

REMOTE MONITORING OF POWER PLANTS



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ABSTRACT

Remote monitoring of power plants, both plant units and fleet of plants, significantly improves the plant operation and maintenance activity by providing condition monitoring continuously which avoids downtime and improves performance. In order to improve asset life time, secure higher reliability and availability of the equipment, power plant owners are giving a very high priority to remote monitoring of plant equipment. Traditionally, data was collected manually from monitoring devices. Given the massive amount of data available, monitoring of all data is no longer feasible. Remote monitoring and automated guidance is crucial to transform data base into useful actionable data that can be presented on a customized dashboard at a fleet/ plant/ equipment level.

Remote monitoring also provides significant benefits by connecting the power plant operating staff online to the best domain experts, ensuring real time efficient operations.

INTRODUCTION

In today's scenario, justifications of plant budgets are not only based on engineering criteria associated with Operation and Maintenance (O&M), but also on Return On Assets (ROA). Asset Management reduces costs by identifying problems related to performance of equipment, improvisation in predictive maintenance, extension of asset life cycle in addition to assisting development of business plans for further investments. Remote monitoring of plant typically consists of:

- a. Monitoring equipment condition and identification of their performance.
- b. Improving the focus on predictive maintenance and reduce the downtime.
- c. Optimize plantasset lifecycle and assessasset failure impact.
- d. Access to decisions and solutions by domain experts.
- e. Ensure compliance to security and safety regulations.

AVAILABILITY OF PLANT

Reducing unplanned maintenance time is key to improving both Overall Equipment Effectiveness (OEE) and ROA of a plant. Important aspects to focus are to increase equipment's performance and availability so as to minimize the assets lifecycle costs. Unplanned maintenance in a Power plant has been proven to significantly impact a plant's operating profit. Improvements in information technology and communication systems that allows transmission of sizeable volumes of data across the globe and their analysis substantially reduces unplanned maintenance in power generating plants.

Remote monitoring of plants on real time basis mitigates the risk associated with their failures. The aim of the plant managers would be to improve equipment performance and availability in addition to minimizing the asset lifecycle costs. It is important for plant managers to know the condition and performance of the plant and its equipment before any kind of optimization and control decisions are made. In addition to this, the asset lifecycle cost approach intimates the operator about the influence of his action on the future plant state. Based on this information, a decision can be taken on, e.g. whether to initiate maintenance in advance, or to operate the plant by extending the maintenance interval.

REMOTE MONITORING STRATEGY

Remote Monitoring assists in identifying equipment performance and reliability issues through collection of data and their analysis – called fingerprints. It generates both a system benchmark and an improvised plan which can be informed either on-site or remotely, using a remote access platform. These fingerprints are the building blocks for a three-step optimization process: Diagnose, Implement, Sustain.

DIAGNOSE:

The preliminary fingerprints generate performance reports which are delivered at various frequencies depending upon requirements of system and user. For example fingerprints for Control Systems include measurement and analysis of control system performance, network communication, and controller loading, specifically: software, firmware, network parameters, cyber security settings, etc.

Implement:

On the basis of the fingerprints obtained, expert recommendations are determined and planned for implementation, to facilitate the start of optimization process. These improvements may be completed all at once or scheduled to be completed incrementally over a period of time. In either case, implementation ensures that changes can be made and maintained remotely with steady progress toward the performance goals.

Sustain:

Regular fingerprinting, implementation and sustaining of these services are recommended to achieve and continue the improvement process.



These three processes - Diagnose, Implementation of corrective action, Sustain targets, early detection of power plant equipment abnormal operating condition ensuring improvement in plant operation, availability and reliability. Numerous data acquisition tools could be used for acquiring day to day operational information from power plant equipment like steam generators, steam turbines, heat recovery boilers, gas turbines, electrical generators, and transformers.

The remote monitoring centers have advance diagnostics software to analyze data, enabling failure detection and performance anomaly with right expertise and minimum time. The state of art diagnostic software enables expert engineers to quickly identify problem areas so as to take corrective actions preventing abnormal alarm levels. The diagnostics plant engineers/ domain experts bring in the entire knowledge at one center for remote monitoring. Remote Monitoring Centers would provide prioritized notification at client sites through remote monitoring support further reducing average downtime, enhancing machine reliability and ensuring lower maintenance costs.

Earlier, Original Equipment Manufacturers (OEMs) would tend to provide “Two Pass repair”, i.e., first inspection visit to identify and access parts and collect data followed by root cause analyses and suggestions for repair. Now with remote asset health monitoring and analytics, OEMs get advance alarms and plan for zero downtime maintenance. This also enables best practice sharing across their equipment at different sites and lessons learnt from one site may be useful for avoidance of a similar problem at another site located in an entirely different geography. With the above benefits, OEM’s have a huge opportunity to make maintenance a profitable business using the remote monitoring of their equipment.

REMOTE SECURITY ACCESS

The remote service platform software provide all the required connection security between the Remote Monitoring Center and the user sites. This platform enables secure, real-time remote monitoring and control of equipment installed at client sites(Figure – 1)

The plant site and the Remote Monitoring Center shall perform two-way authentication before initiating communication. To provide end-to-end security, remote service shall utilize standard secure communication protocols with encryption. Based on the security policy of the plant owner the remote service platform shall be configurable by enabling / disabling data access.

