POWER ANALYTICS™

Real-time Power Analytics Software Increasing Production Availability in Offshore Platforms

Overview

Business Situation

The reliability and availability of electrical power generation and distribution in onshore and offshore oil and gas plants is mission-critical for two vital reasons:

- The first issue is that the emergency and uninterruptible power infrastructure relate directly to safety.

- Second, maintaining oil and gas production without unscheduled electrical power interruptions has a large financial value. Failures of major electrical equipment or system blackouts represent both expensive production shutdowns as well as stress on vital equipment, possibly leading to later breakdowns.

Traditionally, the electrical systems for oil and gas plants are designed on paper; once put into operation, equipment is monitored as individual components rather than systems. However, advances in real-time Power Analytics software offer valuable additional capabilities within mission-critical systems.

Implementing power analytics is a two-stage process: it begins with the up-front phase and concludes with the implementation phase… the continual, post-deployment process during which the reliability, capacity, and energy efficiency of the structure is assessed in real time so performance can be optimized.

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Technical Situation

As noted, there are two main phases of a successful power analytics implementation, the design phase and the real-time diagnostics phase.

1) Design Phase: Power Analytics Paladin software, an integrated package of electrical system design and analysis simulation programs, can be used for design and real-time analysis of electrical systems. It is an internationalized design system that can be used to create, analyze, and simulate virtually any type of electrical power distribution system regardless of complexity. Unlike conventional design/CAD packages, Paladin DesignBase provides the means to create a robust electrical "design base" – a detailed design and knowledge base of the performance specifications of the entire electrical distribution system.

It provides the technological richness needed to analyze systems from a variety of perspectives; from static to dynamic simulations including the ability to model and embed the detailed control logic of such factors as power management systems, prime mover speed controllers, automatic voltage regulators, transformer on load tap changers, and variable speed drive controllers.

2) Implementation Phase: After a detailed model of the oil and gas facility is created, the model is re-deployed in online mode, using the Power Analytics Paladin Live™ platform. Using the design specifications in the original CAD model, Paladin Live intelligently predicts potential vulnerabilities in the distribution system and where they have the potential to occur.

Once deployed, Paladin Live protects the continuity of the oil and gas facility by relentlessly probing the power systems infrastructure for potential anomalies. Using the design specifications encoded in the original power systems model, it can accurately predict the precise nature and location of potential failures, diagnose them, and ultimately devise their resolution.

The system can then be instructed to preempt potential failures on its own, or make intelligent recommendations to operators. The system treats energy as a business-critical commodity, giving oil and gas facility operators the means to manage the cost, quality, capacity, and reliability of energy. It assists users in implementing capacity planning, energy efficiency, load curtailment, and power quality programs to protect failsafe business activities.

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Project Planning

The use of Power Analytics technology provides some very important benefits for the design process of an oil and gas facility. If we consider the project life cycle shown in Figure 1, it must be recognized that the electrical system design process takes place over several project phases from the early feasibility studies all the way until operation.

Fast-track projects have a tendency to overlap the different phases in order to compress the total project run-through time. This does not make the electrical challenge any less. The second issue to consider is that the electrical system design process has a repetitive nature. There are a number of trade-off considerations, such as between strong power supply with ability to start large loads direct on line and high fault levels with their effect on electrical safety and arc flash exposure.

The electrical design analysis starting from feasibility stage needs to rely on scarce and mostly experience-based typical data. For this purpose the Paladin DesignBase™ platform holds a large CAD component library and allows the use of simplified simulation methods suited for this early design stage. As the project evolves through the different phases, additional layers of data can be added and more complex and higher accuracy simulation methods used.

