Engineering Service: Hydro Power Plant Operation and Maintenance

Features
The Tokyo Electric Power Company (TEPCO) owns and operates hydroelectric power plants at 160 locations, including 9 pumped storage-type plants (generation facility capacity: 8,986 MW).

TEPCO’s engineering services are not only design and construction supervision but also operation and maintenance with the aim of achieving sustainable development with following features:

- Effective utilization of water resource
- Effective maintenance and operation of hydroelectric power plants
  - Study measures for minimum cost for maintenance with keeping supply reliability
  - Engineering methods and other techniques of facility diagnosis while the plant is in operation

Basic Concept or Summary

Example 1. Reconstruction of Hydro Power Plant
In order for operation reliability improvement, efficient use of water resources, and economical benefit, it is necessary to rehabilitate or reconstruct the aged hydro power plants. With over 30 years of experience in rehabilitation and reconstruction work on hydroelectric power plants, TEPCO provides engineering services that range from planning to implementation of rehabilitation and reconstruction work.

<table>
<thead>
<tr>
<th>Table Example of reconstruction</th>
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<tbody>
<tr>
<td>Parameter</td>
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<td>-----------</td>
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<tr>
<td>Output [kW]</td>
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<tr>
<td>Max Discharge [m³/s]</td>
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<tr>
<td>Net head [m]</td>
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<tr>
<td>Rotating Speed [rpm]</td>
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<tr>
<td>Number of unit</td>
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<tr>
<td>Type</td>
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<td>Commencement of year</td>
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Fig. 1 Classification of contaminants

Example 2. Lubrication Oil Diagnosis for Hydro Power Facilities
Turbine oil is used as bearing lubrication oil for hydraulic turbine generators. Through long time of operation, oxide compounds and worn particles in the oil increase and this may cause the bad conditions such as temperature increase of bearing metal, poor lubrication, etc. To prevent bearing metal abrasion, it is necessary to analyze oil viscosity, water content, oxidation degree, etc. Diagnosis of lubrication oil includes the analysis of worn particles in the oil, which contribute to find a sign of bad condition.

Fig. 2 Diagnostic equipment for lubricating oil
Example 3. Service Life Assessment for Generator Stator Windings

The purpose of the Service Life Assessment method is to evaluate the present Dielectric Strength of Generator Stator Windings in hydroelectric power plants, and to decide the effective measures of accident prevention and the economical maintenance intervals. This method is developed by cooperative research. It is required unit stoppage for nondestructive performance test.

The scope of the Service Life Assessment method refers to resin-insulated generators with a rated voltage of 6kV or more. This method is also applied to compound insulation, and to insulation with a rated voltage of less than 6kV.

**Effects or Remarks**

- Effective utilization of water resource
- Maintenance cost reduction for hydro power plant due to following
  - Appropriate maintenance method and maintenance cycle by evaluating facility performance
  - Avoidance of severe troubles by appropriate diagnose
  - Early time maintenance with remaining life assessment of equipment

**Installation in Practice or Schedule**

**Domestic**
- Operation and maintenance of hydroelectric power stations within TEPCO (164 locations, 8,983MW)

**Overseas**
- “Hydro Power Plant to protect Rice Terrace World Heritage Site Project in the Philippines” (2010)

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