CHAPTER II

Compliance Audit Observations relating to Power Sector Undertakings

Implementation of Small Hydro Electric Projects by Kerala State Electricity Board Limited

Introduction

2.1 Small Hydro Electric Projects[14] (SHEPs) are benign and clean source of energy. Therefore, Governments give more importance to SHEPs through various financial supports and policy initiatives. As of March 2012, there were 19 SHEPs in the State with an installed capacity of 145.65 MW. The Small Hydro Power Policy, 2012 announced by the Government of Kerala (GoK) anticipated additional capacity of 390 MW including 150 MW through private participation by the end of March 2017.

Kerala State Electricity Board Limited[15] (KSEBL) identified 151 potential sites and envisaged implementing 22 SHEPs with total capacity of 148 MW during the twelfth five-year plan (2012-17) as shown in ***Appendix 2***. Against this target, KSEBL commissioned seven SHEPs with capacity of 39.35 MW, while six SHEPs with total capacity of 66.50 MW were in progress as of March 2018. In respect of the remaining nine SHEPs with capacity of 45 MW, no work was taken up as of March 2018.

In order to ascertain whether the planning and implementation of SHEPs was in accordance with relevant Acts, rules, notifications *etc.* and to evaluate the performance of the commissioned SHEPs, Audit selected[16] three SHEPs each from the completed[17] and the on-going projects[18].

Audit findings

2.2 Audit findings on the implementation of six selected SHEPs are discussed in the succeeding paragraphs.

Planning for implementation of projects

Deficient Detailed Project Reports

2.3 SHEPs are eligible for financial assistance from Ministry of New and Renewable Energy (MNRE) at the rate of ₹3.50 crore per MW limited to ₹20 crore per project. KSEBL took up all the SHEPs with MNRE assistance. In order to be eligible for the financial assistance, the implementing agency has to follow the guidelines prescribed by MNRE. According to the guidelines, a Detailed Project Report (DPR) shall be prepared based on detailed surveys and investigation to assess the technical and financial

---

[14] **Hydro electric projects with station installed capacity of less than 25 mega-watt.**
[15] **Erstwhile Kerala State Electricity Board.**
[16] **Selection was based on the expenditure incurred for implementation. Sample was chosen from SHEPs commissioned and on-going during 2015-16 to 2017-18.**
[17] **Perunthenaruvi, Barapole and Adyanpara.**
[18] **Bhoothathankettu, Poringalkuthu and Kakkayam.**

feasibility of the project before its execution. Audit observations on preparation of DPR are discussed in ***Paragraph 2.3.1 and 2.3.2.***

Defective financial appraisal

2.3.1 As per the guidelines issued by the MNRE, the financial viability of an SHEP was to be assessed by computing the Payback Period (PBP)[19], Net Present Value (NPV)[20], Internal Rate of Return (IRR)[21] or Debt Service Coverage Ratio. For considering a project financially feasible, the NPV should be positive and the IRR should not be less than the cost of capital. As per the DPR, the cost of capital was 10 *per cent.*

Audit observed that by adopting incorrect criteria and methodology, four financially unviable projects were selected for execution as detailed in **Table 2.1**:

Table 2.1: Details of defects in financial appraisal of SHEPs

Name of the SHEP	Defects in financial appraisal
Barapole	• For calculating the IRR, equity capital alone was considered instead of the total estimated project cost (TPC), while the NPV was not calculated. • Based on the TPC, the NPV would become negative i.e., ₹ (-)15.23 crore and; • The IRR (8.75 *per cent*) would fall below the cost of capital.
Kakkayam	• The cash inflows for assessing NPV/IRR were worked out based on the power purchase cost of KSEBL (₹5.50 per unit) which was higher than the average realisation of ₹3.80 per unit at the time of preparation of DPR. • Based on the average realisation (for the year 2008), the NPV of the SHEP would be ₹(-)5.35 crore. • Similarly, IRR of the SHEP would become 8 *per cent* which was less than the cost of capital.
Adyanpara	• Financial viability was assessed based on PBP alone by adopting levelised tariff[22] (₹3.83 per unit) without evaluating the NPV and IRR. • Audit noticed that the NPV of the project based on average realisation (₹3.38 per unit) was ₹(-)13.87 crore. • Similarly, IRR (4.36 *per cent*) of the project was also less than the cost of capital.
Perunthenaruvi	• Financial viability of the SHEP was based on PBP alone by adopting levelised tariff (₹3.17 per unit) without evaluating the NPV and IRR. • Audit noticed that the NPV of the project based on average realisation (₹3.25 per unit) was ₹(-)21.40 crore. • Similarly, IRR (6.45 *per cent*) of the project was also less than the cost of capital.

