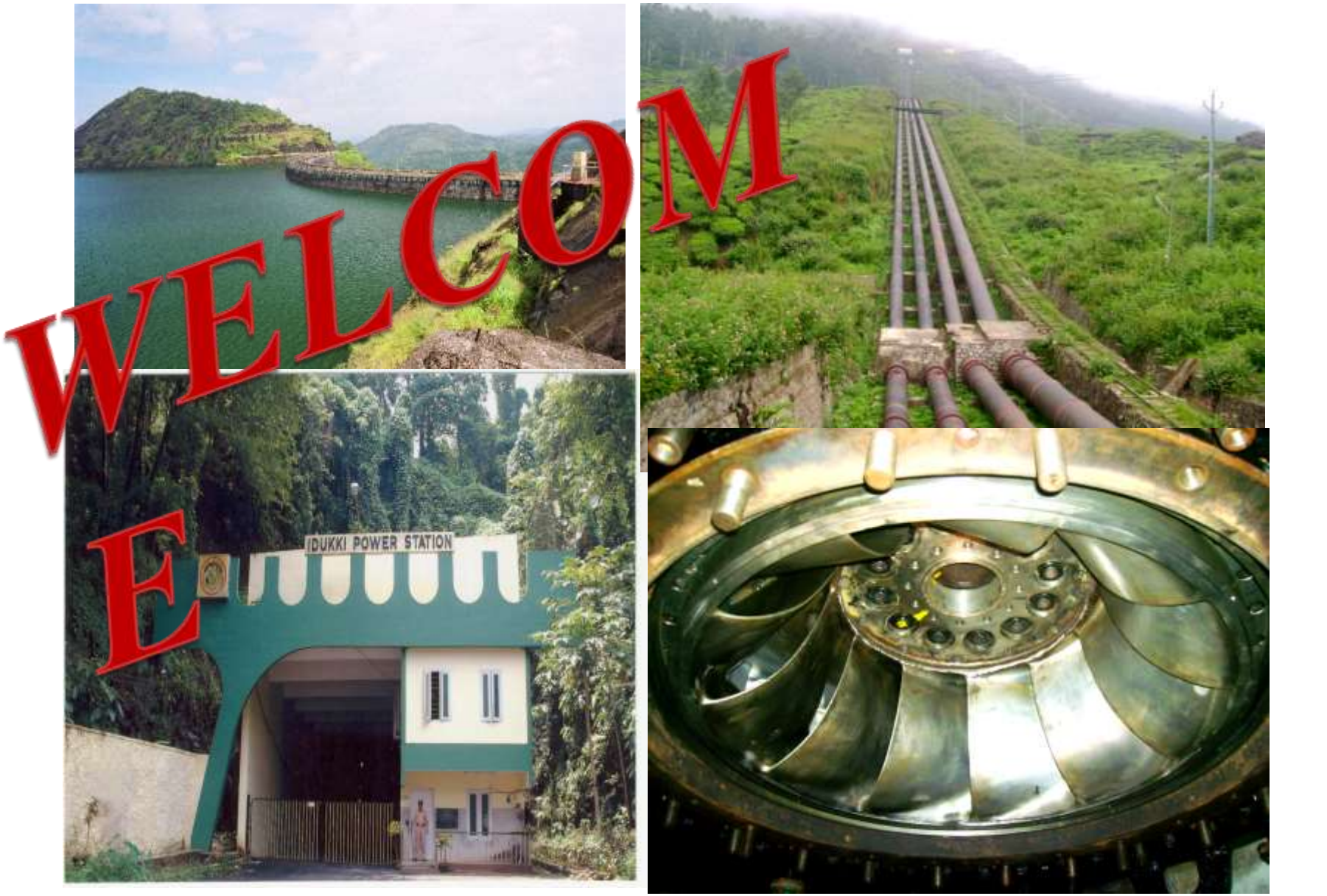
WELCOM
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IDUKKI POWER STATION

KERALA STATE ELECTRICITY BOARD LIMITED

RENOVATION, MODERNISATION, UPRATING & LIFE EXTENSION OF HYDROPOWER PLANT- DIVERSE ISSUES AND HANDLING STRATEGIES

INTRODUCTION

- Kerala grid comprises mainly of Hydro stations which is conventional, renewable, cost effective, eco friendly and is contributing to the green energy.
- Support for the Southern grid by exporting onto the grid the required MW when required and at the same time withdraw from the grid and thus conserving the water in the reservoir (Flexibility of operation)

Hydro electric power station in Kerala

- Pallivasal commissioned in early 1940s(First in Kerala)
- Sengulam,
- Panniar,
- Poringalkuthu,
- Neriamangalam,
- Sholayar,
- Sabarigiri,
- Kuttiyadi,
- Idukki
- Idamalayar
- Lower Periyar.
- Kakkad

At present

- 12 stations having installed capacity more than 25 MW
- 20 stations with capacity less than 25 MW
- 2 Thermal stations and one wind farm
- Total installed capacity of 2211.735 MW
- The back bone of the Kerala grid is the 780 MW Idukki HEP (Under ground station 130 X 6)
- The major power stations in Kerala were commissioned during the period from 1940s to 1980s.

