

# **Integration of Distributed Generators and Electric Vehicles into Electric Power System: Challenges and Opportunities**

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## **Abstract**

In a smart grid context, new participants such as distributed generators (DGs) and Electric Vehicles (EVs) are attracting attentions because of their positive economical and societal impacts. Since Electric Power System (EPS) has not been fully transitioned from traditional structure to smart structure, integration of new participants into EPS introduces several challenges. For example, intermittencies of renewable resources can exacerbate transient stability concerns or charging EVs can increase the stress on EPS. On the other hand, inclusion of these new participants in operation of EPS, can create opportunities for system operator to improve the efficiency, economics, and sustainability of power delivery system. An EV charging network is a typical cyber-physical system, which includes a power grid, DGs and a large number of EVs as well as aggregators that collect information and control the charging procedure. Presentation will start with the review of challenges in integrating DGs and EVs into EPS. Then discuss potential opportunities from adaptation of DGs and EVs. DGs take important role in fulfilling the ever growing power demand while bringing in economic and environmental benefits. EVs bring in opportunities related to active and reactive power delivery. EVs can provide several services including coordinated charging; demand response; and frequency regulation. In addition, EVs can participate in the injection or absorption of reactive power to improve the stability and reliability of the power system. Some results of our research in this area will be presented to highlight the complexity and opportunities in integrating DGs and EVs into EPS.

Keywords: distribute generators, electric vehicles, active power, reactive power.