[19] Payback period is the period within which the investor would recover his cost.
[20] NPV is the difference between present value of cash inflow during project life and total investment.
[21] IRR is the discount rate at which present value of benefits becomes equal to the present value of project investment.
[22] Net present value of the unit-cost of electricity over the lifetime of SHEP.

The Management replied (November 2018) that financial analysis was done in accordance with the guidelines issued by the State Electricity Regulatory Commission (SERC) and Central Electricity Regulatory Commission (CERC) using different financial tools like IRR, NPV, PBP *etc*. Other factors like operational flexibility, Renewable Purchase Obligation, socio-economic benefits were also considered while approving the projects.

The Management reply was not acceptable because as per the guidelines issued by SERC and CERC, the SHEPs were to be financially viable. But KSEBL assessed the financial viability of SHEPs using incorrect criteria and thereby financial tools like IRR, NPV *etc*. were made out to be attractive.

Non-assurance of water availability

2.3.2 As per the guidelines issued (March 2004/ July 2008) by the Central Electricity Authority/MNRE, the water availability studies for SHEPs shall be based on the water availability of 90 *per cent* dependable year. The 90 *per cent* dependable year[23] is the year in which the annual generation has the probability of being equal to or exceeding 90 *per cent* of the expected period of operation of the scheme.

Audit observed that:

- Out of the six selected projects, water availability of Bhoothathankettu SHEP only was assessed based on 90 *per cent* dependable year. The water availability of Kakkayam SHEP was assessed based on water discharge of Kuttiyadi Additional Extension Scheme. The water availability of the remaining four SHEPs was assessed based on the average potential of available water data. Based on the water availability of 90 *per cent* dependable year, two SHEPs (Poringalkuthu and Adyanpara) did not pay back during the expected life time of 35 years.

  The Management stated (November 2018) that the guidelines were not to be complied statutorily. KSEBL was duty-bound and had the authority to conceive the projects considering various aspects judiciously to safeguard the interests of the State.

  The reply was not acceptable as KSEBL did not formulate any guideline/manual for implementation of SHEPs specific to Kerala. Hence, the criteria for analysing the project feasibility were derived from the guidelines issued by MNRE. Moreover, in the case of Bhoothathankettu SHEP, KSEBL followed the 90 *per cent* dependable year criteria suggested by MNRE.

- The weir of Perunthenaruvi SHEP was constructed just above an existing pumping station of Kerala Water Authority (KWA). For ensuring the water requirement for drinking water, KSEBL was to release 96,739 cubic metre of water per day from the weir. The impact of sharing of water with KWA was, however, not considered at the time of preparation of DPR. After commencing

[23] For determination of 90 *per cent* dependable year, the total energy generation in all the years for which hydrological data is available is arranged in descending order and the (N+1) x 0.9th year would represent the 90 *per cent* dependable year.

the operation of the project in July 2017, power generation was interrupted from September 2017 due to low water level. Considering the water discharge for KWA, generation loss from September 2017 to May 2018 (9 months) was 1.08 million units (MUs) valuing ₹0.56 crore at the rate of ₹5.15 per unit[24]. The generation loss worked out to 4.19 *per cent* of the expected annual generation and this loss is likely to recur every year.

The Management stated (November 2018) that the sharing of water with KWA was factored in the DPR and accordingly, the installed capacity of the project was reduced from 9 MW to 6 MW. Further, Perunthenaruvi SHEP planned to utilise water during the monsoon season when the water requirement of KWA was negligible.

The reply was not acceptable as the DPR anticipated that the existing water pumping scheme of KWA would be affected by the project and suggested to relocate the intake of the pumping station to the reservoir. This was not acted upon and hence KWA demanded release of sufficient water for the drinking water purpose. Further, the Perunthenaruvi SHEP envisaged generation of power during non-monsoon season as well. Had the expected generation been limited to the monsoon seasons, the Perunthenaruvi SHEP would have been financially unviable.

Award of work

2.4 KSEBL invited separate tenders for civil works and electro-mechanical (E&M) works in the six SHEPs except in Adyanpara SHEP. According to the guidelines issued (November 2008) by the Central Vigilance Commission (CVC), tenders shall be finalised and contracts awarded in a time bound manner within the original validity of the tender.

There was delay in finalising the tender for civil work and electro-mechanical works of all the selected SHEPs, except Kakkayam, ranging from 13 days to 520 days. The major reasons for the delay were rectification of incomplete prequalification documents, change in the estimates due to change in the scope of work, design of power houses as per change in E&M equipment *etc*. as shown in ***Appendix 3***. The delay in finalisation of the tender resulted in corresponding delay in implementation of the project.