Why Renovation, Modernization and up-rating (RMU)

- Faster and cost effective option to bridge the demand-supply gap
- To achieve guidelines from Central Electricity Authority (CEA)
- The existing stations which were commissioned during 1950s were due for renovation for better reliability and availability.
- Technology Advancement (SCADA, Automation, AMR, Efficiency of equipment).

The Renovation plan of KSEB ltd. is listed below

Sl.No	STATION	CAPACITY in MW	Year of commissioning	Renovation completed on	Plan period in which renovation was proposed
1	Pallivasal	37.5	1940	2002	9th plan
2	Panniar	32	1963	2003	9th plan
3	Sengulam	51.2	1954	2002	9th plan
4	Neriamangalam	52.65	1961	2006	10th plan
5	Sabarigiri	335	1966	2009	10th plan
6	Poringalkuthu	36	1957	2015	11th plan
7	Sholayar	54	1966	Work awarded in 2015. drawing approval in progress	12th plan

The Renovation plan of KSEB ltd. is listed below Continued

Sl.No	STATION	CAPACITY in MW	Year of commissioning	Renovation completed on	Plan period in which renovation was proposed
8	Idukki Stage 1	390	1976	Agreement executed, Work started on Nov 2016 Contractor- M/s. GE Power	12th plan
9	Kuttiadi	75	1972	DPR in final preparation	12th plan
10	Idukki stage 2	390	1986		14th plan
10	Edamalayar	75	1987	Special maintenance was completed during 2012. The exciter, governor, oil system for thrust bearing, coolers etc were replaced at an estimated cost of 14.5 crores	
11	Lower Periyar	180	1997	Renovation not due	
12	Kakkad	50	1999	Renovation not due	

General Procedure for renovation of Hydro Power Projects

- **RLA STUDY**
  - Residual life all equipments starting from the intake in the dam till the power take off has to be studied in detail.
  - Usually, Intake trash rack will be in worn out condition and needs repair/ replacement.
  - Usually the intake shutters require refurbishment,
  - Tunnels will generally be in good condition.

- Butterfly Valve -It is difficult to decide on the residual life of existing which are performing well.
  - new versions with competitive design with a view to reduce cost may not perform in the long run
- Trash rack inside the surge requires replacement.
- For the penstock- inside corroding causes much problem.
  - In the case of Poringalkuthu the riveted joints were found weak where as the penstock is in good condition.

- After removing the riveted joints, welded joints were provided. May be this is the first time a penstock is being reused after repair.
- While the work was progressing, it was noticed that the inside of the penstock was corroded and flakes of rust were peeling out.
- Based on the expert opinion from CPRI, it was decided to sand blast and paint the inside of the penstock.
- All the expansion joints, manholes needed overhauling
- By this, there was an increase in the capacity of the Unit from 9.3MW to 9.9MW.

– The MIV is to be replaced if it is not in good condition.
– The entire Turbine and its controls, PRV, Generator and controls, Exciter, Governor are to be replaced with modern equipment and controls.

- Old transformers are observed to be in good condition and can be used if no further up rating is proposed
  - relay and control panels are to be replaced with modern ones.
- Switch Yard equipment like the Breakers, CTs, PTs, LA mostly require replacement with modern ones with required accuracy class.

DPR PREPARATION

- After RLA study, next process is the DPR preparation.
  - each and every equipment are to be included in the report.
  - It will be a meticulous work involving the constraints imposed by the existing equipment, Building, which are to be retained.

