

Critical aspects of wind energy systems in smart grid applications

By: Colak, I (Colak, Ilhami)^[2]; Fulli, G (Fulli, Gianluca)^[1]; Bayhan, S (Bayhan, Sertac)^[3,5]; Chondrogiannis, S (Chondrogiannis, Stamatios)^[1]; Demirbas, S (Demirbas, Sevki)^[4]

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Abstract

Wind energy is an important contributor of modern power systems as a renewable energy source. However, wind energy poses new challenges because of its unique characteristics, such as limited predictability, short-term and long-term variability and close-to-zero marginal cost. This paper puts forward the critical aspects of wind energy systems in respect to the transformation of the power system into a "smart grid". Issues discussed include the electro-mechanical matters like the selection of wind turbine technology, the structure of wind system, the robustness of mechanical parts (gear box and blades) and fault diagnosis. In addition, the system operational challenges such as complexity, instability, unbalance loading, grid interactive problems and impact of wind energy on power system are discussed in this paper. Moreover, the economical subjects such as investment costs and energy management, communication requirements, and security are involved as important titles. Finally, environmental aspects of wind energy are also highlighted to show that the wind energy is an environmentally friendly energy source since it is sustainable, clean and safe. (C) 2015 Elsevier Ltd. All rights reserved.

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Author Information

Reprint Address: Colak, I (reprint author)

Istanbul [Gelisim Univ](#), Fac Engr & Architecture, Istanbul, Turkey.

Addresses:

[1] Commiss European Communities, JRC, Inst Energy & Transport, Petten, Netherlands

[2] Istanbul **Gelisim Univ**, Fac Engr & Architecture, Istanbul, Turkey

[3] Gazi Univ, Vocat Sch Tech Sci, TR-06500 Ankara, Turkey

[4] Gazi Univ, Fac Technol, TR-06500 Ankara, Turkey

[5] Texas A&M Univ Qatar, Dept Elect & Comp Engr, Doha, Qatar

E-mail

Addresses: icolak@gelisim.edu.tr; Gianluca.Fulli@ec.europa.eu; sbayhan@gazi.edu.tr; stamatiou.s.chondrogiannis@jrc.ec.europa.eu; demirbas@gazi.edu.tr

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