Audit noticed the following irregularities in the selection of contractors:

Undue favour to the bidders by relaxing prequalification criteria

2.4.1 As per the guidelines issued (July 2003) by the CVC, criteria for selection of bidders should be spelt out at the time of inviting tenders so that the basic concept of transparency and the interests of equity and fairness are ensured. The acceptance or rejection of any bid should be based on laid down specifications.

Audit observed that:

[24] **Average rate for the period 2012-17.**

- One of the eligibility criteria of bidders for Kakkayam SHEP was the completion of similar works of value not less than ₹11.75 crore as a prime contractor/developer during the last seven years as on the date of notice inviting bid. Out of seven bidders, only Paulose George Construction Company Private Limited (PGCCL) met the criterion. Though the value of similar work done by KK Engineering Company and Steel Industrials Kerala Limited was ₹5.36 crore and ₹4.61 crore respectively, KSEBL prequalified both the bidders along with PGCCL. KK Engineering Company became the lowest bidder and bagged the contract.

- One of the eligibility criteria of bidders for Perunthenaruvi and Barapole SHEPs was total annual turnover above ₹23.25 crore and ₹41.62 crore respectively. Two (out of seven) and three (out of eight) bidders respectively met the prequalification criterion. Annual turnover of one of the bidders, PGCCL, ranged between ₹15.22 crore and ₹21.69 crore. KSEBL prequalified the bidder in both the tenders. PGCCL turned out to be the lowest bidder on price bid opening and both the contracts were awarded to PGCCL.

Thus, relaxation of pre-qualification criteria during evaluation resulted in undue benefit to the ineligible bidders, who were finally awarded the works.

The Management stated (November 2018) that KK Engineering Company was prequalified for the implementation of Kakkayam SHEP in order to ensure better competition, as a special case. In the case of Perunthenaruvi SHEP, the tender clause regarding turnover could be interpreted as either annual turnover for each of the last three years or the total of the annual turnover for the last three years. Therefore, based on the directions of the Board of Directors, the total turnover of the last three years was considered as qualification criteria.

The reply of the Management was not acceptable as the CVC guidelines stipulated that evaluation/exclusion criteria should be made explicit at the time of inviting the tender. Therefore, relaxation of the criteria after opening of the technical bid lacked transparency.

Execution of work

2.5 The six selected SHEPs were scheduled for commissioning between January 2012 and March 2016 at a projected cost of ₹667.85 crore. Against this, three SHEPs were commissioned between September 2015 and October 2017 after delays ranging from 3 years and 4 months to 3 years and 7 months. The three ongoing SHEPs were delayed for periods ranging from 2 years and 1 month to 3 years and 6 months as of March 2018[25]. The cost incurred for the six SHEPs was ₹549.29 crore up to March 2018.

The reasons for the delay in completion of the SHEPs were as described below:

[25] **These three projects were not commissioned as of December 2018 but, the delay in months has been worked out up to 31 March 2018.**

Delay in diversion of forest land

2.5.1 As per the General Conditions of Contract, KSEBL was to hand over land to the contractors within one month of award of work. The implementation of the six selected projects required forest land, government land and private land. As per Section 2 of the Forest Conservation Act, 1980, forest land can be used for non-forest purposes only with the approval of the Central Government which shall be given in two stages. Providing land for Compensatory Afforestation (CA) or certificate by Chief Secretary to the Government regarding non-availability of alternate land for CA in the State and funds for raising compensatory afforestation thereof, a certificate from State Government as to the compliance of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA) *etc.* were mandatory requirements for diversion of forest land.

Three SHEPs selected for scrutiny required forest land for their implementation. Audit noticed that in all the three cases, there were delays in handing over forest land as shown in **Table 2.2** below:

Table 2.2: Details of delay in handing over forest land to contractors

Sl. No.	Name of SHEP	Date of issue of work order	Date of handing over forest land	Reason for delay
1	Perunthenaruvi	November 2010	December 2011	Acquisition of original land identified (2006) for Compensatory Afforestation (CA) was cancelled as there was increase in the cost of land due to delay in acquisition. Alternate land required for CA could be acquired only in February 2011.
2	Bhoothathankettu	February 2014	January 2016	The proposal for diversion of forest land was submitted in January 2012. But KSEBL submitted the mandatory compliance report on Scheduled tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, only in January 2014. The final approval of Ministry of Environment and Forests (MoEF) was received in April 2015. But there was further delay in clearing the site by removing the standing trees.
3	Poringalkuthu	August 2011	March 2014	KSEBL submitted a proposal to the MoEF in November 2011 without the required certificates regarding non-availability of non-forest land by Chief Secretary of Kerala. This was submitted later (April 2012). MoEF accorded final approval in March 2014 after KSEBL complied with the conditions of in principle approval given (July 2013).

