

Chapter - V

Small Hydro Power

1. Introduction

MNRE has been vested with the responsibility of developing Small Hydro Power (SHP) projects up to 25 MW capacities. SHP projects can play a critical role in improving the overall energy scenario of the country and, in particular, for remote and inaccessible areas. Most of the potential is in the Himalayan States as river-based projects and in other States on irrigation canals. MNRE's aim was to install about 7,000 MW by the end of 12th Five Year Plan (FYP) i.e. 2017.

2. Potential, Target and Achievement

MNRE had identified¹ and created a database of 6,474 potential sites with an aggregate capacity of 19,749 MW. The State Governments also assessed the potential in their respective States. The independent Power Producers could also identify the potential and install projects.

2.1. Targets and achievements

The installed capacity of grid interactive SHP projects in the country at the beginning of the 11th FYP was 1,976 MW. The targets and achievements of MNRE under the 11th Five Year Plan (FYP) and 12th FYP upto 2013-14 were as given in Table 21 below:

Table 21: Targets and achievement under 11th and 12th FYP

S. No.	Year	Target (in MW)	Achievement (in MW)	Excess(+)/ Shortfall(-) (in per cent)	CFA released (In ₹ crore)
11th Five Year Plan Period (2007-12)					
1	2007-08	200	205	2	49
2	2008-09	250	249	0	72
3	2009-10	300	305	2	100
4	2010-11	300	307	2	152
5	2011-12	350	353	1	154
	Total	1,400	1,419	1	527
12th Five Year Plan Period (upto 2014)					
6	2012-13	350	237	-32	159
7	2013-14	300	171	-43	123
	Total	650	408	-37	282
	Grand Total	2,050	1,827	-11	809

Source: MNRE

¹ With the assistance of Alternate Hydro Energy Centre (AHEC), Roorkee.

During 2007-12, MNRE was able to achieve its target. However, during 2012-14 there was a shortfall of around 38 *per cent*.

As of March 2014, of the identified 6,474 potential sites for SHP projects of 19,749 MW, only 997 projects (3,803 MW) were completed and 254 projects (895 MW) were under implementation i.e. only 19 *per cent* of total potential sites had been exploited. MNRE had planned to install 7,000 MW by the end of 12th FYP (upto 2017). Based on analysis of the target and achievement, the following observations are made:

- i. MNRE had achieved 3,803 MW² as on 31 March 2014, which was 58 *per cent* of target set to be achieved by the end of 2017.
- ii. There had been a substantial shortfall in achieved targets in the first two years of the 12th FYP. The capacity addition in these two years i.e. 2012-14 had only been 408 MW. This implies that MNRE will be required to make a concerted effort to add another 3,197 MW capacity approximately, starting from conceptualization to commissioning, in the coming three years to meet its 12th FYP targets.

2.2. Small Hydro policy of Government of India (GoI)

MNRE, from time to time, formulated SHP policy. Prior to 2009-10 the policy was part of combined RE policy of MNRE. The exclusive SHP policy came in November 2009. The policy was revised in July 2014.

The GoI had also launched the schemes of PM's Special Package for Arunachal Pradesh and Ladakh Renewable Energy Initiative targeting development of local SHP and solar resources to meet the energy needs of the region. Audit findings on these programmes are discussed in Chapter X and XI, respectively, of this report.

2.3. State wise potential and cumulative achievement

The State wise detail of estimated potential and cumulative installed capacity is given in **Annexure X**. From the annexure, it can be observed that of the 29 States/UTs endowed with SHP potential, Andaman and Nicobar Islands and Haryana reported highest potential exploitation at 66 and 64 *per cent*, respectively. However, since the potential in these states was marginal, the contribution to aggregated installed capacity by these States was a meager 75 MW at eight sites. The highest capacity addition was made in Karnataka at 1,032 MW, which was also the State with highest potential.

For better analysis and appreciation of performance, Audit identified that six States were endowed with 61 *per cent* of the SHP potential in the country and five States with 20 *per cent* of the SHP potential. Together, these eleven States were endowed with 81 *per cent* of the country's SHP potential. The details are brought out in the following Table 22 with the data of these 11 States.

² Including 895 MW not yet commissioned

Table 22: Estimated potential, targets and achievement (Grid connected) for the States endowed with 81 per cent of country's SHP potential, as of March 2014

(in MW)

S. No.	State	Estimated potential	As per SNA		Installed capacity	Per cent installed
			Target fixed	Achievement		
High³ potential States with 61 per cent of the SHP potential						
1	Karnataka	4,141	600*	742	1,032	25
2	Himachal Pradesh	2,398	2,473	438	639	27
3	Uttarakhand	1,708	NA	14	175	10
4	Jammu & Kashmir	1,431	Not fixed	144	148	10
5	Arunachal Pradesh	1,341	79.85	28	104	8
6	Chhattisgarh	1,107	NA	27	52	5
	Total	12,126			2,150	18
Medium⁴ potential States with 20 per cent of the SHP potential						
7	Andhra Pradesh ⁵	978	NA	127	221	23
8	Madhya Pradesh	820	266.50	NA	86	11
9	Maharashtra	794	40 [#]	41	327	41
10	Kerala	704	Nil	163	158	22
11	Tamil Nadu	660	Nil	107	123	19
	Total	3,956			915	23

* Only 2009-14, [#]2010-11 to 2013-14

An analysis of these eleven States indicates that:

- i. Though cumulatively the high potential category States contributed more toward capacity installed in absolute values i.e. 2,150 MW as compared with medium potential category States with 915 MW, the latter performed better in terms of percentage of potential exploited i.e. 23 per cent as compared with 18 per cent;
- ii. In the high potential category States, Himachal Pradesh and Karnataka had exploited 27 and 25 per cent of their potential as compared with five to 10 per cent exploitation by the other four States in this category;
- iii. In the medium potential category, Maharashtra stood out with highest contribution both in terms of capacity creation and potential exploited followed closely by Andhra Pradesh, Kerala and Tamil Nadu. Madhya Pradesh, though endowed with considerable potential, lagged behind in exploiting it.

