Presentation Number	Type	ParticipantID	Title	Abstract
POW09-P003	Paper	Stuart	Low-Level Opacity Monitoring	Opacity monitoring remains the most widely-used method for measuring emissions of smoke and particulate matter from stacks. Although more sensitive techniques are available, opacity monitors have a number of features which make them especially attractive, including the ability to calibrate the analyser using a traceable neutral density filter. Opacity measurements can also be compared to a visual estimate made according to US EPA Method 9, giving a simple remote check of the indicated value. Traditionally, opacity monitors have been used only in applications where the emission limit value is at least 10% opacity. However, there have been a number of applications in electric arc furnaces and elsewhere where emission limit values of 6% or even 3% opacity have been applied. These values present serious challenges even to the latest generation of opacity monitors but correct optical and electronic design, careful attention to correct installation and adequate ongoing maintenance allow opacity values below 5% to be measured reliably.
POW09-P0037	Paper	Laird	Using a Comprehensive Approach for Monitoring Generator Health	In the past, plant maintenance personnel have used ad hoc methods for transition from the traditional time-based maintenance methodology to a condition-based maintenance strategy for the turbine generators. This paper discusses the need for combining flexible time-based maintenance and condition-based maintenance strategies for monitoring generator health. Generator stresses and mitigation of risks are discussed. Basic elements of condition-based maintenance are reviewed as well as the quality of real time condition assessment. A general description of a comprehensive approach for monitoring general health is provided. The equipment used for monitoring the critical components for the generator are integrated into a single comprehensive monitoring system.

POW09-P004	Powerpoint	Buckbee	Managing Maintenance and Operations with Real-Time Metrics	Maintenance and Operations can be improved using real-time metrics directly from the control system. This presentation illustrates how you can gather real-time performance data from the control system, and use this information to make specific improvements to the process. Some of the metrics and actions are targeted at improving equipment reliability, especially for instrumentation and valves. Other metrics can be used to improve process control performance, which leads directly to improved efficiencies, and in some cases, to increased production rate. The use of real-time metrics is critical, because it allows the plant to address minor issues as they arise rather than wait until they cascade into larger problems. For example, some flow measurement instruments exhibit warning signs of failure days or even weeks in advance. By monitoring for these warning signs, plant may be able to avoid boiler trips and other process upsets. Other metrics address operational performance, highlighting process bottlenecks and isolating the effect of upstream interactions. This allows plant personnel to focus on the root cause of issues, rather th
POW09-P005	Powerpoint	Gerry	Combined-Cycle Production Increase Using Performance Supervision	This presentation is a case study of a performance increase at a combined-cycle power plant. The presentation will illustrate the specific steps taken and tools used to stabilize the plant and then increase its performance. The work was accomplished with a small team of plant-level engineers, along with one consultant from the DCS vendor. At the start of the project, the team started monitoring all control loops in the facility, using automated methods. Using these tools, they identified control loops that were experiencing performance problems. The problem loops were addressed in phases. First, some quick fixes could be made, resolving obvious errors, such as inappropriate filtering of instrument values. Then, the group identified control valve issues. Some of these could be addressed immediately, while others required system downtime for repair or replacement. Finally, the group addressed controller tuning. Process results included increased stability, reduced turbine trips, and an increase in average production capacity. Results will be covered in more detail during the presentation.
POW09-P006	Paper	Gunther	A Framework for Evaluating the Effects of Degraded Digital I&C Systems on Human Performance	New and advanced reactors will rely heavily on integrated digital I&C equipment and systems. Because they are the primary means by which operating personnel obtain information about the plant's status, their degradation will have a significant impact on the operator's ability to monitor the plant, detect disturbances, assess the plant situation, and take actions in response to unfolding conditions. While reliable, the failure or degradation of I&C equipment and systems can pose additional challenges by causing abnormal operating conditions due to erroneous automatic action. The review of various sources of nuclear power plant operating experience has identified examples of degradations of digital I&C systems or components that have affected human performance. These data indicate that: 1) failures of digital I&C components and systems occur regularly; 2) these failures have an important impact on nuclear power plant operations; and 3) the operating personnel are sometimes significantly challenged to restore the plant to a normal operating condition because of a lack of control or misleading information caused by the digital I&C system d

POW09-P010	Paper	Key	Nuclear Densitometer Validation and Calibration Method.	Nuclear densitometers are valued for their non-intrusive ability to measure density of material within piping and vessels. Safety concerns, regulations and paperwork required for their installation are the main obstacles impeding a wider spread use. With the effort needed to install, maintaining good calibration can lead to a better value over their lifetime. A nuclear densitometer measurement is can be skewed by several factors including product moisture and temperature. Also, details of the installation can limit the ability to provide a controlled reference material to calibrate the instrument. . This paper addresses methods and procedures for developing a densitometer calibration standard that is non in-situ and independent of product moisture and temperature.
POW09-P012	Paper	Howard	Application of Controller Performance Assessment Methods in a Cogeneration Power Plant	UConn Cogen employs over 150 control loops to regulate and coordinate plant operation. The variation in the demands has multiple effects on the control loops. Nonlinearities in the unit operations and wear on the equipment can cause controller performance to degrade and reduce the efficiency of the plant. In this work, we present controller performance assessment methods which have been used to track controller behavior and identify underperforming loops. The key novel method is an automated adaption of the autocorrelation function (ACF). Without performing tests on the processes or waiting for large disruptions, our ACF tool uses regulatory (constant set point) data to classify the controller response patterns. The method not only identifies changes in controller performance, but also defines the manner in which the response has changed. Additionally, the ACF method includes a guide for retuning the controller to regain desired performance.
POW09-P014	Paper	Aguilar	Automated System To Apply Mechanical Tests To High-Voltage Alternating-Current Circuit Breakers And Reclosers	The paper presents a computerized system developed to automatically apply mechanical tests to high-voltage alternating-current circuit-breakers, circuit-reclosers, and fault interrupters in order to verify their compliance with the international standards
POW09-P015	Paper	Parker	Centralized Alarm Management for Power Generation	Since EEMUA 191 'Alarm Systems - A Guide to Design, Management and Procurement' was first released in 1999, alarm systems for modern industrial plants have had a well-structured plan to follow. The EEMUA 191 document is, however, vague in particular industrial applications, i.e. a coal-fired power plant will have different alarming requirements and specifications than an oil refinery or other non-electric power producing plants. This paper is written to specify EEMUA 191 standards and practices applicable to the power industry in particular, stating specific variations in alarming practices that are tailored for today's power plants. Within the power plant, "packaged" subsystems like turbine control, water pretreatment, and wastewater treatment have unique alarming characteristics that the operator may need to view on separate user interfaces – such as the plant DCS. There is a desire for one centralized and consolidated alarming program/interface that operators can view, assess, and act upon plant-wide alarms. From this interface, a rationalization of overall alarm priorities, alarm graphic coloration, alarm audible annunciation, and

