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Scheduling of Wind Energy in a Multi-Objective Generation Function

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Abstract

In economic dispatch of electric power generation, the committed generating units are scheduled to meet the load demand at minimum operating cost with satisfying all unit and system equality and inequality constraints. Generation of electricity from the fossil fuel releases several contaminants into the atmosphere. So the economic dispatch objective can no longer be considered alone due to the environmental concerns that arise from the emissions produced by fossil fueled electric power plants. Due to Clean Air Act Amendments 1990 and the increasing public awareness for environmental protection, the electric utilities have been forced to change their operational strategies to reduce the pollution and atmospheric emissions of the thermal power plants. This poster presents the concept of environmental/economic generation scheduling with traditional and renewable energy sources. Environmental/economic dispatch is a multi-objective problem with conflicting objectives since emission minimization is conflicting with fuel cost minimization.

Production and consumption of fossil fuel is closely related to environmental degradation. This causes negative effects to human health and the quality of life. Depletion of the fossil fuel resources will also be challenging for the presently employed energy systems to cope with future energy requirements. On the other hand, renewable energy source such as wind energy is abundant, inexhaustible and widely available. It uses native resource and has the capacity to meet the present and the future energy demands of the world with almost nil emissions of air pollutants and greenhouse gases. The fossil fuel and wind energy prices and social and environmental costs of each are also heading in opposite directions. The economic policies needed to support the widespread and sustainable markets for wind energy source are rapidly evolving.

The contribution of this research centers on solving the economic dispatch problem of a system under environmental restrictions. Due to the more stringent environmental requirements imposed on electric utilities, utilities must adopt new technologies for the cleaner production of electricity. This research suggests an effective solution of wind energy to the existing fossil fueled electric utilities for the cheaper and cleaner production of electricity with hourly emission target. Since minimizing the emissions and fuel cost are conflicting objectives, a practical approach based on multi-objective optimization is proposed in this poster to obtain compromised solutions in single simulation run using genetic algorithm. These solutions are known by non-inferior or Pareto-optimal solutions, graphically illustrated by the trade-off curves between criteria fuel cost and pollutant emission. The efficacy of the proposed approach is illustrated with the help of results for a sample system with three thermal and one wind energy unit. Implementation of the proposed concept would be useful for the society, electric utilities, consultants, regulatory bodies, policy makers and planners.