TENDERING AND AWARDING OF WORK

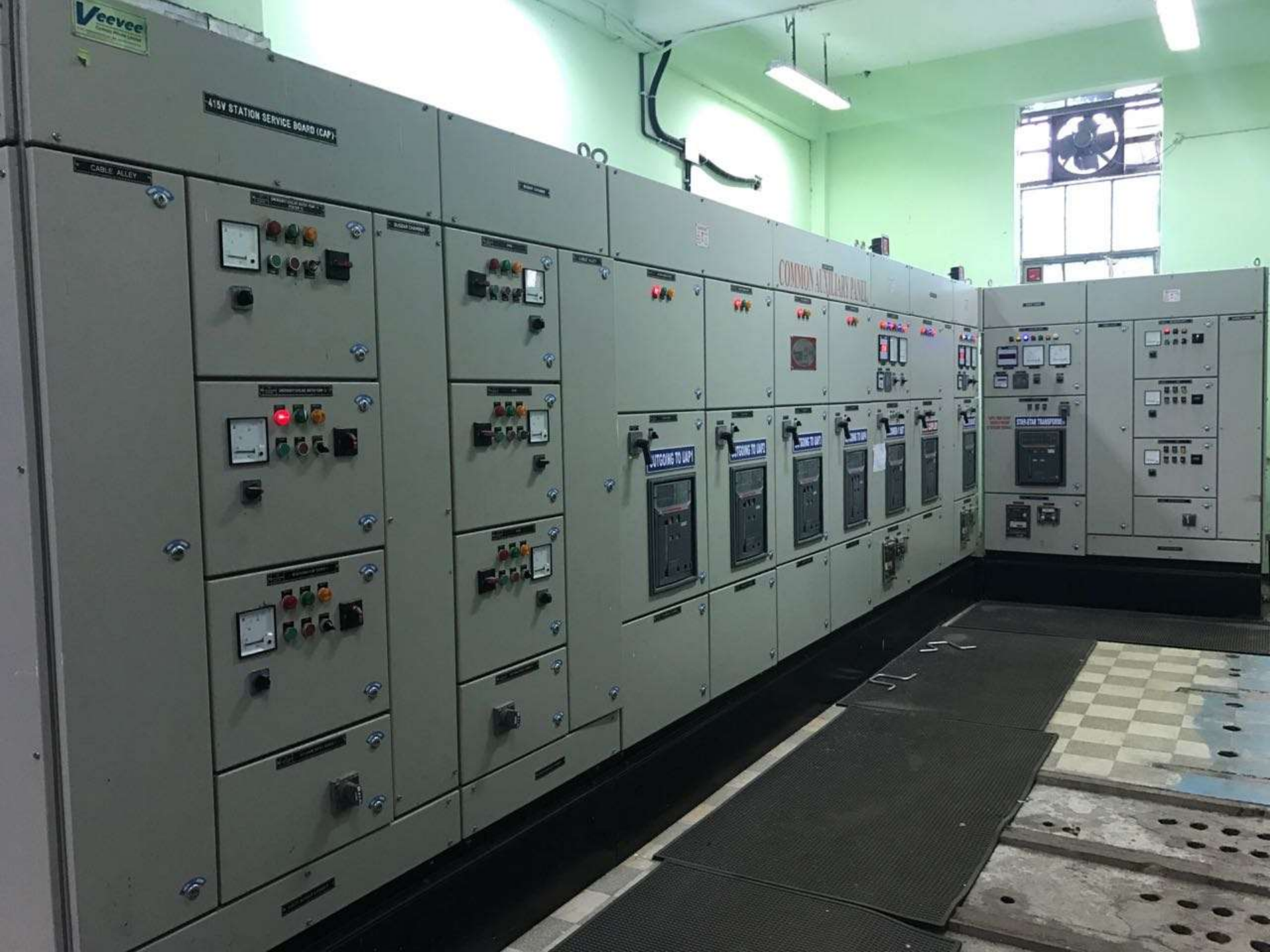
- Detailed and **rigid** specification has to be prepared.
- Laisoning between different contractors and the Department is to be clearly defined.
- When many of the parts are to be retained, it is inevitable that, the OEM will have an edge over the other suppliers.
- The tender conditions are to be carefully framed for ensuring the participation of reputed firms in bidding.
- All the tendering process shall be transparent.

MODEL TESTING, DRAWING APPROVAL

- All the stakeholders including the project Engineers, Field Engineers, Contractor used to sit together for the verification of the drawing and make corrections then and there itself and issue approval so as to save time and avoid communication gap.

EXECUTION

- Prepare to tackle diverse issues coming up
  - Usually the work of one machine has to be carried out while the other machines are running.
  - At Poringalkuthu, there are 4 generating units of 8MW to be up rated to 9MW Units
  - The work was started with U#1 while the other machines were running.


Veevee
415V STATION SERVICE BOARD (CAP)
CABLE ALLEY
COMMON AUXILIARY PANEL
OUTGOING TO UAP1
OUTGOING TO UAP2
STAR-STAR TRANSFORMER

