints and other limitations of the conventional thermal power, planning of 1.75 lakh MW of renewable energy, and in view of global climate concerns and international commitments, we are left with no option but to strategize our efforts and resources in such a way that it ensures optimum harnessing of available hydro potential within a definite timeframe.

II. EVALUATION OF HYDRO POWER SECTOR

1.8 Hydro Power Installed Capacity at the end of the 1st Five Year Plan was about 1,061 MW which has grown to 42,433.4 MW as on 30.09.2015. The present status of hydro power potential in the country is as follows:

Status	Capacity (MW)
Identified Hydro Potential (Schemes of above 25 MW)	1,45,320
Schemes under Operation	37,648*
Schemes under Construction	11,812*
Schemes for which DPRs Concurred by CEA but yet to be taken up for construction	26,638
DPRs under examination in CEA	6,989
DPRs appraised in CEA and returned for revision	8,496*
Schemes under Survey & Investigation (S&I) for preparation of DPRs	14,147*
Schemes allotted for development on which S&I is held up/ yet to be taken up	13,628
Balance Hydro Potential to be taken up for Development	25,962
* Excluding Pumped Storage Schemes (4785.6 MW under operation, 1080 MW under construction, 500 MW returned and 1000 MW under S&I)	

1.9 In addition to the above, Pumped Storage Schemes for an aggregate capacity of about 96,524 MW have also been identified by CEA during the reassessment study completed in 1987. The present status of Pumped Storage Schemes in the country is given below:

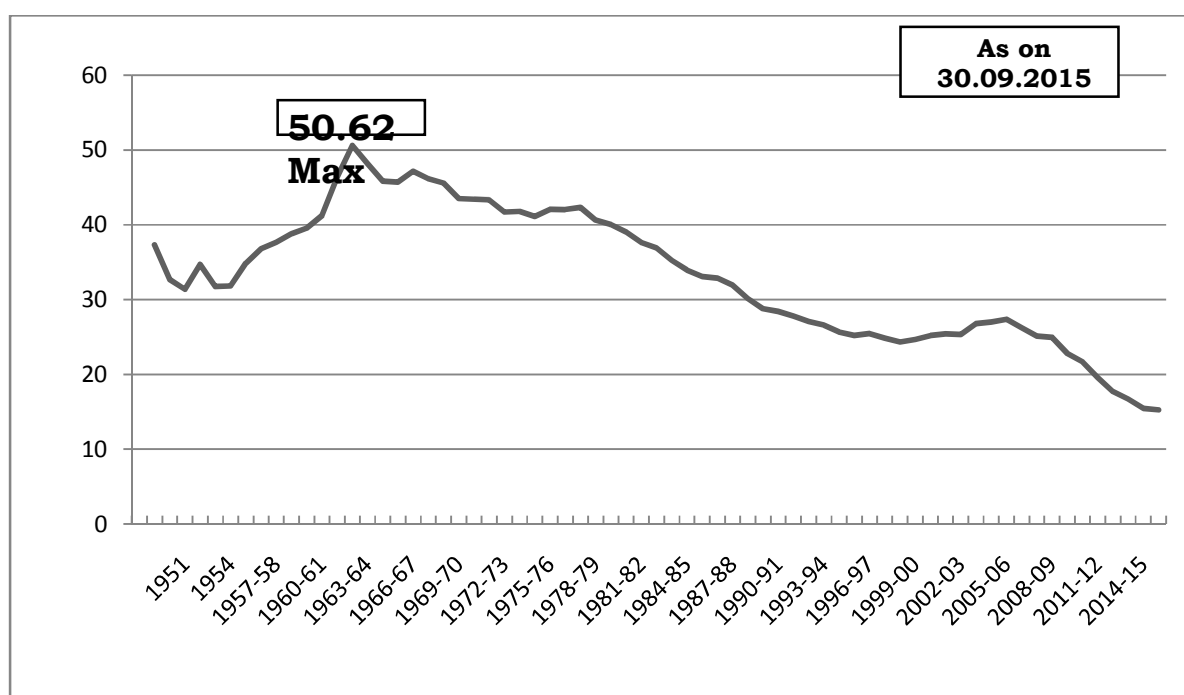
	Nos.	Capacity (MW)
Pumped Storage Scheme identified	63	96,524.0
Under Operation	9	4,785.6
Under Construction	2	1,080.0
DPR prepared and submitted to CEA	1	1,000.0

1.10 As on 30.09.2015, the total installed capacity in the country is 2,78,883.62 MW and hydro share accounts for 15.2 % as given below:

Type of Station	Installed Capacity (MW)	%age
Hydro	42,433.42	15.22
Thermal	1,94,199.56	69.63
Nuclear	5,780.0	2.07
R.E.S.	36,470.64	13.08
Total	2,78,883.62	100

*R.E.S. includes Small Hydro/Biomass/ Urban & Industrial waste power/ Wind power etc.

1.11 The share of hydro power in the Indian power sector increased and reached upto a maximum of 50.62% in 1962-63. Thereafter, it has been declining and at present it is 15.22 %.



1.12 At present, 193 nos. of hydro stations with total installed capacity of 42,433.4 MW, including 9 pumped storage schemes (PSS) with installed capacity of 4,785.6 MW, are under operation. Sector-wise summary of Hydro Electric Projects under operation is given below:

Sector	Nos.	I.C. (MW)	%age
Central	38	14,357.72	33.83
State	140	24,921.70	58.73
Private	15	3,154.00	7.43
Total	193	42,433.42	100

1.13 State-wise overview of Hydropower Development is given below:

STATE	EXPLOITABLE POTENTIAL (MW)	DEVELOPED (MW)	UNDER DEVELOPMENT (MW)	TO BE DEVELOPED (MW)
Arunachal Pradesh	50,064	405	2,854	46,805
Uttarakhand	17,998	3,756	1,430	12,812
Jammu & Kashmir	13,543	2,969	1,330	9,244
Himachal Pradesh	18,540	9,308	2,216	7,016
Karnataka	6,459	3,585	0	2,874
West Bengal	2,829	272	280	2,277
Meghalaya	2,298	282	40	1,976
Kerala	3,378	1,881	100	1,397
Sikkim	4,248	765	2,526	957
Odisha	2,981	2,027	0	954
Maharashtra	3,314	2,487	0	827
Andhra Pradesh	2,341	1,747	50	544
Other States	17,327	8,164	986	8,177
TOTAL	1,45,320	37,648	11,812	95,860

1.14 The details of development of Small Hydro Power Projects less than 25 MW are given below:

State	Sites	Potential (MW)	Achievement (MW)	% Utilisation
Karnataka	834	4141	1177.93	28.45
Himachal Pradesh	531	2397	739.91	30.87
Uttarakhand	448	1707	209.32	12.26
Jammu & Kashmir	245	1430	156.53	10.95
Arunachal Pradesh	677	1341	104.6	7.80
Chhattisgarh	200	1107	52	4.70
Andhra Pradesh & Telangana	387	978	232.23	23.75
Madhya Pradesh	299	820	86.16	10.51

Maharashtra	274	794	335.425	42.24
Kerala	245	704	168.92	23.99
Tamil Nadu	197	659	123.05	18.67
Uttar Pradesh	251	460	25.1	5.46
Punjab	259	441	157.4	35.69
West Bengal	203	396	98.4	24.85
Others	1424	2362.5	463.48	19.62
Total	6474	19737.5	4130.46	20.93

1.15 At present, 47 nos. of Hydro Electric Schemes with total installed capacity of 12,892 MW, including 2 pumped storage schemes (PSS) with installed capacity of 1,080 MW, are under various stages of construction.

1.16 42 nos. of Hydro Electric Schemes with installed capacity 26,638 MW have been cleared by CEA which are yet to be taken up for construction. The DPRs of 12 Nos. of H.E. Schemes with total installed capacity of 6,989 MW are presently under examination in CEA. The DPRs of 27 Nos. of Hydro Electric Schemes with an aggregate installed capacity 8,996 MW, including 1 pumped storage scheme (PSS) with installed capacity of 500 MW, have been returned to the project authorities for re-submission after compliance of various observations of CEA/CWC/GSI and other apprising agencies.

1.17 45 nos. of hydro schemes with an aggregate installed capacity of 13,421 MW are under various stages of Survey & Investigation in the country. At present, there are 48 nos. of hydro schemes with an aggregate installed capacity of 14,498 MW on which S&I is held up/yet to be taken up.

1.18 Hydro projects which are under construction/concurred and yet to be taken up for construction has been categorized in 3 categories:

Category-I - Hydro projects under construction with no major constraints as per details at **Annexure-I**.

Category-II - Hydro projects under construction having major constraints as per details at **Annexure-II**.

Category-III - Proposed Hydro Projects at DPR / Early stages as per details at **Annexure-III**.

1.19 Summary of the above mentioned projects is given below:

	Nos.	MW
Category-I	36	8,190
Category-II	11	4,852
Category-III	35	24,025

1.20 Targets and achievements in regard to generation capacity addition programme during the 11th Five Year Plan are as under:

(in MW)

Sector	Thermal		Hydro		Nuclear		Total	
	Tgt.	Ach.	Tgt.	Ach.	Tgt.	Ach.	Tgt.	Ach.
Central	24,840	12,790	8,654	1,550	3,380	880	36,874	15,220
State	23,301	14,030	3,482	2,702		0	26,783	16,732
Private	11,552	21,720	3,491	1,292		0	15,043	23,012
Total	59,693	48,540*	15,627	5,544	3,380	880	78,700	54,964

*Includes additional capacity of 9,678.5 MW not included in the original target.

1.21 Targets and achievements in regard to generation capacity addition programme during the 12th Five Year Plan so far are as under:

(in MW)

Sector	Hydro		Thermal		Nuclear		Total	
	Target	Ach till 29.2.16	Target	Ach till 29.2.16	Target	Ach till 29.2.16	Target	Ach till 29.2.16
Central	6,004	2,464.02	14,878	11,228.1	5,300	1,000	26,182	14,692.1
State	1,608	672	13,922	14,569.1	0	0	15,530	15,241.1
Private	3,285	595	43,540	44,667.5	0	0	46,825	45,262.5
Total	10,897	3,731.02	72,340	70,464.7	5,300	1,000	88,537	75,195.7

1.22 A hydro capacity addition of 10,897 MW is programmed for the 12th Plan (2012-17).

Sector-wise details are as under:

(up to 30.09.2015)

Sector	Commissioned (MW)	Under Execution (MW)	Total (MW)
Central Sector	2,424	3,580	6,004
State Sector	442	1,166	1,608
Private Sector	595	2,690	3,285
Total:	3,461	7,436	10,897

1.23 It is expected that hydro electric capacity to the tune of 6,746 MW will be added during the 12th Plan period. The detail of Hydro Electric Projects commissioned and likely to be commissioned in the remaining period of the 12th Plan and beyond is enclosed at **Annexure-IV.**

1.24 The Generation Performance of Hydro Stations (above 25 MW) since 2010-11 is given below:

Year	Target (MU)	Achievement (MU)	Achievement/Target (%)
2010-11	1,11,352	1,14,257.36	102.61
2011-12	1,12,050	1,30,509.52	116.47
2012-13	1,22,045	1,13,720.29	93.18
2013-14	1,22,263	1,34,847.52	110.29
2014-15	1,24,297	1,29,243.68	103.98
2015-16 (as on 30.09.2015)	77,830	79,958.14	102.73

1.25 *When the Committee asked for the comparative per unit generation cost of a typical hydro and a coal based thermal power plant, the Ministry, in their reply, have furnished the following information:*

“The per unit capital cost of Hydro Projects ranges between Rs. 6 Crore to 10 Crore / MW as compared to Rs. 3 Crore to Rs. 5 Crore for thermal plants. The initial capital cost of HEPs is high on account of high civil construction cost, difficult terrain, poor connectivity, high cost of Survey & Investigation etc. The following chart gives an idea of the average sale rate of thermal power vis-à-vis hydro power in the years 2011-12 to 2013-14:-

Mode of Generation	2011-12	2012-13	2013-14
Hydro	233.58 paise/KWh	238.89 paise/KWh	232.98 paise/KWh
Thermal	313.41 paise/KWh	333.00 paise/KWh	336.43 paise/KWh

1.26 *The Ministry have stated that the normal construction period of hydro projects after the award of works ranges from about four years to seven years depending upon the size and features of the project and the geographical terrain of the site, amongst other factors. When the Committee desired to know whether all the functional projects of various PSUs of the Government of India have become operational within the stipulated period, the Ministry have furnished the following information:*

“Majority of the hydro projects of various CPSUs functional in the 12th Plan Period could not be commissioned within the stipulated period. The details of these projects along with the reasons for time overrun are enclosed at **Annexure-V**. However, some of the CPSU Projects viz. Omkareshwar HEP, Chamera-II HEP etc., commissioned during the earlier Plans, were commissioned within the stipulated time period.”