It is therefore important that MNRE and respective Governments of these States prioritize development of hydro potential in the next three years in order to achieve the 12th FYP targets.

³ States with estimated potential higher than 1,000 MW.

⁴ States with estimated potential between 1,000 MW and 600 MW.

⁵ Figures refer to the position before bifurcation into separate States of Andhra Pradesh and Telangana.

Audit's findings of the reasons for low capacity creation in some of these States, based on examination of records are given below:

Arunachal Pradesh

Memoranda of Agreement were entered with private developers and the State Government for setting up 52 Small/Mini/Micro Hydro Power projects with a capacity of 714.40 MW (upto 25 MW) between 2007-08 and 2014-15. However, none of the projects have been commissioned yet. These were still in the preliminary stages due to various reasons, like pending forest and environment clearances and public hearings, etc.

Chhattisgarh

Chhattisgarh State Renewable Energy Development Agency (CREDA) sanctioned 50 SHP projects of 612.25 MW and identified (2010) about 70 potential sites for development of SHP/Mini Hydro Power (MHP) projects of 2,997 kW but none had been commissioned till December 2014 because of delay in obtaining No Objection Certificate (NOC), local issues and non-execution of Power Purchase Agreement (PPA).

Himachal Pradesh

- i. Hydro Power Policy 2006 of the State Government stipulated the timeline for preparation of feasibility report and Detailed Project Report (DPR) submission as 24 months from the date of issue of consent letter / MoU. Himachal Pradesh Energy Development Agency (Himurja) issued 37 consent letters in June and July 2009 but even after five years the Independent Power Producers (IPPs) have not submitted the DPRs. Himurja had levied extension fee of ₹ 1.79 crore (up to December 2013) on 37 IPPs of which only six IPPs had paid full extension fee of ₹ 0.25 crore, 25 IPPs paid partly (₹ 0.33 crore) and six IPPs did not pay at all. Himurja cancelled two⁶ projects, 14 were recommended for cancellation and 15 were given show cause notice.
- ii. Himurja submitted 88 DPRs between April 2003 and March 2013 for total capacity creation of 278.76 MW to the Department of Energy (DoE) for technical approval but none had been approved so far (August 2014).
- iii. IPPs had not submitted the feasibility study report of 78 projects (total capacity 217.87 MW) allotted between February 2008 and March 2013.

Himurja stated (February 2015) that matter had been taken with the State Government for extension beyond the period mentioned in the policy. In respect of the non serious IPPs who have neither responded to show cause notice nor deposited any extension fee, the project allotted to them had been recommended for cancellation. The reply is not tenable as Himurja took a long time to act and the projects have still not been cancelled.

Karnataka

The State Government, keeping in view the environmental issues, restricted the mini hydro projects to five MWs and only run-of-the-river projects were encouraged in Western Ghats Districts/Forest areas. Audit observed that 167 allotments made for establishing Mini Hydro projects in the State were held up due to non clearance from the Forest Department.

⁶ Dehar-III one MW, Jiya one MW.

The State Government informed (November 2014) that obtaining clearances in this ecologically sensitive region was a major hurdle for implementation of projects and achieving targets.

Uttarakhand

- i. The State Government approved (February 2006) 250 kW SHP project at Gauri Chhina (Pauri) for ₹ 2.24 crore with a Central Financial Assistance (CFA) of ₹ 0.93 crore. Scrutiny of records revealed that even after a lapse of seven years from the date of work order (April 2007), only 15 *per cent* of the work was completed at an expenditure of ₹ 0.69 crore. The construction work was discontinued in October 2013. There was also a delay of two years in transfer of forest land. However, Uttarakhand Renewable Energy Development Agency (UREDA) had given assurance to MNRE at the time of seeking CFA that no forest land was involved at the site of the project. Further, there was lack of interest of the firm⁷ towards completion of work. The State Government accepted the facts (January 2015).
- ii. Gangori SHP (4 X 200 kW) project was commissioned in March 1987 but the project was lying closed since 1990. After the formation of Uttarakhand, the project was transferred to Uttarakhand Jal Vidyut Nigam Ltd (UJVNL) without the land records. UJVNL prepared a proposal (September 2003) for Renovation, Modernization and Upgradation (RMU) of Gangori SHP project of ₹ 1.91 crore. DPR of the project was approved by UJVNL in December 2007, after delay of four years. Due to agitation by the local villagers claiming compensation for the land, which could not be refuted in absence of proper land deeds, it was decided in February 2014 to abandon the project. Expenditure of ₹ 1.60 crore incurred till then was rendered wasteful. The State Government accepted the facts (January 2015).
- iii. Scrutiny of 31 SHP projects sanctioned during 2007-14 revealed that 13 projects, to be constructed on public community participation mode, were not only delayed but had not been completed till date (June 2014) due to lack of interest and poor co-ordination of sharing partners which resulted in blocking of funds of ₹ 6.51 crore. The State Government accepted the facts.