Challenges

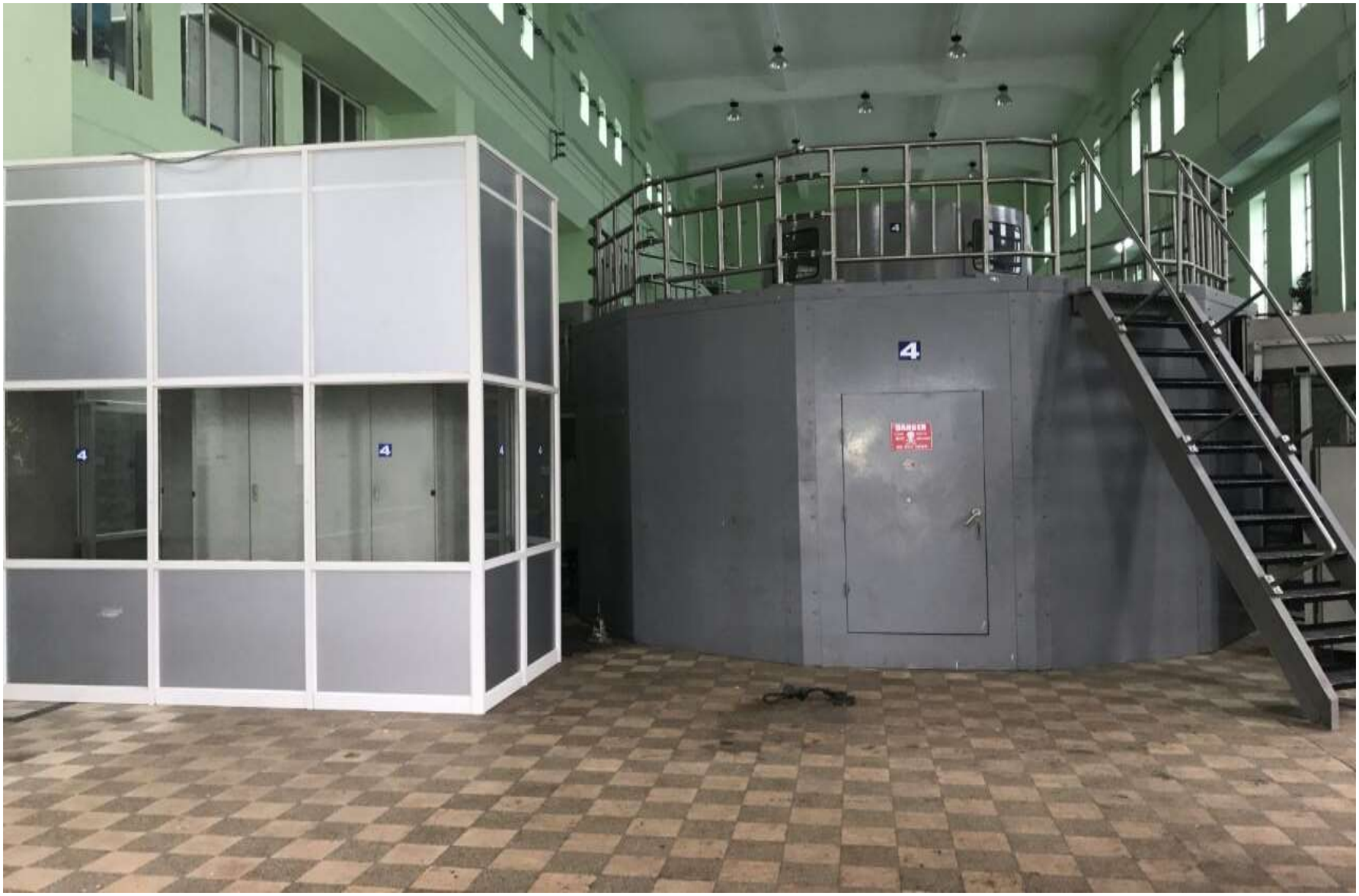
- Retaining some components imposes heavy restriction on the supplier for design of other components matching and mating with those retained.
- Same foundation is used with modification so as to not to affect the structural stability.
- Dismantling and erecting new machine while all other machines are working is very difficult.
- Every day new unexpected problems came out and we had to reschedule accordingly.

