Idukki dam

Revamping of HVAC System at the Underground Idukki Hydroelectric Power Plant

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Introduction

We were asked in 2010 to suggest how to renovate the complete HVAC system and interface the Building Management System at the underground Idukki Hydroelectric Power Plant of Kerala State Electricity Board (KSEB) in Moolamattom. The existing plant was thirty four years old then, and had outlived its economical life. KSEB was not able to pay for our initial visit, and even the stay in their guest house was chargeable. The only freebie was the ride from Kochi Airport to Moolamattom, and back the next day. We wanted to take this project as a challenge, and went ahead.

Existing Plant

The project was tricky, as the plant was installed along with turbines and extensive welding had been carried out. Welding was feasible during the original installation in 1974-76 through Canadian collaboration. In an operating hydroelectric power plant, any welding is hazardous. Thus, a decision was taken to use grooved couplings in the HVAC plant room due to difficulties with retrofit in the existing tunnel structure, such as confined space and fire watch/ safety requirements. When we suggested this to KSEB, they initially did not agree and informed us that they would manage to give welding power without affecting the operation of the power plant. But they were persuaded to go along with our suggestion.

The existing air conditioning plant comprising five numbers 80 TR reciprocating chiller packages was not being maintained by the original installer, and was somehow being operated without proper maintenance, thus deteriorating gradually. Especially in summers, the inside conditions would go up, adversely affecting power plant operation and putting pressure on the plant engineers as well as KSEB. The issue aggravated as the some of the components were replaced by a third party, and were not functioning as required. The plant operating engineers had escalated the issue to speed up the tendering process for replacing the plant.

Scope of Work

Our scope of work comprised project consultancy for replacing the old plant consisting of five water cooled reciprocating chilled water systems of 80 TR each along with four air handling units

About the Author

V. Sridhar, a 1976 graduate in chemical engineering from Annamalai University, started his career with NDDB Anand and moved to Voltas after a three year stint, where he spent 16 years in various branches and functions. He also worked with ETA and Bahwan Engineering. In 2002, he established Enervac Engineering Consultants, a consultancy for process cooling and other mechanical projects, whose customers include Wipro Technologies, CMC Hospital (Vellore), Kerala State Electricity Board, MICO (Nashik), SPBPC and TNPL.

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Photo 1: The author - facing the challenges in replacing a 34 year old underground plant

Photo2: Grooved valves and fittings for chilled water and cooling water lines

Photo 3: Grooved valves and fittings with tunnel rock in the background

having chilled water cooling coils, with three new 150 TR water cooled screw chiller packages. We had given the estimate for consultancy fees excluding site visits, boarding and lodging, as these are dynamic. But KSEB wanted the cost inclusive of travelling, boarding and lodging for the consultancy work. The final tender notice was published and although six or seven vendors bought the tender documents, only two finally participated in the tender. KSEB was wondering whether to refloat the tender. Finally, they decided to finalize the order based on two offers, with the lowest getting the order as per their norms.

The Project

After receiving the order we checked the peak heat load for the entire power plant, which came to around 463 TR. As the plant is operational 24/7, the required AC plant capacity was around 400 TR but the client insisted upon 450 TR. Accordingly, three plants each of 150 TR water cooled screw chillers were installed, and in addition one 100 TR water cooled screw chiller was also installed.

Idukki Hydroelectric Power Plant is crucial to the entire KSEB operations. The 100 TR chiller package was commissioned with four AHUs feeding all five levels of the underground power plant. Each AHU of 36,000 cfm is located at the upper-most level of the power plant, and complete supply air shaft cum plenum already existed in good shape, so it was retained and only a few air distribution components like small ducting and grills were replaced. After commissioning the 100 TR chiller, the other three chillers of 150 TR each were installed.

In this plant the cooling water is once-through, i.e. cooling water is taken from upstream passes through the condenser and left downstream; accordingly, there is no cooling water pump or cooling tower. Cooling water piping and chilled water piping were carried out using grooved piping system, i.e. without any welding at site.

Grooved Couplings

While carrying out the initial survey, we found grooved couplings and valves at three or four places used by the Canadian engineers during the original project, which were in good shape even after thirty four years. When we sought details from KSEB engineers, they were not aware of the material or make. We got in touch with the manufacturers' representative, who visited the site with us and made a presentation to KSEB engineers, which persuaded them to use similar couplings during the revamp. The existing grooved fittings on some of the water lines were also identified to be from the same manufacturer.

The tender was prepared with grooved type fittings for complete cooling water and chilled water piping. KSEB wanted a large number of bidders to participate so as to get competitive bids, but we convinced KSEB to restrict the bidding to three good contracting companies so as to ensure the quality of job execution and its completion as per requirement.

Project Execution

We received three bids and, as per KSEB norms, the lowest bidder was selected who completed the job without any welding, completely with grooved piping systems. The job looks neat, and once the piping was completed, the pressure test was passed without any leaks in the first instance.

The original control system was pneumatic, but now we have gone for direct digital controls as a package from the HVAC vendor.

Conclusion

Due to the numerous challenges faced in executing the project from the beginning, it was a satisfying experience to complete it successfully.