The above cases illustrate that there was an urgent need to resolve the hindrances confronting the planning, approval and implementation of projects.

3. Implementation of the SHP Scheme

The SHP scheme was implemented through the State Government Departments, State Electricity Board, State Nodal Agencies (SNAs), private developers, individual entrepreneurs, Non Governmental Organisations (NGOs), Financial Institutions/ banks etc. There were delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. The detailed audit findings are given below:

⁷ M/s Standard Electronics Instruments Corporation, Roorkee.

3.1. Identification of new potential sites and preparation of plan and DPR

MNRE provided financial support for the overall estimation of potential of SHP projects in the States, identification of new potential SHP sites and for preparation of plan for systematic SHP development in the States.

3.1.1. Few feasibility studies and site identification done by the States

Identification of sites and assessing potential for SHP projects was a critical planning activity. Audit separately enquired from the selected 24 States of feasibility studies and site identification done in each State. Of the 24 selected States only three set targets for conducting feasibility studies between 2007-14 as shown in the Table 23 below:

Table 23: Targets for conducting feasibility studies and achievement

State	Target	No. of studies conducted	No of sites identified
Himachal Pradesh	78	78	Nil*
Nagaland	24	24	13
Uttarakhand	23	23	52

*IPPs had not submitted feasibility/non feasibility report.

This indicates that very few States undertook the process of site identification in a planned manner by setting targets and monitoring against them, beyond the exercise done by MNRE.

MNRE stated (July 2015) that it had no role in this process. The expressions of interest/proposals/bids from private developers are invited by the State Government. MNRE should have ensured that the States take up feasibility studies and identification of sites as MNRE was responsible for developing SHP projects upto 25 MW. Identification of new potential sites and systematic detailed survey and investigation of all identified potential sites was a primary and critical component for SHP development.

3.1.2. Delays and problems in the DPRs prepared by the States

Apart from the three States mentioned above, some States also conducted feasibility studies, though no targets for such studies were set. Due to delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. Audit findings on the status and quality of feasibility studies are presented below:

Chhattisgarh

CREDA awarded DPR work (May 2005) to M/s Savitri Power Projects Ltd, Hyderabad for ₹ 2.52 lakh along with the project at an estimated project cost of ₹ 7.28 crore. However, the application of the firm requesting for release of assistance for preparing DPR was pending with MNRE for eight years. MNRE stated (July 2015) that CREDA had not taken the prior approval/sanction for DPR work, hence the CFA was not considered.

Himachal Pradesh

The potential sites were identified on the basis of preliminary reconnaissance only and no system existed to assess power potential accurately to obviate the chances of enhancement of capacity or cancellation of projects due to non-feasibility at a later stage.

Audit scrutiny (July 2014) revealed that because of above there was a variation of 40 to 1,300 *per cent* in the capacity allotted to the various SHP projects (136.50 MW) and the actual capacity addition (407 MW) in SHP projects.

Tamil Nadu

As per notification dated 11 December 2009 of the MNRE, Tamil Nadu Generation and Distribution Corporation (TANGEDCO) was entitled to receive subsidy for preparation of DPRs for the identified SHP projects, as also capital subsidy for setting up the projects. Though TANGEDCO had claimed the eligible subsidy in 2010 and followed it up with several reminders with MNRE, it was yet to receive the eligible amount of ₹ 25.90 crore. MNRE stated (July 2015) that TANGEDCO had not taken the prior approval/sanction for DPR and also work awarded the on single tender basis which was violation of provision of guideline, hence the CFA was not considered.

Uttar Pradesh

MNRE has identified 251 sites and estimated potential of 460.75 MW in Uttar Pradesh whereas the State Government had identified only 57 sites and potential of 167 MW for installation of SHP projects. Out of the 57 sites, pre- feasibility report and DPR in case of only 11 sites had been prepared in 2004-05.

3.2 Delays in allotment of projects

Audit observed instances when allotment of projects where DPRs had been prepared was inordinately delayed, hampering the exploitation of potential. These instances are reported below:

Himachal Pradesh

Himurja prepared DPRs for 16 projects (total installed capacity 63.05 MW) at a cost of ₹ 88.71 lakh for which MNRE sanctioned CFA of ₹ 72 lakh during 2010-11. It took up the matter with the State Government for execution of the projects. However, the State Government allowed Himurja to set up only three projects⁸ (14.5 MW) on BOT (Built Operate and Transfer) basis and the remaining 13 projects were yet to be allotted though a period of more than three years had elapsed since the preparation of DPRs. The three projects allotted to Himurja had also not been taken up for execution so far (March 2014).

⁸ Lower Sumej, Tauhak and Kareri.

Punjab

Punjab Energy Development Agency (PEDA) allotted (between August 1999 and January 2010) 19 MHP sites having power potential of 17.13 MW on Built, Operate and Own (BOO) basis to six private developers, to be developed within two years of allotment. Audit noticed that the developers did not take any steps to perform their obligations after signing Implementation Agreements (IAs) with PEDA even after getting extension ranging between 450 and 1,391 days. Resultantly, PEDA terminated all the agreements between June 2009 and October 2013 and encashed performance bank guarantee of ₹ 49 lakh. Audit further noticed that out of these 19 cancelled MHP sites, seven MHP sites with power potential of 9.40 MW only were re-allotted during March 2010 to October 2013 and 12 MHP sites with power potential of 7.73 MW were not allotted even after a lapse of eight to 60 months. PEDA stated that efforts were being made to harness the potential.