POW09-P016	Paper	Hartman	Power Plant Condition Monitoring System	UpTimeTM, developed by InSyst Ltd., is the next generation of power plant condition monitoring and fault detection systems. UpTime features a process visualization technique that clearly defines the boundaries of plant normal operating behavior. The system compares the current state and behavior of the process to the appropriate models of normal conditions, issuing alerts when these boundaries are crossed. This methodology enables UpTime to quickly detect abnormalities at an early stage throughout the entire power plant. Recognition of the patterns of alerts enhances the ability of plant personnel to diagnose problems and better schedule maintenance activities. The system combines proprietary statistical methods with engineering domain knowledge to analyze plant data for each component as well as for entire systems. UpTime creates empirical-statistical, multivariate, probabilistic models that depend exclusively on the actual historical plant data. In addition to the plant measurements, UpTime models calculate additional parameters based on fundamental engineering analysis, such as mass and energy balances and performance metrics. T
POW09-P017	Paper	Cooper	Modeling Non-Steady State Data for PID Controller Tuning in a Cogen Plant	A 25 MW combined-cycle cogeneration plant at the University of Connecticut supplies electricity to the entire UConn campus with three natural gas combustion turbine generators and one high pressure steam turbine generator. Low pressure steam is used to provide building heat in the winter and to drive refrigeration compressors for chilled water cooling in the summer. The UConn Cogen plant is not permitted to charge for power it exports to the grid. All imported power cost the University the same as any large utility customer. The control system thus seeks to operate the plant on a knife-edge as constantly fluctuating demand competes with the desire to maintain zero import and zero export of electric power. The highly integrated natural of the thermal cycles in the Cogen plant makes the concept of steady state operation a fleeting occurrence. Yet modern PID loop tuning tools suggest that a measured process variable (PV) should first be steadied before it is bumped so a dynamic controller output (CO) to PV relationship (i.e. dynamic process model) can be established for reliable PID loop tuning. This paper explores a novel method of obtaining appro
POW09-P018	Paper	Deprugney	Condensate throttling strategy for minimized boiler stress and inscreased operating load	This article presents a new strategy using condensate valves at Cordemais Power Plant in order to - Minimize boiler stress, - Increase high load operating point, while providing ancillary services (AS) to the grid. Cordemais Power Plant – Unit 5 (CO5) is a 600 MW once-through coal-fired plant. Back in 2006, CO5 did not provide AS to the grid due to boiler sensitiveness. A new advanced controller (NAC) coordinating boiler and turbine was implemented at CO5 in order to resume AS supply. The NAC was designed to minimize boiler stress (in particular, non linear increases in waterwall temperature). However, after 2 years operating CO5 with the NAC, waterwa temperature excursions are still observed in some particular operating conditions (low load & poor coal quality). As a consequence, Cordemais staff put EDF R&D department in charge of investigating a solution to their boiler sensitiveness problem. The study shows that control strategy n°1, (coordinated with the NAC) protects the boiler, along with the plant providing AS to the grid. Control strategy n°2, allows the plant to operate at a higher load (without increasing boiler stress) w

POW09-P019	Paper	Clout	Life Cycle Management of Automation Systems	Control system technology for power plants was, in the past, treated as a one-time expenditure and was often the last item on the priority list for any future business investments. The competitiveness of today's energy market has forced power generators to depend on control system technology to stay ahead of the competition by improving efficiency, enhancing reliability and in-market-availability and increasing generation output. Like most IT technologies, control systems normally evolve faster than process equipment. Hence, its life cycle management has become more important than ever in today's ever changing, high-demanding and competitive power generation industry. While many process equipments such as turbines and boilers have a predefined life cycle of 30 to 40 years, the life expenditure of a control system is nothing close to such a long-term prospect. The life cycle for a control system is mainly determined by the commercial-off-the-shelf (COTS) components like servers, computers and other IT equipment, most of which have no more than 5 to 10 years life time due to today's rapid technological advance
POW09-P020	Paper	Yang	Optimal Control of a Drum-Boiler Turbine System Using PSO Predictive Control	This paper will examine the optimal control of a nonlinear model for a Drum-Boiler Turbine system using a Predictive Control technique. The Predictive Control makes use of a Particle Swam Optimizer for the development of the optimal control law. Due to the nonlinear dynamics of the drum-boiler model, the problem of developing a controller which calculates an optimal control law quickly is necessary in order to operate in near real-time. An optimal controller was developed which can drive multiple pressures within the Drum-Boiler system to their desired set point value. The Predictive Control technique was chosen due to its ability to change the control law gains at every sampling step in addition to its ability to handle state constraints by predicting the future trajectories of the pressure states. A unique approach to the control of the Drum-Boiler Turbine is the use of an evolutionary algorithm called Particle Swarm Optimization for calculating the control law. Particle Swarm Optimization is a non-gradient stochastic based optimization method that was inspired by the search techniques of social insects such as ants or bees. Multiple individual particle
POW09-P022	Powerpoint	Zadiraka	Primary Air Control Requirements and Dynamics for Pulverized Coal Firing	In today's typical pulverized coal system with medium speed pulverizers, the primary air flow portion of the pulverized fuel system must perform a variety of different functions. Primary air is used to dry and remove moisture from the coal to improve the grinding and combustion process, to transport and circulate coal through the grinding and classification process in the pulverizer, to transport the pulverized coal through the burner lines to the furnace, to maintain the temperature of the coal-air mixture at the burner as required for proper combustion, and finally to provide part of the combustion air requirements for burning the fuel. Some of the traditional implementations of the primary air flow and temperature controls for a pulverized fuel system based on two independent SISO control loops can have a negative impact on the overall pulverizer and boiler performance by contributing to operational problems such as incomplete combustion, excessive mill dribble, and coal layout in burner lines. This paper will review the evolution of the primary air system for pulverized coal firing and the requirements and constraints that apply to the primary air c