Thus, there were delays ranging from 13 months to 31 months in handing over forest land to the contractor from the date of award of work.

Delay in acquiring private land

2.5.2 According to the modified guidelines issued (June 2005) by GoK for acquiring land for fast track projects, the revenue authorities were empowered to take advance possession of land under Section 17 of the Land Acquisition Act, 1894 (LA Act) after giving 15 days' notice to the land owners, if the land owners were not willing to enter into a direct sale deed or where direct purchase could not be effected for any other specific reasons.

Audit observed that there were delays in acquiring private land from the due date of taking possession in three SHEPS[26] examined in audit as discussed in **Table 2.3:**

Table 2.3: Details of acquisition of private land

Sl. No.	SHEP	Month of award of civil work	Month of sanction by GoK for acquiring land under Section 17(4)	Month of notice	Due date of taking advance possession	Actual month of taking possession	Delay
a	b	c	d	e	f	g	h=g-f
1	Perunthenaruvi (1.35 hectares)	November 2010	August 2013	December 2013	15/01/2014	June 2016	2 years and 5 months
2	Kakkayam (0.41 hectares)	March 2011	August 2011	November 2012	01/12/2012	October 2013	10 months
3	Barapole (8.07 hectares)	August 2010	March 2008	December 2009	25/12/2009	September 2011	1 year and 8 months

As a result of cascading effect of delay in handing over of land, KSEBL amended (December 2015) the General Conditions of Contract and paid price escalation of ₹3.59 crore to the contractor of civil works in Poringalkuthu SHEP. In the case of Barapole and Perunthenaruvi SHEPs also, KSEBL sanctioned payment of price variation of ₹1.25 crore and ₹0.58 crore respectively to the contractors which was yet to be released.

Due to the delay in acquiring private land for Kakkayam SHEP, validity of contract awarded (March 2011) for civil works expired (March 2013) and the contractor refused to carry out the remaining work at the same rate and hence, the contract was foreclosed. Subsequently, the balance work was retendered and awarded in October 2014 with an additional cost of ₹2.34 crore due to revision of rate.

The Management stated (November 2018) that the process of land acquisition through negotiated purchase or under Land Acquisition Act could be carried out through the Revenue Department only. In respect of Perunthenaruvi SHEP, the Management also stated that the delay was due to ownership dispute between the family members. The Management further replied that it was not practical to commence any project after acquiring full land. In case of Barapole SHEP, if the work was tendered after acquiring the whole land *i.e.*, after April 2013, the work would not have been completed by January 2016. Thus, early tendering has contributed towards early generation from the project.

[26] **No private land was required for Bhoothathankettu and Poringalkuthu SHEPs and the land required for Adyanpara SHEP was already in possession before tendering.**

The reply was not acceptable because the GoK sanctioned taking advance possession of land by invoking Section 17 of LA Act well ahead of the tendering of the work. Further, the guidelines followed by KSEBL and the terms of contract also required that the land shall be in possession before awarding the work. During the Exit Meeting (November 2018), Joint Secretary, Power Department, GoK assured that a Joint Mechanism consisting of various stakeholder departments would be put in place to speed up land acquisition for hydel projects.

Delay in implementation due to defective DPR

2.5.3 As per the Manual on Planning and Design of Small Hydroelectric Schemes published (2001) by the Central Board of Irrigation and Power (CBIP), in areas where slope of the hill is steep and where there is a history of landslides, tunnels are to be constructed for water conductor systems[27].

The DPR of Adyanpara SHEP proposed an open channel for the water conductor system although the area was mountainous and had a history of landslides. Civil work involving construction of the open channel was awarded to Kirloskar Brothers Limited-Aryacon Contractors and Engineers Limited (KBL-AECL) Consortium at a cost of ₹8.10 crore.

During execution of work, the open channel was found unfeasible and hence, the same was replaced (September 2008) by a tunnel with revision of estimate to ₹10.50 crore. KSEBL's attempt to execute the tunnel works separately through another tender was not accepted by KBL-AECL and also refused (January 2008) to execute the tunnel work at their quoted rate of 49.80 *per cent* above Schedule of Rates (SOR) 2004. Therefore, KSEBL terminated (August 2009) the contract at the risk and cost of KBL-AECL. In the retender also (July 2010), KBL-AECL turned out to be the L1. However, the party did not turn up to execute the agreement as the Letter of Acceptance issued in December 2011 included a specific clause as to the recovery of risk and cost of the earlier contract. Yet, KSEBL neither cancelled the work nor re-floated the tender. Meanwhile, the Hon'ble High Court of Kerala dismissed the Writ Appeal (May 2012) filed by KBL-AECL against the cancellation of the original work order in favour of KSEBL. Despite this, KSEBL waived the assessed risk and cost liability of ₹1.10 crore in favour of KBL-AECL.