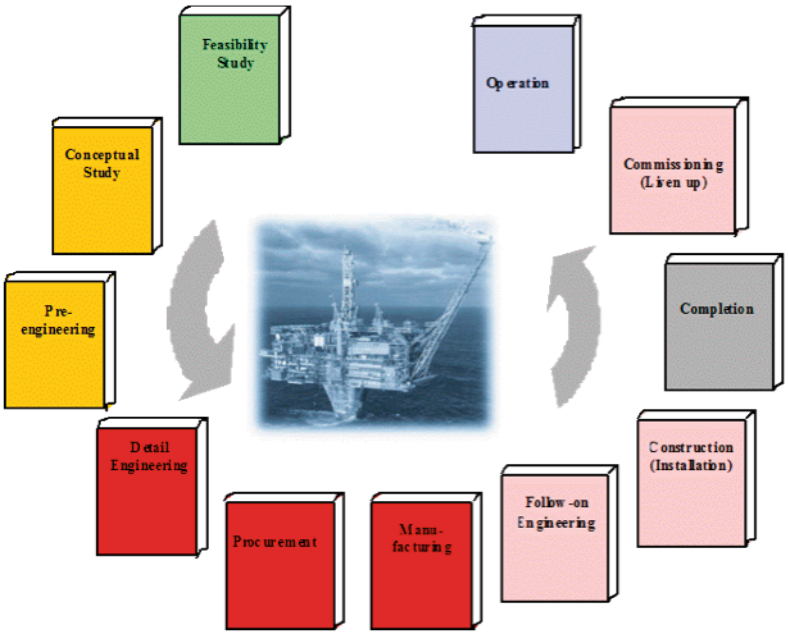

Figure 1: The Project Life Cycle

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Paladin Live System Architecture

Physical interfacing to the facility is by direct connection with switchboard equipment, and local package equipment controllers for generators, Uninterruptible Power Supplies (UPS), etc., are provided. Hardwired interfaces with respect to essential digital signals allow an architecture where high resolution time stamping down to 1 msec can be applied. This allows for a high-quality data integration, where sequence of events can be analyzed after incidents, blackouts, or breakdowns. In addition, network and serial interfaces are provided with associated protocol drivers as required for the interfaced equipment. It is also possible to interface Power Analytics systems on a higher level in existing facility control systems, but this approach will limit the time resolution of received data and time stamping.

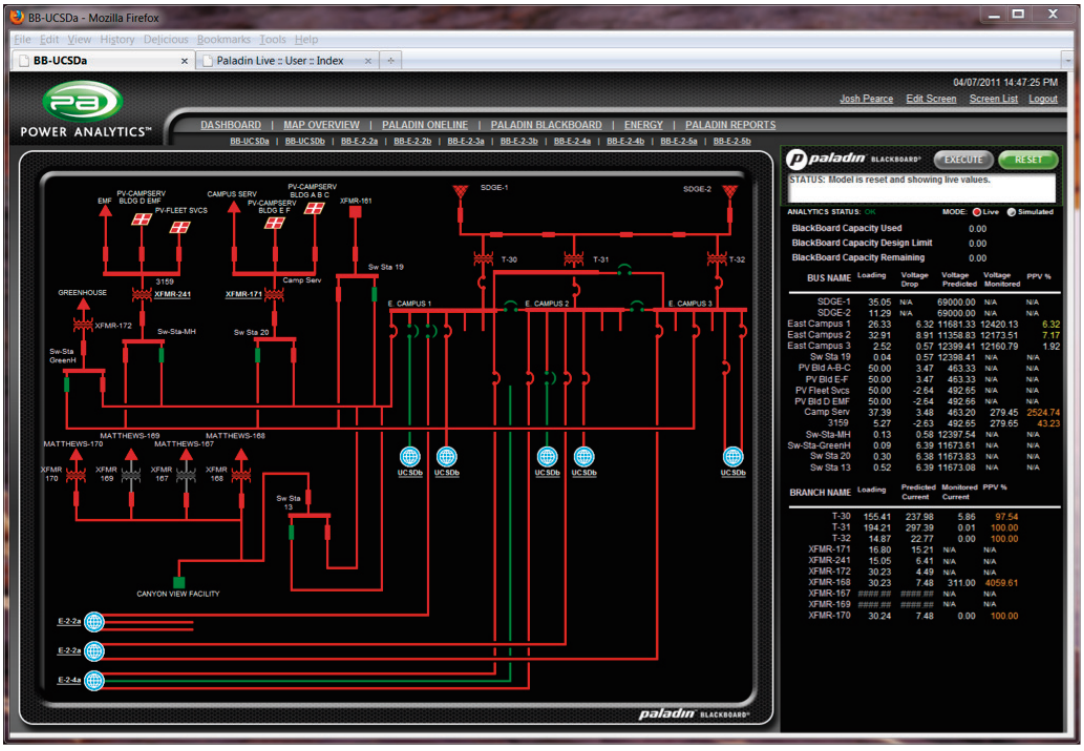

Figure 2: Paladin Electrical Network Graphical View

Facility power quality meters are interfaced directly by serial communication, and vendor independent waveform analysis is available through manufacturer-specific protocol drivers that interface natively with equipment. Paladin Live features very robust waveform viewer technology that communicates to the most advanced power quality meters.