1.27 *On being inquired by the Committee whether there is any scope for curtailment of the gestation period in view of the advancement in engineering/technology, the Ministry have stated as below:*

“The major advancements during the recent years are use of advanced Tunnel Boring Machines for excavation of tunnels (Kishanganga HEP), Tunnel Seismic Prediction machine to predict the geology ahead of the tunnel face upto 200m, use of advanced Drill Jumbos for excavation of tunnels etc. These machines help in reducing the construction period to some extent. However, prediction of geology deep inside the mountains has not been addressed in case of under construction hydro projects.”

1.28 *When the Committee further desired to know whether the long gestation and heavy initial capital cost in hydro power projects are compensated in the long run, the Ministry stated as under:*

“It is felt that the long gestation period and heavy capital investment in Hydro Power projects get compensated in the long run since the actual life of the hydro projects is much more than the normative useful life of thermal plants. Beyond that stage, hydro power proves to be cheaper option, when all loans are recovered and the plant is fully depreciated.”

1.29 *On being asked by the Committee whether implementing provisions, viz. differential tariff for hydro power, specifying mandatory use of hydro power by the Discoms and Hydro Power Purchase Obligation will provide impetus to the sector and what are the barriers in implementing these, the Ministry, in their written reply, have stated as under:*

“The provision of differential tariff for Hydro Power and Hydro Power Purchase Obligations are likely to give boost to the development of Hydro Power Projects. Of-late, the capital cost of hydro projects is gradually increasing, leading to a corresponding increase in the tariff of hydro power.

Ministry of Power had sought views/comments of State Governments on introduction of Hydropower Purchase Obligation on the lines of Renewable Purchase Obligation. Several major States, having less or negligible hydro potential, are not in favour of the implementation of HPO. Govt. of Chhattisgarh and Odisha stated that these States mostly rely on thermal projects for their power requirements. These States have negligible hydro power potential. Therefore, it would not be possible to come to the terms of the HPO. Some of the States (like UP, Chhattisgarh, Odisha) also opined that there is no need to implement HPO as a similar RPO is already in place.”

1.30 *During the examination of the subject, the Committee observed that at present Private Sector's share in hydro power generation is a meager 7.43%. When the Committee desired to know the reason for the same, the Ministry, in their written reply, have stated as under:*

“Hydro Power development involves large capital investment and has a longer gestation period than other types of Power Projects (Thermal/Wind/Solar etc.). These projects also involve risk and challenges during execution viz. geological risks due to young Himalayan mountains; remote locations & poor infrastructure; adverse weather conditions; local issues; environment & forest issues; land acquisition problems; natural calamities like flash floods, cloud burst, earthquake, etc.”

1.31 *On being asked by the Committee for the details of the efforts of the Government that are being made by the Government to improve this situation, the Ministry have stated as under:*

“45 nos. of H.E. Projects having aggregate installed capacity of 12,722 MW have been identified for benefits during 13th Plan. Out of which 25 Nos. of H.E. projects having aggregate installed capacity of 5,830 MW (45.83%) are from private sector. The private sector has a substantial share in the projects under construction which are likely to yield benefits during 12th Plan and beyond. However, the above mentioned factors have caused appreciable time and cost overruns in some of the projects. The funds constraint faced by the Private Developers due to their inability to get additional equity for the increased cost has affected the progress of the works. Further, the low returns vis-à-vis risks involved in case of hydro projects could also be deterrent to Private Developers to enter this field. The Govt. of India has taken a number of steps to promote private sector.”

1.32 *The Committee observed that the share of hydro power in the total energy mix has constantly been on the decline. At present, the share of Hydro Power is only 15%. When the Committee asked for the details of the specific efforts that have been made by the Government to increase the share of hydro power, the Ministry of Power, in their written reply, have furnished the following details:*

“It is true that over the years, the share of hydro in the total installed capacity has declined from a maximum of about 51% (2,936 out of a total of 5,801 MW) in the year 1962-63 to about 15% (42,433 MW out of a total of 2,78,883 MW) now. It is mainly due to the fact that upto 1960s, the major emphasis of the government was on development of multi-purpose reservoir based hydro projects mainly to have irrigation for better food security which also led to development of hydro capacity. Major multi-purpose projects constructed till the 1960s include Hirakund, Bhakhra, Damodar Valley projects etc. However, apart from lack of adequate infrastructure, drying-up of funding by bilateral/ multi-lateral agencies, increasingly stringent environment clearance regime for hydro projects after 1970s due to world-wide focus on environmental / ecological / R&R issues and consequent activism against the development of hydro projects by NGOs/ Environmental activists, greater emphasis on rapid development of thermal power during 1970s for quicker capacity addition in view of large scale industrialization have contributed to the slow growth/ decline of hydro share in subsequent years. In addition, factors like

Land acquisition issues, R&R issues, inter-state issues and non-tie-up/ non-availability of requisite finances on long term basis etc. have further slowed down the development of hydro power.

The Govt. has taken a number of steps to give boost to the development of hydro project development by introducing policies like National Electricity Policy, Hydro Power Policy- 2008, and Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act, 2013. Further, apart from rigorous monitoring of the projects under construction, Govt. has also introduced a multi-pronged strategy involving a Consultation approach for Fast Tracking of S&I activities and preparation of Quality DPRs and introduced norms for time bound appraisal of DPRs. Various policy initiatives as well as other measures undertaken by this Ministry to give impetus to development of hydro power are below:

➤ **National Electricity Policy, 2005:**

The policy lays maximum emphasis on full development of the feasible hydro potential in the country which will facilitate economical development of States, particularly North Eastern States, Uttarakhand, Himachal Pradesh and Jammu & Kashmir. Since the hydel projects call for comparatively larger capital investment, debt financing of longer tenure has been recommended. The State Governments have been advised to review procedure for land acquisition and other approvals / clearances for speedy implementation of hydro projects. Full support of Central Government has been extended for hydel development by offering the services of CPSUs like NHPC, NEEPCO, SJVNL, THDC, etc.

➤ **Hydro Power Policy- 2008:** Salient Features (including subsequent changes): Hydro Power Policy, 2008 has been notified by Govt. of India on 31.3.2008. The salient features of the policy are given below:

- The cost plus Tariff regime (in which tariff is to be determined by the regulator under section 62 of Electricity Act, 2003) has been extended for public as well as private sector hydro power projects up to December 2015.
- Transparent selection criteria for awarding sites to private developers.
- Enables developer to recover his additional costs through merchant sale of upto a maximum of 40% of the saleable energy. 5% reduction for a delay of every six months. – Balance long term PPAs
- For 10 years from the COD, developer to provide 100 units of electricity per month to each Project Affected Family (PAF) - in cash or kind or a combination of both.

- The host State is provided with 12% free power of the total installed capacity of the project.
- Additional 1% free power from the project (over and above 12% free power earmarked for the host State) for a Local Area Development Fund- regular revenue stream for welfare schemes, creation of additional infrastructure and common facilities.
- The State Governments would also contribute a matching 1% from their share of 12% free power.

OTHER MEASURES TAKEN FOR INCREASING THE HYDRO CAPACITY

Central Electricity Authority (CEA) monitors the progress of each project regularly through frequent site visits, interaction with the developers and critical study of the progress reports. CEA holds review meetings with the developers and other stakeholders to sort out the critical issues.

- A Power Project Monitoring Panel (PPMP) has been set up by the Ministry of Power to independently follow up and monitor the progress of the hydro projects.
- Review meetings are taken by Ministry of Power/CEA regularly with the concerned officers of CEA, equipment manufacturers, State Utilities/ CPSUs/ Project developers, etc. to sort out the critical issues.

Review meetings are taken by MoP/CEA with Border Roads Organization, Ministry of Road Transport and Highways etc. to sort out the infrastructure issues and with MoEF & CC to sort out clearance issues.”

1.33 During the examination of the subject, the representative of the Ministry of Power, while enumerating the various constraints in development of hydro power, has deposed as under:

“We have analysed the reason as to why hydro power is not coming up at a desired stage. The reasons which we have understood so far are various clearances. When I say various clearances, clearances mean environmental and forest clearances and then there are some land acquisition issues; there are rehabilitation and resettlement issues; and there are legal and social problems also. In the last ten to fifteen years, there has been tremendous social resistance to the large hydro projects. We have dealt extensively about the financial aspects of hydro power projects. How can we promote hydro power projects by incentivising them, by way of cheap finance, cheap loans or by giving some other incentives like tax holiday or tax free instruments? We are trying to address those at our own level.”

1.34 As the Committee have been stressing the need for speedy development of hydro power sector, the representative of the Ministry of power, while stating the steps taken by the Ministry in this regard, deposed before the Committee as under:

“We have formed two sub-committees to look at the overall legal and regulatory framework of hydro power. Another Committee has been constituted with the objective of looking into the various financing options of hydro power. One thing is legal regulatory framework – how can we ease it, how can we simplify it or what changes are required to be made in the regulatory framework to promote hydro power? One Committee is constituted with the terms of reference of looking into as to how we can arrange the cheap finances or innovative financing instrument for funding the hydro power projects.”

1.35 While stating the steps taken by these Committees, he further deposed before the Committee as under:

“We should be able to come up with some firm steps in the next two to three months. We have kept the internal deadline of April of this year. We will be ready with the draft paper in the next three months. We have taken some concrete steps also. Recently, the Cabinet has approved the new tariff policy in which hydro power has been exempted from the renewable solar power obligation. Earlier the position was different. If the total capacity in the State is, for example, 10,000 MW, then certain percentage of that total capacity was required to be from solar or from renewable. Now that obligation to buy solar power, renewable power will be calculated after excluding the hydro power capacity. That is an incentive for hydro power. We have discussed in the past also that hydro power has a very typical kind of a tariff framework in which the tariff is higher in the first year and it gradually decreases as and when loan is repaid and depreciation comes down. States are reluctant to buy hydro power because the initial tariff is high. Now we have given that flexibility to the developers to modify the depreciation rate so that the tariff is either flat or it increases with the passage of time. Earlier this flexibility was not there with the developers. He had to fix depreciation rate determined by CERC and he had no option but to charge the depreciation at that rate which made the tariff in the initial year very high. As a result, States were reluctant to buy that power. Now we have given that flexibility. If the developer wants to charge lower tariff in the initial year and higher tariff in the subsequent years, that option is now available to the developers.”

