

PROJECT SUMMARY

| | | | |
|---------|--|----------|-----------------------------------|
| DATE | 2016 | LOCATION | Coventry Waste Disposal Plant, UK |
| SUBJECT | Retrofit of Control System for 4MW Steam Turbine | | |

Overview

Coventry and Solihull Waste Disposal Company Ltd (CSWDC) operate a waste processing plant in Coventry. Some of the waste is burnt and the resultant heat is used to produce steam which in turn is used to generate electricity through two steam turbines rated at 5MW_e and 12MW_e. The control system of the 5 MW steam turbine was becoming increasingly unreliable resulting in a number of unscheduled shutdowns.

The Problem

The key requirement of the steam turbines are to run continuously for long periods between shutdowns. The waste incinerators can only operate if there is place to process the produced steam, reduce the pressure and temperature. Although this can also be done via a steam bypass let down system this will result in a loss of generation revenue.

The existing control system fitted to the steam turbine consisted of:-

- Simplex steam turbine governor and control PLC, based on GE Fanuc hardware
- TMR steam turbine protection system, including overspeed trip
- Allen Bradley PLC5 air cooled condenser (ACC) and steam bypass control system
- Local screen based HMI
- Bently Nevada turbine supervisory
- Alstom AVR and generator protection

The existing control equipment was reaching the end of its supported life-cycle with more regular failures and spare parts had become harder to source. In addition fault diagnosis was awkward due to the limited visibility of the control algorithms in the PLC systems. The result was numerous service calls from the OEM for even minor faults and setpoint changes.

CSWDC employed TCL to design and install a replacement steam turbine control and protection system.



Figure 1 ControlLogix PLC with dual redundant processors

The Solution

The steam turbine control system was replaced with a modern state of the art microprocessor based system. In this case the Allen Bradley ControlLogix5000 range of PLC equipment was selected. This was configured in a duty/standby processor configuration with ControlNet communications for key control signals.

PROJECT SUMMARY

| | | | |
|----------------|---|-----------------|--|
| DATE | 2016 | LOCATION | Coventry Waste Disposal Plant, UK |
| SUBJECT | Retrofit of Control System for 4MW Steam Turbine | | |

The steam turbine governor controls were replaced with a Woodward 505 controller.

The ACC and bypass controls were also replaced with a ControlLogix5000 PLC configured in a simplex processor configuration.

The Steam turbine protection system was replaced with a duplex plant safety system based on the Pilz range of machinery protection relays.

The following equipment was removed:-

- ACC steam bypass PLC5 controller
- Steam turbine control and governing system, GE Fanuc
- TMR Steam turbine protection system, GE Fanuc
- Generator protection relay
- Automatic voltage regulator, Alstom Digirec
- Bently Nevada turbine supervisory monitor

The following equipment was installed:-

- Simplex ControlLogix5000 PLC for ACC and steam turbine bypass control
- Duplex ControlLogix5000 PLC for steam turbine control
- Woodward 505 for steam turbine governor control
- Dual/redundant plant safety system (PSS), Pilz safety relays
- Vibrometer turbine supervisory monitor
- Jaquet overspeed trip monitor
- Basler DECS250 duty/standby AVR
- Generator protection relay P346 - MICOM



Figure 2 Modified control panel

This was a turnkey project and TCL were responsible for the design, testing and installation. One of the key elements of the design was the configuration and integration of all the different parts of the complete system, including AVR, Woodward 505 and the generator protection relay. This also involved configuring a number of different communications protocols in order to pass signals to and from the different elements of the hardware.

The equipment was installed in two phases. Firstly the ACC and steam turbine bypass PLC5 controls were replaced with an Allen Bradley ControlLogix5000 Based system. During the second outage the steam turbine control and protection system was installed. At the same time the steam bypass control was moved to the Steam turbine control system, leaving the previously installed Controllogix PLC as a back-up in case of a steam turbine outage. This required careful planning and execution of the installation and commissioning in order to limit the bypass system outage to a minimum and also to ensure plant and personnel safety.