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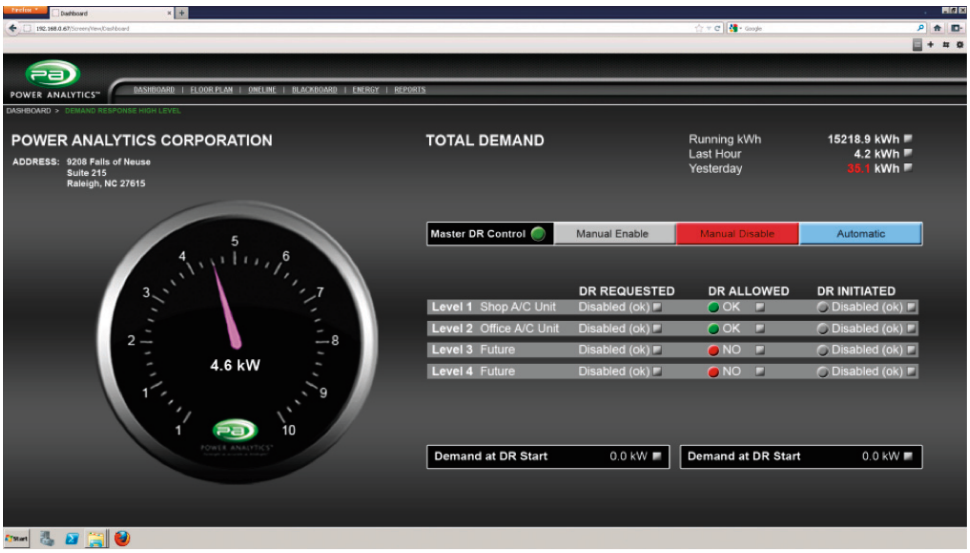

Figure 3: Paladin Demand Graphics View

Power Analytics Engine and Simulation Model

Receiving status signals and analog measurements from the facility generation and distribution equipment, it is possible to automatically configure and update an electrical simulation model of the system. Circuit breaker status, power, and current readings are all fed into the simulation model. Depending on the amount of facility real-time data supplied to the model, the real-time analytic capabilities are more comprehensive than those of any other system. Electrical simulation of load flow, short circuit, and arc flash exposure can all be done in real time. The embedded blackboard function creates a virtual simulation mode of the electrical system, i.e., based on a current operation condition it is possible to carry out "what if" analysis of intended switching operations before they are actually executed. Any overload condition, start-up problem, or similar problems associated with the intended switching operation can thus be detected in simulation mode; this provides highly valuable decision-making support to the operator.

Benefits

For oil and gas platform applications, the electrical system infrastructure benefits include:

- Perform arc flash analysis in real time for personnel protection
- Avoid system errors and loss of production
- Increase the safety and reliability of the electrical network
- Ensure integrity of electrical network

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Products and Services Your Company Used

Power Analytics' Paladin® software is the only solution to provide analytical foresight and optimization for your power system infrastructure. Considering that nearly 80 percent of business downtime is caused by internal electrical power problems, today's organizations require this real-time intelligence, management, and control of their electrical infrastructure.

Paladin is the only solution capable of going beyond SCADA and simple monitoring by measuring and diagnosing the operational health of your electrical network with a proven, patented process. Our solution begins with the design and system analysis of your electrical network, ensuring that it is "perfect on paper" before procurement or going live. This model then becomes the foundation by which the real-time version is compared using the powerful solution engines to provide "model-validated" analytics. This comparison and analysis enables the capture of interactions and outcomes arising from system complexities with the ability to zero in on potential problems before they become catastrophic events.

Power Analytics Software:

Paladin® DesignBase™ Modeling Platform

Planning based designs, models, analysis certifies behavior of complex electrical distribution systems; creates a virtual schematic (or "Design") containing expert knowledge of the low and medium voltage distribution system including the distribution grid all the way down to the end use customer power devices.

Paladin® Live™ Real-Time Analytics Engine

Real-time power and energy management with critical state information; compares as-designed (modeled) to as-built (live) electrical network data; uses as-designed data vs. actual power performance to predict when and where power problems may occur, and accurately reflects actual state information.

Paladin® SmartGrid Power Management System™ (SPMS)

Serves as a SmartGrid Power Management System™ for low or medium voltage intelligent power designs, management, controls, monitoring, and compliance reporting; monitors power quality, utilization, and capacity in real time, in order to optimize excess capacity. Paladin SPMS enables controls, scenario and contingency planning, and capabilities to reliably transfer onto or off a utility grid for end use customers.

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Paladin® BlackBoard Simulation Environment

A virtual environment part of Paladin Live that provides an online, mirror image of Paladin Live operations; allows any changes to processes, procedures, hardware, or maintenance activities to be simulated before they are implemented and saved as cases.