1.36 When the Committee raised the issue of transparency in allocation of hydro power projects, the representative of the Ministry of Power, deposed before the Committee as under:

"Regarding the allotment of projects in the states, for example in the State of Arunachal Pradesh, it were allotted on first come first serve basis and on the basis of upfront premium. In the Uttarakhand, where the matter went to court, one time premium was given. At few places, there are allotted on bidding and at some places it is allotted on the basis that who will be giving more free power to the State. Sometimes it happens that due to lack of due diligence also few projects have been allotted to the promoters also, as regarding the NEEPCO, have MD of NEEPCO is also available; there are four food projects of Arunachal Pradesh with good tariff but the private institute is not also to do it. The reason can be technical capacity or financial capacity or any other reason. We had raised this issue in the power ministers conference. We have been requesting the states to have a uniform policy on this issue. This should also be transparent because now due to increased allocation of the matter goes to court and capacity gets stuck up which cannot be given to any other also. This is not applicable to our PSUs but is for IIPs.

1.37 The Secretary Power further expounded:

"In premium-basis bidding, premium is not the cost of the project and that premium is not included in the tariff determination, if that is not pass through then wherefrom the premium comes. If I take the project by paying the premium, premium is not a part of the tariff. Premium is not a part of the tariff. Then, how does the developer make up for the premiums? To be frank, that is what I was saying. I did not say in so many words, but this is what is happening. That is why I said it should be transparent."

1.38 In regard to provision of upfront fee for allotment of hydro power projects, CMD, NEEPCO deposed before the Committee as under:

During 2008 when hydro policy was formulated in Arunachal Pradesh, they had made provision of upfront fee. That time all the project which were with NHPC were taken back and after taking the upfront free there were allotted to private companies. NEEPCO could not pay upfront fee because there was no such provision in the government company. In that PFR for the few was complete and for the few others it was going on. After that many letters have gone from our ministry. Whatever money was spent by the ministry, that money has also not been received back. We have received money for one project. We prepared DPR for that project. Money for only that project has been received. No money has been received for the remaining twelve projects. On that issue we have taken up matter on each forum and matter has been taken up. Secretary, Power has also written a letter on the subject. Then also, there has been no response from there, and they say clearly that they will not pay any money. They also say that you can take money from private companies who have been allotted projects. How can we take money from these companies at our level because the support of state government is required in this matter. Where the state government has not made

any provision of any penalty on them that company will not make payment. Like this the matter is pending. In that we have stated of 225 crore rupees including the interest."

III. FINANCIAL ISSUES

1.39 In regard to funding pattern of hydro power projects, the Ministry have stated that the debt equity ratio for a hydro power project is generally 70:30 for Central Hydro Projects and 80:20 for State Hydro Projects. This ratio is adhered to in most of the cases. However, sometimes the equity may be different from the ratios given above.

1.40 When the Committee asked for the details of the terms of loan and depreciation rate for hydro power projects, the Ministry, in their reply, have stated as under:

“Financial institutions grant loan for hydro projects— normally for a period of 10-15 years whereas the life of hydro project is 35 years. The term of loan is not concurrent with the life of the project. However, recently Power Finance Corporation (PFC) has amended their policy to extend loan for longer periods (upto 80% of the useful life of asset) for power projects. There is a moratorium given for the purpose of repayment of principal portion of the loan during the construction period. Thereafter, at present, the loan is repaid in equated monthly installments of principal amount plus interest over the term of the loan. As per the principles of accounting, the depreciation should be charged on a straight line method over the useful life of asset. However, since the term of the loan is less than the life of asset, i.e., the debt is required to be repaid in 12-15 years as against the useful life of 35 years or more. Therefore, higher cash flow is required in initial years on account of repayment of debt. To meet the increased cash flow requirement, higher rate of depreciation is allowed (5.28%) for initial period of 12 years for the purpose of determination of tariff. As a result, the tariff of Hydro Power Project is on the higher side in initial years. The tariff of hydro power station then reduces after the loan is repaid and plant is depreciated. However, the O&M charges, which also form part of the tariff of hydro power stations is escalated at a pre-fixed rate during the tariff period based on a combination of WPI & CPI.”

1.41 In regard to the desire of the Committee to make available long-term finances to hydro power sector, the representative of the Ministry of Power deposed as under:

“We have two financial institutions viz. Rural Electricity Corporation and Power Finance Corporation and they have modified their policies. Now they are willing to extend loans for a longer duration up to 85 per cent of the useful life of the power plant. They are also ready to pay down on long term. Now they are ready to

give loan for 25 years. So, it would act as a cushion to our developers that they pay less amount of loan during the initial years.

1.42 *When the Committee desired to know the link between term of loan and the rate of depreciation of hydro power projects, the Secretary, Power, stated before the Committee as under:*

“When you speak of the financial, it get linked to the depreciation. Because both go hand in hand. So, if we make 12 years into 30 years then depreciation needs to be reset. So, in the current circumstances, it has been said that CERC will stipulate or determine a particular depreciation rate which SERC will adopt. What we are saying in our policy is that they will indicate a depreciation rate which will be an upper ceiling for the developer of a hydro project. If he chooses so, depending on the financial instrument that he is using, he may accept a low depreciation rate so that he can match the depreciation along with that financial instrument. That is why, I was linking it up. It is all flowing from there.

1.43 When the Committee desired to know the view point of the Central Electricity Regulatory Commission (CERC) in respect of rate of depreciation of hydro power projects, the representative of CERC deposited before the Committee as under:

“As far as CERC is concerned, we are with the Government. So far as our regulations are concerned, these are based on the policy decided by the Government and regarding the issue that why depreciation is given for 12 years, all the developers said that currently we are getting loan for 12 years. To make the project financially viable, depreciation is given for the initial 12 years so that they can make prepayment of the loan. Therefore, our regulations are based on extensive consultations with the developer, with the stakeholder, where everybody participates, based on which we prepare our regulations. I want to assure through your medium. CERC is open to any modification in the regulation provided the policy is changed. If there are loans available for 30 years, 35 years, we would be able to reduce the depreciation for repayment in 35 years. The only point I would like to submit it will be back-loaded from front-loaded I can tell that in the levelised tariff, it will not make much difference. Levelised tariff will come down by only ten paise or twelve paise; may be in the initial 11 years, the tariff based on depreciation/reduction will come down from fifty paise to eighty paise and subsequently it will go up after the eleventh year, but interest liability will come up because if the loans are getting repaid in 11 years, you will be repaying only 22 per cent of the loan amount, if you are giving two per cent depreciation in that. Therefore, that factor also has to be considered. The major portion which we

consider in hydro projects, as it has been rightly raised, is the capital cost. When the project is conceived, the capital cost is taken as Rs. 5 crore. When you end up, you will end up with Rs. 10 crore or Rs. 15 crore. Every Rs. 1 crore increase in the capital cost has an impact of 40 to 60 paise per unit cost. That is the kind of variation. Suppose Rs. 5 crore becomes Rs. 10 crore, Rs. 3 per unit cost automatically increases. Therefore, so far as CERC is concerned, we are open to any suggestion. We will definitely cooperate and support in modifying our regulations.”

1.44 While elaborating the financial constraints being faced by hydro power projects, the representative of the Ministry of Power deposed before the Committee as under:

“There are many problems in hydro viz. rehabilitation, environmental, inter-state and social issues. If Secretary, Finance will come than utilizing the moment, I would like to project one problem. We are facing the problem that it takes 8-10 years in making a hydro project, whereas solar plant is ready in one year. The returns of the solar plant start yielding after one year, in case of _____ the returns starts after 4-5 years but in case of hydro, the returns starts coming after 8-10 years. Whatever is the affecting rate of return of the investor, if we are giving equity on the same returns, the return on equity reduces of 16 percentage of hydro, thermal or solar because there is no returns for the 10 years. If I separate the returns and investment out of the overall project life cycle, the hydro comes lesser than the solar and thermal. The cost is more and that is the reason this problem is coming that the tariff of power project is coming in the range of five to six rupees and the states are not ready to purchase this. Our Kishanganga project is under construction in Jammu and Kashmir. Through Ministry of Finance, it has got subordinate debt also, but despite that we are not able to execute the power cost which is with PPA and power purchase agreement states. States claim that it is very costly and they are getting thermal power in cheaper rates. We are facing this problem. We have problem of environment, rehabilitation, resettlement, social issues and these are major issues. Seven to eight years also there was no huge problem of financing or costing. But now, this has become a huge problem. Regarding the hydro, have thought, as the Hon'ble Chairman has said that though we get the finance for 12 or 15 years, we have to repay the complete loan within 12 to 15 years. The cash flow to repay the loan can be derived from tariff only. So, during the initial years, we have to fix the tariff more. The provisions were made in the policy accordingly. Recently, cabinet has given approval to the tariff policy and in that we have given flexibility to the developers that if you are getting long term finance then you can increase the tariff in the later years by reducing the tariff in the initial years. We have kept such provision in the new tariff policy which has been approved by the cabinet. If we can get long term finance from the institutions, we can reduce the tariff during the initial years and can increase it later on by reworking the tariff. This would only be possible once we get the long

term finance. If we do not get long term finance, we will have the requirement of cash flow and during the initial 12-15 years, we will have to recover that cash flow from the buyer as a tariff.

1.45 He further stated:

“Second, since the hydro has become very critical, as there is provision of tax free bonds or capital gain bonds for road sector, they get concession in income tax under section 54 or get tax free bonds and the cost of loan or finance reduces. Currently, tax free bonds are able to get money from the market at the rate of seven to seven and half percent per cent in comparison to the normal bonds which are on nine to quarter past nine percent. We can have a saving of one and half to two per cent in this. We had calculated and that was presented in the last meeting also, if our cost of finance is reduced by two percent then our tariff of first year will reduce by 50 to 60 paise. If we can get cheap finance then it would be a great convenience to the hydro power sector. If we get a window in the form of tax free bonds or get a facility of capital gas bond or government can provide us multilateral funding from World Bank or Jaica or from ADB and if the government borrows that fund and does its exchange fluctuation by foreign currency fund or the government absorbs it or provides such holding mechanism to us by which we can get long term multilateral funding then that will go a long way in sensitivising hydro power projects.

Regarding the sovereign guarantee, as the Secretary Finance said, sovereign guarantee is a window, space for them. While getting the hydro power projects loan from market, in the form of bond or institutions or from multilateral organization such as ADB or World Bank if they get sovereign guarantee from Government of India it would lead to reduction in the cost loan. Sovereign guarantee is such for instance NHPC has taken loan from the market. If government of India gives guarantee then NHPC can pick up the same loan from the market in 8.5 percent rate instead of nine percent. That would be beneficial for NHPC. The moment it gets sovereign guarantee, the rate of loan will be reduced.

1.46 He also stated:

“Recently many states have imposed water cess. It is leading to lots of implications. It has affected viability of the hydro power projects. For example in J&K it has led to difference of more than one rupee in the tariff due to hydro cess. More than this, hydro cess has been imposed. This is also an issue.”

1.47 *On being asked by the Committee as to how the cost of hydro power could be reduced, the representative of the Ministry of Power deposed before the Committee as under:*

“We have made calculation in that and have taken one sample. If we make repayment in 12 years and in that we have the interest rate of 12 percent and we make repayment in 12 years and fix the depreciation in that order than we get the tariff of 4.38 rupees for the first year. The same loan if we repay in 30 years and depreciation and we write it off in 30 years, currently we are clarifying 5.28 percent depreciation; if these are changed in the tariff policy than we will also lower the depreciation rate because if we have to repay the loan in 30 years than our tariff will be reduced to 3.87 rupees from 4.38 rupees. It will make difference of 50 paisa. If we can lower the rate of interest also to 7.5 per cent from 12 percent, we can get permission to raise the tax free bonds than the tariff can be brought to 3.08 rupees from 4.38 rupees. If we align the depreciation also in that direction than our tariff can be brought to 3.08 rupees from 4.38 rupees.