POW09-P023	Paper	Leibbrant	Improve Your Plant's In-Market-Availability and Realize Increased Revenue with Innovative I&C Technology	In today's competitive power generation business, the bottom line has never been more important. Making money is the number one priority for most power producers. Modernizing and revamping generation assets by implementing innovative controls technology provides plants with an opportunity to improve in-market-availability and to generate increased revenue. Modern control technology provides a single plant form and harmonizes the plant's overall processes and major components, spanning from gas turbines, steam turbines and heat recovery steam generators to the rest of the balance of the plant. The innovative system also integrates functionalities like operations, engineering, diagnostics, archive, alarm and field devices into one easy-to-use platform, which can be accessed securely anytime and anywhere. All of these attributes directly impact the plant's overall reliability, operation, flexibility, diagnostics and maintainability in today's fast changing, high-demanding and competitive power generation environment. Most importantly, upgrading the legacy system to the most state-of-the-art technology now becomes a must due to t
POW09-P026	Powerpoint	Toms	Multi-Unit Scrubbers and Digital Bus Technology	When the Progress Energy Roxboro Plant was tasked with improving emissions controls in 2002, it was one of the first plants in North America to make extensive use of digital bus technologies to control the Flue Gas Desulfurization (FGD) process. The Roxboro Power Plant is a four unit, 2425 megawatt coal fired plant. Both Foundation Fieldbus (FF) and DeviceNet (DN) digital bus technologies are employed extensively throughout the FGD system. Currently, 285 Foundation Fieldbus devices and 619 DeviceNet devices are installed on this project. This paper will follow a large bus technology project from concept to commissioning. We will review the goals established for the project, the controversy surrounding bus technologies, the bus selection criteria, design tradeoffs and implementation challenges. We will investigate how design decisions and implementation affect reliability, cost, and maintenance. At the end of the presentation, we will walk through the commissioning process to demonstrate how to develop debugging techniques, to document lessons learned, and to compare final results to initial objectives.
POW09-P027	Paper	Zhao	Study of Advanced Digital Fieldbus Technology Application and Its Licensing Implications for Nuclear Power Industry	The advanced digital fieldbus technology has been successfully used in the oil, petrochemical, and other industries. It has also been found to be implemented increasingly in the fossil power industry. However, so far there is very limited application of the advanced digital fieldbus technology in the non-safety related systems in the nuclear industry, and only one application has been proposed to utilize it for the safety related nuclear system. An overview of advanced digital fieldbus technology application in both the fossil and nuclear power industries will be presented in this paper. Then various functional features for different types of digital fieldbus technologies are reviewed and evaluated. This paper will also provide a detailed study case for a typical power plant system to demonstrate the benefits and advantages of using the digital fieldbus technology during the life cycle of a power plant. Finally the possible licensing implications and issues of applying the digital fieldbus technology to the safety-related nuclear systems are investigated and analyzed as well in this paper.

POW09-P029	Paper	Schuster	Integrated Non-model-based Adaptive Optimal Control of SCR and APH Systems at Cayuga Unit 1	AES Cayuga Unit 1 is a 160 MW unit, equipped with a low-NOx firing system and an anhydrous ammonia, TiO2/V2O5/WO3 Selective Catalytic Reduction (SCR) system for NOx emissions control. A Breen Energy Solutions ammonium bisulfate (ABS) probe was retrofit to the SCR to monitor ABS formation in real-time. A recently proposed control system upgrade includes a control strategy provision for the air preheater (APH) bypass damper. Such control strategy regulates the ABS deposition location by manipulating the average cold end APH temperature with the ultimate goal of minimizing APH plugging (ABS concentration). Extremum Seeking (ES) is an adaptive control method, usable for optimally tuning both set-points and controller parameters in regulation problems. It is a non-model based method of adaptive optimal control, and, as such, it solves, in a rigorous and practical way, some of the same problems as artificial neural network (ANN) and other intelligent control techniques. ES is applicable in situations where there is a nonlinearity in the control problem, and the nonlinearity has a local minimum or a maximum. The nonlinearity may be in the plant, as a phys
POW09-P030	Powerpoint	Nyenhuis	Once-Through Boiler Control Fundamentals Published previously? Yes Where published: Ovation/WDPF Users' Group Conference -- Aug, 2008	This tutorial via PowerPoint presentation is intended to provide a fundamental overview of the principles and methods involved in developing and implementing process control strategies for once-through boilers. The presentation will begin with an introduction to once-through boiler design, steam cycle and operational modes. Also discussed in the introduction are the thermodynamic principles behind once-through boiler operations and the differences between once through and conventional drum boilers. Following the above background introduction, the tutorial provide a detailed discussion of once-through control fundamentals including the boiler master for both feedwater and firing rate control, the firing rate master for air and fuel control, configuration of start-up sequences for both wet and dry modes, pressure and temperature control. Also covered will be various advanced control options including unit response optimization as well as differences that should be considered in developing controls for once-through boilers supplied by various manufactures.
POW09-P031	Paper	Flores	Implementation of a System of Advanced Control of Furnace	The control of the gases of the ISASMELT Furnace, depends directly on the work of the suction fan to control the induced pressure that it should stay in the port of feeding of the Furnace, with the purpose of to capture these gases and to and to pass them through the boiler of recovery of heat (WHB) and of the electro-precipitador (ESP). This paper discusses the issues before and after implementation of an advanced furnace pressure control strategy.
POW09-P032	Paper	Qian	Real-Time Optimal Control of A Boiler-Turbine System Using Pseudospectral Methods	Recently due to the increasing electricity demand along with the environmental impact, power producers pay more attention to the implementation of high-efficiency and low-emission power plants. However, it is not easy to achieve both goals since the current control systems in power plants focus more on stabilizing the system than optimizing the system. In recent years, however, pseudospectral (PS) methods have demonstrated that real- time solutions to optimal control problems are quite possible. Computer simulations are conducted and their results are also presented to verify the applicability of the pseudospectral optimal control in power plants.