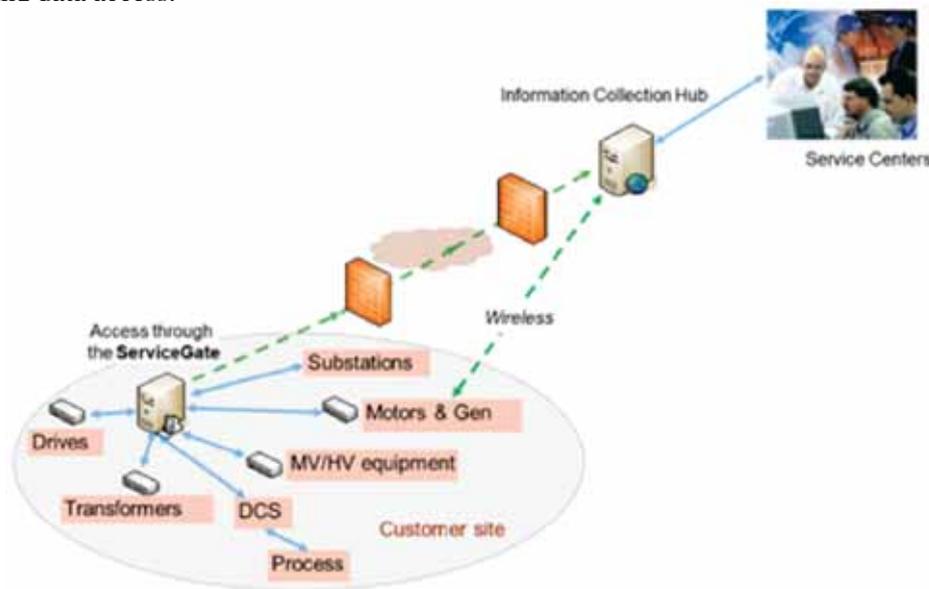


Figure -1 Remote Monitoring – Site to Expert Center

DATA ACQUISITION

Technology for remote monitoring has matured by leaps and bounds over last few years with advancement of high speed internet and cost-effective smart sensors/devices. This facilitates process engineers to look at the plant process parameters in a real time from any part of the globe. Sensors measuring the parameters required for sending data to the system can be either analog or digital signals with relevant information received from related multifunction sensors.

DATA ANALYSIS

Data Analysis is largely executed at Remote Monitoring Centers. Automated applications for analysis and diagnostic actions are a fusion of multiple software tools with human intelligence, expertise, judgment updations from process



domain engineers and specialists at different locations. This gives comfort and confidence to plant operators that the diagnosis and expertise communicated have a high level of validation.

The OEMs have the advantage of having access to wealth of knowledge of consolidated annually compounded operating data from an entire fleet. With access to the vast data, it is increasingly difficult to review and arrive at the right conclusions to obtain desired result. Hence, it is mandatory to have powerful software tool(s) to sort identical events, analyze them and revert with corrective actions. The common feature of these tools & systems is to provide plant – area- unit- specific operating characteristics providing early detection of abnormal drifts. If the plant operators face any new or unusual issues, they could easily consult one of the many specialists who add expertise in the evaluation of specific operational or hardware related issues.

DIAGNOSTIC FINDINGS AND BENEFITS

There are a number of advantages of remote monitoring shared by plant owner and respective OEMs. OEM's can reduce potential damages of plant equipment being monitored by collecting operating data from plant site and evaluating it on a daily basis. The diagnostic tools available are designed to detect small deviations of monitored parameters with respect to expectation. These changes/ deviations are meticulously analyzed to provide online operation based advice to the plant operators. Early fault detection in certain conditions would be able to mitigate consequential damage and in turn help reduction in overall repair costs considering time availability to plan all required actions upfront, like arranging spare parts and manpower at site when the plant equipment is shut down for repair.

At times, the Government imposes restrictions on generating plants in taking operating units for maintenance due to high demand for power. Under these circumstances, remote monitoring services would present the plant operator with better information to continue to operate the plant and delay the scheduled maintenance.

CONCLUSION

Remote monitoring is being widely adapted by the power generation industry. Remote Monitoring Systems have data acquisition, data storage, data analysis and reporting capabilities that are being exploited for the identification of abnormal operating conditions of power plant equipment. This information, along with associated recommendations paves the way for taking more informed corrective action regarding diagnostics concerns. Fact-based decisions can give huge financial benefits to plant owners.

Remote monitoring of plants substantially supplements the internal operators and OEM's on the site support in improving the effectiveness of the operation and maintenance works. Remote services provide expertise guidance to plant operator in a cost-effective and efficient way.

Remote monitoring of plant equipment can track and report key performance indicators of the plant, for taking proactive actions. Thus, maintenance work, dispatching and lifecycle management can be planned more efficiently. Downtimes are minimized, and recovery times after defects are reduced, thereby avoiding loss of production and possible penalties.

Remote monitoring philosophy is growing fast in energy sector. Intelligent/ smart maintenance and diagnostic programs are available today that provide data acquisition, analysis, reporting capabilities as well as early detection of impending failures. The important advantages from remote monitoring of Power plants are faster resolutions with improved efficiencies, proactive maintenance and valuable insights based on the available expertise.

References

- 1) ABB - Remote Services for Power Generation Equipment by Marc Antoine
- 2) ON-LINE monitoring of power plants by Dr. Hans-Gerd Brummel