Uttar Pradesh

Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) invited bids for 11 projects in December 2010 and January 2013 but only one project (Walipura, Bulandsahar) had been allotted so far (November 2014). Proposal for another two were pending with MNRE. Considering that Uttar Pradesh was an electricity deficit State there was need for greater efforts to harness the small hydro energy.

3.3 Problems in Land acquisition and Forest and Environmental clearances

In 24 selected States Audit observed that a number of SHPs were held up for problems in acquiring land or getting forest clearances. While the impact of problems in getting clearances on projects in Karnataka and Uttarakhand has been reported in para 2.3, other such instances that came to the notice of Audit are reported below:

Bihar

Audit observed that MNRE released CFA of ₹ 1.31 crore to three⁹ SHP projects during 1995-96. All the three projects were held up for want of forest clearances. Neither Bihar State Hydroelectric Power Corporation limited (BSHPCL) nor MNRE monitored the projects. BSHPCL could not furnish the details of fund utilised and work executed. As per the terms and condition of the MNRE sanction, the BSHPCL was liable to return the CFA along with interest of ₹ 3.20 crore.

Meghalaya

MNRE sanctioned (March 2001) ₹ 7.39 crore for revival of abandoned Sonapani SHP project. Meghalaya State Electricity Board (MeSEB) could take the possession of land, free from all encumbrances only in October 2009. Similarly Lakroh SHP project was sanctioned (March 2001) by MNRE for ₹ 11.76 crore. MeSEB could acquire the required land only in January 2008 after a delay of more than six years. The projects had not been commissioned so far (September 2014).

⁹ Lower Ghagri ₹ 40 lakh, Sadani ₹ 90 lakh and Netharhat ₹ 1 lakh.

MNRE stated (July 2015) that the Techno-Economic Clearances were provided by the State Government and will advise all the State Government to expedite the pre-requisite clearances.

3.4 Delay in completion of projects – time and cost overruns attributable to implementing agencies

As per guidelines of MNRE, the projects should be completed within five years of release of first installment for run-of-the-river project and three years for canal based projects. Approved projects could not be completed due to negligence of contractors, midway changes in design, etc. resulting in significant time and cost overruns. The detailed audit findings are highlighted below:

Assam

Lungnit SHP project was approved (March 2000) by MNRE. The State Government approached the Ministry of Environment and Forests (MoEF) for forest clearance in February 2004, after a delay of four years. MoEF accorded the clearance in December 2004. The estimated cost of the project was ₹ 55.61 crore and the contracted value was ₹ 47.08 crore. Till November 2014 expenditure of ₹ 11.11 crore had been incurred but the project was still in initial stages only. The project was delayed due to the negligence of the contractor to whom a mobilization advance of ₹ 4.32 crore was released. The contract was terminated in August 2012 without recovering ₹ 3.93 crore. The contract had not been re-awarded as yet (December 2014).

Bihar

BSHPCL was sanctioned 23 projects by MNRE during the period 2005-12. Only eight projects were completed and remaining 15 under construction projects were yet to be completed despite lapse of time ranging between 37 to 88 months from the date of release of first installment of subsidy and after incurring an expenditure of ₹ 128.19 crore, including MNRE subsidy of ₹ 19.15 crore. The last installment of ₹ 2.95 crore for eight projects was not released by the MNRE due to non submission of completion report, Utilisation Certificate (UC), audited accounts etc. Four projects¹⁰ could not be started due to non-availability of forest land. No reply was furnished by BSHPCL.

Audit scrutiny further revealed that each of the eight completed projects was delayed. The delays ranged between 41 to 59 months from date of release of first installment in three canal based projects¹¹ and between nine to 68 months in all eight commissioned projects. The cost overrun in these eight projects was ₹ 48.06 crore.

Mizoram

MNRE approved (October 2011) five MW SHP projects for ₹ 56.93 crore. The project which was necessary for North Eastern Rural Development Blocks of Mizoram especially for Ngopa, Khawzawl and S. Khawbung having 114 villages located in the remotest corner bordering Myanmar was to be completed within 36 months. But, monthly progress

¹⁰ Dhobaha SHP, Sadani SHP, Lower Ghaghri SHP and Netarhat SHP.

¹¹ Arwal, Belsar and Sewari.

report as of June 2014 revealed that the progress of work was very slow. Zoram Energy Development Agency (ZEDA) in its reply (January 2015) stated that the delay was due to late tender process, non inclusion of items of work like bailey bridge, transmission lines in the contractor's package and non release of mobilization advance by the State Government.

Punjab

As per Project Implementation Schedule, 19 projects were to be commissioned within 16 months¹² from the date of Implementation Agreement (IA). Audit noticed that out of 12 projects at 19 sites of 11.05 MW, commissioned between 2009-14, only one¹³ project was commissioned within scheduled time and the remaining 11 projects were commissioned with delays ranging between three and 86 months.