POW09-P034	Powerpoint	Hollifield	The High Performance HMI	Poorly designed and poorly performing Human Machine Interfaces (HMIs - and particularly the graphics used for process control) are rampant throughout our industries. They can degrade safety, production, quality, and profitability. Time after time they are cited as contributing factors to major industrial accidents. The High Performance HMI Handbook is the first and only comprehensive book to detail the need, the proper design, and the implementation of an optimal HMI for process operators and the automation systems used to control complex process operations. This overview presentation of material in the book covers the many existing poor practices embodied in process control HMIs and provides examples of much improved methods.
POW09-P035	Powerpoint	Schumann	Water Optimization Using Pump VFD Speed Control	EPA regulation 316b requires utilities and other users of water resources to use state of the art technology to reduce the impact on marine life. US Power did extensive marine surveying and concluded that the best solution was to add variable frequency drive speed control to the circulating water pump motors to be able to reduce cooling water usage when not necessary to support unit load. This had additional benefit of saving considerable horsepower due to lower pump demands at reduced speed. Design of the system included review of the electrical system fo adequacy as well as the pumps, valves, etc. Potential issues include grounding problems, motor stator temperatures, resonance at the new operating speeds, system priming and filling procedures, and others. This paper will address the benefits of such a modification and point out some of the areas of concern for investigation prior to implementation
POW09-P037	Paper	Douglas	Advanced Control Systems Upgrade with a New Engineering Tool	The main goal of a profitable power plant is maximum availability, operational reliability, and reduced maintenance costs of critical equipment. Unplanned costly interruption of service and extension of the unit's lifetime without losing reliability is of vital concern. Utilities have recognized the need to upgrade their aging control systems. Obsolescence, scarcity and price of replacement parts, attrition of maintenance expertise, and operational reliability are key factors for investment justification. Power producers now have a choice to upgrade to a state-of-the-art, robust control system with advanced engineering tools without breaking the bank or facing near term obsolescence issues. In this paper, we will be discussing the control system and engineering tools in-depth, as well as citing a real world application. The processing capabilities of these newer control system modules are faster, more energy efficient with a higher density/smaller footprint, easily configurable, and have built in high-speed servicing ports. The engineering tool uses the Integrated Development Environment (IDE) style that allows users to create logic in a Function Bloc

POW09-P038	Paper	Lu	Wireless Monitoring of Power Plants: State Estimation by a Moving Horizon-Based Optimization Approach	Wireless sensor network (WSN) is receiving increasing attention in the Power Industry community because of a number of obvious advantages over wired cable, such as low cost, flexible installation and easy upgrade, to just name a few. To replace the wired systems via wireless ones, several technical challenges including, for instance, constrained communication capabilities, must be overcome. Due to wireless communication limits, sending data packets are subject to losses and delays. The purpose of this paper is to present a strategy that addresses the issue, by developing a wireless monitoring scheme for power plant systems that includes a data recover estimator. Under the assumption that the delivering rates from sensors satisfy certain conditions, the states of the power plant systems can be estimated by an online, moving horizon-based optimization approach. Plant control simulation results are given to illustrate the effectiveness of the proposed estimation and monitoring scheme.
POW09-P039	Paper	Huber, Jr	STEAM TURBINE WATER INGRESS PREVENTION: A CONTROLS PERSPECTIVE	This paper references ASME TDP-1 - Recommended Practices For The Prevention Of Damage To Steam Turbines Used For Electric Power Generation, and describes the design considerations and control strategies involved in the above areas. The paper reviews control design and implementation to ensure safe and efficient control, including the need to avoid single point failure. Strategies for control system design that would distinguish start up, normal operation and shut down conditions of the plant by measurement of appropriate process parameters are presented in this paper. These strategies envisage operator intervention only in case of unavoidable equipment non-availability. The control for each section of the plant that has a potential for creating water ingress into the turbine has to be specifically designed. The considerations for design vary from section to section and are discussed in detail in the paper. Typical equipment and logic configurations are used in the paper to review control system design. Alternate strategies of control, where applicable, are also presented. Since the control implementation in modern power p
POW09-P040	Paper	Pan	A HIERARCHY ELD BASED ON FLOW-BALANCED ZONES OF PARALLEL COURSING POWER UNITS WITH A HEADER	Due to a higher cost and a worse stability usually caused by the traditional economic load dispatch (ELD) on parallel coursing power units with a steam header, a new hierarchy ELD method based on flow-balanced zones is advanced. For solving the less considering of the balancing relationship between the steam supply and need in the local zones on a header in previous ELD way, the total load of a system is dispatched hierarchically from system, flow-balanced zones, down to boilers/steam turbines, and flow-balanced zones are used as a middle level to search optimal solution in the new method. In each level, many kinds of optimizing arithmetic like Immune and Genetic Arithmetic can be used to achieve its optimal solution. When searing solution, the first level and the second level are in orrelative calculation and the optimal solution of the second level would be returned to the first level as its individual's target function value. The final solution can agree with the balance of steam flow and the lest consumption of coal both in whole and local header, so it can be used in ELD with multi-targets on the system of units with header. Some simul

