

# Contributions of Renewable Energy Resources to Resource Diversity

George Gross, *Fellow, IEEE*

*Abstract* — This is a summary of the presentation on the panel entitled “Energy Resource Flexibility and Diversity” at the 2006 IEEE/PES GM in Montreal, Quebec, Canada.

*Index Terms* — Renewable Energy Systems, Resource Diversity, Resource Economics, Energy security, Integration and Interconnection of Distributed Resources, Environmental Attributes of Renewable Resources

## PANEL PRESENTATION SUMMARY

THE myriad changes underway in the electricity industry, the rapid advances in technology, the policy strategies on energy from renewables and the increasing environmental pressures have brought to prominence the role of renewable energy resources in meeting future energy needs. The dwindling oil supplies and their increasing costs have significantly shifted reliance on renewables throughout the world. In fact, the use of sources such as wind, solar, photovoltaic, biofuels, geothermal and hydro for energy supply are important aspects of many nations’ energy strategies. As some of the technologies have attained economic viability vis-à-vis conventional energy generation approaches, their adoption and integration into today’s electricity networks is becoming increasingly widespread. The concerns about environmental sensitivity and the pressing needs of developing energy supplies that are sustainable will continue to push the increasingly important role of renewables. This presentation gives an overview of the contributions of renewables to providing diversity, flexibility and security in energy supply that will meet future energy needs.

The discussion starts out with an assessment of the various renewable energy sources from both economic and environmental perspectives. The focus is on wind, photovoltaic, geothermal and biofuel resources. The current state of application of renewable resources is surveyed. Some of the major challenges in the integration of renewables are evaluated.

The environmental issues in the increased penetration of renewables are assessed and the impacts on sustainabi-

lity are analyzed. The presentation will also discuss the role of renewables in reliability and their ability to improve energy security.

The implications of the increasingly important role of renewable resources in meeting future energy needs are wide and far reaching. The presentation will enumerate some of the key issues and challenges arising from the changes in the resource mix. The overview of the re-

newable resources of this presentation will set the stage for the other presentations of this panel



## BIOGRAPHY

**George Gross** is Professor of Electrical and Computer Engineering and Professor, Institute of Government and Public Affairs, at the University of Illinois at Urbana-Champaign. His research and teaching activities are in the areas of power system analysis, economics and operations, utility regulatory policy, renewable resource integration and industry restructuring. He was formerly with the Pacific Gas and Electric Company, where, Dr. Gross founded the company’s Management Science Department and held other key management, technical and policy positions. During 1992-93, Dr. Gross was at the Electric Research Power Institute to develop research directions on open access transmission. A Fellow of IEEE, Dr. Gross was awarded the Franz Edelman Management Science Achievement Award by the Institute of Management Science. Dr. Gross is the author of a large number of publications and book chapters. He was a Visiting Professor at the Politecnico di Milano, University of Pavia and the Politecnico di Torino during the academic year 1999 - 2000. George Gross received his undergraduate degree at McGill University in Montreal and he did his graduate studies at the University of California, Berkeley.

Dr. Gross has consulted on electricity issues with utilities, government organizations and research institutions in North America, Europe, South America, Australia and Asia. He has lectured widely and has given numerous invited presentations at leading universities and research institutions throughout the world. Dr. Gross is the founder of the Power System Computing, Analysis and Economics Committee of the IEEE Power Engineering Society and was its first Chairman. He is on the editorial board of a number of publications in the power systems area.