Challenges at Poringalkuthu

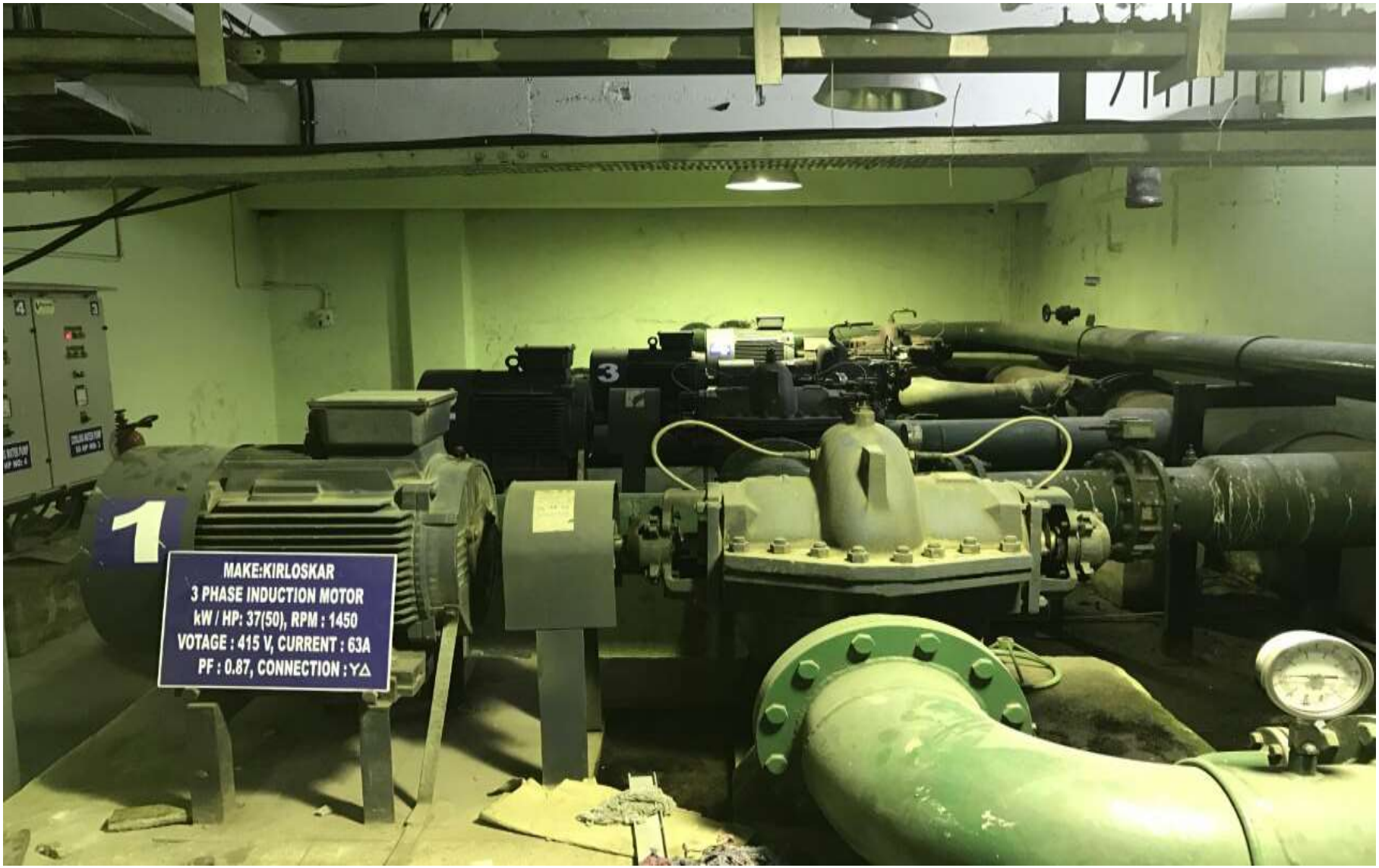
- U#1 was first taken for renovation and the difficulties briefed above were faced during execution subsequently situations improved for other machines**.**
- **Manpower management**
  - They need to work between running machines
  - Electrical isolation will not be practically possible.
  - So sufficient supervisory staff has to be engaged to avoid untoward incidents