1.48 Since the matter of long-term loan, issuance of bonds and providing other incentives are dealt with by the Ministry of Finance, the Committee also held a discussion with the representatives of the Ministry of Finance. During the discussion on the subject, the representative of the Ministry of Finance, while suggesting solutions to the financing constraints in the hydro power projects, deposed before the Committee as under:

“We have observed that the project financing cycle of hydro projects is very different from project financing cycle of other infrastructure projects like highways and railways and the main reason is that in a hydro project the investigation on the site, pre-investigation survey, preparation of DPR is far more complex and takes a longer time. Secondly, the environment and forest clearance is a very tortuous process. Then coming to land acquisition and rehabilitation, it is a very long third stage process. Normally it happens that initially DPR is made after pre-investigation. But by the time DPR is made, the appraisal approved becomes as routine from the normal route. But by the time we get the clearance by the time DPR becomes old and we reach in the already first revise estimate. By the time land acquisition takes place by that time practically we reach in the second revise cost estimate. Thereafter the work begins. Due to this such a confusion is created in the financing, debt financing, bank financing, equity financing that all the project authorities get entangled in these three cycles. The most difficult part on the bottlenecks is project clearance, regularity clearance and of approval. There is a practical suggestion that we should not do financial appraisal and approved in one step. Whatever original DPR is made that goes for the clearance and by that stage it is not to be considered as original cost estimate. Approval not to be accorded at that stage but should be bifurcated into two parts. First, we can call it as pre-investment equity. For the pre investment equity, Finance Ministry had made delegation

enhancement of a specific window; the delegation power of the ministry was increased and in that window has been liberalised. The work which was supposed to be done before the actual start, should be done as financial appraisal approved as pre investment equity and not as a original cost estimate. This would lead to continuity of the job which is on spot as the clearances keep coming. If we get the land, take possession, have rehabilitation but the financial approval should be taken only when we are in the position of starting the work of dam actually. We can call this stage as original cost estimate and should restrict a timeline for this purpose. If we will do like this then whatever cost escalation comes in the timeline, we will not have to take the project approval again for all the cost escalation. Here is a practical solution that if we look at the project financing cycle like this than we can reduce the the difficulties being faced during the financing and execution.

1.49 He further stated:

“I would like to give two more practical suggestions that there is typically mixing of equity and debt. Earlier sometime, we had given equity out of the budget also. Our companies are involved in the hydro project and are doing wello. They have worked under the pressure. We also agree that a support should be provided to the Nationalised Companies in this sector. Nationalised companies are earning well overseas. We should give the same support to them in our country. We get the equity, cash is also available, sometimes these take support from the budget. Finance Secretary has suggested of co-financing with other PSUs which are cash rich. This is good suggestion. Now we would come to the financing of the debt site. The practical problem of our banks and financial institutes is that whatever credit they provide, they have to rotate that. it leads to difficulty for the period of 20, 25 or 30 years and probably it goes upto 12 to 15 years. There is mismatch between the cash flow cycle of the project and tenure of the debt financing that is available. Broad financing is a good way to remove this mismatch. Till now, we have been doing the sovereign borrowing. We might have floated bonds of 10, 15 or maximum for 20 years but now we are floating the bonds of 10 years. 10 years bonds which have sovereign guarantee, are benchmark in the market because this is finances linking of all the private sector and of the projects. If Power Ministry gives such a proposal then we can consider it favourably. In the long term bond financing FRBM Ltd. of power projects, there is window of 5 percent GDP guarantee for 25, 30 years. We can give priority to hydro projects in that so that the kind of facility being given to Railways or Highways, similar facility can be given to these. Third practical way about which Finance Secretary has also thought on. As far as possible it should be multilateral or bilateral financing because this is of long term than the typically debt financing. This should also be explored. Maybe that this is not possible at everyplace due to strategic issue but wherever possible, we should explore that way also through the Deptt of Economic Affairs.

1.50 In regard to providing long term finances to hydro power sector, the Secretary Finance deposed as under:

“One of the demands which have been raised on the financing side of hydro projects is the requirement of long-term financing for them, with the loan spread over the entire life-cycle, say 50 years instead of 12 years. Unless this is done, the problem of levelised tariff, which you raised, will be there. As you said that earlier it was made as 6 rupees and later on it was reduced. In a one way you are subsidising it. It is a distortion. So, we have to look at the tenure of the loan. It is basically a project finance issue on which we have to work together - the Ministry of Finance and the Ministry of Power. There are perhaps ways of addressing this problem. They have been demanding infrastructure bonds to finance these projects. We can look at long term infrastructure bonds.”

IV. CLEARANCES AND ENVIRONMENTAL ISSUES

1.51 On being asked by the Committee, it was stated by the Ministry that 12 nos. of DPRs of Hydro Electric Schemes aggregating to installed capacity of 6,989 MW are under examination in CEA for accord of concurrence of Authority u/s 8 of the Electricity Act, 2003. The details of these are enclosed at **Annexure-VI**.

1.52 *During the examination of the subject, when the Committee asked about the role of the Central Electricity Authority (CEA) in the Hydro Sector, the representative of CEA deposed as under:*

“Our role is basically to fast-track the concurrence of the hydro-electric projects, which are submitted to CEA. So, to fast-track the clearances, which is required for DPRs, we have streamlined that mechanism. The appraisal is done by various concerned specialised organisations like the Central Water Commission, Geological Survey of India, Central Soil and Material Research Station, and various other divisions of CEA.

At present, developers are required to coordinate with CEA and our divisions of CEA and various aspects -- which are covered in the DPRs of these hydro-projects -- are discussed by developers and periodical meetings are taken in the CEA to provide them guidance for preparing various chapters and clearances are given for various chapters by CEA. If they have some queries or some issues, then they are discussed and before taking up DPR formally for concurrence. So, that these hydro-electric projects can be taken up for implementation, after the DPR is cleared. So, probably around 36 months are required for preparing the DPRs with coordination with all the organisations. Thereafter, DPR is taken up for appraisal by CEA and a time period of 150 days is required for approval of design of structure and equipment, vetting the financial aspect, lay-out and other issues and concurrence of the scheme.

At present, 12 DPRs are under examination. We are in the process of doing appraisal of those and for DPRs which are under preparation, periodical consultation meetings are taken by Member (Hydro) and Chairperson (CEA) and all other organisations are invited there. So, we are rendering guidance to developers for preparing various chapters so that proper DPRs are submitted and time for concurrence should also be minimised. This is the broad framework in which CEA is working for concurrence of DPRs.”

1.53 *When the Committee asked about the normative time taken by CEA to grant clearance, it was stated by the Ministry as under:*

“As per the “Guideline for Formulation of Detailed Project Reports for Hydro Electric Schemes, their Acceptance and Examination for concurrence” revised by Central Electricity Authority in January, 2015, in case the Hydro Electric Scheme is found technical and economically viable with necessary inputs/clearances having been tied up, the Authority may accord concurrence for implementation of the hydro electric scheme within a period of 150 working days (excluding time taken by the Developer for compliance of observations of CEA/CWC/GSI/CSMRS etc.) after submission of DPR complete in all respects.”

1.54 *When the Committee desired to know the details of the projects which took more time in grant of clearance by CEA and the reasons for the same, the Ministry furnished the following information:*

“Generally, the Detailed Project Reports received in CEA for accord of Concurrence are framed based on inadequate investigations of project site. As a result, appraising groups in CEA/ CWC/ GSI/ CSMRS send back references to the developer and developer takes time in submitting the DPR to an examinable level after carrying out the suggested investigations. As such, the projects take more time in grant of concurrence by CEA. A list of DPRs concurred by CEA from 2002-03 onwards indicating the time taken in grant of concurrence is enclosed at **Annexure-VII.**”

1.55 In regard to appraisal process of DPR, the Committee was apprised that is has been divided into two stages as under:

- a) Pre-DPR stage: Preparation and approval of Chapters prior to submission of DPR:
The process of preparation of Detailed Project Report shall be completed by the developer indicatively in a period of 30 months from the date of allotment/signing of MoU of the project, extendable by 6 months for reasons beyond the control of the Developer.
- b) Post DPR stage: Examination and Concurrence of DPR:
In case the Hydro Electric Scheme is found technical and economically viable with necessary inputs/clearances having been tied up the Authority may accord concurrence for implementation of the hydro electric scheme within a

period of 150 working days (excluding time taken by the Developer for compliance of observations of CEA/CWC/GSI/CSMRS etc.) after submission of DPR complete in all respects.

The Developers have to seek Environment and Forest clearances from MoEF&CC before start of work at site.

1.56 *On being enquired by the Committee about the steps taken by CEA to reduce the time taken in grant of clearance, it was stated as under:*

“To reduce the time taken by CEA in grant of concurrence of DPRs, following steps have been taken by CEA:

- a) The guidelines for concurrence of DPR have been revised. As per new guidelines, the hydroelectric projects shall be appraised in two parts. The Developer has to get nine chapters (mainly relating to planning of the Project) appraised from respective appraising groups prior to submission of DPR. The appraising groups are involved from the very beginning and the Developer is facilitated/ provided the required guidance for framing of the chapters and DPRs. After appraisal of these chapters, the DPR is submitted. At this stage, very little scope may be left for back references and the DPR can be concurred as per the stipulated time frame. As per the Guidelines, in case the Hydro Electric Scheme is found technical and economically viable with necessary inputs/clearances having been tied up, the Authority may accord concurrence for implementation of the hydro electric scheme within a period of 150 working days (excluding time taken by the Developer for compliance of observations of CEA/CWC/GSI/CSMRS, etc.) after submission of DPR complete in all respects.
- b. Digitization of concurrence process has been carried out and based on this process the DPRs will be submitted ‘online’ in CEA. Observations, compliance and Approval of various aspects of DPRs shall also be given ‘online’ by the respective appraising groups and project developer.
- c. Periodical review of DPRs under examination is carried out by inviting the project developers and appraising groups in CEA/ CWC/ GSI and the issues are discussed and resolved.”

1.57 As per present policy, hydro power projects upto the capacity of 25 MW are considered as renewable energy sources and above that capacity as conventional energy sources. When the Committee desired to know the logic behind such categorization and why all the hydro

power projects, irrespective of their capacity, cannot be considered as renewable energy sources, the Ministry in their reply have stated as under:

“As per Allocation of Business Rules, all matters relating to Small / Micro Hydel Project of and below 25 MW capacity comes under the domain of Ministry of New & Renewable Energy (MNRE). Declaring all Hydro power projects as renewable energy source is a policy decision which may involve joint consultation between Ministry of Power, Ministry of New and Renewable Energy, State Governments and other stakeholders.”

1.58 *On being asked by the Committee for the details of any recent study done in regard to the environmental impacts of hydro power projects, the Ministry, in their written reply, have furnished the following information:*

“Following pre-impoundment as well as post-impoundment studies were undertaken in respect of Tehri Power Complex to assess the impact of the project on environment:-

1. Vegetation of the Tehri Dam Submersible Area: An Environment Impact Assessment Floristic Survey and Analysis of Tehri Dam Environs

a. Pre-Impoundment

Vegetation of the Tehri Dam Submersible Area: An Environment Impact Assessment was conducted through Botanical Survey of India in 1993. During the course of study, three plant collection tours were undertaken in the area in different seasons, i.e. Aug' 1992, Oct' 1992 & April' 1993. The major observations made in the report are as under:

- The forests are mostly at the higher level than the proposed reservoir site and thus are safe.
- The number of plant species present today is bound to increase as the river water may continuously bring with it seed of plants from higher reaches, some of which may settle down in the valley.
- None of the economically or otherwise useful species grow in the area are not restricted to project area alone but are distributed in the adjoining as well as distant localities of our country even outside. Hence, the construction of proposed dam will in no way lead to extermination of any species.

b. Post-Impoundment

Post-Impoundment Floristic Survey and Analysis of Tehri Dam Environs was conducted through Botanical Survey of India, Dehradun from April' 2009 to October' 2011. Under the project, four 10-days floristic survey and plant collection was undertaken during Apr – May' 2009, July' 2010, April' 2011 and Oct' 2011.