Audit observed that the lapse of KSEBL in opting for open channel for water conductor system in the DPR resulted in change of the water conductor system during execution of the work and subsequent termination of the contract. Further, the decision of KSEBL to continue with the same delinquent contractor resulted in avoidable delay of 28 months with loss of potential generation of 21.02 MUs of power worth ₹10.83 crore at the rate of ₹5.15 per unit and also risk and cost liability.

The Management replied (November 2018) that the cost increase occurred because of the stoppage of work by the contractor, subsequent termination of the contract and retendering of the work.

[27] **Water conductor system is used to draw water from the intake pool to the generating station. It may include open channel, forebay and penstock or tunnel, surge shaft, pressure shaft and penstock.**

Since the stoppage of work by the contractor was due to the change in scope of work, the reply of the Management was not acceptable.

Delay due to non-synchronisation of Civil and Electrical & Mechanical works

2.5.4 Construction of the Power House (PH) building under civil work was dependent on finalisation of the design of the E&M equipment under E&M work. The foundation work for the E&M equipment could be carried out by the civil contractor only on receipt of the approved drawings from the E&M contractor. Since KSEBL selected separate contractors for the civil and E&M works, adherence to the timelines and proper synchronisation of both the works was essential for timely commissioning of the SHEPs.

For synchronisation of project works, the Management formed a Project Management Unit for each project and a Project Monitoring Cell for monitoring the progress of all the projects. In addition, for overall monitoring of the projects, a Project Monitoring Committee including Chief Engineers was also formed. Audit noticed synchronisation issues in respect of three projects where multiple contractors were engaged for electrical & mechanical and civil works. Meanwhile, no synchronisation issues were noticed in the project where a single contractor was engaged. This indicated that the monitoring mechanism put in place by KSEBL was ineffective in addressing the synchronisation issues which eventually led to avoidable delays up to 25 months and cost overruns. Delays in completing the projects is shown in ***Table 2.4*****:**

Table 2.4: Details of synchronisation of Civil and Electrical & Mechanical works

Sl. No	SHEP	Date of providing design of PH		Supply of E&M equipment	Completion of construction of PH		Delay in completion of PH building (months)
		Schedule	Actual		Schedule	Actual	
a	b	c	d	e	f	g	h = g - f
1	Perunthenaruvi	September 2011	October 2012	April 2013 to August 2015	March 2014	April 2016	25
2	Bhoothathankettu	February 2015	December 2015	November 2016 to June 2018	February 2016	Ongoing	25 (up to March 2018)
3	Barapole	October 2012	October 2013	May 2014	February 2013	October 2014	20

In the case of Perunthenaruvi SHEP:

- There was delay of 13 months in providing the approved design and layout for PH building due to delay in submission (August 2012) of the design and layout by the E&M contractor and its approval (October 2012) by KSEBL.

- As per the schedule, the construction of the PH building was to be completed in two years from October 2012[28]. However, due to non-mobilisation of adequate men and machinery by the contractor (PGCCL) who was awarded the work relaxing prequalification criteria as discussed in ***Paragraph 2.4.1***, the work could not be completed within the scheduled time (October 2014). In order to complete

[28] **Revised schedule as per the actual date of providing design and layout.**

the construction of the PH by March 2016, PGCCL proposed (September 2015) to replace the concrete building with a pre-engineered building (PEB). Even though, the life span of the PEB was only 20 years as against 40 years for the concrete structure and this entailed extra expenditure of ₹0.31 crore, KSEBL accepted the proposal so as to commission the project in June 2016 and to utilise the monsoon season of 2016 for generation. The contractor completed the civil works in April 2016 and handed over the site to the E&M contractor for the erection of Electric Overhead Travelling (EOT) crane.

Due to the delay, the E&M equipment supplied during April 2013 to August 2015 could not be commissioned and its quality deteriorated. The E&M contractor took 15 months to complete (July 2017) the E&M work due to removal of rust and replacement of necessary equipment.

Thus, in spite of unfruitful additional expenditure of ₹0.31 crore and compromising the life span of the structure by 50 *per cent*, the project could be commissioned only in October 2017.

The Management reply (November 2018) did not address the issue of delay in providing design and layout to the contractor and delay in construction of PH building by the contractor due to non-mobilisation of adequate men and machinery.

In the case of Bhoothathankettu SHEP**:**

- Even after providing the design and layout (December 2015) and land (January 2016), the contractor for civil works could not complete the civil work and handover the site to E&M contractor for erection of E&M equipment as envisaged due to the lapses in mobilising material and financial problems. As a result, E&M equipment worth ₹51.59 crore supplied (November 2016 to June 2018) by the E&M contractor remained idle.