Paladin® Live™ Real-Time Energy Management Advisor

Increases energy efficiency by showing precisely where, when, and how energy and capacity are being consumed or available, in order to assess where opportunities for energy saving may exist, and enables end use personnel to conduct detailed, what-if simulations of energy efficiency strategies as well as point out bad or defective equipment.

Paladin® Live™ Real-Time Arc Flash Advisor

Maintains an uninterrupted, 360° 7 by 24 view of the end user facility and potential real-time arc flash hazards. Paladin Live Arc Flash Advisor provides detailed, updated advisories regarding the appropriate safety requirements and protective gear recommended to work in a given vicinity. Paladin Live Arc Flash Advisor provides real-time work order structure reflecting the conditions before work proceeds.

Paladin® Reports Report Generation Tool

Aggregates raw textual data from a nearly infinite number of devices, resulting in a relational, searchable repository of exposed information gathered from across the enterprise; enables the creation of high quality professional reports that depict their findings, customized for a particular site or customer. Paladin Reports provides extremely fast performance for real-time dashboards and after-the-fact operational reports.

Paladin® Gateway™

Power Analytics Service Oriented Architecture (SOA) that extends Power Analytics capability to multiple platforms and architecture. Gateway also allows two-way communication with nearly any power device or system from nearly any major vendor and solves one of the most vexing problems facing electrical system operators: the lack of networkability and interoperability between competing vendors' systems, which prohibits the sharing of data between them. Capability to significantly reduce the risk of data integration between systems-installed electrical systems.

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Paladin® DesignView™

Revolutionary real-time scientific visualization software tool that lets users easily create incredibly detailed "dashboards" and operator screens that provide up-to-the-millisecond detail about their power infrastructure performance. A browser independent environment that enables highly configurable operator screens, the ability to port to smart devices, and ability to import third party systems "widgets."

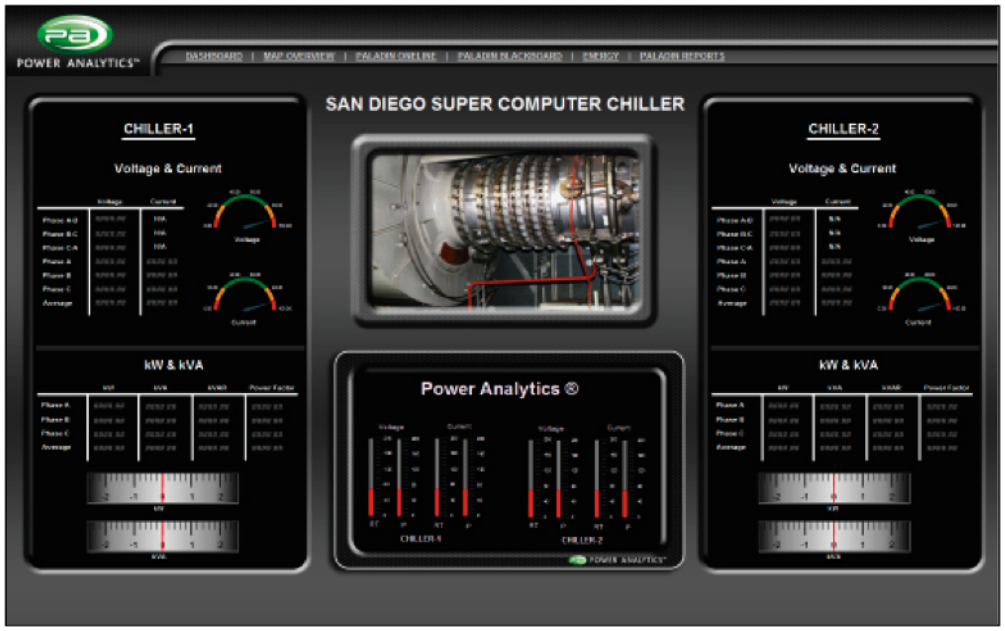

Figure 4: Paladin Equipment View

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About Power Analytics Corporation

Used by the power industry for more than 25 years, Power Analytics' software solutions have surged to the forefront of the electrical system planning, operation, and smart grid market space for use in energy intensive, mission-critical facilities and microgrids. Paladin products currently protect more than $100 billion in customer assets including financial data centers, air traffic control sites, military installations, deep sea oil platforms, and power generation and distribution facilities. The company is headquartered in San Diego, Calif., and has a smart grid center of excellence in Raleigh, N.C.

For more information about Power Analytics' Paladin Software, visit www.PowerAnalytics.com.

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