Entire catchment covering Bhagirathi-Bhilangana valley parts, New Tehri-Dharasu, New Tehri-Ghansali, Ghansali-Pratapnagar (Lambgaon & Gomethi Dhar both route separately) was surveyed and 613 specimens were collected.

It is concluded that the moisture regime of Dam is exerting positive effect and area is progressively becoming green. Since community development is non-immediate and gradual process, the radical changes cannot be expected in short duration. Tehri Hydro Development Corporation and Tehri dam forest Division is already doing appreciable efforts in conservation and with their additional accelerated efforts in coming decade or two, the prediction of green valley with moisture regime supporting luxuriant vegetation and lake serving as a wintering habitat to aqua-fauna like waterfowls would turn into a reality in near future.

2. Environment Impact Assessment Study: Faunal Analysis

a. Pre-Impoundment -

Environment Impact Assessment Study: Faunal Analysis was conducted through Zoological Survey of India, Dehradun in 1992- 93. The study overall established that there is no adverse impact on the fauna of the dam, except in case of “Mahseer” fish, which though widely distributed in the other tributaries of Ganges river and also elsewhere, may not be able to go upstream for spawning purposes. To minimize the possible impact on Mahseer fishes, action plan was prepared by the M/s Tropical Fisheries Consultants Services (TFCS), Delhi, and was submitted to the MoEF in June’94. In compliance to this, Directorate of Coldwater Fisheries Research, Bhimtal (formerly known as National Research Centre on Coldwater Fisheries) was engaged and Mahseer fish hatchery was developed at Koteshwar from where fish seeds of Mahseer and Common Carp were introduced in the upper reaches of the reservoir and also in downstream of reservoir.

b. Post-Impoundment

Post-Impoundment Faunal Survey and Analysis of Tehri Dam Environs was conducted through H. N. B. Garhwal University (A Central University), Srinagar. In this study, comparisons between Pre- & Post-impoundment were also made between status of Freshwater Invertebrates, Fish, Rhopalocera, Amphibian, Reptilian, Avian and Mammals, etc.

Overall conclusion drawn from the study is “there is no adverse impact on the fauna in fact Tehri Reservoir creates a new environs which is favorable for the fauna density and diversity”. Fish diversity and density have also increased.

3. Evaluation of the Catchment Area Treatment Plan under Tehri Dam Hydroelectric Project

Evaluation of the Catchment Area Treatment Plan under Tehri Power Complex was done by ICFRE, Dehradun & IIFM Bhopal.

Report established that CAT activities works have improved the tangible benefits in the form of environmental up gradation, carbon sink, soil moisture conservation

and noise control, increase in forest cover, protection of soil erosion, enhanced the availability of fuel and fodder for the villagers, new species of plant were introduced, enhanced the natural regeneration, plan was implemented with the help of local community which resulted in employment gain, development of community assets, etc.

4. River Water Quality Studies

i. Thermal and Water Quality Modelling of Tehri Reservoir study was conducted in 1992 through IIT Roorkee (formerly known as University of Roorkee).

Report established that higher temperature of water release from Tehri reservoir upto Deoprayag is not going to affect fish culture adversely. Report also states that the Dissolved Oxygen level of water released from Tehri reservoir is higher than the one required for various water uses and is thus not harmful for aquatic life or for other downstream uses.

ii. Mathematical Model Studies to investigate hydrodynamics of the Tehri Reservoir was conducted through Central Water and Power Research Station (CWPRS), Pune.

The study revealed that during the monsoon period the inflow volume of water nearly equal to the storage below Minimum Draw Down Level (MDDL), is added to reservoir in just 17 days, thus replenishing the whole storage below MDDL in 17 days, whereas the gross storage volume is fed into the reservoir within 67 days of active monsoon. Hence, Tehri reservoir completes the cycle of replenishment of storage every year.

iii. Self-Purification capacity of river Bhagirathi: Impact of Tehri dam was conducted through National Environmental Engineering Research Institute (NEERI), Nagpur for 02 years (2002 – 2004).

The study concludes that Tehri dam is not affecting the quality or self-preservation property of river Bhagirathi/ Ganga, as it mimics a static container which is conducive for conditions responsible to maintain the water quality.

iv. Water Quality of Bhagirathi / Ganga River in Himalayan Region was conducted through National Environmental Engineering Research Institute (NEERI), Nagpur for 3 years (April 2008 - July 2011).

The study concludes that the uniqueness of river Bhagirathi/Ganga lies in its sediment content which is more radioactive compared to other river and lake water sediments and can release Cu & Cr which have bactericidal properties and can harbour and cause proliferation (under static condition) of coliphages that reduce and ultimately eliminates coliforms from overlying water column. Average annual flow of 258 (with SS conc. 29.5 mg/l) and 467 (with SS conc. 32.2 mg/l) cubic meter per second in Bhagirathi and Alaknanda rivers, respectively, and sediments received through Aviral Dhara at Tehri dam and springs in between Tehri and Devprayag carry enormous sediment particles. Investigation further

indicated that particulate matters of Alaknanda river have identical anti-bacterial property as those of Bhagirathi river.

v. From Aug' 2003 to June' 2014, Water Quality was monitored at 05 different locations. From Sept' 2014 onwards, one additional location was added. Water samples are tested for various Physico-Chemical parameters and compared with Drinking water standards. It is established that parameters are well within the permissible limits and is of good quality."

1.59 *When the Committee asked about the barriers/deterrence/drawback in generation of hydro power through run of the river instead of designing it in a manner best suited for peaking power requirement, the Ministry replied as under:*

"Hydro projects are primarily best suited to meet the peak demand requirements for which certain pondage is required. Even in case the project is designed without consideration of peaking requirements, the project would still involve certain amount of submergence due to requirement of a pool for locating intake (and some cushion for acting as a water seal) for diversion of water to the power house for generation.

The Run-of-the River (RoR) projects envisage utilising the real-time available water in the river (to its designed capacity) and would generate power as base load station. Since the demand of electricity fluctuates during the day the RoR projects would not be able to provide the peaking requirement during the deficit generation period which would severely impact the grid stability.

In case of RoR projects with limited pondage, a small diversion structure (dam) is constructed which stores water in the upstream reservoir for its use in generating power during the demand period.

Regarding land requirements, apart from submerged reservoir area, land is required for constructing other components of the project like diversion structure, power house, water conductor system, switch yard, colony, stores and roads etc. As such, even if the project is designed without consideration of peaking requirements, the overall land requirement may not get substantially reduced."

1.60 *On being asked by the Committee about the study done in regard to flash floods in Uttarakhand in the year 2013, the Ministry of Power furnished the following information:*

"MoEF constituted an Expert Body (EB) in October, 2013 consisting of representatives of the State Government, WII, Central Electricity Authority, Central Water Commission and other expert bodies to make a detailed study as to whether Hydroelectric Power Projects existing and under construction, have contributed to the environmental degradation. If so, to what extent and also

whether it has contributed to the present tragedy occurred at Uttarakhand in the month of June, 2013.

The Expert Body (EB) excluding representative of CEA and CWC submitted report to MOEF in April 2014. A separate report was submitted by CWC and CEA representatives in EB on the subject covering all the related issues.”

1.61 In reply to the specific query of the Committee whether the power projects in Uttarakhand aggravated the impact of flash floods, the Ministry have stated that it has been concluded in both the reports that the Tehri project in Uttarakhand did not aggravate the impact of flash floods.

1.62 The Committee had been given to understand that the delay in obtaining environmental and forest clearances is the main reason for the slow development of this sector. *When the Committee asked for clarifications on the issue, the representatives of the Ministry of Environment, Forest and Climate Change deposed before the Committee as under:*

“Regarding the Environment Forest and Climate Change Ministry it was the general perception that there is some delay due to the forest clearance. It would like to place 2.3 facts in front of the Committee. In the year 2006 EIA notification came and after that 72 projects were given environment clearance in the country in which 25698 megawatt is under construction for the last 10 years and in majority no where the work has been started. Though all the States have small hydel power projects but there are mainly in two states Uttarakhand and Arunachal Pradesh. These are in Himachal, Jammu and Kashmir and in other states there are multipurpose projects at some or the other places and these have hydel part as well. First of all I would talk about the Arunachal Pradesh. As per the identification of Arunachal Pradesh it has potential of 45000 megawatt and these are spread over 7 river valley. Out of this 45,000 megawatt Arunachal Pradesh government has allocated total power projects. Out of these 12000 megawatt power projects have been approved by environment and forest. Only 405 are operational and 2710 are under construction. On the rest 8500 megawatt all the clearances have been obtained but no work is going on. The work has not even started. Currently, out of 45000 megawatts, the request of 6600 megawatts of projects is pending with the ministry and there is no other request pending. Cabinet Secretariat reviews on regular basis the pending 44 projects of Arunachal Pradesh alongwith Power Ministry. Out of this 17 are prioritized and all the projects are on the trek of approval. Around 2010, Ministry had these problems that many projects started coming and each project had separate configuration. In 2013 the ministry made a new system that a river basin study would be conducted

and whatever outcome to be there that would be applied commonly on all the projects, whether it is environmental flow, disaster, litigation or whether it is litigation under biodiversity. Arunachal Pradesh has of river basin studies. Out of these 4 are complete and out of these four out of 45000 the approved are 33000 megawatts. The projects which were rejected based on the river basin, the total capacity of Siyan river basin was 18750 megawatt and were 44 projects, out of this 15 projects were rejected in the beginning but the total megawatt was only 475. In many projects, it was proposed to change the configuration based on environmental flow, inter-project distance for free flowing movement of the river. Moreover, Power Ministry and Arunachal Government has some problems. There have been three meetings between us and the power ministry and the three major projects which were raised by the Power Ministry, have been sorted out. Regarding Arunachal Pradesh, the situation is that approvals are on time and river basin study four has been completed and the rest of the three river basin studies will be completed before 30 April. The work of the power construction could not be started. The reasons thereof are not known to me. Our duty is to give approval and clearance.

