

**Discussion Deadline:** September 2002

### **A Software Architecture for Power Market Supporting System and Reengineering of Legacy EMS**

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**Abstract:** In this paper, a heterogeneous software architectural style is designed for the web-based software system to support and electronic commerce solution for deregulated power markets, which is flexible for various power market structures and extendible for the fast-changing industry environment. A wrapping technique is designed to transfer the legacy energy management system (EMS) modules into reusable components for the power market supporting software system.

**Keywords:** Software architectural style, electronic commerce, energy management system, power market.

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### **Hedging With Futures Contracts in a Deregulated Electricity Industry**

Tanlapco, E.; Lawarree, J.; Liu, C.C.

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**Abstract:** This paper is a statistical study of direct and cross hedging strategies using futures contracts in an electricity market. A comparison of the strategies is based on the standard deviation or risk of the values of the hedging positions. Results indicate that the use of electricity futures contracts is superior to using other related futures contracts such as crude oil.

**Keywords:** Electricity deregulation, risk management.

**Preprint Order Number:** PE-041PRS (04-2002)

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### **Multiple Criteria Decision-Making and Risk Analysis as Risk Management Tools for Power Systems Planning**

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**Abstract:** Uncertainties in power systems planning are gaining importance due to the liberalization of the electricity industry and the increasing concern for the environmental impact of electricity generation. This paper presents an electricity planning model that deals with uncertainty and its associated risk at two levels: at the first level, by minimizing environmental risk through a multiple-criteria model; at the second level, by performing a risk analysis consistent with the multiple criteria model used before and which applies classical decision rules for selecting the best planning strategy under uncertainty. Results show that the incorporation of additional criteria produce much more flexible and efficient strategies, which greatly reduce environmental risk at a little cost increment while the risk analysis process selects flexible and robust strategies for the scenarios analyzed.

**Keywords:** Power system planning, decision-making, risk analysis, uncertainty.

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### **Trading Wind Generation in Short-Term Energy Markets**

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**Abstract:** Even with state-of-the-art forecasting methods, the short-term generation of wind farms cannot be predicted with a high degree of accuracy. In a market situation, these forecasting errors lead

to commercial risk through imbalance costs when advance contracting. This situation is one that needs to be addressed due to the steady increase in the amount of grid-connected wind generation, combined with the rise of deregulated, market-orientated electricity systems. In the presence of imbalance prices and uncertain generation, a method is required to determine the optimum level of contract energy to be sold on the advance markets. Such a method is presented here using Markov probabilities for a wind farm and demonstrates substantial reductions in the imbalance costs. The effect of market closure delays and forecasting window lengths are also shown.

**Keywords:** Wind energy, risk analysis, Markov processes, NETA, energy markets.

**Preprint Order Number:** PE-285PRS (04-2002)

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### **An Efficient Algorithm for Assessing Reliability Indices of General Distribution Systems**

Wang, Z.; Shokooh, F.; Qiu, J.

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**Abstract:** This paper presents a practical reliability assessment algorithm for distribution systems of general network configurations. This algorithm is an extension of the analytical simulation approach for radial distribution systems. In the proposed algorithm, the meshed network is first converted to a radial network. All network elements are divided into three main classes according to their probability to obtain power supplies from different directions. Accordingly, three different methods are employed to obtain two types of reliability topology zones for the elements. The algorithm is efficient for large-scale radial/meshed distribution systems and can accommodate the effects of fault isolation and load restoration. The validity and effectiveness of the proposed algorithm is demonstrated by applying a computer program which was developed based on the proposed algorithm to a number of test systems and hundreds of real distribution networks.

**Keywords:** Reliability analysis, distribution systems, network analysis.

**Preprint Order Number:** PE-391PRS (04-2002)

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### **Dynamic Analysis of Generation Control Performance Standards**

Sasaki, T.; Enomoto, K.

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**Abstract:** This paper presents an evaluation of the North American Electric Reliability Council's (NERC) new control performance standards, as they might be applied to the Western Japanese 60 Hz system. Dynamic simulation of the systems frequency response, including the effects of primary and secondary frequency control, power plant response, and load fluctuation characteristic were performed using a load flow program during normal system operation. Parameter sensitivities have been studied for some of the pertinent control parameters influencing the generation control performance, including power plant and AGC response parameters, and amounts of generation under control for governor and AGO.

**Keywords:** Power system, generation control, control performance standards, control area.

**Preprint Order Number:** PE-456PRS (04-2002)

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### **Adaptation in Load Shedding Under Vulnerable Operation Conditions**

Jung, J.; Liu, C.C.; Tanimoto, S.L.; Vittal, V.

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**Abstract:** The proposed approach to avoiding catastrophic failures in interconnected power systems uses a defensive system based on