  The Management stated (November 2018) that erection work of E&M equipment could only be commenced after the PH was handed over to the E&M contractor. As the supply of E&M equipment was staggered from November 2016 to June 2018 in accordance with the progress of the civil work, there was no idling of E&M equipment.

  The reply, however, did not specify the reasons for delay in the civil work. Moreover, equipment worth ₹51.59 crore supplied by the E&M contractor remained idle as there was delay in handing over the PH to the E&M contractor.

In the case of Barapole SHEP:

- Though, the land for the construction of the PH building was handed over to the contractor for civil works in September 2010, the work order for E&M works was issued only in September 2012 due to change in specification after floating tender (November 2010). Hence, the PH design was finalised only in October 2013 leading to delay in commencement of PH civil works. The PH building was handed over to the E&M contractor for erection of equipment in October

2014. The erection was completed only in February 2016 due to change in power evacuation system and delay in supply of Main Inlet Valves, cooling water pumps, control panels *etc*.

The Management replied (November 2018) that the design for the PH was received from the E&M contractor on 01/10/2013 and same was issued to the contractor for civil work on 11/10/2013. Hence there was no delay in issuing drawings of the PH.

The reply was not acceptable as there was inordinate delay in awarding E&M works even after handing over of the site (November 2010) for the construction of the PH building. There was further delay of one year in submission of design for the PH building by the E&M contractor.

Irregular payment of mobilisation advance

2.5.5 As per the guidelines issued (June 2004) by the Central Vigilance Commission, mobilisation advance can be given only if it is expressly stated in the tender document, including the amount, rate of interest *etc*. General Conditions of Contract for the civil work of Poringalkuthu SHEP provided that under special circumstances, advance to the extent of five *per cent* of the contract price or 90 *per cent* of the value of the material/equipment brought to the site, whichever is less can be granted on the security of such material/equipment to be adjusted in the contract contingent bill with interest. KSEBL sanctioned mobilisation advance of ₹4.58 crore equal to five *per cent* of the tender amount of ₹91.61 crore.

Audit observed that as the contractor did not make any supplies as on the date of request for mobilisation advance, the contractor was not eligible for any advance. As such, the sanctioning of mobilisation advance was an undue favour to the contractor and inconsistent with the CVC guidelines.

Audit also observed that the tunneling of low pressure pipe could not be completed within the scheduled period (April 2016) due to non-availability of plant and machinery required for tunneling of inclined pressure shaft. Further, out of 1,925 MT steel plates required for lining of tunnel, only 800 MT was procured and fabricated up to March 2018.Thus, despite providing mobilisation advance, contrary to the provisions of the tender, the contractor did not complete the work within the agreed time.

The Management replied (November 2018) that the advance was granted on the presumption that it would give an impetus to the contractor to keep up the momentum and complete the project at the earliest. It was also stated that while sanctioning the advance, Adit [29] and Horizontal Pressure Shaft driving were progressing ahead of schedule. Moreover, the contractor had brought several machineries for the excavation/drilling purpose at that time to carry out the work in three shifts.

The reply was not acceptable as no documentary evidence was available for the supply of material/equipment at site and the value thereof was also not considered while sanctioning the advance as required by the terms of contract. Further the value of work

[29] Adit is an opening in the face of a dam or tunnel to access the operating chamber.

done during the four months up to July 2014 was ₹0.86 crore only which was less than one *per cent* of the probable amount of contract (PAC). The reply was also silent on the observation regarding the delay even after sanctioning the advance.

Non-imposition of liquidated damages

2.6 Clause 5.3.11 of the General Conditions of the Contract provides for levy of liquidated damages for delay in completion of work at the rate of 0.05 *per cent* of the accepted contract value per day of delay subject to a maximum of 10 *per cent* of the contract value.

The contractors of six SHEPs were given extension of completion time due to delays in land acquisition, geological surprises *etc*. In two[30] out of three commissioned SHEPs, the contractors, however, failed to complete the work even within the extended time warranting imposition of liquidated damages. Despite suffering loss of potential generation of power, KSEBL did not impose liquidated damages amounting to ₹3.77 crore in respect of these two SHEPs.

The Management replied (November 2018) that liquidated damages for delay in completion of work were not imposed as the reasons for delay were beyond the control of the contractors.

The reply was not acceptable in view of the fact that the contractors failed to complete the works even after being granted extension of time for delay in acquisition of land, geological surprises *etc.*

Lack of supervision

2.7 KSEBL constituted (May 2011) Project Monitoring Committees (PMC) under the chairmanship of the Chief Engineer concerned (Civil Construction – South/North/Central). The Project Manager was the convener of the PMC. The PMC was to closely monitor the progress of the implementation by meeting at site at least once in two months to tackle various issues that affected the project execution.