1.63 He further added:

“Now I will speak about the Uttarakhand. There are total 69 projects in Uttarakhand. BRO has touched two points on wild life and forest clearance. During the last one and half years the norms got systematic for forest clearance included a major approval wherein linear project was included in the general approval clause. Road comes under the linear projects. Every month we conduct forest clearance meeting and we review it and whatever diversions projects we have these are below 40 hectare. It was earlier so. Earlier, the power of 5 hectare was with Regional officer and state government had below 5 hectare. Now, we have given power of diversions below 40 hectare to the Regional Officer, Shillong. Majority of diversions are linear in nature. They are below 40 hectares. None of these are supposed to come to Delhi office and go into FAC. It is all decentralised. They can sit together and get it clarified with the State Government. We do not delay the forest clearance. since the land belongs to forest so it is of state government. The proposal gets originated from the State Government. These are same problems of reaching from DFO to Chief Conservator of Forest. In order to sort out this issue, Ministry has developed a system of inviolate areas. The forest which has 70% canopy cover, are declared as inviolate areas because these are the dense forests of the country. Apart from that if there are linear projects, medium density or less density or degraded forests then it is only a procedural requirement of getting the diversion, if it is less than 40 hectares, it comes at the regional office level. If it is more than that, it may take more time, maybe 6 months more, but it comes to Delhi. As on today, there is rarely a linear project pending for approval in the Ministry. In terms of wild life, prohibition is ESZ of a protected area. If there is any

protected area and has ESZ decided, we cannot accord any approval as per the order of Supreme Court. However, in that also, we have kept an exception of road development for the linear. If it is bared by ESZ then, there is a very clear cut system. There is a State Board of Wildlife, NBWL. The rate of rejection of project is only rare except where the rare endangered and threatened species are detected as per the wildlife studies. Only then the project is rejected. The rate of periodicity of meeting is every 30 days. As on today, the pending cases in the Wildlife Division of the Ministry are 36. Majority of them are not for the roads. They are very rare. Now I will come to the Uttarakhand. There are 60 projects in Uttarakhand. The total capacity of this is 9026 megawatt. Out of which, 17 projects are operational. Out of these, five projects belong to afater 2005 year and the others are of earlier period. Out of the remaining 52 projects, 17 projects are in the process of approval. In Uttarakhand there is a golden word of 24 projects. On the basis of the Ministry, wild life had conducted a study in the year 2010. Out of 52 projects, Wildlife Institute of India declared that these 24 projects may be rejected on account of their serious impact on the biodiversity, terrestrial as well as aquatic. That case is subjudice before the Supreme Court. On the basis of Supreme Court three Committees have been appointed. Regarding the 6 projects, we have filed latest report in the Supreme Court. A policy decision has been taken by the Ministry. Minimum one thousand cusec natural stream flow will be there in the three major tributaries Alaknanda, Mandakini and Bhagirathi. If any other tributary or sub-tributary has any power project then there is no problem about its being sanctioned from environmental consideration provided it meets disaster management and biodiversity requirement which is already laid down. This is in respect of Uttarakhand.”

1.64 He also stated:

“Crying for environmental clearance of more hydel projects is not very healthy till you construct, or at least begin the construction of, those projects you have already got approval for...In the thermal power, during 2005 to 2013 we gave environmental clearance upto 2,07,000 megawatt. The construction have started only for 57,000. Similarly, as I told that out of the 12,000 approvals of Arunachal Pradesh, 2705 are under construction and under operation are only 200 projects. Similar is the condition of Uttarakhand. There is necessity of a serious effort from the developer’s side – State Government or Power Ministry – to at least start construction of the projects for which approval is there.”

1.65 *When the Committee raised the issue of fragility of the Himalayan Region and desired to know the opinion of the MoEF&CC, the representative of the Ministry, during the sitting of the Committee, stated as under:*

“Projects have to be developed. Environment has to be kept intact. The mitigation measures have to be appropriate to reduce and minimise the damages. Where at the stage of appraisal process it is felt that the damage would be irreversible, we do not agree with that project. Regarding the different opinions being given regarding the particular 24 projects in Himalaya, around seven expert Committees have been there. All the experts have different opinions. But there is almost a unanimity that some areas of Himalayas should not be touched. Above 3000 meter in Himalayas, we are not touching. There are pockets in Himalayas where there are rare endangered species of biodiversity. So, we are not touching that area. Regarding the import of tunnelling, you can do it in Himalaya or Aravali or Western Ghats, it can be controlled with the new technology. There is no problem in it. New technology about dam construction and design can always minimise the impact. The hydro power, as the hon. Chairman has suggested in the beginning, meets our requirement which we have committed in Col-21 in INDC as well. We have to have a hydro power back up. We cannot live without this.”

V. ENABLING INFRASTRUCTURE ISSUES

1.66 Most of the hydro power potential sites identified lie in the remote and border areas where there is no road connectivity. In view of this, the developers find it difficult to develop hydro power projects. If they wait for the road to be constructed by the Government agencies, then there is every possibility of long delay. If they themselves construct the road, there will be cost escalation of the project which will ultimately be passed on to consumers in the form of higher tariff.

1.67 The Border Road Organization (BRO) has been entrusted with the work of construction of roads to these sites. During examination of the subject, the representative of the BRO, while stating the status of the connecting road projects, deposed before the Committee as under:

“Under all these projects we have been entrusted with responsibility of construction of roads. Approximately there are 17 projects in these four villages i.e. Devang, Siyang, Tawang and Lohit which are under your privatization constituting road length of around 100 km. Out of which 500 Km road is being constructed by NHIDCL and only 600 Km road is being constructed by BRO. Out of this 1100 km. If I go valley-wise, there are two main projects of 6000 MW capacity – Italin and Devang in Devang Valley. The main roads in this are Bika, Humli, Anini which is in total is 237 Km road and out of this 19 Km road is with BRO and 225 Km is under our charge, however, the responsibility for its development is given to NHIDCL. As far as our road, i.e. 19 Km is concerned, it included 19 Km road and two bridges and their was not completed yet. I would like to tell you that work on both the bridges has been resumed and in case of 19 Km road iwe have almost sanctioned works likely to be carried out. We hope that the work of 19 km road plus bridges will be completed by the end of this year or mid of the year. We go to next valley that is Siyang there are four projects Tatotu, Siyom, Herong and Naeeng of 3200 MW capacity. Akajan – Likabali road is 105 km long. Out of this, 20 km road is with BRO and remaining road is with NHIDCL. We have divided this 20 km into two parts – one is 12 km and other is 8 km. We have almost completed the work in 12 km road and our resources are now engaged in the next 8 km. Work in our 20 km road is in progress and is going as per the schedule. Other road is Laang, Taato, Mechuka which is 170 km long. On this road we have divided our work into three parts from 0 to 73 km. First part is 0 to 10 out of which around 10 per cent work has been done, Second part is 10 to 45 km, out of which we have completed

almost 25 per cent work and the we have started the thrd part just a month back and its progress is approx one percent.

1.68 He further added:

"The third valley is Twang. There are three projects under it namely Twang Two, Niyamjhungchu and Twang one involving a capacity of two thousand seven hundred eighty megawatt. Two roads Balipara and Chardwar are affected under it. The length of Twang road is 317 km. I can approximately say that there are already class 9 roads in this road and it is being converted as per NHDL specifications. There one or two problems in it which I would like to place before you. Approximately this road is running on board. We intend to convert the road as per NHDL specifications nearly by 2019. The second is road stretch between Twang and Jimithang. In respect of Twang to Jimithang, actually one road stretch is from Twang to Jimithang and from Twang to Lumla is for the second project. The combined total road length is about 60 km. a survey was conducted for this. At this stage, decision regarding funding arrangement for this stretch of 60 km is yet to be taken. Fourth is Lohit Valley under which there is only one project Vemway Lower involving 17 hundred megawatt. There is only one road Vemway, Hivilyang, Hiwai. We have about 22 km. stretch of this road. The remaining work has been entrusted with NHIDCL. the DPR for the stretch of 22 km which we have, is under preparation. I would like to tell you broadly that as per the PDC we have decided, we are trying to construct the road network that have been entrusted to BRO by 2019. We have committed to do it very soon until and unless there is any major disaster or something like that because these areas are very tough.

1.69 *When the Committee sought clarity on the funding of these projects, he further stated:*

"All the funding is done either by the MoD or the MoRTH. As of now, no fund either from the Ministry of Power or from the developer has been given. For this particular route, in the last monitoring committee there was a discussion and deliberation. The decision was given that the NHPC would possibly fund the thing. Then, it has not been clarified. That is why I said about the funding, as of now, there is no clarity as to who is going to fund this 60 kilometres of road. We are also funding the road which was in the ambit of Defence alongwith the road which we have.

1.70 Replying to the query of the Committee about the challenges faced by BRO in these projects, the representative of BRO deposed as under:

"The biggest challenge is land. I myself have commanded a project in Jammu-Kashmir, I have been in Bhutan. I have seen three to four border road projects. Land is the major problem. As the land belongs to the state, we cannot get land. There are many such cases where we acquired land through revenue authority by

paying them. The concerned amount was disbursed among people but mutation of land is done in our name even after disbursement of the money. If we do not get land then how a road can be constructed. About 20 years ago, the concerns of the Ministry of Environment and Forest were comparatively limited. We are conflicting with those things. Requirement conflict takes place. If we do not get wild life clearance for the place where we want to construct a road and we commit here to complete the said project within a period of three years then what will happen. The period of commitment of three years should start after getting the required clearances because we don't get clearances as per requirement. The persons holding the concerned posts get changed. They cannot give answer to you because years get exhausted in getting forest, wild life clearances. We face problems in getting labourers in these states specially in Arunachal Pradesh because the local people there do not allow labourers from outside and local labourers are not available. This is the biggest problem. We are facing this problem in Jammu and Kashmir and in Arunachal Pradesh. If we don't have quarries then how can we prepare construction material, if construction material is not available how can the roads be constructed. These are basic issues land is not available, quarries is not available. This is just like a situation where a military man is not having a weapon and he is being asked to fight. In regard to border road at present, the same situation prevails.

1.71 *When the Committee enquired about the number of sanctioned projects which are pending due to forest and wildlife clearances, the representative of BRO deposed before the Committee as under:*

“Regarding forest clearance, a very few percentage will be there. The project cannot get started. Our project is road project. It is 100 km. road. May be that for want of forest clearance the work on 20 km. road may not be under progress. 70 km is working but because of that 20 km, PDC of that 100 km keeps differeneing. That is the concern which we intend to bring out. 70 KM is working but because of that 20 KM, PDC of that 100 KM keeps differing. That is the concern which we intend to bring out.

1.72 *When the Committee desired to know whether it will be appropriate to assign all border related work to BRO with the liberty to engage private contractors for completion of work, the representative of BRO stated as under:*

“Absolutely correct. We are also going in that direction. At present, with the capacity, the vehicle equipment plants and manpower we have the organization has not the capacity to carry out the concerned development within the timeframe you want. So, the Organisation has to look outwards.

Part – II

Observations/ Recommendations of the Committee

Hydro Power as Renewable Source of Energy

2.1 The Committee note that as per the present policy, hydro power plants upto 25 MW capacities are considered as renewable energy sources and are under the purview of the Ministry of New and Renewable Energy, whereas, hydro power plants having capacities more than 25 MW are considered conventional energy source and are dealt with by the Ministry of Power. In reply to the query of the Committee as to why not all the hydro power projects, irrespective of their capacity, cannot be considered as renewable energy sources, the Ministry have stated that as per the Allocation of Business Rules, all matters relating to Small / Micro Hydel Project of and below 25 MW capacity comes under the domain of the Ministry of New & Renewable Energy (MNRE). Declaring all hydro power projects as renewable energy source is a policy decision which may involve joint consultation between the Ministry of Power, Ministry of New and Renewable Energy, State Governments and other stakeholders. The Committee, during the examination of the subject, have learned that hydro power is a clean and green source of energy and unlike conventional thermal plants does not emit pollutants into the environment. The Committee also found that there is no logic for segregation of hydro power into renewable energy and conventional energy and also its baseline, viz. 25 MW. The Committee wonder if perpetuity of the source and non-emission of pollutants are the criteria for considering a source as renewable energy, then why cannot hydro power projects having capacity of more than 25 MW be also counted as renewable sources. The

Committee was informed by the Ministry that in view of the examination of the subject, the Cabinet has recently approved the new tariff policy in which hydro power has been exempted from the renewable solar power obligation. The result of the new tariff policy will be exemption of hydro power from the account for meeting the obligation of buying solar power. The Committee believe that this is a step in the right direction and will act as an incentive for the hydro power sector. The Committee feel that the spirit of the tariff policy in exempting hydro power from the solar obligation is also an endorsement that hydro power, irrespective of the capacity, should be treated as renewable sources of energy because solar power obligation is nothing but equivalent of renewable power obligation and hydro power exemption signifies that it meets the basic criteria of these obligations. The Committee, therefore, recommend that:

- (i) All types of hydro power should be treated as renewable sources of energy.
- (ii) If necessary, legislative provisions may be introduced in this regard as defining hydro as a renewable source involves a policy decision and allocation of business in the Government as well.
- (iii) The exemption of hydro power from solar power obligation in the new tariff policy be made permanent.

