Review of Charging Station for E-Vehicle Using Renewable based Smart Grid

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Abstract: The switching of conventional energy to renewable energy sources is a need of every country in the world, as the conventional sources are limited in nature and for the survival of coming generation, it is mandatory for all the countries to switch into renewable energy sources. The generated energy plays a vital role in the economy of a country. The major areas for energy are transportation, defence, agriculture, medical, engineering, industrialization, importexport and every little luxury of our life related, which may fulfill directly or indirectly by energy. The utilization of generated energy channelized in optimal and reliable way. The new era for the researches in this area is not to switch over alternate energy sources but also considering the pollution constraints. Therefore, in this paper, an extensive literature covers to switch over alternate energy source and its application in charging of electric vehicle using smart grid.

Keywords: electric-vehicle, infrastructure of charging station, renewable energy, smart grid.

1. INTRODUCTION

The pressure on power utility engineers is to meet the quality of power as well as regulate the required electrical network demand. The availability of conventional sources are limited in nature so bound us to use them in optimal way otherwise these became extinct. The existing total demand of energy does not meet by conventional sources of energy. Therefore, the researchers and utility engineers are working on integration of renewable and conventional sources, which tries to meet the required demand. The demand of electric vehicle is more prominent as these vehicles have high efficiency, which lies from 80 to 95% [1], whereas in case of conventional vehicle the efficiency goes up to 22% [2]. Even though the electric vehicles have high efficiency and low maintenance, peoples are less motivated to use E-vehicle. The reason behind is to face many problem as high cost, availability of charging point, limited capability of battery and its charging time become the major issue in front of electric vehicle manufacturing company [3, 4]. The power utility engineers are working on providing charging point for electric vehicle. It is not quite possible for the power utility engineers to provide charging stations, which are easily available for public use by already existing electrical network. Therefore, there is a need of renewable energy connected with grid to fulfill this bridge, which supports the charging station for electric vehicle [5]. The researchers, manufacturing companies as well as energy centre are working on minimizing the charging time and maximizing storage capability of battery in electric vehicle. The development in the area of electric vehicle leads to begin a spark on charging station [6-11]. Renewable energy based charging station have high efficiency [12] and low cost [13] as well as easy to make charging arrangement [14,15] in comparison to traditional charging station[7,8,11]. The other challenges in traditional charging station are voltage outage as well as its fluctuation and use of power electronic devices leads to harmonic in the quality of electrical power.

a. Renewable charging station for electric vehicle:

Many research scholars have worked on renewable energy based charging stations for electric vehicle [16-20]. The infrastructure for charging station of electric vehicle in different countries has already installed [16]. The management and control of renewable generated electricity at charging station is done by configuring the load dispatch as well as on grid system [17]. The main problem in front power utility engineers is for unregulated charging of electric vehicle would leads to overloading on feeders and the charging time as well as storage capacity [18]. To improve the quality of renewable energy as well as need to redirect the generated energy with the help of central controller which is demonstrated in figure 1. The central controller worked on maximum power point tracker and pulse width modulated approaches [19].

Government gives incentive polices for purchasing the electric vehicle and installing charging station such as China gives 60000 yans for battery electric vehicle and 50000yans for hybrid vehicle. The optimal location of charging station for electric vehicle formulated by mathematical programming using genetic algorithm based procedure [20].



Figure 1: Layout of renewable charging station for electric vehicle.

CONCLUSION

An extensive literature is present in this paper, which help to locate the location of charging station and infrastructure for renewable charging station. The need of renewable and electric vehicle is an alternative switching to power generation and fossil fuel vehicle.

REFERENCES

- 1. L.Canals Casals, E.Martinez-Laserna, B.Amante García, N.Nieto, "Sustainability analysis of the electric vehicle use in Europe for CO2 emissions reduction", Journal of Clean. Prod., 127, pp.425–437, 2016.
- 2. M.Åhman, "Primary energy efficiency of alternative power trains in vehicles", Energy, 26, 973–989, 2001.