POW09-P041	Powerpoint	Williams	Optimization of Emissions Reduction Equipment (SCR)	This presentation will outline the benefits of using optimization technologies to keep the SCR Catalyst in the most effective range of operation, which is between 585°F & 600°F. The dynamic electricity market that Brandon Shores participates in (PJM) requires the unit to regulate the load and regulate in the dispatch automatic mode for maximum economic benefit. The second important factor is the NOx generated by the plant when the SCR is not in operation needs to be offset by Constellation internal allowances or market purchases of NOx credits. The solution was an artificial intelligence application to optimize the controls that have a direct impact SCR flue gas inlet temperature. The optimization was implemented in such a manner that upcoming needs caused by following load changes and regulation demands would be anticipated. This significantly increased the amount of NOx removed from the flue gas and reduced the NOx emissions of the plant.
POW09-P042	Powerpoint	Williams	Unit Response Improvements	This presentation will discuss the operational philosophy changes required for coal fired generation assets to become greener. The concept of supporting a deregulated market and new complications related to providing reliable, affordable electricity to their customers, while capturing the renewable energy from wind farms. The ability to seamlessly integrate dynamic boiler and turbine models to the existing control schemes would be important to maintain the unit's availability and provide ideal operator acceptance of these new operating modes. The results of this new control design enhancement to unit coordinated control will be discussed. We will show how project has been a high return on investment by improving ramp rates, capturing available wind energy, and having high utilization rates since the commissioning of the new modes of operation.
POW09-P043	Powerpoint	Haines	Use and Application of Gas Detection	This paper will provide the attendee with basic guidance on when and when not to use gas detection, alternative detection technologies and approaches for laying out gas detection sensors for toxic and flammable gas applications.
POW09-P047	Powerpoint	Apple	Lifecycle approach to Alarm Management- How can the ISA18 help to resolve alarm issues	The ISA18 standard soon to be released will prove to be a great benefit to those who are experiencing alarm trouble, and who are concerned that they may be facing an unknown risk. Remember- one incident can cost you more than all the control and optimization work can gain you. This presentation will discuss how to make use of a lifecycle approach to alarm management to either correctly launch a new alarm system, or to fix a broken alarm system. Such an approach can drastically reduce your risk to unplanned incidents, and the resultant regulatory nightmare.

POW09-P048	Paper	Risser	Migration of CFB Control Location from PLC to DCS in Design Phase	Several trends in the power plant design industry are driving the optimal control system location for major equipment from supplier provided Programmable Logic Controllers (PLC) towards centralized distributed control systems (DCS). Traditional design and procurement of circulating fluidized bed (CFB) power plant equipment includes the purchase of large functional equipment packages from specialized suppliers. For example, the boiler, air quality control systems (AQCS), material handling, cooling tower, water treatment, and steam turbine generator (STG) systems are all purchased as major equipment packages, leveraging decades of supplier expertise and economic efficiency. These packages are then connected by the balance of plant (BOP) systems to form the power plant. Owners recognize there are several distinct long term advantages to place the control systems for these major equipment packages in the centralized DCS. Such an integrated platform yields several operating expenditure (OPEX) reduction opportunities, especially in the area of operations and maintenance (O&M). There are several industry trends in control equ
POW09-P049	Paper	McArthur	Unique Challenges Associated with Controlling Biomass Fired Boilers	Biomass has many advantages as a fuel for boilers. It's inexpensive, readily available in many regions, CO2 neutral and its use warrants government subsidies, all of which make it economically attractive. It also presents unique issues to the designers, owners and operators of plants that use it. One of the more challenging aspects is the control system, specifically the control strategies employed. Bio-fuels are by their very nature not homogeneous. This paper will deal with these challenges and offer suggestions on the control strategies.
POW09-P050	Paper	Campbell	Control System Enhancements to Resolve Boiler Surging on a CFB Boiler	This paper presents the seasonal operational issues that the Scrubgrass Generating Plant encountered with excessive solids recirculation in their fluid bed boilers following implementation of a common boiler modification to reduce combustor temperatures. The paper includes a description and trend examples of surge events, how to identify the excessive solids circulation in the boiler, the effects on power output during the surging events, and a description of the changes made to the control system that eliminated the surging problems and improved boiler performance.

POW09-P051	Paper	Leppakoski	Optimizing Sulfur Capture in Fluidized Bed Boilers	Limestone is used in circulating fluidized bed combustion to capture SO2 originating from fuels, such as various coals, petroleum coke or TDF. Physical conditions of the combustion zone, properties of the fuel and reactivity of the limestone all together determine efficiency to the capture. After analysis of these parameters, it is possible to estimate what kind of results can be expected if a set of these parameters is controlled with a combustion optimization system. Typically there are parameters that are difficult or impossible to affect automatically on an existing boiler, such as limestone milling or selected fuel, but the effect these parameters can be estimated to support decisions on limestone or fuel purchasing – or investments on new equipment such as a limestone pulverizer. On the other hand there are number of crucial parameters that can be easily affected, such as combustion zone temperature or residual flue gas oxygen, as well as combustion symmetry. This paper presents basic methodology on the analysis of the sulfur capture and illustrates the complex interdependencies of the phenomena. We then m improve sulfur capture.
POW09-P052	Paper	Sorge	Advanced Steam Temperature Control Using Controller–Resident MPC Algorithm	Steam temperature control in fossil power plants is a difficult control application because of slow process response and many potential disturbance sources. Advanced multi-variable control methods can improve system performance but have traditionally required a separate workstation to run the complex functions. In this paper, an advanced control application for superheat and reheat steam temperature control using a model predictive control (MPC) algorithm which operates in the normal DCS control processor will be described. Each step of the project including model identification testing, control design and implementation, simulation testing and actual plant testing will be covered. A comparison between the performance of the existing PID-based strategy and the MPC-based strategy will also be provided.
POW09-P053	Paper	Taft	Low-Cost Wireless Sensor Testing in a Fossil Power Plant	Low cost, battery powered wireless sensors have recently become commercially available and have the potential to radically alter traditional methods of equipment monitoring in power plants. This paper reports on a research project co-sponsored by Southern Company and EPRI to demonstrate wireless sensors in a power plant environment. The focus of the project was on the radio performance of the sensors and their battery life. Each wireless device, or mote, consisted of two small circuit boards, one for the processor and radio and the other for sensors or data acquisition. Two types of processors and radios and three types of sensor boards were deployed. The senso boards had several built-in sensors for temperature, ambient light intensity, barametric pressure, sound, magnetic field, and acceleration in both x and y directions along with general purpose data acquisition capabilities. The wireless communication conformed to the IEEE 802.15.4 standard for low power, low data rate sensors with mesh networking capabilities. The paper presents results of a radio frequency site survey conducted be configuration is also described.