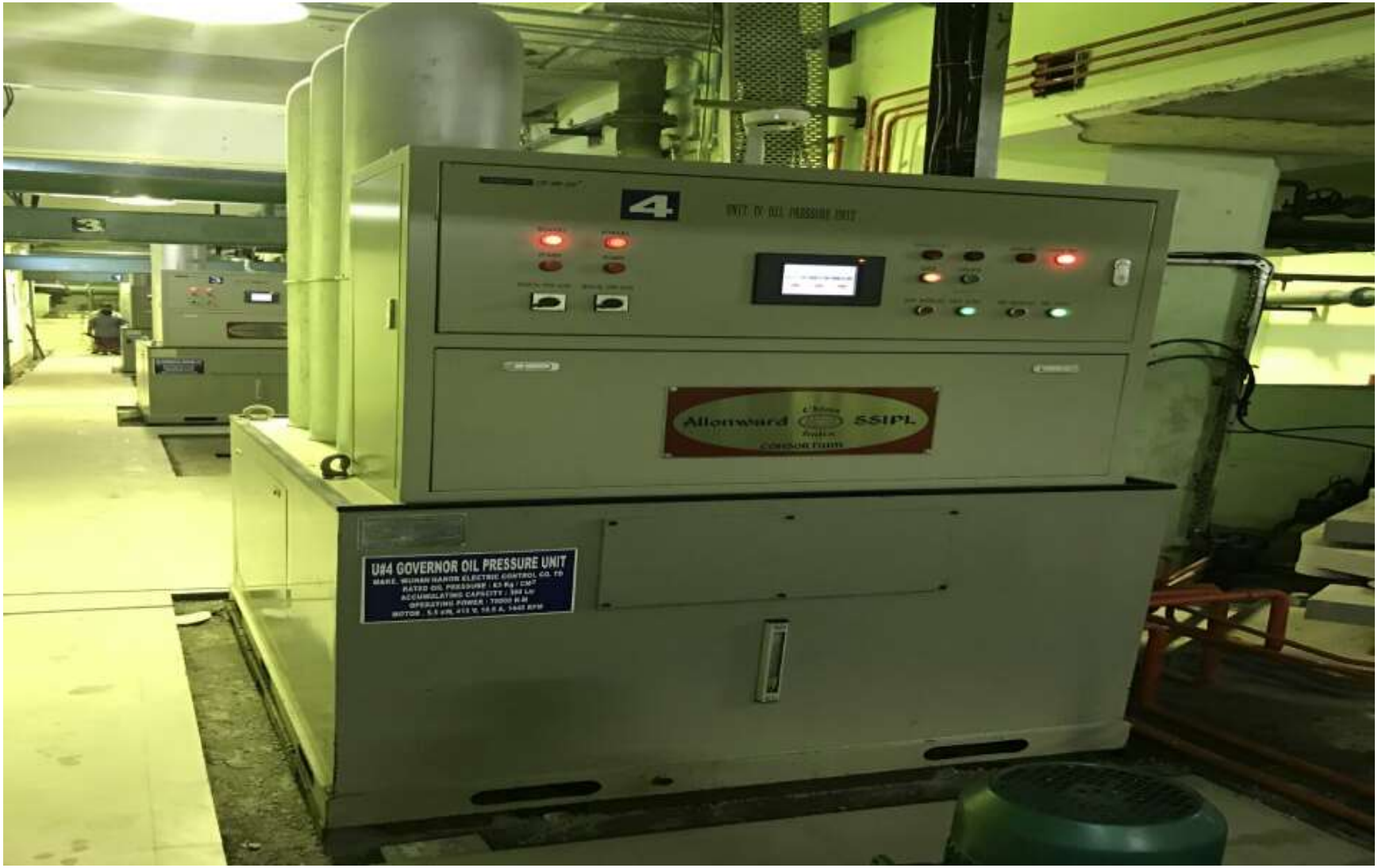
- **Safety First**
  - A separate independent safety monitoring team shall be formed for ensuring safety.
  - Moving men and materials in the restricted area poses serious threat to safety. Both the operational staff and the staff engaged in the renovation work has to work in good coordination.
  - Physical barricades has to be provided
  - The smoke, dust and fumes from the work area may hamper the operating crew.
  - If possible provide surveillance camera for monitoring.
  - Frequent safety meeting shall be conducted.
- **The CW system replacement**
  - This was the first task. This necessitated the total shutdown of the generating station to dismantle existing pumps and pipes, erect new pumps, pipes, panel etc. It was very difficult to achieve the schedule due to very bad condition of existing pipes.

After renovation



Cooling water system

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Allonward
SSIPL
U#4 GOVERNOR OIL PRESSURE UNIT

- **Breaking and removal of old spiral casing and concreting**
  - To be carried out with out affecting the structural stability.
  - The reinforcement bars were to be cut, then welded to the spiral casing
  - Additional reinforcements were to be provided in certain places.

Replacing of old control panels inside control room

- New panels were to be erected while that of the running units could not to be disturbed.
- This was done by installing the new panels on the other side of the Control Room as the panels cannot be individually taken out due to common wiring which cannot be disturbed.
- For the convenience of drawing cable, raised flooring inside the Control Room was resorted to.

Finding route for cable trays and cooling water pipe lines inside PH

- Routing the same inside the power house was complex
- New holes could not be drilled on machine floor slab.
- Existing holes were used which resulted in increase in length and bends for cable and pipes.

Separate cable trench was not available

- Removal of the old cables was also not possible. With these constraints, laying of new cables to yard was very difficult.
- It was challenging for the maintenance staff for rendering the cables dead for removing the same.

For old machines

- Auxiliary supply was extended from one machine to another. Hence it was not easy to electrically isolate machine under RMU.

