CASE STUDY: Performance Monitoring for a Cogeneration Captive Power Plant of an Oil PSU

OVERVIEW

An Oil PSU in northern India had its refinery built and commissioned in 1998 with a capacity of 6 MMT/year. After the commissioning of its expansion project, its refining capacity has increased to 12 MMT/year. Today, it is referred to as one of the India’s most modern refineries. To meet its power requirements, 227 MW of captive cogeneration power plant was commissioned by integrating with the steam systems of its Naptha Cracker Complex. The site is a petrochemical complex, which includes process units and supporting off-sites and utility facilities.

The complete project included Energy Management System, DCS implementation and Performance Monitoring System (PMS). Kalkitech executed the designing and implementation of PMS for the Oil PSU's Cogeneration CPP.

IMPLEMENTATION DETAILS

Country : India
Year of implementation : 2009
Key Platforms : Visual Basic 6.0, Microsoft .NET 2005, Visual C++
End Customer : CCPP, Haryana

CLIENT REQUIREMENTS

Client wanted the PMS solution to identify equipment degradation and display equipment status. It also has to perform the efficiency calculations of both primary and auxiliary equipments of the power plant. Also, solution had to easily integrate with the power plant communication and control systems.

SOLUTIONS

First the PMS solution was customized and installed as per the site requirements. As there were no drivers present for communication, the communication was carried out over OPC and thus communication between Honeywell DCS and PMS solution was established. PMS calculation tags were compared with the field tags and the calculation engine was upgraded after finding mismatch in units of flow parameters. To avoid mismatch between DCS and PMS, communication loop was checked several times.
Solution Architecture is as given below:

![Solution Architecture Diagram](image)

Figure 1: Solution Architecture

The solution provided user friendly graphical displays. The results of the performance calculations were displayed as given below:
Thermal efficiency calculations and monitoring of the utility boiler is based on guidelines provided in ASME PTC 4.0.
The performance monitoring for the gas turbine is carried out by performing calculations of power output and heat rate after taking readings of the various parameters from the online measuring instruments to the DCS and correction factors as per the GTG performance curves. The measured Gross Heat Rate of the gas turbine is computed based on measured gross power and the actual heat input to the gas turbine.
Figure 4: Condenser performance calculations & displays

Thermal efficiency calculations and monitoring of the Surface steam condenser is based on guidelines provided in ASME PTC 12.2
Figure 5: Combined Cycle process performance calculation & display

Thermal efficiency calculations and monitoring of the combined Cycle power plant is based on guidelines provided in ASME PTC 46
Similarly, other ASME PTC Codes followed for calculations are:

ASME PTC 22 – Gas Turbine
ASME PTC 4.4 – Gas Turbine Heat Recovery Steam Generator
ASME PTC 6.0 – Steam Turbine
KEY BENEFITS

- Real time feedback to operator on boiler efficiency, turbine heat rate, cycle efficiency and equipment performance
- Portability and integration to different DCS platforms
- Scalable from unit level to plant level application
- Accurate calculations as per ASME PTC codes
- Facility for user configurable calculations
- Removal of human error in calculations
- Calculations can be done at set interval without manual intervention
- Easy storage of results for a longer duration of time
- Trend analysis and reporting can be done at the DCS
- Configurable formulae and calculations

REFERENCES

- www.kalkitech.com/offerings/eltrix-plant_performance_monitoring
- http://www.kalkitech.com/offerings/eltrix/

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