POW09-P054	Paper	Labbe	NOx, SOx & CO2 Mitigation of Blended Coals Through Optimization	The addition of NOx and SOx removal systems provides an opportunity to widen the spectrum of feed coal and achieve efficiency improvements, CO2 reductions, and/or cost savings for power plants. However, each coal has unique combustion aspects that may adversely impact boiler and emission systems performance. To widen the spectrum of coal supplies that can be successfully applied, boiler and emission control systems must be optimized for the specific requirements. Such optimizations include precise control or air/fuel distribution, furnace soot blowing, gas and steam temperature control, and chemical flow and distribution control. By widening the coal spectrum significant performance improvements can be realized for CO2 mitigation and fuel cost savings while meeting the NOx and SOx emissions reduction requirements.
POW09-P055	Powerpoint	Leimbach	An Overview of the Fluidized Combustion Market	As a result of the original Clean Air Act, the Department of Energy undertook a project to develop a means to utilize "hard-to-burn" fuels in boilers that controlled emissions using less expensive in-situ methods. The result of this work is fluidized bed combustion (FBC) technology. FBC has come a long way since its inception over forty years ago and has evolved into a competitor to pulverized coal firing. With over 170 such installations in the USA, FBC technology is successfully used to burn waste coal and other fuels with high levels of sulfur. It does this while capturing over 95% of the sulfur and without the need for back-end flue gas desulfurization systems (FGDS). In addition, its low furnace temperatures minimize the formation of NOx . In addition, the increasing need to reduce greenhouse gases (GHG) has renewed interest in biomass firing. Agri-waste, lumber mill waste, and other bio-fuels are now in greater demand as fuels for both captive cogeneration plants and IPPs. These fuels present unique issues to the owner operators and the control system designers. The control systems for these plants are not necessarily different in that their basic buil
POW09-P057	Paper	Kiger	Digital Upgrade Concerns and Considerations for EMI/RFI	This paper will present several instances involving the installation of digital upgrades into nuclear power plants and the steps that were taken to minimize the effects of EMI/RFI for the safe and reliable operation of the digital system. Depending on the application as well as the NRC and facility requirements, there may be several different steps that must be fulfilled before approval is granted. An overview of the NRC's Regulatory Guide 1.180 as well as the EPRI technical reportTR 102323 document will be presented with their relevance to digital upgrade qualification testing. In addition to the qualification testing presented in these guidance documents there are several other considerations for controlling EMI/RFI when installing a new digital system. One such test includes the identification of noise generating systems located within the vicinity of the digital upgrade through a background level EMI/RFI survey and either providing for immunity to the noise through the shielding of the digital system or attempting to minimize the emissions at the noise source. Other considerations are the identification of ground loops within a system, the use of proper shielding on cables and cabinets, and an investigation into the plant power distribution whic
POW09-P058	Paper	Bentsman	Simultaneous tuning of PID gains in multi-loop PID-based control systems using Iterative Feedback Tuning methodology	Tuning a complex multi-loop PID based control system requires considerable expertise and experience. In today's power industry the number of available qualified tuners is dwindling due to retirements and promotions. In this paper several methods for the simultaneous automatic tuning of several loops are reviewed and one method, the IFT (iterative feedback tuning) method, is tested on a simple multivariable process and its control system.

POW09-P059	Paper	Singh	Applying concept of Porous Media in Cv Calculation of a Control Valve using CFD Simulation	It's important to size a control valve as per required flow capacity. Flow through control valves is highly turbulent in nature and flow geometry is complex. It is difficult to develop an accurate analytical solution for it. Mostly Lab test is performed to validate flow capacity of a control valve. Bu this process is very expensive and time taking. CFD simulation can be used for calculating flow capacity and visualizing flow inside control valve. Calculating Cv of a control valve using CFD simulation could be extremely cumbersome when trim has hundreds of individual flow paths. For example, "DRAG" trim patented by Control Component Inc have as many as hundreds of flow channels with multiple turns in a single trim. Resolving flow through these individual channels is time consuming and computationally very expensive. Concept of porous media is used for reducing computational effort. This paper explains its implementation in detail. Usage of equivalent Cv equation given in ISA hand book is also explored.
POW09-P060	Paper	Singh	Study Effect of Inlet Radius of Curvature on Flow through Orifice using CFD Simulation and Lab Test	Flow capacity is an important criterion in sizing a control valve. Under-capacity or over capacity of a control valve results in loss of efficiency. It's important to size a control valve as per required flow capacity. For a valve with drill hole case trim, flow capacity primarily depends on the flow capacity of its trim. Hence its flow capacity needs to be accurately calculated. Flow through drill hole cage trim is an example of flow through multiple orifices (also called slug jets). Flow capacity is calculated using standard equation for flow through orifice. In standard equation, sharp corner at the inlet of the orifice is assumed. In reality, there exists finite curvature at the inlet. It is also observed that effect of inlet curvature on flow capacity becomes profound when pressure drop across orifices increases. In this study, CFD simulation along with Lab test are used for quantifying affect of inlet curvature on the flow capacity of slug jets
POW09-P061	Paper	Kaun	High Standards: Challenges with Reliability Standards Facing Utility Companies Today	Reliability standards have created a frenzy over the last few years for corporations in various industries, including pipelines, food and beverage, pharmaceuticals, and oil and gas, but none of these has been more predominant than in the power industry. The most recent of which is the mandatory Critical Infrastructure Protection (CIP) standards issued by the North American Reliability Commission (NERC). This paper addresses some of the challenges that power companies will face with respect to these standards and how they should approach compliance.
POW09-P062	Powerpoint	Lemanowicz	Dealing with emerging security standards, the vendors perspective	Cyber Security standards and regulations are having a big impact on control systems, with no exception for power plant control. The big variety of standards, regulations, guidelines, and best practices hinders a clear understanding of their use, applicability and impact on power plant control and makes it difficult for plant owners to gain an overview of solutions already available today. This talk will first give an overview of those security standards that are most matured and applicable for power plant control systems. A special focus will be given to NERC CIP and ISA S99. The speakers will outline the impact of these standards and how they will change current best practices.

