Keezharkuthu Small Hydro Electric Project (19.8 MW/65 MU)

Joint Site Inspection held on 17.11.2018

Report from KSEB Ltd.

1. Back ground

The Government of Kerala based on its policy to augment installed power generation capacity in the State has embarked upon an ambitious plan to add power from Small Hydro Projects (SHPs) on Build Own Operate Transfer (BOOT) basis to the States grid considering that such projects are environmentally benign. Accordingly vide G.O.(MS) No.23/2014/PD dated 21.07.2014, 25 numbers of SHPs and vide G.O.(MS) No.25/2017/PD dated 11.12.2017 another 20 numbers of SHPs were allotted to various private developers under BOOT basis for 30 years based on a competitive bid through Energy Management Centre (EMC), Government of Kerala.

Keezharkuthu SHP (19.8 MW/65 MU per year) is one among the above projects allotted to M/s Keezharkuthu Power Private Ltd., (KPPL), Kochi, an independent power producer (IPP) which functions as a subsidiary of the General Mechanical Works Pvt. Ltd. (GMW), Chennai. KPPL is mandated with the task of (i) conducting appropriate studies for optimising the project components, (ii) preparation of the Detailed Project Report (DPR) and (iii) other studies required for obtaining the statutory clearances for commencement of construction, commissioning and operation of the project for the concession period of 30 years on BOOT (build, own, operate, transfer) basis. The capital investment and O&M costs for the concession period shall be borne by M/s KPPL, while the power generated from the project will be distributed to the public through the KSEB network based on a power purchase agreement. After 30 years of concession period, the project ownership will automatically vest with KSEB Ltd.

The Keezharkuthu SHP (19.8 MW/65 MU per year) is proposed to be developed as a run-of-the-river scheme in Keezhar, a tributary of Kambar and a sub-tributary of Kaliyar joining Muvattupuzha River. The tail water after power generation will join the parent river downstream. The project requires clearance from the State Forest Department under the Forest (Conservation), Act, 1980. Environmental Clearance under the EIA Notification, 2006 is not required for this SHP since the installed capacity is less than 25 MW.

The Government has also constituted a high power committee chaired by the Chief Secretary for coordination with different stake holder departments for obtaining statutory clearances, leading to early commencement of works and commissioning and also to support such potential investors for boosting the investor friendly image of the State.

M/s KPPL have conducted studies for optimisation of the project components with the primary aim of minimising the extent of forest land and prepared a DPR and got the same approved by the Committee constituted for the same. The proposal as per the DPR involved diversion of 3.4 Ha of forest land under Thodupuzha Range of Kothamangalam Forest Division. The application for diversion of 3.4 Ha of forest land submitted by M/s KPPL was rejected by the State Forest Department stating that the impacts due to the diversion of forest have not been studied scientifically and quantified. Accordingly M/s KPPL have commissioned M/s Agriculture & Ecosystem Group (AGES), Thiruvanathapuram for assessment of the impacts due to the diversion of the forest land and other related environments.

Based on the exhaustive scientific studies that followed, an EIA Report was prepared in February, 2018. As per the report, the power generation scheme primarily consists of a 5.0 m high conventional diversion weir across Keezhar at an average river bed level of + 545 m; an intake structure with single vent consisting of trash rack and intake gate; a water conductor system consisting of D-shaped concrete lined power tunnel with a diameter of 2.5 m for a length of 1600 m, a 5.0 m dia. surge shaft, a penstock pipe of 1400 m long (1.6 m dia.) branching into three pipes of 20 m long (0.8 m dia.); and a powerhouse on the left bank of Kambar (downstream of the confluence of Keezhar with Cheruthenmari) to accommodate three Pelton type turbines with an installed capacity of 6.6 MW each (19.8 MW; annual generation: 65 Mu). A 60 m long trapezoidal shaped tailrace channel will lead the tail water after power generation to Kambar. A 1.0 m dia. cover pipe is provided in the weir for discharging dry weather flow to the downstream of Keezhar. The generated power at 11 kV will be stepped up to 33 kV and will be transmitted through an 33 kV line of 9.0 km length drawn along the panchayat/PWD road to the Udumbanoor substation (110/33/11 kV).

The EIA report states that the project components were optimised and the forest land requirement was reduced from 3.4 Ha to 2.87 Ha during the construction period of 3 years and further to 0.98 Ha (permanent diversion) during the operation period. The proposal is to return 1.89 Ha (2.87 Ha-0.98 Ha) of forest land after use in construction, since the same is required for access and temporary use during construction period of 2 years. Based on the above EIA report, M/s KPPL have submitted a revised application for forest clearance on 30.06.2018 to the State Forest Department.