Further, out of 19 projects (at 20 sites) under execution with power potential of 28.94 MW allotted (between April 1998 and October 2013) by PEDDA to private developers as of March 2014, IAs were signed for 16 projects between August 2001 and October 2012. Out of these 16 projects, commissioning of nine projects with power potential of 18.05 MW were inordinately delayed by 16 to 135 months (position as of March 2014) beyond the prescribed time period. Remaining three projects allotted between December 2009 and October 2013 were at DPR stage and IAs were not signed as yet (October 2014).

Tamil Nadu

Test check in audit of seven¹⁴ completed/ongoing SHP projects revealed that in all the seven projects, there were slippages in time schedule ranging between 49 and 87 months with consequential cost overrun of ₹ 448.75 crore. Even after commissioning, the Perunchani and Periyar Vaigai Projects suffered frequent forced outages due to mechanical problems, causing loss of generation. The delays in commissioning together with the outages caused loss of generation equivalent to 455.42 MUs during the period 2007-2014. The factors contributing to the increase in cost of the projects were delays in awarding of contracts, midway changes in design, increase in cost of materials and equipment etc.

From the above findings it was evident that poor planning and implementation led to low exploitation of SHP resources in the country, apart from time and cost overruns.

4. Deficiencies in operation and maintenance of the projects

4.1 Non/under performance of commissioned projects

The success of the SHP programme lay not only in commissioning projects but also in ensuring that these were properly run and maintained after commissioning. During test check in audit in five States, 60 projects¹⁵ were found shut down or under repairs and

¹² 485 days.

¹³ Terkiana head works.

¹⁴ Perunchani Mini Hydel, Periyar Vaigai Small Hydro (PV-I to IV) and Bhavani Barrage Small Hydro (BB-I and II)

¹⁵ Arunachal Pradesh (47 projects), Bihar (one project), Himachal Pradesh (five projects), Punjab (four projects), and Mizoram (three projects).

maintenance or working below capacity due to low discharge of water, leading to loss of power generation and revenue. Individual cases of interest that were noticed during audit are reported below:

Arunachal Pradesh

Department of Hydro Power Development (DHPD)

- i. Between 2007 and 2014, the installed capacity under DHPD increased from 34.095 MW to 61.810 MW but the percentage of electricity generation decreased from 17.48 *per cent* (2007-08) to 9.91 *per cent* (2013-14). Due to low generation, the power loss was 3,018.23 MU. This was because DHPD did not operate/under-operated 19 SHP projects since their commissioning, due to non-availability of sufficient operating staff (seven projects), low discharge of water (eight projects), non-repair/replacement of defective Electrical & Mechanical equipment and non-availability of sufficient transmission and distribution lines (two projects), fixing of unsuitable head (one project) and non-commissioning (one project), resulting in unfruitful expenditure of ₹ 33.70 crore, besides depriving 171 villages of electricity.
- ii. In addition, DHPD started (January 2011) Renovation & Modernization (R&M) of 15 SHP projects to be completed by November 2012. But even after incurring an expenditure of ₹ 43.29 crore¹⁶ the work has not been completed (September 2014) as the State Government only released ₹ 4.94 crore out of committed share of ₹ 32.46 crore leaving a balance of ₹ 27.52 crore. DHPD stated that the R&M projects were rescheduled to be completed by March 2015, subject to release of funds from MNRE.
- iii. In respect of Rina SHP project it was observed that due to low discharge of water and non-availability of sufficient transmission capacity, DHPD generated 9.30 MUs of power against the targeted generation of 63.06 MUs, resulting in loss of generation of 53.76 MUs during 2008-14.
- iv. Both machines of Units I & II of Bramdhongchung - I SHP (100 kW) project were not working (July 2013) due to turbine problems and the machines were taken out and kept in the power house.

Arunachal Pradesh Energy Development Agency (APEDA)

- v. In respect of 11 test-checked SHP projects (485 kW) of APEDA, generation was very low, where APEDA lost generation of 3.09 MUs. Reasons for the shortfall were not on record.
- vi. 11 SHP projects, with a capacity of 275 kW and constructed at a cost of ₹ 4.17 crore, were rendered non-operative after working for 18 to 72 months due to availability of local grid connection to the villages. Neither the State Government nor APEDA re-deployed the energy systems to other needy places nor connected the plants to the local grid for continuous operation. Besides, the plant and machinery would become unusable due to wear and tear, rust, etc.

¹⁶ CFA of ₹ 10.77 crore, State share ₹ 4.94 crore and Prime Minister's Package of ₹ 27.58 crore.

Bihar

- i. One unit of 1.5 MW Triveni Link Canal project (1.5X2 MW) at Valmikina (Bihar) installed in February 2009 was shut down since May 2013 due to inadequate repair and maintenance.
- ii. BSHPCL generated only 56.70 MUs (20 *per cent*) of energy during the period 2013-14 as against design energy of 278 MUs for SHP projects.

Himachal Pradesh

Himachal Pradesh Electricity Regulatory Commission (November 2013) specified capacity utilisation factor of 55 *per cent* for SHP projects for the purpose of tariff determination. Test check (August 2014) of five SHP projects¹⁷ revealed that against a target of 172.48 MUs during the period 2007-14, the projects could generate only 83.40 MUs leading to a loss of ₹ 26.28 crore¹⁸.

