

Electrical Energy Storage – The Future Roles and Challenges

Prof. Dr. Ahmed F. Zobaa
Brunel University
U. K.

The recent IEC white paper on Electrical Energy Storage presented that energy storage has played three main roles. First, it reduces cost of electricity costs by storing electricity during off-peak times for use at peak times. Secondly, it improves the reliability of the power supply by supporting the users during power interruptions. Thirdly, it improves power quality, frequency and voltage. Energy storage is expected to solve many problems including excessive power fluctuation and undependable power supply due to the use of large penetration levels of renewable energy. Electric vehicles with batteries are the most promising technology to replace fossil fuels by electricity from mostly renewable energy sources. This tutorial presents the future roles and challenges of electrical energy storage.

Contents

- The roles of energy storage technologies in electricity use
- Types and features of energy storage systems
- Markets for energy storage
- Forecast of energy storage market potential by 2030.



Ahmed Faheem Zobaa received the B.Sc. (Hons), M.Sc., and Ph.D. degrees in electrical power and machines from Cairo University, Egypt, in 1992, 1997, and 2002, respectively. From 2007 to 2010, he was a Senior Lecturer in renewable energy at the University of Exeter, U.K. He was also an Instructor from 1992 to 1997, a Teaching Assistant from 1997 to 2002, an Assistant Professor from 2003 to 2008, and an Associate Professor from 2008 to 2013 at Cairo University where he has also been a Professor (on leave) since December 2013. Currently, he is a Senior Lecturer in power systems, an MSc Course Director and a Full Member of the Institute of Energy Futures at Brunel University London, U. K. His main areas of expertise are power quality, (marine) renewable energy, smart grids, energy efficiency, and lighting applications. Dr. Zobaa is an Editor-in-Chief for the *International Journal of Renewable Energy Technology* and *Technology and Economics of Smart Grids and Sustainable Energy*. He is also an Editorial Board member, Editor, Associate Editor, and Editorial Advisory Board member for many international journals. He is a registered Chartered Engineer, Chartered Energy Engineer, European Engineer, and International Professional Engineer. He is also a registered member of the Engineering Council U.K., Egypt Syndicate of Engineers, and the Egyptian Society of Engineers. He is a Senior Fellow of the Higher Education Academy of U.K. He is a Fellow of the Institution of Engineering and Technology, the Energy Institute of U.K., the Chartered Institution of Building Services Engineers, the Institution of Mechanical Engineers, the Royal Society of Arts, the African Academy of Science, and the Chartered Institute of Educational Assessors. He is a senior member of the Institute of Electrical and Electronics Engineers. Also, He is a member of the International Solar Energy Society, the European Power Electronics and Drives Association, and the IEEE Standards Association.