POW09-P063	Paper	De Lara Jayme	Application Of Neurofuzzy Speed And Load Control For Gas Turbine Power Units	A neurofuzzy PI controller applied to a Gas Turbine Power Unit (GT) for speed and load control is presented. The capacity for empirical knowledge acquisition from artificial intelligence systems was utilized in the development of the strategy. The PI is a neuro-fuzzy system obtained from process data. ... The main functions were implemented according to the state-of-the-art IEC 1131-3 programming standard. Comparisons between conventional and neurofuzzy PI controllers were made for startup and load phases, using the IAE performance index and fuel consumption values. The analysis of these two factors shows better results for the neurofuzzy PI controller; in general, it exhibited improvements to reference changes and operation disturbances at any single point of operation in the startup phase and generation phase as well.
POW09-P064	Paper	Li	Dynamic Simulation of Pressure Transients of an Oxy-coal Power Plant	In the current worldwide concern about global warming, CO2 capture and sequestration techniques are receiving increasing attention from both academia and industry. Among the several proposed techniques for CO2 capture for coal power plants, oxygen coal (oxy-coal) combustion is a promising one based on both technological and economical considerations. In the design of a new oxygen coal combustion plant, the dynamic pressure transient of its burner system is one of the major concerns because it is a critical issue for safe operations. Compared with a normal air fired coal power plant, the burner of an oxy-coal power plant is more self-contained and can reach the critical safety pressure level more easily under the same disturbances. Since there are still no oxy-coal plants in operation now, dynamic simulation is a good tool to study possible scenarios. For this purpose, a dynamic model of the burner system of an oxy-coal power plant is described in this paper, which includes the major parts in the system such as the furnace, pulverizers, air heaters, fans, purification units, flue gas recycling, and the CO2 processing unit. The last two are unique to
POW09-P065	Paper	Czerwiak	Instrumented Protective Systems: Testing Procedures Strategies and Requirements	This tutorial presents a set of guidelines when developing testing procedures for instrumented systems. These guidelines are divided in 3 main aspects: 1. Procedure Format and Content: Use of templates and tables. Main sections to be included. Test setup and closeout. Signatures. Requirements. Field installation inspection. Functional Test. Pass/Fail Criteria. Testing of collateral BPCS functions. HMI behavior. Configuration and testing of the transmitter failure mode. Diagnostics alarms. Power failure response (electrical or pneumatic) 2. Procedure Strategy: Preferred device simulation method, leak and stroke test requirements for valves, final elements testing: breakers/contactors, hydraulic drives, etc. 3. Procedure Types: SAT (Site Acceptance Test, Commissioning), off-line, on-line, synchronous (end-to-end), asynchronous (inputs and outputs), trip test, pre-startup test. The presentation concludes emphasizing the benefits, not only in cost savings, but also in training and development of the personnel involved, ownership, and consistent results among others, when these guidelines are implemented at a site or corporate level.

POW09-P066	Powerpoint	Ukelson	The Israeli Electric Corporation Drives Operational Excellence	The Israeli Electric Corporation (IEC), like the rest of energy industry, operates in a very complex environment – a highly distributed workforce, stringent and dynamic health safety and environmental regulations, requirements for quality compliance and an on-going need for operational excellence. To be effective, the head office needs a consistent view across the organization's status critical processes, while still enabling a collaborative approach to corporate accountability and responsibility across different areas. Recently, organizations such as the IEC, have been undergoing a thorough transformation towards highly flexible and agile collaborations. Such collaborative human-centric processes and activities are handled through with emails and documents but these make the follow up process impossible, leaving managers and process owners with email information overload and no proper way to manage such processes. The IEC has chosen a Human Process Management System (HMPS). HPMS' integration with Microsoft Office allows continuation of current skills and practices, while providing the flexibility needed for th processes. HPMS creates an audit trail for all assigned action items and creates a central reposito
POW09-P067	Paper	Harpster, Timothy	Instrumentation, Methods & Analysis Tools for Comprehensive Condenser Testing, Monitoring & Troubleshooting	Proper monitoring philosophy in combination with available, accurate and reliable instrumentation for comprehensive condenser performance testing, monitoring and troubleshooting is presented. Practical engineering guidance resulting from the use of advanced instrumentation with proven utility has contributed to the identification of new beneficial performance indicators these will be discussed and illustrated employing data from case studies. The case studies show how the new instruments and developed comprehension have contributed to: implementing safe operating practices, modern test codes modifying power plant operations, improving maintenance and optimizing various condenser components resulting in maximization of unit performance as well as controlling water chemistry. Condenser monitoring data from operating plants utilizing an online analytical software package will also be discussed and used to identify the root causes of chemistry upsets and excess pressure, and to show how end users not only can gather data from selected instrumentation, but more important, interpret the data to identify actionable items. Some of the cas
POW09-P068	Paper	Xiao-Feng	Application Of Fuzzy Self-Adapting Pid Controller And Fuzzy Non-Uniform Grid Scheduling To WFGD	the fuzzy-PID controller algorithm is proposed to the problem that the change of the absorber slurry pH value is nonlinear and inconstant with a large number of uncertainties in the limestone-gypsum wet flue gas desulphurization technology. To meet the real-time response requirement for a PID controller design. A new cascade control scheme has been developed to improve the dynamics of PH response by combining fuzzy self-tuning with adaptive control techniques, with the concept that the Inner loop is designed to provide feed-forward control to obtain the required limestone reagent feed rate, and the outer loop is designed to improve the nonlinear and undesired pH response by adopting fuzzy non-uniform grid scheduling grid approach to PID gain calculation. The objective of the control effort is to maintain the pH at a reference trajectory in the presence of severe load changes in the fuel sulfur content and/or gas flow. The strategy is applicable to many typical Distributed Control System (DCS) and one case of the application shows that the proposed Fuzzy PID algorithm is stable and has additional advantages such as quick response and high control accuracy.

