Alternative Energy: Global Perspectives and Power Quality Impacts

Mark Halpin

IEEE Industry Applications Society Distinguished Lecturer 2010-2011

Alabama Power Company Distinguished Professor, Auburn University, AL USA

Mark Halpin (F' 05) was born in 1965 in Sandersville, GA, USA. He received his PhD degree from Auburn University in 1993. He has been actively involved in teaching, research, and service for his entire career. He presently holds the position of Alabama Power Company Distinguished Professor at Auburn University. He is active in IEEE and IEC standards development and has been involved in numerous Standardsmaking bodies in both leadership and technical contributor roles. He has been responsible for over US$25M in funded research and has authored or co-authored over 110 technical papers, articles, and book chapters which have been published in leading journals or by major scientific publishing companies, or presented at conferences and symposia focusing on power and energy. A significant portion of Dr. Halpin's accomplishments are related to development and application of standards in areas related to power and energy systems. He has been instrumental in many aspects of the IEEE Color Book series of standards, IEEE Standard 519 (harmonic control in power systems), and IEEE Standard 1453 (voltage flicker in power systems). His widespread involvement in IEEE standards has led to numerous invitations to participate in both technical and leadership positions in non IEEE standardsmaking and technical organizations such as IEC, CIGRE, and CIRED where he is a member of the following groups focusing on power quality: IEC TC77/SC77A WG1 ("harmonics") and WG8 ("electromagnetic compatibility"); United States National Committee (of the IEC) Technical Advisory Group for IEC TC77/77A ("power quality"); CIGRE/CIRED JWGs C4.103 "Emission Limits for Disturbing Installations," C4.108 "Flicker Objectives," and C4.109 "Power Quality Assessment."

He has created application training programs based on IEEE and IEC standards which have been delivered around the globe including the countries of China, India, Italy, Spain, Germany, Czech Republic, and Canada. The core of these programs has been incorporated in his *Expert Now* educational module on power quality developed for the IEEE Educational Activities Board. He has authored, coauthored, or contributed to over 150 standards and technical papers related to electric power quality in utility and industrial electric energy systems and he has been a member of over 40 standards development Working Groups. His accomplishments in areas related to IEEE and IEC standards were recognized by his receipt of the 2006 IEEE Charles Proteus Steinmetz Award presented by the IEEE Standards Association and his elevation to IEEE Fellow in 2005. Dr. Halpin is a past-President of the IEEE-IAS and, through his support of IAS Chapters in his role as President, is completely comfortable and familiar with issues associated with and faced by Chapters as they strive to offer valuable technical content for their local membership.

Dr. Halpin has delivered numerous technical lectures in areas related to the following topics and would offer these types of topics for presentation as a part of the IAS Distinguished Lecturer program

E-mail: halpism@auburn.edu

Summary of the presentation:

Energy, in various forms, is the fuel for modern global industry. While each local, regional, and national area has different specific objectives, there is one major similarity that cuts across all boundaries—each involved party is interested in cheaper energy that is protective of the environment. Energy could be in the form of petroleum products for transportation, natural gas for industrial processes, or electric power. In the context considered in this lecture, the focus is on electrical energy used in industrial, commercial, and residential facilities.

Electrical energy has become a three-fold issue and this lecture topic touches on each of them. Firstly, electrical energy is a technical issue. There are numerous possibilities for alternative energy production, each with its own set of advantages and disadvantages. Secondly, the production of electrical energy is a political issue. Many governments have formally or principally adopted the Kyoto Accord (or its key features) regarding control of climate change and environmental activists often create significant political pressure to carry out their agenda. Thirdly, electrical energy is an economic issue. In most cases, alternative energy sources are not cost-competitive with conventional electrical energy sources with government subsidies (political) nor are they suitable for major power production (technical). It is clearly impractical to consider any one part of the issue while neglecting the other aspects.

These three categories of issues related to alternative energy are clearly manipulated by involved parties in order to achieve some (perhaps unspecified) end result. The end-user is often at the mercy of the press and other media outlets when it comes to reasonable information regarding what is really true and what is perhaps being exaggerated for some purpose. This lecture will focus on United States energy policy in a critical sense with particular attention paid to stated goals and objectives for managing climate change coupled with what is economically feasible in terms of alternative energy sources. These goals and objectives, and any measurable progress toward them, will be compared with other international activities so as to maintain an overall global perspective.

As a second part to this lecture, the technical issues associated with the impact of alternative energy on electric power quality will be discussed. In the event that alternative energy sources do in fact become widespread at some future point, there is significant potential for many assumptions regarding power system analysis to become no longer credible. In the particular area of electric power quality, significant standardization at the regional, national, and international levels has taken place over the last 20 years, and utility and end-use companies rely on standardized rules, regulations, and procedures in order to operate their respective system in a equitable and reliable manner. The inclusion of significant alternative energy sources in any evaluation of electromagnetic compatibility stands to significantly alter the assumption set to the point that it is no longer valid—what then should utility and end-use companies do in order to maximize system performance and minimize costs on a total societal basis?

This second lecture part will focus on the assumption sets that support various power quality standards and point out areas where unintended (and possibly undesirable) conclusions may be reached if alternative energy sources are not properly taken into account. While this portion of the lecture is not intended to offer final solutions, it should help to make all involved parties more aware of the issues so that necessary changes can be made before unfortunate circumstances arise.