Simultaneously M/s KPPL, in lieu of the EIA study report, requested the Government for support in re-opening of the file relating to diversions of forest land, which was earlier rejected by the State Forest Department. The High Power Committee chaired by the Chief Secretary in its meeting held on 08.05.2018 decided to have a joint inspection of the project site with members from State Forest Department, Power Department, EMC, KSEB and M/s KPPL. Accordingly the joint site inspection was

held on 17.11.2018. The list of members who attended the joint site inspection is attached as Appendix 1.

This is a report from the side of KSEB Ltd., based on the site inspection.

1. Discussion at Forest Range Office, Velur, Kottakavala - @ 10 am

1.1 The Chief Conservator of Forests (CCF), Kottayam welcomed all the members who have come for the joint site inspection based on the directions of the High Power Committee chaired by the Chief Secretary held on 08.05.2018. CCF informed that the earlier application submitted by M/s KPPL for diversion of 3.4 Ha of forest land under Thodupuzha Range of Kothamangalam Forest Division was rejected since the impacts due to the diversion of forest have not been studied scientifically and quantified. The DFO, Kothamangalam observed that construction of road to the weir site would open up the forest and would create human-animal conflict.

1.2 M/s KPPL have informed that subsequently they have conducted an EIA study. One copy of EIA report was presented in the meeting. They have informed that based on the EIA study, the project components were optimised and the forest land requirement was reduced from 3.4 Ha (as in the initial proposal which was rejected by KFD) to 2.87 Ha during the construction period of 2 years and further to 0.98 Ha (permanent diversion) during the operation period. The proposal is to return 1.89 Ha (2.87 Ha-0.98 Ha) of forest land after construction, since the same is required only for access and temporary use during construction period of 2 years. They presented the split up of forest land as detailed in Table 01.

Table-01: Details of land required for the project

Sl. No.	Project Components	Forestland (in m^2)			Private land (in m^2)
		Requirement during construction	Area to be returned	Net requirement	
1.	Approach road to weir (1000 m X 4.5 m)	4500	4500	-	-
2.	Weir (60 X 50 m)	3000	-	3000	-
3.	Tunnel intake (40 m X 20 m)	800	600	200	-
4.	Reservoir area	5000	-	5000	-
5.	Working area near weir site (30 m X 30 m)	900	900	-	-
6.	Power tunnel (1600 X 3 m)	4800	4800	-	-

7.	Surge shaft (60 X 3 m)	1800	1600	200	-
8.	Working area near surge site (30 m X 30 m)	900	900	-	-
9.	Penstock and rail track	7000	5600	1400	2800
10.	Powerhouse and switch yard	-	-	-	8400
11.	Tailrace channel	-	-	-	600
12.	Temporary dumping yard-1 (Kaithappara)	-	-	-	1600
	Temporary dumping yard-2 (near powerhouse)	-	-	-	1600
13.	Transmission line	-	-	-	-
14.	Compensatory afforestation				28700
	Total	**28700** (2.87 ha)	**18900** (1.89 ha)	**9800** (0.98 ha)	**43700** (4.37 ha)

The private required is 4.37 ha, including 2.87 ha for compensatory afforestation. Since the transmission is proposed through existing roads, no land acquisition is necessitated.

M/s KPPL also highlighted the following optimizations that were made to minimize forestland requirement during construction to 2.87 Ha and the requirement of permanent forest diversion to 0.98 Ha.

i. Approach road to penstock/surge which involved 1.10 ha of forestland has been avoided. The muck from the surge and part of tunnel near surge are now proposed to be conveyed out of the forestland using rail and winch mechanism. This optimization has resulted in minimizing diversion of the forestland, avoiding opening of forest for public access during construction and operation and thereby ensuring free movement of wildlife.

ii. The two dump yards (0.18 ha), earlier proposed within the forestland have been shifted outside the forest boundary for minimizing the impact on ecology and wildlife.

iii. 800 m length of penstock (out of 1000 m within forestland) earlier proposed over ground has been converted to underground (cut and cover) thereby avoiding hindrance to movement of wildlife; 200 m length of penstock lie in steep rocky stretch. Accordingly the covered extent (0.56 ha) of the penstock

route can be returned to the State Forest Department for forestry use after construction.

iv. The approach road to weir site (0.45 ha), working space at intake, weir and surge shaft (0.26 ha), outer area of surge shaft (0.16 ha) and the full surface area of power tunnel (0.48 ha) are proposed to be returned to the Forest Department for forestry use after construction.