POW09-P069	Paper	Flowers	Non-Technical Issues Impacting Digital Upgrades	For many engineers involved in digital upgrades, their focus is on the technical issues of hardware and software design, the development and execution of test plans, or field implementation of communication networks. Unfortunately, a digital upgrade can be technically successfully but doomed to failure because of the non-technical side. This paper will examine three non-technical areas that need to be addressed for digital upgrades to be considered successful.
POW09-P070	Paper	Nino	Information Technology in the Power Industry – A 430 MW Gas Fired Plant Experience	The purpose of this paper is to demonstrate, by using a case study approach, how the combination of Information Technology available to the plant floor combined with consulting services can provide tangible benefits to the operation of a thermal power station
POW09-P072	Paper	Widmer	ZONAL™ COMBUSTION TUNING SYSTEMS FOR IMPROVING T -FIRED BOILER PERFORMANCE	Coal-fired power plants firing low cost coals or equipped with combustion modifications for NOx controls are challenged with maintaining good combustion conditions while maximizing generation and minimizing emissions. By improving combustion at every point within the furnace, the boiler can operate at reduced excess O2 and reduced furnace exit gas temperature (FEGT) levels while also reducing localized hot spots, corrosive gas conditions, slag or clinker formation and carbon-in-ash (CIA). Benefits include improving efficiency, reducing NOx emissions, increasing output and maximizing availability. This paper presents the results from implementing GE's Zonal™ Combustion Tuning System at the PacifiCorp Hunter Station
POW09-P074	Paper	Davelaar	Optimization of Ancillary Service Capabilities and Model-based Control of a Combined Cycle Power Plant Equipped with Duct Burners	Facing the difficulty of balancing electricity production and consumption, the flexibility of combined cycle power plants is very important to meet the grid conditions defined in Europe by UCTE. The requirements say that participating plants must be able to increase their power output by 2.5 % within 30 seconds (primary frequency control) and by 4.5 % within 133 seconds (secondary frequency control). Nevertheless, the electricity producer has to know the maximum power reserves of its plants that can be delivered in a given time, in order to optimize its financial revenue. The paper proposes a model-based solution to optimize the power response of a combined cycle power plant in three stages. First, a generic design of a simple dynamic model is described. Steam tables and data collected during specific transients intervene in the model design . The model complexity is kept as simple as possible to be used for control design. The model inputs are the gas turbine and the duct burner gas flowrate, the steam turbine throttle opening and the desuperheating water flowrate. Secondly, a method is presented to determine the maximum power
POW09-P075	Paper	Joshi	Automated Tests for Nonlinear Model Identification and Predictive Control using a Boiler Simulator	Motivated by the potential benefits of improving overall performance, reducing operating costs and improving load changing abilities, Alstom's Power Plant Laboratories (PPL) has been studying the use of power plant controls with optimization using a boiler dynamic simulator to analyze the potential. This paper examines automated test design for the development of non-linear model-based controllers.

POW09-P077	Paper	Engel	Alarm Management for Power	Power companies have begun to realize the importance of sound alarm management principles in the day-to-day operations of their facilities. The effects of a poor performing alarm system can have negative effects on availability, safety, forced outages and so on. This paper will focus on a comprehensive and proven methodology for the implementation of a successful alarm management program in power plants. A five step process will be reviewed that covers the importance of the Alarm Philosophy, Benchmarking and Assessment, Alarm Engineering and Operations Analysis, Management of Change, and Continuous Improvement. The principles contained in the "EPRI Alarm Management and Annunciator Applications Guideline" will be highlighted by the presenters.
POW09-P078	Powerpoint	Engel	Fleet-wide Monitoring Solutions	Today's power producers are highly focused on delivering higher availability and reduced EFOR. As a result, many companies have embarked on fleet-wide performance monitoring. Industry leaders have formed centralized monitoring centers, staffed 24x7 to continuously oversee operations and provide early warning of impending problems. Several components are involved in the successful implementation of a fleet-wide monitoring initiative. This presentation will focus on the technology that can and has been successfully deployed at a variety of power generators. A specific case study will be presented that highlights some of the technology used for early fault detection, control system performance monitoring, heat rate monitoring, etc., and how these can be applied towards predictive maintenance and early warning systems.
POW09-P079	Paper	Wang	TIS: Trip-cause Information System	TIS (Trip-cause Information System) - a plant trip monitoring and analysis system. The Taean thermal power plant, unit #7, produces 500 MWatts of electricity, faces of the problem of plant trip during last few years and concerned with damage to the assets and the loss of productivity which lead to significant loss in profits. Though we found the plant trip were rare event occurring in the plant installed with the latest system yet we were unable to justify the root cause of such plant trips. Looking at this situation the power plant management decided to adopt a preventive approach by means of installing the software system which would detects the faults in advance and also provides with the advice how they can be avoided on the basis of present and historical data. As we sensed the benefits of adopting such a preventive approach, we found TIS (Trip-cause Information System) to meets all our requirements.
POW09-P080	Paper	Volkmann	IEMI Impacts on the Electric Transmission System	It is well known that microprocessor-based equipment is susceptible to upset or damage by electromagnetic signals. The relatively low levels normally encountered by equipment unintentionally transmitting EM signals is enough to cause interference or upset and fuel the EMC industry. Intentional Electromagnetic Interference (IEMI) exploits the vulnerabilities of microprocessor-based systems to deliberately cause interference or destruction of components without physical contact. ... This paper addresses the results of testing a distributed control system against a military standard for electromagnetic interference and an RF Weapon that could be used for intentional electromagnetic interference (IEMI) along with a discussion of the potential risks to the Bulk Electromagnetic System and remediation techniques. This testing reveals significant concerns for the ability of the distributed control equipment in substations and power plants to operate reliably in an IEMI event.

POW09-P081	Paper	Favenec	Fouling Phenomena in Steam Generators of NPPs : possibilities of innovative monitoring with plant data processed on SG dynamic model	Steam Generators of Pressurized Water Reactor (PWR SGs) are large components whose main function is to cool the fission reactor by extracting the thermal power conveyed by the primary coolant, and thus to produce steam for the turbine-generator. A new method to assess a global estimator of the SG fouling rate is presented : this method is based on a 1D-2D physical model of the SG that reproduces the complex dynamics of the two-phase flow phenomena inside the SG. The method is still under validation. However, first results show that it is able to give global estimators that are consistent with local ones.
POW09-P083	Powerpoint	Kropp	Convergence of Security and Work Flow Management for NERC CIP Compliance	The NERC CIP-002 through CIP-009 Cyber Security Standards not only require that an electric power company identify and secure their Critical Cyber Assets but also that they document these efforts. The documentation must be sufficient to demonstrate compliance to an auditor. New technologies are emerging which provide both of these functions. These technologies provide network protection for control system networks, passive identification of each network node, a single secure repository for document storage, and a well designed user interface to allow compliance mangers to easily ascertain the compliance status of their organization. This presentation will discuss some of these emerging technologies.