Audit observed that as against the required 215 meetings in respect of the six selected SHEPs, actual number of meetings was only 40. Further, except the PMC of Barapole SHEP, the first PMC meeting of other SHEPs was convened after delays[31] ranging from 516 days to 1,604 days. This was despite the delays in acquisition of land and slow progress of works.

Similarly, KSEBL formed (August 2013) another Project Monitoring Cell independent of the project implementation wing under the control of the Chief Engineer (Project, Electrical and Design) to visit all the project sites every month and to report the progress of the implementation of all the projects to the Board of Directors (BoD) of KSBEL through Director (Generation-Civil). This monitoring was not carried out as no separate staff was deployed to conduct the site visit. Thus, the supervision by the higher level management was almost absent and not effective.

[30] **Perunthenaruvi and Barapole SHEPs.**
[31] **Calculated with reference to award of work or May 2011, whichever is later**.

The Management replied (November 2018) that as there was no meaning in convening the PMC meeting before the commencement of actual construction works, the first PMC meeting was convened after achieving a considerable progress in the construction works. The PMC was convened only for specific purposes, such as sanctioning extra item, excess quantities *etc*. The non-conduct of the PMC every two months, did not affect the progress of work.

The reply was not acceptable as the very purpose of the constitution of the PMC was to regularly review the progress and ensure that the projects were completed in a time bound manner. However, the delay in acquisition of land and finalisation of E&M contracts was not taken as a serious issue affecting the implementation of projects. The role of PMC was relegated to the sanctioning of the excess quantities/extra items, extension of time of completion and cost escalations.

Impact of delay in completion

2.8 The Kerala State Electricity Regulatory Commission (Renewable Purchase Obligation and its Compliance) Regulations 2010[32] made it obligatory for all distribution licensees to purchase not less than three[33] *per cent* (0.25 *per cent* from solar and 2.75 *per cent* from non-solar sources) of their consumption of energy from renewable sources. Shortfall, if any, was to be met through purchase of Renewable Energy Certificates (REC).

Audit observed that:

- As a result of delay in commissioning the six selected SHEPs within the scheduled time due to delay in diversion of forest land/ acquisition of private land, non-synchronisation of civil and E&M work, there was loss of generation of 608.93 MUs of energy valuing ₹313.59 crore. Audit also observed that the shortfall in non-solar Renewable Purchase Obligation (RPO) for the period 2011-17 was 978 MUs. In order to meet the shortfall in RPO, as directed (March 2016) by KSERC, KSEBL purchased (April 2016) one lakh RECs equivalent to 100 MUs for ₹15 crore. The commissioning of the six selected SHEPs within the scheduled time would have enabled KSEBL to meet RPO to an extent of 608.93 MUs against the shortfall of 978 MUs[34].

  The Management accepted (November 2018) that the delay in commissioning SHEPs ultimately led to short fall in meeting RPO with consequent additional financial burden on KSEBL in purchasing RECs to meet RPO shortfall.

- Delay in completion of the project resulted in corresponding retention of the Project Implementing Units at the project site and additional interest burden leading to cost overrun to the extent of ₹58.23 crore in respect of three[35] commissioned SHEPs.

---

[32] Notified on 23/11/2010.

[33] Enhanced to not less than 4.50 *per cent* (0.36 *per cent* from solar and 4.14 *per cent* from non-solar sources) from the year 2015-16 with an annual increase of 0.50 percentage per year until it reaches 10 percentage of the total supply, as modified by KSERC (Renewable Energy) Regulations, 2015.

[34] 200 MUs plus 878 MUs as reduced by 100 MUs for which RECs were purchased.

[35] Perunthenaruvi (₹ 17.91 crore), Adyanpara (₹19.52 crore) and Barapole (₹ 20.80 crore).

The Management replied (November 2018) that the implementation of the project was delayed due to delay in getting forest clearance. Bare minimum staff were posted at the project site and that the project team had attended to other project works also, namely, preparation of drawing and construction of office buildings, establishment of solar projects *etc.*

The reply was not acceptable as the delay in obtaining forest clearances was avoidable. Moreover, there were further delays in completion of work due to delay in acquisition of private land and absence of proper synchronisation of works.

Low generation of power from commissioned SHEPs

2.9 The three commissioned SHEPs projected generation of 116.65 MUs. Against this, the actual generation was 83.28 MUs due to the following:

- Terms of contract and technical specifications of E&M equipment provides that before taking over the plant, pre-commissioning tests of continuous operation of 72 hours and load rejection test at 110 *per cent* capacity shall be successfully completed. The E&M contractors should guarantee the performance of equipment for a period of three years from the date of taking over of the equipment.