Punjab

Mention was made in paragraph 3.14.7 of the Audit Report No. 4 of 2009-10, Government of Punjab regarding less¹⁹ generation of power from four MHP projects having total capacity of 3.9 MW²⁰ during 2005-2010. Audit further noticed that generation of power from these MHP projects during the year 2010-11 was 0.44 MUs only against the annual target of 10 MUs and the Operation and Maintenance (O&M) contractor stopped generation in all four MHP projects from May 2010. On failure of the contractor to execute the contract as per provisions, Punjab State Power Corporation Limited (PSPCL) sent (April 2011) the Bank guarantee (BG) of ₹ 25 lakh for encashment to the Bank, but the same could not be done because the serial number of the stamp paper of the BG did not match with its copy in the Bank. The possession of these MHP projects was taken over from the contractor (March 2012) but PSPCL noticed that major components of the plants were missing from the sites. Arbitrator awarded (14 August 2012) finally a claim of ₹ 6.28 crore in favour of PSPCL which was not recovered from the contractor as of February 2015.

Mizoram

- i. Serlui-B project should have generated 178.72 MU in four years but it only generated 104.33 MUs leading to loss in revenue of ₹ 22.31²¹ crore. ZEDA in its reply (January 2015) attributed the low generation to occurrence of non repairable defects in third unit after trial run. It further stated due to the absence of provision for third party inspection in original project, this had not been conducted.
- ii. Out of 11 hydro power stations in Mizoram, Turivang power station (300 kW) was not operating since long. As per DPR the remaining projects should have operated at 70 *per cent* load factor for seven months every year. Audit observed that during 2007-14 against the required generation of 565.35 MUs, the SHP projects only generated 211.547 MUs. ZEDA stated (January 2015) that the generation was

¹⁷ Lingti, Rukti, Nogli, Aloe and Kothi

¹⁸ 89.08 MU x ₹ 2.95 (tariff) = ₹ 26.28 crore.

¹⁹ During 2005-10, only 28.2 MUs were generated against the projected 50 MUs (10 MUs per year).

²⁰ Nidampur (0.80 MW), Rohti (0.80 MW), Thuhi (0.80 MW) and Daudhar (1.50 MW).

²¹ 74.39 MU x ₹ 3.00(tariff) = ₹ 22.31 crore.

affected as many of the SHP projects are more than 20 years old and one SHP project at Tuipanglui was damaged due to cloud burst. Further, it stated paucity of fund for operation and maintenance, resulting in low generation.

- iii. Serlui-A, one MW SHP project in Mizoram was commissioned in 1984. MNRE sanctioned (March 2004) R&M for ₹ 1.91 crore, which was completed (September 2007) and the project was re-commissioned (July 2008) at a cost of ₹ 2.57 crore. Audit observed that as against desired generation of 3.53 MUs annually, the SHP project generated only 2.34 MUs annually during 2008-14. ZEDA in its reply (January 2015) assigned the reasons for low generation as poor hydrology in the area but remained silent on non reparability of machines as observed by the Original Equipment Manufacturer (OEM). Audit observed that ZEDA ignored the fact of poor hydrology, age of the project (over 20 years old) and observation made by the OEM, and carried out repair and modernization work. Thus the expenditure incurred on the project proved to be infructuous.

The above findings indicate that there were a large number of projects that had been commissioned and reported as a part of installed capacity in the country, but were either not functioning or functioning sub-optimally.

4.2 Non collection of consumption charges

As per Agreements with contractors, Arunachal Pradesh Energy Development Agency (APEDA) was required to form Village Energy Management Committees (VEMCs), for operation and maintenance of SHP projects, with beneficiaries as members. However, APEDA formed only 12 VEMCs for 74 SHP projects commissioned between January 2005 and February 2014. In the absence of VEMCs, APEDA incurred an expenditure of ₹ 82.30 lakh for operation, maintenance and repair of damaged works etc; on its own. Besides, APEDA did not collect consumption charges of ₹ 1.73 crore from beneficiaries for supply of 6.30 MUs of energy.

4.3 Generation and Evacuation of power

Adequate infrastructure and PPAs are a prerequisite for ensuring the successful functioning of projects. As per guideline of MNRE the project developer had to enter into PPAs with the State Utility before submitting application for financial support from MNRE. Audit examination revealed deficiencies in Himachal Pradesh on both arrangements as reported below:

- i. Electricity generation of SHP (Beas Kund nine MW) project commissioned in June 2012, was blocked (7.5 MUs) during 2012-14 due to inadequate evacuation infrastructure. This resulted in loss of energy to the extent of ₹ 2.21 crore²².
- ii. PPA in respect of one SHP (Binwa IV) project with installed capacity of four MW, commissioned in July 2013 had not been signed with distribution licensee so far (August 2014).

²² 7.5 MU X ₹ 2.95 (tariff) = ₹ 2.21 crore.

5. Other audit findings

5.1 Unwarranted financial accommodation of developers

5.1.1 Non levy and recovery of Liquidated damages, environmental dues, capacity enhancement, commitment fees, etc.

Audit observed certain instances of unwarranted financial accommodation of the developers by the State Agencies, in contravention of applicable terms and conditions of the award of contract. These are reported below:

Himachal Pradesh

- i. Hydro Power Policy of the State stipulated that if the capacity of the project below five MW was enhanced the IPP would have to pay additional premium and additional free power as applicable for projects above five MW. Audit noticed (July 2014) that capacity addition charges/upfront premium of ₹ 3.90 crore was not deposited by four developers²³ for capacity enhancement. These projects were allotted initially for total 6.60 MW during 2005-07 which was later enhanced to 45.60 MW. Neither IAs had been signed nor upfront premium/capacity addition charges deposited even after lapse of more than seven to nine years.
- ii. Further the Hydro Power Policy 2006 provided that 1.5 *per cent* of the final cost of the projects above five MW and one per cent of the final cost up to five MW would be contributed towards Local Area Development Fund (LADF) for Environmental Management Plan, Catchment Area Treatment Plan, Compensatory Afforestation etc. Audit observed (September 2014) that four IPPs were commissioned between January 2008 and May 2013 but LADF of ₹ 4.87 crore²⁴ was not deposited by them.