M/s KPPL, based on the strength of the EIA report concluded that since most of the land including the access road to the weir site is returned to the forest department after construction for afforestation and forestry use, and no routine operation are required at the ungated weir and other components located in forest land, impact on forest and wild life will be minimal and that too limited to construction period. The concern relating to human-animal conflict was also ruled out by them, stating that the movement of O&M staff will be limited from their colony to power house site, both of which are proposed in private land.

They informed about the enumeration of the trees to be felled as only 364, covering 58 species. They have also identified 2.87 Ha private land (adjoining the forest boundary) although the permanent diversion is limited to 0.98 ha. This in effect, would result in a net increase of 1.89 ha of forestland in the State. Further they pointed out that the project would be eligible for Carbon Credits under Clean Development Mechanism (CDM) as its clean power (65 MU per year) would avert emission of 48,360 MT of CO_2 per annum or would avert a cumulative reduction of 3 Million MT of CO_2 emission in its 60 year life. Further the net increase in forest area (1.89 ha) with compensatory afforestation for 2.87 ha would provide further sink for CO_2 thereby providing a share in the global effort for carbon sequestration.

Based on the above optimisations in the EIA report, M/s KPPL have informed that they submitted a revised application for forest clearance on 30.06.2018 to the State Forest Department. M/s KPPL requested to re-open the file to consider the revised proposal. They also assured the joint site inspection committee that they are open to accommodate suggestions, if any, if the same is technically feasible.

1.3 **Representatives of EMC** highlighted that SHPs are one of the appropriate and environmentally safe renewable energy source and involves very little storage causing no or negligible environmental degradation, and is one of the best sources of eco-friendly power. Government of India, in its efforts to reduce the effects of climate change and global warming has devised a policy for reduction in greenhouse gases from power generation by promoting more number of hydropower projects through the Ministry of New and Renewable Energy (MNRE). As part of this policy benefits

in the form of Carbon Credits under Clean Development Mechanism (CDM) is extended to the development of small hydropower project, for which the Keezharkuthu SHP is also eligible.

In view of these advantageous features and towards initiating private participation in power development, the Government of Kerala, through EMC have allotted a set of small hydro power schemes under Independent Power Projects by private sector participation. Keezharkuthu Small Hydro Electric Project (19.8 MW) is one of such proposals, which is in an advanced stage of study/clearance. EMC also observed that M/s KPPL based on the EIA study have made sincere efforts in minimising the forest land to contain the impacts sustainably and the proposal needs a relook from the side of KFD.

1.4 KSEB Ltd., lauded the efforts made by M/s KPPL in optimising the project features and minimising the extent of permanent forest diversions to 0.98 Ha. It was also highlighted that diversions of 0.98 Ha of forest land for generating 65 MU of clean energy (annually) from 19.8 MW installed capacity from a SHP is the barest minimum in the history of the State and deserves due consideration from KFD.

2. **Site visit - @ 11 am**

2.1 **Approach road to the weir site:** The CCF opined that as per the estimation by M/s KPPL, the forest land to be diverted for access road to weir site is 0.45 Ha considering 1000 m length and 4.5 m width. However considering the meandering nature of the proposed road with cutting on one side an filling on the other side, the effective width requirement would be much more. Further once the trees are cut that would affect the continuity and an equivalent or more width of trees on either side will be affected due to invasion of alien species/slope destabilisation etc., which eventually would affect the forest cover and thereby the wild life.

M/s KPPL informed that the general width requirement is only 3.0 m, but they have taken 4.5 m to account for sharp curves, cutting and filling etc. They also said that the entire extent of land for approach road (0.45 Ha) would be handed over back to KFD for afforestation and forestry activities and the impact would be limited to construction period only. Since the road will be of mud base, regeneration of trees after use may not be difficult.

2.2 **Weir site and submergence:** The CCF expressed concern as to whether the downstream stretch of river will be impacted due to diversion of water for power generation.

M/s KPPL informed that a 1 m diameter discharge pipe is proposed to be embedded in the body of the weir at river bed for releasing ecological flow downstream during the lean summer season when power generation is not envisaged. The power generation is envisaged only during the surplus monsoon months and during that period also, about 44% of water will overflow through the weir downstream thus keeping the riverine ecology intact. Moreover, the portion of water used for power generation will join the same river below the power house without any change in quantity or quality since no inter basin diversion is envisaged. The small pondage created in the upstream side of the weir would be advantageous for the wild life for drinking water in lean months.