  Even though, Perunthenaruvi SHEP and Barapole SHEP were commissioned and started generating power, KSEBL was yet to take over these projects as the contractors did not complete all the work.

  In respect of Perunthenaruvi SHEP, though there were interruptions lasting 2 hours 37 minutes (in six instances) in Unit I and 3 hours 51 minutes (in 18 instances) in Unit II in the pre-commissioning test, KSEBL accepted the test run results. During July 2017 to March 2018, there was loss of generation of 7.08 MUs valuing ₹3.64 crore[36] for 4,579 hours due to mechanical failure/repair.

  In respect of Barapole SHEP, 72 hours continuous test run and load rejection tests at 110 *per cent* output were not conducted till June 2018. The three units of Barapole SHEP were synchronised with the grid in June/July 2016. Immediately after synchronisation of Unit-I, mechanical faults were found in the machine and generation was stopped, leading to loss of generation of six MUs[37] valuing ₹3.09 crore. The unit was put back in to operation in December 2016 only.

  As there was no mechanism to ensure early takeover of the project after commissioning, KSEBL did not penalise the contractors for loss of generation during the intervening period of commissioning and takeover of the project.

  The Management replied (November 2018) that the contractor of Barapole SHEP was being continuously persuaded to commission the units along with all the other pending works as required in the contract. An amount of ₹5.36 crore was due to the contractor which would be released only after assessing the due

[36] **Worked out at the rate of ₹5.15 per unit.**
[37] **Estimated generation per unit 12 MU/12 months x 6 months (June 2016 to November 2016).**

penalty/generation loss. In respect of Perunthenaruvi SHEP, the Management stated that the operation of the station at the initial period of commissioning was very critical and had to be stopped even for minor issues noticed. The contractor has to clear all punch points observed during initial period and hence a lot of fine tuning was necessary to make the system in a stable condition.

The reply of the Management was partially correct to the extent that the final bills were not yet released and lot of fine tuning would be required before taking over the project. However, there was no specific time period fixed to be considered as initial period of operation. Both the stations were not taken over even after the test run and one year of operation.

- According to the guidelines issued (February 2008) by MNRE, to prevent the entry of debris into power channel/ tunnel, a trash rack with 14 degree inclination shall be placed at the entry to the power channel/ tunnel.

  Audit noticed that the trash rack at Adyanpara SHEP was placed in vertical position resulting in accumulation of trash reducing flow of water into the power channel and non-operation of power house at its full capacity of 3.50 MW. Exact generation loss due to this could not be quantified by Audit.

  The Management replied (November 2018) that a new trash rack having inclination was constructed at Adyanpara SHEP.

- During the construction stage of Adyanpara SHEP, landslides occurred at the tunnel portal (opening at tunnel) on several occasions and proposals were submitted for providing protective measures. However, the proposals were not attended to and the project was commissioned in September 2015. During September 2017, landslides occurred resulting in stoppage of generation for 49 days. Another landslide occurred on 13 June 2018 and heavy mass of earth and boulders fell on the tunnel portal obstructing the flow of water requiring three months for rectification. The generation loss due to landslides worked out to 11.68 MUs on the two occasions (4.12 MU[38]+ 7.56 MU[39]) valuing ₹6.02 crore[40].

Conclusion

Against the envisaged capacity addition of 148 MW through commissioning of 22 SHEPs during the twelfth five-year plan period (2012-17), actual capacity addition was 39.35 MW by commissioning seven SHEPs as of March 2018. Detailed Project Reports were prepared without considering water availability based on 90 *per cent* dependable year and realistic financial viability indicators. Delay in diversion of forest land and acquisition of private land, defective DPR and non-synchronisation of civil and E&M works led to extension of completion time and resultant loss of generation of 608.93 MUs of energy valuing ₹313.59 crore. Further, KSEBL sustained avoidable liability to purchase 6.09 lakh Renewable Energy Certificates to meet Renewable Purchase Obligation. Performance of the commissioned units

[38] **3.50 MW x 1000 x 24 Hrs x 49 days = 4.12 MU.**
[39] **3.50 MW x 1000 x 24 Hrs x 90 days = 7.56 MU.**
[40] **11.68 MU x ₹5.15/unit = ₹6.02 crore.**

did not match the projections due to failure of equipment, obstructions in the free flow of water to the water conductor system *etc*.

Audit observation is based on our analysis on sample cases only. Since there is a possibility of more such cases occurring in other projects, KSEBL may examine the projects not covered in audit and take suitable corrective action.