Proper coordination between

- Civil wing,
- Electrical wing
- Operating wing
- Contractor

Is essential for smooth and safe execution of the work

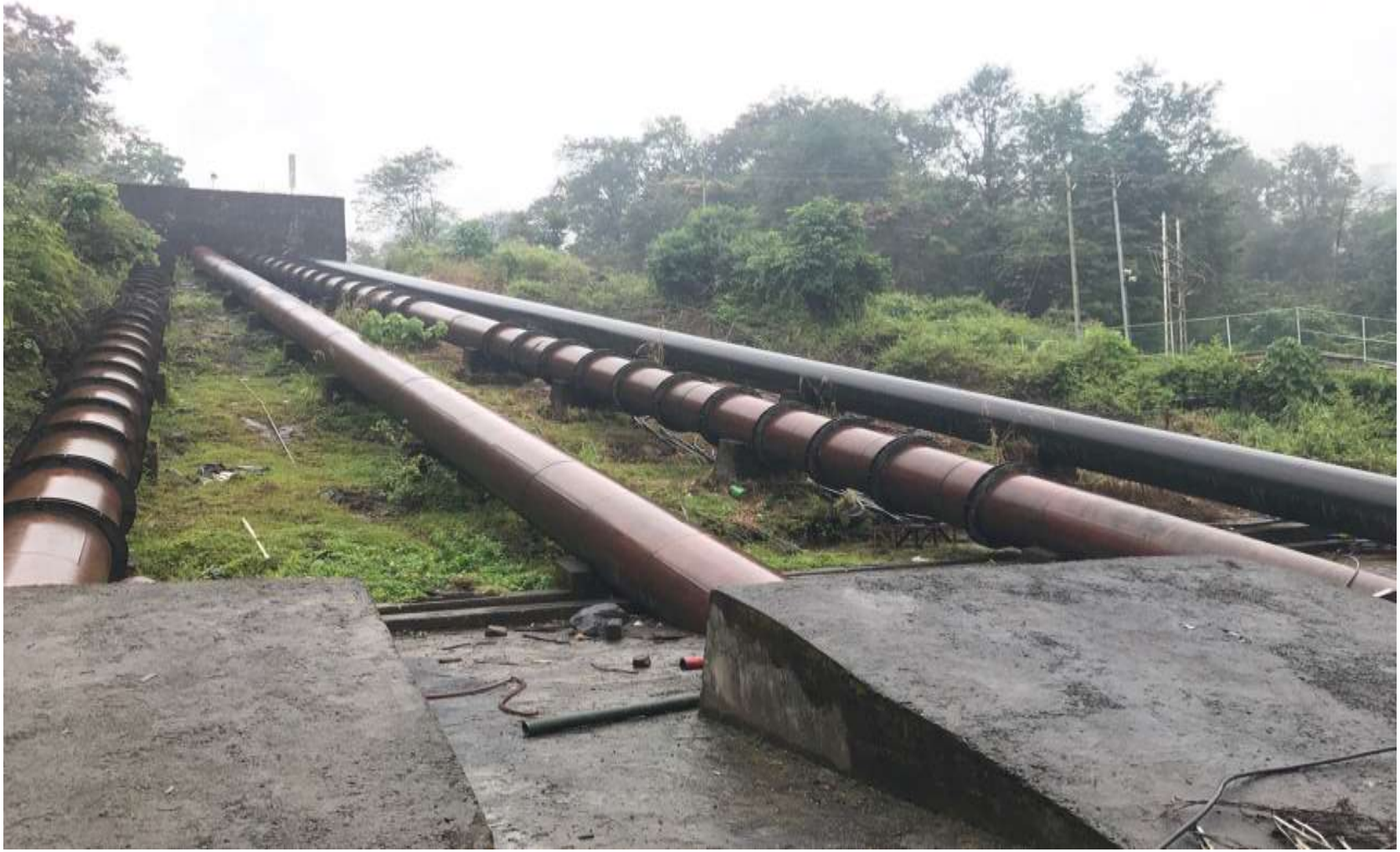
Storing

- Space for new machine parts were to be taken care of.
- Storing of dismantled machine parts was challenging.
- Earnest effort were taken to dispose the scrap immediately .

Communication

- With Chinese Engineers
- Every time a translator was required and proper communication was challenging.

Penstock repair



Obtaining shut down for the unit

- Shut down of the unit is allowed from the LD station only for one unit at a time and only during the restricted seasons.
- This is because Poringalkuthu river basin forms the source of drinking and irrigation water supply to the river and has to be kept in strict adherence in view of the interstate agreement.

- In spite of all the constraints explained above KSEB ltd was able to carry out the RMU work of E & M equipments as per schedule. The work started in 2013 and was completed in 2015.

Other RMU Works completed

Sabirigiri

- Many unexpected works came up during execution mainly refurbishing of MIV of all machines. The estimate of extra work was in the tune of 6 crores. It was difficult to assess the condition of the embedded equipments while preparing DPR. Hence it is advisable to incorporate provisions for such items in the estimate to avoid such problems. Also the contract conditions shall be framed in such a manner that we can include the extra work arising during the execution.