(Recommendation Sl. No.1, Para No.1)

Evaluation of Hydro Power Sector

2.2 The Committee note that the country has total installed power generation capacity of 2,78,884 MW, wherein, the share of hydro power is only 15% as compared

to thermal power, which is 70%. The Committee also note that the share of hydro power in the total energy mix has been falling ever since 1962-63, when the share of hydro was at its peak of 51%. The Committee further note that against the total assessed potential of 1,45,320 MW of hydro power in the country, 37,648 MW capacity is installed and operational and 11,812 MW capacity is under development stage, whereas a whopping 95,860 MW capacity is yet to be developed. In regard to the falling share of hydro, the Ministry have stated that lack of adequate infrastructure, drying-up of funding by bilateral/ multilateral agencies, increasingly stringent environment clearance regime for hydro projects after the 1970s due to the worldwide focus on environmental / ecological / R&R issues and consequent activism against the development of hydro projects by NGOs/ Environmental activists, and greater emphasis on rapid development of thermal power during the 1970s for quicker capacity addition in view of large scale industrialization have contributed to the slow growth/ decline of hydro share in the subsequent years. In addition, factors like land acquisition issues, R&R issues, inter-State issues and non-tie-up/ non-availability of requisite finances on long term basis, etc. have further slowed down the development of hydro power. The Ministry have stated various steps that have been taken by the Government to boost the hydro power sector. However, in the considered view of the Committee, the present installed capacity of hydro power proves that they were not effective enough. The Committee have been given to understand that a capacity addition of 1.75 lakh MW of Solar and Wind power has been envisaged by the Government. Since these sources of energy are intermittent in nature, there will be a need for balancing power which could start-up and shut down quickly to provide

stability to the grid – this could be gas powered thermal power or hydro power. It is a well known fact that there are many gas powered power plants which are either stranded or running way below their optimum PLF due to non-availability of the required amount of gas. Hence, development of hydro power becomes the only option. Moreover, for fulfilling global commitments to contain emission levels, choosing hydro power will be more judicious. Therefore, the Committee believe that we are left with no choice but to develop the hydro power sector rapidly. The Committee was apprised by the Ministry that owing to detailed examination of ‘Hydro Power’ subject by this Standing Committee, they have formed two sub-Committees to look into the overall legal regulatory framework and various financing options for hydro power. The Committee are pleased with the prompt action taken by the Ministry and are of the belief that this will go a long way in identifying and resolving the issues that have been hindering the development of the hydro power sector. The Committee recommend that:

- (i) The Government should adopt a holistic approach for optimum development of the hydro power sector in the country and thoroughly revise the present Hydro Power Policy, as per the needs of the time.
- (ii) The two sub-Committees, formed by the Ministry to look after various issues related to the subject should meet regularly and examine the subject intensively and extensively by holding meetings with various Government agencies involved and other stakeholders.
- (iii) Further, the findings/recommendations of these sub-Committees should be sincerely and promptly implemented by the Government.

(Recommendation Sl. No.2, Para No.2)

2.3 The Committee note that out of the total potential of 1,45,320 MW assessed in the country. Arunanchal Pradesh alone has 46,805 MW of hydro power capacity that is to be developed. The Committee note that in Arunanchal Pradesh, where there is approval for 12,000 MW capacities, only 2,705 MW capacity is under development and a meager 200 MW is under operation. It is a well known fact that the gestation period of hydro power projects is comparatively longer, owing to the elaborate process of survey, preparing DPR and obtaining various clearances and difficulties faced during construction of the project itself, which are mostly in remote and uninhabitable areas. The Committee are concerned to note that there are 25,962 MW capacities which are yet to be taken up for any development. There is every possibility that the projects which are at various stages of development could take upto 7-8 years or even more to be operational. In this scenario, the future of about 26,000 MW capacity which has not been taken up for development, looks very bleak. It is also a fact that in the long run, hydro power proves cheaper as flowing water is used for its operation; therefore, the sooner we develop and start harnessing hydro power, the lesser will be the per unit cost. The Committee, therefore, strongly recommend that:

- (i) All-out efforts should be made by the Government to ensure that the construction work on the projects which have got all the clearances should be started without any loss of time.**
- (ii) To ensure that the timeline for the projects, which are under various stages of development is adhered to, the Government should take pre-emptive as well as prompt resolution of any issue which may crop up during their development.**

(iii) The Committee strongly recommend to the Government to make efforts on priority basis to ensure that the balance capacity of 25,962 MW, which is yet to be developed, is allocated for development at the earliest.

(Recommendation Sl. No.3, Para No.3)

Private Sector in Hydro Power

2.4 The Committee note that out of the total installed hydro power capacity of 42,433.4 MW, only 3,154 MW capacity, which stands at a meager 7%, belongs to the Private Sector. The Committee further note that the Private Sector, in the 11th Plan period, could manage to achieve only 1,292 MW hydro power generation capacity against their mediocre target of 3,491 MW. Also, during the ongoing 12th Plan, their actual achievement so far is only 595 MW against the target of 3,285 MW. The Committee find that this is in sharp contrast with their contribution in the thermal power sector in the 11th and in the ongoing 12th Plan. The Private Sector, in thermal power, during the 11th Plan had achieved 21,720 MW against their target of 11,552, a whopping 188% of their target. Even in the ongoing 12th Plan, they have already achieved 44,667.5 MW capacities, against the target of 43,540 MW and there is one more year to go for the Plan period to be completed. The Committee are dismayed over the grim condition of hydro power sector in respect of capacity addition, wherein, even the Private Sector, an outstanding performer in thermal power, has miserably failed. The above mentioned figures speak volumes about the hydro power scenario of the country. The Committee, during the examination of the subject, learnt that many private players who have been allocated hydro power projects are finding it difficult to

construct/complete the project due to various reasons, including their inexperience in the field. It has also been learnt that in some cases, though they have managed to complete the projects, their faulty construction is a cause of concern now. Since hydro power projects are site-specific and mostly located in remote areas, they demand a high level of expertise and quality manpower, whereas most of the private players are lacking in this aspect. The hydro power sector has been neglected for decades and hardly any effort has been made by the Government to ease numerous obstacles in their development. This has led to a shift of focus of the private players to thermal power which is much easier and less risky to develop and that too with a shorter gestation period. However, the Committee are of the considered view that to bring about a rapid growth in hydro power similar to the thermal sector, it is imperative to involve private players. Since the Government have now put its focus back on hydro power, the Committee feel that the steps taken in regard to reviving the sector should not become an unproductive exercise but should be concrete and capable of making this sector attractive for the Private Sector on sustainable basis.

(i) The Committee, therefore, recommend that the Government, while drawing up the plan and policies to revive the sector should also make enabling provisions to attract private players to this sector in a big way.

(ii) The Committee also desire that the Government should make suitable provisions/ take steps so that only private players with required capabilities and expertise could be allocated hydro power projects so as to ensure that the allocated projects are developed within the stipulated time period.

(Recommendation Sl. No.4, Para No.4)

Hydro Power PSUs

2.5 The Committee, in the preceding para, have noted that the performance of the Private Sector in hydro power has not been up to the mark for various reasons. The Committee are of the firm belief that involvement of private players in a big way is necessary for the development of hydro power sector. However, they are not sure whether this would happen soon. On the other hand, the Committee find that the Government have giant Public Sector Undertakings like NHPC, NEEPCO, THDC, etc., having the required infrastructure, manpower and expertise, who are also specialized in the development of hydro projects. Despite all these, these PSUs have not many projects to develop. The Committee feel that under-utilization of these PSUs is nothing but sheer waste of available resources and expertise. In Arunachal Pradesh, after utilizing their expertise to prepare DPRs, many projects have been assigned to private players who are new in this field. The Committee have also been apprised that hydro power projects were allotted in Arunachal Pradesh on payment of upfront premium on 'First come-First served basis'. Since this upfront premium is not included in the cost of the projects, the same cannot be calculated for tariff determination. However, NHPC or Government PSUs cannot pay upfront premium as they do not have provision for the same, because of which all the projects allocated to them were taken back and allocated to private companies who paid upfront premium. The Committee, therefore, strongly recommend that:

- (i) It has become imperative to promote PSUs engaged in hydro power by allocating them more and more projects as they have the required infrastructure, expertise and

resources to work in remote areas; besides, they do not have problems in arranging finances for projects.

(ii) The Government should take necessary steps to discontinue the practice of payment of upfront premium for allocation of hydro projects.

(Recommendation Sl. No.5, Para No.5)

Pumped Storage System

2.6 The Committee note that 96,524 MW capacity of pumped storage scheme has been identified in the country. Out of this, capacity of 4,785.6 MW is under operation and 1,080 MW is under construction, whereas 1,000 MW projects DPR are prepared and submitted to CEA. The Committee find that development of pumped storage scheme in the country is at a rudimentary stage and its present utilization against the total potential is meager. Considering the vast network of electricity grid in the country and the quantum of electricity demand, it is not difficult to gauge the range of fluctuation in power demands. Pumped storage schemes are meant for storing energy and using at times when demands for electricity soars. Hence, pumped storage scheme will be quite beneficial for developing ancillary power market and in meeting sudden high demands of electricity. The Committee, therefore, recommend that due attention should also be given to develop identified pumped storage schemes in the country.

(Recommendation Sl. No.6, Para No.6)

Technological Advancement

2.7 The Committee note that the development of a hydro power project is a long and cumbersome process. It is also a fact that little technological advancements have been made in this sector either to curtail the long gestation period or increase the efficiency of generation of electricity with lesser amount of water. During the examination of the subject, the Ministry stated that the major advancements during recent years have been the use of advanced Tunnel Boring Machines for excavation of tunnels, Tunnel Seismic Prediction machines to predict the geology ahead of the tunnel face upto 200m, use of advanced Drill Jumbos for excavation of tunnels etc. These technologies help in reducing the construction period to some extent. The Committee firmly believe that technological advancements can provide further boost to the distressed hydro power sector. However, not much attention has been paid to this crucial aspect. The advancements as apprised to the Committee have been limited to the excavation of the land only. Improvement in the size and efficiency of generator, turbines and other related equipment is one area which has not been paid the desired attention. Improvement in this area with a scientific approach may open up new avenues in reducing the time and cost involvements. During the visit to Narmada, the Committee was apprised that a new technology, namely, "Screw Technology" has been invented in Germany which is capable of running turbines with the flow of only 10% of water as compared to the requirement of present day technology. If this technology is found to be successful and effective, it will give a fillip to the hydro sector. The Committee, therefore, recommend that:

- (i) Government must give utmost priority to research and development activities of hydro power.
- (ii) Emphasis should be on indigenous research and development relating to hydro power.
- (iii) We should also explore the options of collaboration with advance technologies in this sphere across the world and if needed, latest technologies from advanced countries should be adopted.