2.3 Tunnel, Surge & Penstock sites: CCF opined that although the driving works of the tunnel and surge are underground, the mucking activity and its disposal would create impact. Further removal of trees in the penstock route will also have impacts due to loss of trees.

M/s KPPL informed that the tunnel/surge muck will be taken in covered trucks and disposed outside the forest land in designated land with appropriate slope protection/stabilisation including afforestation. The road to the surge/penstock route from the power house side has been avoided to minimise loss of forest. Alternately penstock is proposed to be conveyed and erected through winches along the penstock route. The penstocks will be embedded in trenches and backfilled/stabilised/slope protected with soil of appropriate depth and planted with trees/plantation/turfing to regain the naturality. This will allow the free movement of wild life without any hindrance and impacts, and impacts, if any will be limited to the construction period only.

2.4 **Power House & Tail race site:** As this site is outside the forest land, no impacts are anticipated to forestry and wild life.

M/s KPPL informed that all the impacts have been duly addressed in the EIA report. The EIA report has suggested mitigatory measures including compensatory afforestation in 2.87 Ha of forest land, although 0.98 Ha is required to be diverted permanently. KPPL assured to carry out Environmental Management & Monitoring Plan as outlined in the EIA report scrupulously so as to contain the impact within the carrying capacity of the ecosystem. Since most of the forest land is returned to forest department after construction, no human interference to forest and wild life is not expected in the operation phase. Considering all these, M/s KPPL requested the committee to recommend to consider the revised proposal.

The CCF in his concluding remarks observed that the main impact from the project is expected from the 1 km road proposed to the weir site. Although the suggestion of returning the road site to KFD for afforestation sounds good, it is practically impossible for regeneration. Further the cutting and filling with destabilise the terrain leading to further earth slides, erosion and uprooting of trees, there by affecting the ecology and wild life in this stretch. Further he informed that no major repair works will be allowed in the existing Kottakavila- Kaithappara mud road.

The representative from KSEB Ltd., enquired M/s KPPL to consider avoiding the construction of 1 km road to the weir site and use temporary Ropeway with steel towers at required intervals for transport of muck from weir, tunnel/surge site to outside the forest and to take construction materials/concrete to the project sites. The ropeway could be dismantled after construction. This will eliminate the impact on forest and wild life due to the construction of the road, as feared by the CCF. Further the diversion of forest land/tree felling could be limited to the location of the ropeway towers only, and that too temporarily. Only pruning of trees would be required for the ropeway route similar to the right of way clearance to transmission lines.

M/s KPPL informed that although it is difficult, it is practically possible to convey the materials through rope way and accepted the suggestion of Ropeway in lieu of road to weir house site, considering the larger vision of sustainable development with minimal disturbance to forest and wild life. They also assured to give a declaration to the effect that that no major repair works will be sought in the existing Kottakavila-Kaithappara mud road during construction, as desired by the CCF.

The CCF commented that the proposal to transport materials to and from weir site through rope way instead of 1 km road is a welcome suggestion from the management perspective of forestry and wild life. The CCF advised M/s KPPL to firm up their proposal and submit to this committee for inclusion in the site inspection report.

The Joint Secretary, Power was requested to collect the reports/views from the members for consolidation as a single report to be submitted to the High Power Committee headed by the Chief Secretary.

The site visits and discussions concluded at 6pm.

Appendix 1. List of members who attended the joint site inspection on 17.11.2018

1. **Forest Department**
   - 1.1 Mr. Deepak Misra, I.F.S, Chief Conservator of Forests, Kottayam.
   - 1.2 Mr. Unnikrishnan, Divisional Forest Officer, Kothamangalam.
2. **Power Department**
   - 2.1 Mr. Gopakumaran Nair, Joint Secretary to Government
3. **Energy Management Centre**
   - 3.1 Mr. M.K.Parameswaran Nair, Technical Committee Member of Kerala Govt. for SHP
   - 3.2 Mr. G.Anil, Joint Director
   - 3.3 Mr. Dineshkumar, Energy Technologist
4. **Kerala State Electricity Board**
   - 4.1 Mr. Ajit S, Asst.Executive Engineer
5. **Keezharkuthu Power Private Limited**
   - 5.1 Mr. Onkar Singh, Managing director
   - 5.2 Mr. Jasbir Singh, Joint Managing director
   - 5.3 Dr. Shaji P.K., Environmental Specialist, Agriculture & Eco systems Management Centre, Trivandrum.