Neriamangalam

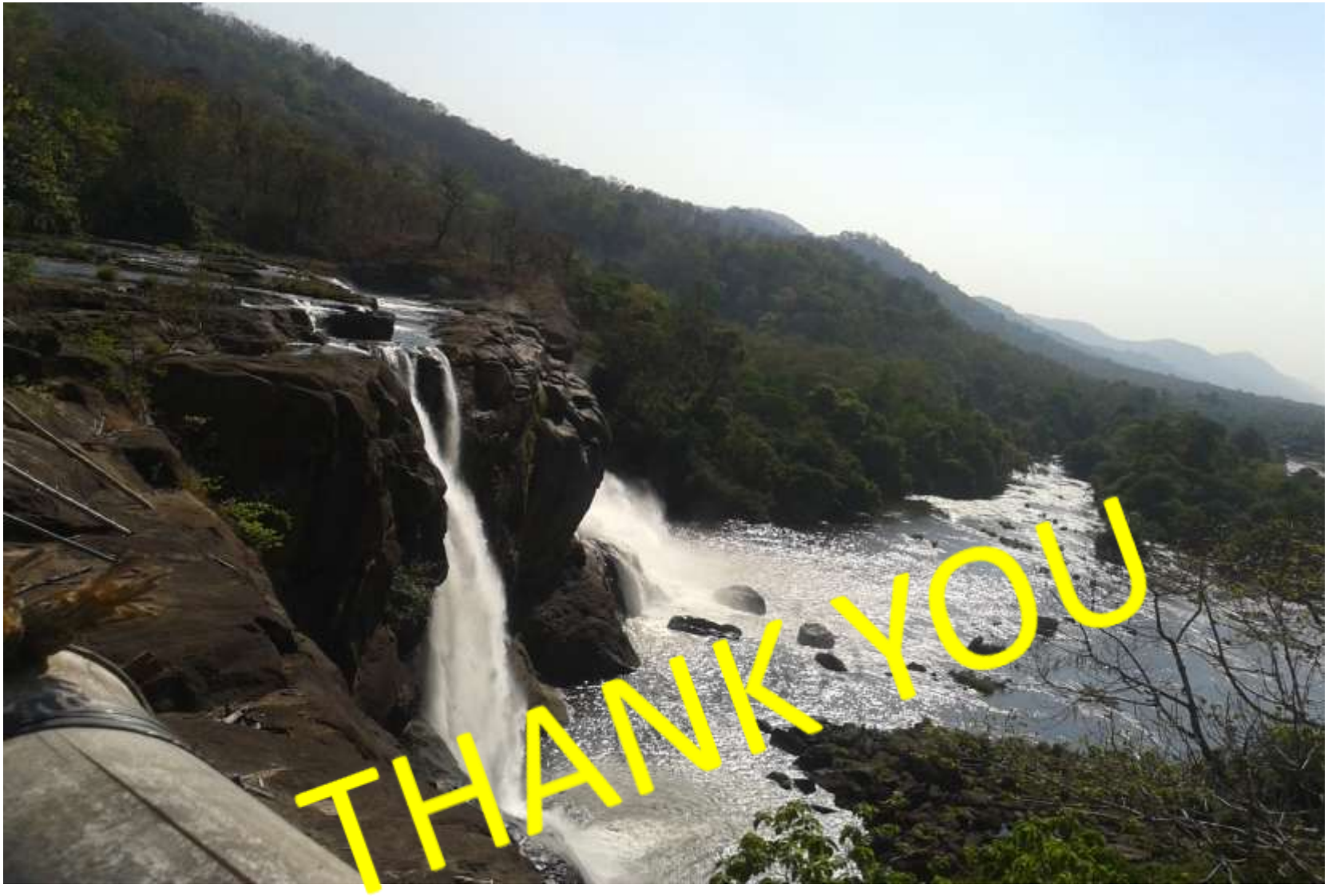
- Though lot of works other than the works included in the estimate were carried out during RMU, the overall schedule of the work was not affected. The contractor carried out the extra works at no extra cost.

Pallivasal, Panniar, Sengulam

- The renovation works of all the above stations were carried out by SNC Lavlin
- Turbines and Generators at Pallivasal and Sengulam HEPs were replaced and that of Panniar was refurbished. Machines were supplied by M/s Alstom.
- During the construction of Pallivasal HEP in 1940s the factor of safety taken was on the higher side. So the quantity of concrete structure to be removed was excess than that in estimate. This excess quantity of work amounted to Rs.1 crore approximately.

Conclusion

- After renovation of the power projects, the performance and availability of the machines has increased.
- Utmost care has to be taken from the RLA study till the commissioning of the renovated project.
- Better coordination among all the stakeholders like Contractor, Supervisory Department staff, Project Engineering wing is mandatory for the success of the project.
- Safety shall of utmost priority.
- Project time schedule is critical and shall be adhered by implementing modern time management.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