(Recommendation Sl. No.7, Para No.7)

Financial Issues

2.8 The Committee observe that a hydro power project consists of various assets, e.g. civil, electrical, mechanical and electrical works. The life of civil works, in most of the cases, goes beyond 100 years while the life of other assets ranged between 25 and 50 years. However, banks and financial institutes provide loan to hydro power project for the 10-12 years only. Therefore, higher cash flow is required in the initial 10-12 years on account of repayment of debt. To meet the increased cash flow requirement, a higher rate of depreciation is allowed (5.28%) for the initial period of 12 years for the purpose of determination of tariff. As a result, the tariff of hydro power is quite high for the first 12 years (which is sometimes as high as Rs.6 per unit). The tariff then reduces and comes down to less than Rs.1/unit, once the loan is repaid and the plant is fully depreciated. That being so, the issue of the initial higher tariff of hydro power has become one of the biggest concerns as the same has gone up to Rs. 5-6 per unit. Since thermal power tariff is still on the lower side, the States are naturally finding tariff of hydro power too high; therefore, they are not ready to purchase it, causing non-

execution of Power Purchase Agreements in some instances. The Committee are concerned with the state of affairs and feel that it will be most undesirable for hydro power to become unsellable for whatever reasons. Almost all the stake holders have accepted this flaw and requested the Committee to review the same. The Committee, therefore, are of the firm opinion that while calculating the cost of power for hydro project, the actual life of hydro project be considered which as per experts opinion goes beyond 40 years. The provision of long term financing will help in levelizing the tariff of hydro power in place of higher tariff in the first 12 years. The Committee, during the examination of the subject, was apprised that two financial institutions relating to the power sector, namely, PFC and REC have now modified their policy to extend loans for a longer period of 25 years to hydro power projects. The Committee are happy with the prompt action taken by the Ministry and further recommend that:

- (i) The provision of providing long term loans should not be limited to these two PSUs but utmost efforts be made by the Government to make the required provisions and persuade other financial institutions and banks as well to lend finances to hydro power projects for longer tenure.
- (ii) The Committee recommends that the average lifespan of the hydro power, for calculation of tariff per unit, be treated as 30 to 40 years. The Government must change the policy and also ask the financial institutions to give long term finances to make hydro power affordable and attractive.
- (iii) The Committee also recommend that long term bonds with sovereign guarantee should be floated to provide long term finances to this sector.

(Recommendation Sl. No.8, Para No.8)

2.9 The Committee note that there are hydro power projects which are being delayed due to lack of finances. The Committee also note that apart from the problem of getting loan only for shorter tenure, the hydro power projects have to pay high rate of interest on the loan amount. The Committee have further noted that the gestation period of hydro power project, i.e. 8-10 years is longer as compared to thermal plants where it is 4-5 years and solar power plants where it is only one year. Therefore, return on the investment made in hydro power projects starts to flow only after 8-10 years. This way, given the same rate of return and calculating the overall project life cycle, hydro power projects yields a lesser return as compared to thermal and solar power plants. These financial issues are resulting in higher tariff of hydro power which is ultimately paid by the end users. The Committee strongly believe that electricity is critical for the economic progress of the country. Considering the numerous inherent benefits and in view of the upcoming huge capacity addition in renewable source, the development of hydro power sector has become critical. However, so far, hydro power sector has been neglected and not given the due attention. Since the Government, for various reasons, has now decided to focus on hydro power sector, it is important that this sector should not only be provided long term finances but also at more reasonable rate of interest to make tariff of hydro power competitive and sellable. The Committee, therefore, recommend the following:

- (i) Tax free bonds, similar to the infrastructure sector, should be issued for the hydro power sector.**

- (ii) The Government should sincerely find out ways and means to provide multilateral funds from international agencies, viz. World Bank, ADB, etc., for the hydro power sector.**
- (iii) The Government should also explore avenues to provide funds to the hydro power sector by the Life Insurance Corporation of India (LIC) and Pension Funds.**
- (iv) Cash rich PSUs of the country should invest in hydro power sector for diversification, as fossil fuels are limited.**
- (v) Similarly, various PSUs of hydro power should be encouraged to invest in other hydro power projects.**
- (vi) The Committee also desire that hydro power projects, depending on their importance, may be declared as vital infrastructure and should be extended the required support and benefits to overcome any obstacles in their development.**

(Recommendation Sl. No.9, Para No.9)

2.10 The Committee note that the project financing cycle of hydro projects is very different from that of the other infrastructure projects like highways and railways, for the main reason that in a hydro project the investigation on the site, pre-investigation survey, as preparation of DPR are far more complex and take a longer time. Secondly, it takes time to obtain environment and forest clearances. Moreover, land acquisition and rehabilitation is a very long third stage process. Normally, DPR is prepared after pre-investigation which, by the time of obtaining all the clearances, becomes obsolete and requires estimate revision. Till the time land is acquired, the need for second revised estimation looms large. At the time of the start of actual construction work, these

varying estimations create much confusion in various financial calculations. The Committee, therefore, would like to recommend:

- (i) The Ministry should take necessary action in regard to adopting the practice of treating financial appraisal and financial approval as two distinct stages.
- (ii) The activities before the actual start of the construction work should be treated as pre-investment activities. Therefore, the financial appraisal at this stage should be approved as pre-investment activities and not as original cost estimation.
- (iii) The final financial approval taken at the time of actual start of work should be treated as original cost estimate to adjust cost escalation, if any, so that the need for resubmission of project approval in case of any cost escalation does not arise.

(Recommendation Sl. No.10, Para No.10)

2.11 The Committee, during the examination of the subject, was apprised that recently some States have imposed heavy water cess, which has affected the viability of hydro power projects due to increase of tariff by more than one rupee. The Committee feel that this issue will only exacerbate the grim scenario of hydro power sector of the country. They desire the Government to take up this matter with the States concerned and find out some solution to this problem so that the already distressed hydro power sector is exempted from the additional burden in the form of water cess. The Committee, therefore, recommend that:

- (i) There should be no retrospective charges like cess on water reallocation of DPR rate projects for want of upfront premium or any other kind of levy which is likely to impact the competence of the tariff of hydro power.
- (ii) The State Governments concerned may be taken on board in this regard so as to ensure that such lateral super-imposition retrospectively is not taken recourse to for any reason.

(Recommendation Sl. No.11, Para No.11)

Clearances and Environmental Issues

2.12 The Committee, during the examination of the subject, have found that hydro power projects get delayed due to various reasons, which causes cost overrun and ultimately results in increased tariff. The main reason cited for the extended delay is obtaining of environmental clearances, which has been cited as the biggest road block in the development of hydro power sector. To bring clarity on the issue, the Committee heard the views of the Ministry of Environment, Forest and Climate Change.. It was stated that since the notification of EIA in 2006, environmental clearances have already been accorded to numerous hydro power projects. However, in a majority of cases, construction work is yet to be started. Further, out of the assessed hydro power capacity of 45,000 MW in Arunachal Pradesh, only 405 MW capacity is operational and 2,710 MW capacity is under construction. In case of 8,500 MW capacity projects which have all the clearances, the development work has not started yet. In regard to pendency of hydro projects before MoEF&CC for clearance, it was stated that out of 45,000 MW, projects of

6,600 MW only are pending with them. They further stated that they have started to undertake study of various river basins. The outcome of these studies will commonly be applied to all the projects in that basin for the purpose of environmental flow, litigation related to disaster and bio-diversity. In regard to hydro power development in the Himalayan region, they stated that certain pockets and area above 3,000 meter are not being touched in view of the risk of damages to environment and biodiversity. Scrutinizing all the related facts and figures and considering the differing views in regard to environmental clearances, the Committee are of the view that the perception that environmental clearances are the biggest roadblock in the development of the hydro power sector does not hold water. The Committee note that there are various projects which have been accorded all the environmental clearances, even after which they are not being developed. The Committee are also of considered view that both environment and the development of the country are of utmost importance and hence there is an urgent need to strike the light balance between the two. The Committee while endorsing the concept of river basin study, recommend that:

- (i) The work related to study of the remaining river basins should be completed expeditiously.
- (ii) The Committee are of the firm view that certain sensitive areas in respect of environment and bio-diversity should not be touched; however, in rest of the areas there is a need to make the process of granting environmental clearances in a more expeditious and hassle free manner for hydro power projects.

(iii) The Committee further recommend to the Ministry of Environment, Forest and Climate Change to prepare and disseminate clear cut guidelines in respect of granting clearances to all concerned.

(iv) The Committee also recommend that the CEA should further streamline the process of granting clearances to fast track hydro power projects.

(Recommendation Sl. No.12, Para No.12)

2.13 The Committee note that there is an urgent need to fast track hydro electric projects by the CEA. Though it has been stated that the mechanism has been streamlined, yet much more requires to be done with the coordination of various agencies which are involved in the process of according clearance for the projects. The Central Water Commission, Geological Survey of India, Central Soil and Mineral Research Station and several divisions of The Central Electricity Authority take their own time, leading up to several years, before a clearance is given for the project. This unnecessarily leads to huge escalation in cost estimation. The Committee have been informed that before formal taking up of DPR for concurrence, clearances are given for various chapters by CEA. Thereafter, DPR is taken up for appraisal by CEA and a time period of 150 days is required for getting the financial appraisal, lay out and other issues. The Committee feel that this process consumes too much time, which is avoidable. Once chapters are approved with the guidance of CEA and discussed extensively then the time limit of 150 days for CEA to accord approval appears to be a bit longer which requires rationalisation. The Committee, therefore, recommend that:

- (i) The entire process of approval of various stages before the commencement of the DPR requires to be streamlined, with a view to reducing the time frame involved therein.
- (ii) The time limit of 150 days for CEA to accord approval to DPR should be curtailed to not more than 60 days as all the pre-requisites are already completed with the knowledge and concurrence of various divisions of CEA.

(Recommendation Sl. No.13, Para No.13)

Enabling Infrastructure Issues

2.14 The Committee note that most of the hydro power potential lies in far-flung and remote areas. The access to these sites and their development, in the absence of any connecting road and enabling infrastructure, is an issue. In these conditions developers face much difficulties in developing these projects. The Border Roads Organization (BRO) has been entrusted with the work of constructing roads to these sites. During the examination of the subject, when the Committee asked for the reasons for delays in their road projects, the BRO have stated that the major roadblock in development of road projects is acquisition of land. Land being a State subject, lot of problems are being faced. In many cases, even after compensation money was given by BRO to revenue authorities and the same has been disbursed to affected people, mutation of the land has not been done. Secondly, obtaining forest and wildlife clearances takes years leading to further delays in road projects. Also, lack of labourers, especially in the States of Arunachal Pradesh and Jammu & Kashmir, further aggravates the problem. Moreover, the Committee note that the BRO does not have sufficient capacity to construct roads at a required pace and in a definite timeframe. The Committee feel that

these road projects are important enabling elements of hydro power projects; hence they should also be given the due attention. The Committee believe that delay in these road projects will have a cascading effect on the developmental timeline of hydro power projects and result in cost overrun. It is obvious that any cost overrun will ultimately increase the tariff. The Committee, therefore, recommend that:

(i) The Government should take up the matter of land acquisition issue affecting the BRO road projects with the respective State Governments at appropriate level with a view to finding amicable and lasting solutions. They should also persuade the States which are endowed with hydro power, to grant forest and wildlife clearance to BRO road projects more expeditiously and liberally as the time bound development of many hydro power projects are dependent on the timely completion of these connecting roads.

(ii) The BRO should make utmost efforts to expedite the execution pace of the allocated road projects. The Committee also recommend to the Government to consider the issue of augmenting the capacity of BRO or make provisions to allow them to engage private contractors for the time-bound development of these crucial projects, subject to stringent quality control.

(Recommendation Sl. No.14, Para No.14)

**New Delhi;
05th May, 2016
Vaisakha 15, 1938 (Saka)**

**DR. KIRIT SOMAIYA
Chairperson,
Standing Committee on Energy**