Madhya Pradesh

Eleven developers in Madhya Pradesh had originally applied to Narmada Valley Development Authority/ Water Resource Department and were migrated to the new policy (November 2011). Three²⁵ developers did not pay commitment fee of ₹ one lakh per MW after migration to the new policy. None of the developers paid project performance guarantee of ₹ one lakh per MW aggregating to ₹ 2.67 crore. But no action was taken by the SNA. None of the developers executed Hydro Power Development Agreement (HPDA). It was further noticed that no specific project completion and other related activities i.e. DPR etc were prepared by any developer.

Maharashtra

MEDA did not levy Liquidated Damages amounting to ₹ 3.59 crore in respect of seven²⁶ projects, where the projects were commissioned with delays ranging from 360 days to 1,320 days and all RE benefits had been released to these developers.

²³ Parbati project 12 MW - ₹ 1.09 crore, Sharmi project 9.60 MW-₹0.71 crore, Hurla-I project 9.40 MW - ₹ 0.84 crore and Kurpan-III project 14.60 MW- ₹ 1.26 crore.

²⁴ M/s Kapli Mohan & Associates Hydro Power Pvt. Ltd: Beas Kund 9 MW-₹ 1.14 crore; Om Hydro Power Ltd: Neogal 15 MW-₹ 0.77 crore; Rangaraju Ware Housing Pvt Ltd: Sumej 14 MW-₹ 1.08 crore; Patikari Hydro Electric Project Ltd: Patikari 16 MW-₹ 1.88 crore.

²⁵ Hata (4 MW), Danwa (5 MW) and Pancpani (4.5 MW).

²⁶ Veer Nira Left Bank Canal, Sonawade, Kolhapur Kumbhi, Chitri, Gadre Marine Export, Kasari and Dhom Balkawadi.

5.1.2 Excess payments for evacuation arrangements and tariff

Audit observed following instances of excess payments to developers.

Bihar

Loss of revenue

In 2009, on a tariff petition filed by BSHPCL, BEREC²⁷ fixed provisional tariff of ₹ 2.49 per kWh as the annual accounts were in arrear since 2001-02 and also directed BSHPCL to update its accounts and get them audited. In April 2010, BSHPCL filed petition for revision in tariff to ₹3.72 per kWh which was rejected by BEREC in June 2010 because BSHPCL could not submit audited annual accounts from 2001-02 onwards, and the provisional tariff continued to be applicable (December 2014). This led to loss of revenue of ₹ 21.98 crore, during the period 2011-14. Further, Audit observed that the CERC rate for SHP was ₹ 4.00, ₹ 3.65, ₹ 3.84, ₹ 4.16 and ₹ 4.40 per unit during the period 2009-14 which was substantially higher than the rate allowed to BSHPCL. No reply was furnished by BSHPCL.

Maharashtra

Excess payment towards evacuation arrangement

The State Government stipulated (July 2010) that MEDA will reimburse 50 *per cent* of the expenditure on evacuation at the rate ₹ 11 lakh per km, limited to actual expenditure or ₹ 1.10 crore, whichever is lower. Audit scrutiny revealed that MEDA reimbursed ₹ 2.53 crore as against ₹ 0.64 crore admissible in respect of five²⁸ projects having capacity upto five MW.

Punjab

Extra payment due to delay

PEDA(Punjab) allotted (November 1997) five²⁹ MHP projects of 5.05 MW to M/s Triveni³⁰ Engineering and Industries Limited for which Implementation Agreement (IA) was signed (November 2001) and the PPA was to be signed within 90 days from the IA, but the PPA was signed in November 2008. Due to delay in signing of the PPA, Punjab State Power Corporation Limited had to purchase power at higher rates ranging between ₹ 3.81 and ₹ 4.04 per unit during 2009-14 instead of ₹ 3.66 per unit (fixed) as per New and Renewable Sources of Energy Policy 2001³¹. The developer sold 1,039.112 lakh units during 2009-14 on which PSPCL had to make an extra payment of ₹ 3.59 crore.

5.1.3 Payment of higher CFA

In Himachal Pradesh it was observed that a MoU for the construction of three MW capacity Aloe-I SHP project was signed (March 2001) with M/s Aloe Manali Hydro Power Private

²⁷ Bihar Electricity Regulatory Commission.

²⁸ Veer Nira, Sonawade, Kolhpur Kumbhi Lakmapur, Kasari and Tembhu.

²⁹ Akhara, Gholian, Channuwal, Khanpur and Sudhar on Abohar Canal Branch.

³⁰ Renamed as Abohar Powergen Limited.

³¹ As per NRSE policy, 2001, rate per unit was ₹ 3.01 (base year 2000-01) with five *per cent* annual escalation up to 2004-05 for the projects for which PEDA had already entered into MoU/IA. No escalation was to be paid beyond 2004-05.