- 3. W.Kempton, "Electric vehicles: Driving range", Nat. Energy, vol.1, 2016.
- S.Hardman, E.Shiu, R.Steinberger-Wilckens, "Comparing high-end and low-end early adopters of battery electric vehicles", Transp. Res. Part A Policy Pr. Vol. 88, 40–57, 2016.
- A.Von Jouanne, I.Husain, A.Wallace, A.Yokochi, "Gone with the wind: Innovative hydrogen/fuel cell electric vehicle infrastructure based on wind energy sources", IEEE Ind. Appl. Mag., vol.11, 12–19, 2005.
- T.Harakawa, T.Tujimoto, "Efficient solar power equipment for electric vehicles: Improvement of energy conversion efficiency for charging electric vehicles", Proceedings of the IEEE International on Vehicle Electronics Conference, Tottori, Japan, pp. 11–16, 25–28 September 2001.
- M.Etezadi-Amoli, K. Choma, J. Stefani, "Rapid-Charge Electric-Vehicle Stations", IEEE Trans. Power Deliv., vol-25, pp.1883–1887, 2010.
- K.Clement-Nyns, E.Haesen, J.Driesen, "The Impact of Charging Plug-In Hybrid Electric Vehicles on a Residential Distribution Grid", IEEE Trans. Power Syst., vol.-25, pp.371–380, 2009.
- M.A. Abella, F. Chenlo, "Photovoltaic charging station for electrical vehicles", Proceedings of the 3rd World Conference on Photovoltaic Energy Conversion, Osaka, Japan, Volume 3, pp. 2280–2283, 11–18 May 2003.
- D.P. Birnie, "Solar-to-vehicle (S2V) systems for powering commuters of the future", J. Power Sources, vol. 186, pp.539–542, 2009.
- 11. L.P Fernandez, T.G.S Roman, R. Cossent, C.M. Domingo, P. Frias, "Assessment of the Impact of Plug-in Electric Vehicles on Distribution Networks", IEEE Trans. Power Syst., vol. 26, pp. 206–213,2011.
- Y.Huang, J.J.Ye, .Du, L.Y Niu, "Simulation Study of System Operating Efficiency of EV Charging Stations with Different Power Supply Topologies", Appl. Mech. Mater., vol. 494, pp.1500–1508, 2014.
- D.J Hammerstrom, "AC versus DC distribution systems-did we get it right?", Proceedings of the IEEE Power Engineering Society General Meeting, PES, Tampa, FL, USA, 24–28 June 2007.
- H. Kakigano, M.Nomura, T.Ise, "Loss evaluation of DC distribution for residential houses compared with AC system", Proceedings of the International Power Electronics Conference—ECCE ASIA, IPEC, Sapporo, Japan, 21–24 June 2010.
- 15. E.Planas, J.Andreu, J.I.Gárate, I.M.De Alegría, E.Ibarra, " AC and DC technology in microgrids: A review", Renew. and Sustain. Energy Rev., vol. 43, pp.726–749, 2015.
- F. Mwasilu, J.J. Justo, E.K. Kim, T.D. Do, J.W. Jung, "Electric vehicles and smart grid interaction: A review on vehicle to grid and renewable energy sources integration", Renew. Sustain. Energy Rev. vol. 34, pp.501–516, 2014.
- 17. B. Battke, T.S Schmidt, D. Grosspietsch, V.HHoffmann, "A review and probabilistic model of lifecycle costs of stationary batteries in multiple applications", Renew. Sustain. Energy Rev., vol. 25, 240–250, 2013.
- J.N. Ingole, M.A. Choudhary, R.D Kanphade, "Pic Based Solar Charging Controller for Battery", Int. J. Eng. Sci. Technol, vol. 4, pp.384–390, 2012.
- 19. J Motavalli, "China to start pilot program, providing subsidies for electric cars and hybrids", New York Times, 2010.
- 20. Fang He, Yafeng Yin, Jing Zhou, "Deploying public charging stations for electric vehicles on urban road networks", Transportation Research Part C: Emerging Technologies, Volume 60, Pages 227-240, November 2015.