

PRODUCT DESCRIPTION

PS-Plus™ - Plant Operation Margin and Risk Analysis

Introducing PS-PLUS™

Clockwork Solutions announces the latest SPAR™-based application, PS-PLUS™, developed to provide comprehensive means to analyze, quantify, and optimize: plant performance levels (such as availability, reliability, and throughput), spares stocking levels, maintenance requirements, and inspection frequency. This risk analysis system has been implemented successfully for gas turbine operators.

Risk Management Challenge

As industry-leading companies managing physical asset portfolios encounter new financial risks, they must find new ways of dealing with these risks. Key areas of risk are directly associated with equipment performance. Faulty assessment of these risks can have a ruinous impact on plant economics:



- Equipment performance degradation
- Unscheduled outages
- Poorly scheduled planned outages
- Inadequate management of critical spares
- Delivery failure by contracted partners

In order to mitigate the risks associated with equipment degradations, unplanned outages, and planned outages coinciding with peak demand, owners must implement an asset management system that incorporates:

- Accurate and continuous modeling of system reliability
- Establishment of optimum inspection schedules using regular updates from condition monitoring systems and critical component residual life estimation
- Optimum level of critical spares especially for fleet operations supported by pooled repair material inventory
- Life-cycle tracking of critical components
- Maintenance staffing level assessment

PS-PLUS™ Functions:

PS-PLUS™ addresses maintenance support requirements for all the parts and assemblies in a power production plant. Addressing all systems and components, it provides owners and operators with:

- Continuous assessment of the expected costs and margin per production unit.
- Identification of systems and components that have a significant impact on plant performance including sophisticated incorporation of aging problems.
- Optimized adjustment of the timing of costly inspections based on: continuous monitoring of equipment condition and consideration of the risks of increasing the time between inspections.
- Accurate prediction of the cost of spare parts procurement policies.
- Assessment of maintenance staffing and frequency requirements

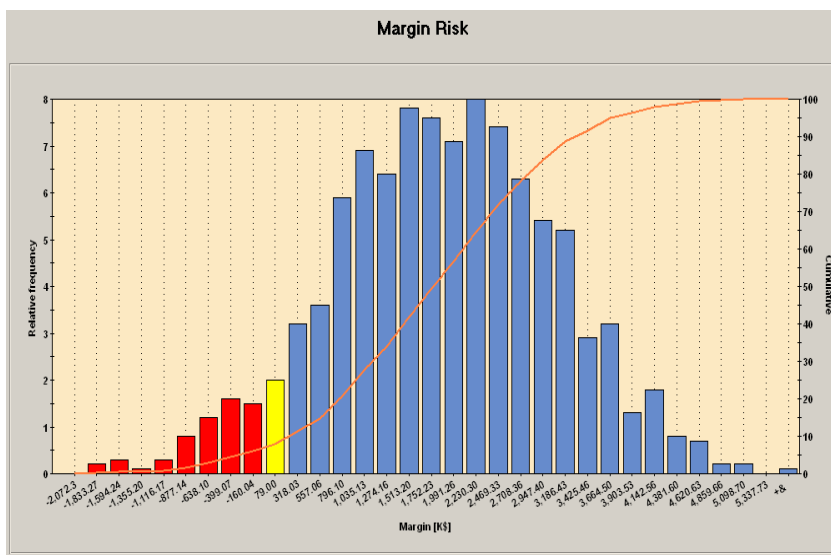
PS-PLUS™'s key element is a predictive life cycle plant model based on and evaluated using Clockwork's SPAR™ simulation technology. The model encompasses the condition states of all critical equipment, assemblies, and parts in the plant such as turbines, fuel gas assemblies, and turbine blades. PS-PLUS™ assesses the condition state of items by testing the likelihood of failure at any given point in time considering the equipment's condition, its age, the time since last overhaul, the load, environmental conditions, and the effects of external conditions such as power surges, and emergency shutdowns.

PS-PLUS™ predicts the plant's life cycle behavior by "running" the plant model into the future, continuously assessing its power production capacity using:

- The time-dependent attributes of each item of equipment, assembly, or component such as its age and aging rates to determine its condition state
- A description of each item's role in the plant along with its relationship to other equipment to determine the effect of the equipment's down time on other equipment and on the plant's ability to manufacture
- A description of the infrastructure resources, such as maintenance personnel and spare parts, to predict the time and cost of returning the failed equipment to an operational state
- Any planned preventive and predictive maintenance activities undertaken while the plant is in operation to detect incipient failures
- The frequency of planned outages, their duration, and their effect on production
- An analysis of plant downtime and its causes to determine the relative contribution of each item to reduction in production

PS-PLUS™ predictions are accurate because of its unique ability to consider critical factors such as:

- Time-dependent phenomena: aging, incipient to catastrophic failure development, and deadlines to respond to an event
- The dynamic behavior of the system, i.e., dynamic reconfiguration, cascade and induced failures
- The effect of maintenance and overhaul actions on the equipment's ability to perform its function relative to the demand placed on it
- The availability of limited resources such as repair and maintenance teams, specialized equipment, and spare parts



PS-PLUS™ can operate as a stand-alone system or can be integrated with a plant operations and maintenance decision support system. As part of a decision support system, PS-PLUS™ is able to incorporate real-time and other data, as well as being able to update the operating system with the output from its automatic simulations.

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