Limited with a CFA of ₹ three crore. But at the time of Techno Economic Clearance in January 2002 it was known that the discharge from Allian Nala would get reduced and the plant capacity would be lower and corresponding eligible CFA would be only ₹ one crore. After 2010, the generation capacity of the unit was reduced to 510 kW due to reduction in water discharge after commissioning of Allian- Duhangan Project. This aspect was ignored at the stage of technical clearance for three MW in September 2006, allowing the developer to claim higher CFA.

5.2 Allotment of project to ineligible contractors

As per bidding document of Jammu & Kashmir Energy Development Agency (JAKEDA) the eligibility criteria for contractors were - permanent resident of Jammu & Kashmir; and experience of developing and executing infrastructure projects of aggregate cost not less than ₹ 0.75 crore, of which ₹ 0.25 crore should be for hydro electric related projects, in the last 10 years. Audit observed that work (six projects) was awarded (February 2013) to five³² ineligible contracts.

5.3 Non maintenance of records of land acquisition

DHPD and APEDA in Arunachal Pradesh did not maintain any evidence of land acquisition for projects. It was stated that in lieu of land compensation, work orders were issued for carrying out civil works. However, details of the extent of land acquired, names of land owners and the number and value of work orders issued were not maintained either by the DHPD or APEDA.

5.4 Poor quality of work executed

As per Schedule of Work, power houses of Sikin Koro and Sinyum Koro SHPs in Arunachal Pradesh were to be constructed with cement concrete. During physical verification of the projects, it was noticed that the power houses were constructed with ordinary material - the walls of power houses were of Corrugated Galvanised Iron Sheets. However, the full amount of ₹ 10.39 lakh was paid to the contractor as per Schedule of Work by the DHPD, which was irregular. DHPD stated (December 2014), that after enquiry, responsibility would be fixed on concerned officers.

6. Monitoring and evaluation

As per MNRE's guideline the implementing agencies would set up reviewing arrangements to closely monitor the implementation of projects. MNRE itself or through third party/consultants may also monitor the implementation and post commissioning of the projects. Implementing agencies were also required to submit monthly generation data to MNRE for ten years after commissioning.

MNRE had conducted third party evaluations for 70 projects installed during the 11th FYP, however, no generation data was available with MNRE.

³² M/s JK Renewable Energy, M/s SA Power Utilities Pvt Ltd, M/s Gousia Road Construction Company, M/s Sharika Enterprises and M/s A.M. Contractors.

7. Conclusion

About 7,000 MW capacity was targeted for installation through Small Hydro Power projects by the end of the 12th Five Year Plan period i.e. by 2017. Of this 3,395 MW i.e. 48.50 *per cent* had been created by the end of the 11th Five Year Plan period i.e. by 2011-12. During the 12th Five Year Plan period, as of 2013-14, MNRE added another 408 MW only and was running behind its targets by 38 *per cent*. This implied that a significant 3,197 MW capacity would be required to be added in the remaining three years of the 12th Five Year Plan period to be able to meet target for development of Small Hydro Power. In eleven States endowed with 81 *per cent* of the National Small Hydro Power potential, the exploitation varied from five to 41 *per cent* of the potential.

MNRE had identified 6,474 potential sites with aggregate capacity of 19,749 MW in 29 States for setting up Small Hydro Power projects. As of 2013-14, 997 projects with capacity of 3,803 MW were installed. Thus, of the total capacity identified, only 19 *per cent* had been exploited so far. 254 projects (895 MW) were under implementation.

Audit observed delays and problems in conducting feasibility studies for identifying potential sites for setting up Small Hydro Power projects, which was a critical planning activity for development of Small Hydro Power. In Himachal Pradesh 37 consent letters were issued but the Independent Power Producers did not submit any Detailed Project Report even after five years; out of 88 Detailed Project Reports submitted by Himurja to the Department of Energy for technical approval none had been approved and the Independent Power Producers had not submitted feasibility study reports for 78 projects allotted to them.

Further, due to delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. In Arunachal Pradesh the State Government had entered into agreement with private developers for setting up 52 Small/Mini/Micro Hydro Power projects of 714.40 MW but none had been commissioned. Similarly, in Chhattisgarh the State Nodal Agency sanctioned 50 Small Hydro Power projects of 612.25 MW but none had been commissioned.

Approved projects could not be completed for various reasons such as negligence of contractors, midway changes in design, etc. This led to significant time and cost overruns. In Bihar 15 projects had not been commissioned even after a delay of 37 to 88 months and incurring an expenditure of ₹ 128 crore.

Audit also observed deficiencies in post-commissioning maintenance of the projects. Test check revealed that 60 projects in five States were shut down, under repair and maintenance or working below capacity, resulting in loss of power generation, revenue losses, unfruitful expenditure on out of order plants, wasteful expenditure on abandoned plants, etc.

There were instances of non-recovery of liquidated damages, environmental dues, commitment fees, diversion of funds, excess payments to developers, non-revision of tariffs, etc. There were also deficiencies in monitoring and evaluation of projects by MNRE and State agencies.

8. Recommendations

- *MNRE must ensure that pre-requisites such as land and statutory clearances are obtained before release of Central Financial Assistance to developers, in order to avoid time and cost overruns.*
- *MNRE should focus on reviewing Small Hydro Power projects that are held up or are under performing, to find solutions to the problems hindering the completion of these projects.*