Preliminary Data Analysis

ITS Team

April 27, 2024

Contents

List of Figures

List of Tables

Glosarium

This chapter provides definition of terms used in this report, which refers to relevant references such as articles or documentations.

Planned shutdown	:	Unit shutdown due to maintenance activity, either preventive (PV) or condition based-maintenance (CD)
Unplanned shutdown	:	Unit shotdown due to total black out (TBO) or furnace grid backout (FBO), or other external factor (transmission line, CB, etc)
Planned maintenance optimization (PMO)	:	

Chapter 1

Introduction

In this chapter, the introduction of observed and analyzed plant (Larona site) will be provided.

1.1 Load Operation

There are three conditions of load operation.

1. Low Load : 10 MW

2. Normal Load : 40 - 45 MW

3. High Load : 55 - 60 MW

1.2 Provided Preliminary Data

The parameters that used as preliminary data (provided by PTVI) are listed below.

1. Mechanical parameter (total 10 parameters)

    (a) Speed 1 (RPM)

    (b) Speed 2 (RPM)

    (c) Wicked Gate Opening (%)

    (d) Penstock Pressure (kg/cm^2)

    (e) Penstock Flow ($Cumecs$)

    (f) Turbine Flow ($Cumecs$)

    (g) Effeciency ($Cumecs/MW$)

    (h) Upper Guide Bearing (UGB) displacement at X- and Y-axis (μm)

    (i) Turbine Guide Bearing (UGB) displacement at X- and Y-axis (μm)

    (j) Lower Guide Bearing (UGB) displacement at X- and Y-axis (μm)

2. Electrical parameter (total 10 parameters)

    (a) Active power (MW)

    (b) Reactive power ($MVAr$)

    (c) Frequency (Hz)

    (d) Excitation Voltage (V)

    (e) Excitation Current (A)

    (f) Voltage on Phase 1, 2, and 3 (V)

(g) Current on Phase 1, 2, and 3 (kA)

(h) Modbus MVAR

(i) Modbus MVA

(j) Power factor ($CosPhi$)

(k) Stator winding temperature 13, 14, and 15 ($^{\circ}C$)

(l) Stator core temperature ($^{\circ}C$)

3. Thermal and Hydrodynamic parameter (total 11 parameters)

(a) UGB metal and oil temperature ($^{\circ}C$)

(b) LGB metal and oil temperature ($^{\circ}C$)

(c) Gen. air cooler water inlet temperature ($^{\circ}C$)

(d) Gen. air cooler air outlet temperature ($^{\circ}C$)

(e) Gen. cooler water flow (LPM)

(f) UGB cooler water flow ($^{\circ}C$)

(g) LGB cooler water flow ($^{\circ}C$)

(h) Lower canal level ($msAL$)

(i) TailRace level ($msAL$)

4. Maintainablity and Availability parameter (total 2 parameters)

(a) Planned and unplanned shutdown time and duration (h)

(b) Daily, monthly, and annually (physical) availability of system (%)

Chapter 2

Data Analysis

2.1 Planned and Unplanned Shutdown

2.2 PMO Hydro Data

2.3 Vibration Data

2.4 Failure Mode and Effect Analysis

2.5 Physical Availability

2.6 Raw Data from PI System

Chapter 3

Discussion

Chapter 4

PI Implementation