Chapter 8
Communications Technologies for Smart Grid Applications: A Review of Advances and Challenges

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ABSTRACT

Smart grid is a modern power grid infrastructure for improved efficiency, reliability, and safety, with smooth integration of renewable and alternative energy sources, through automated control and modern communications technologies. The smart grid offers several advantages over traditional power grids such as reduced operational costs and opening new markets to utility providers, direct communication with customer premises through advanced metering infrastructure, self-healing in case of power drops or outage, providing security against several types of attacks, and preserving power quality by increasing link quality. Typically, a heterogeneous set of networking technologies is found in the smart grid. In this chapter, smart grid communications technologies along with their advantages and disadvantages are explained. Moreover, research challenges and open research issues are provided.

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INTRODUCTION

Electricity is the widely used form of energy and modern society significantly depends on it. On the other hand, although the global demand for electricity is growing tremendously, most of the electrical power systems were built up over more than a century. In addition, most of the installed electricity generation capacity relies heavily on fossil fuels, and this increases carbon dioxide in the atmosphere and makes a significant contribution to climate change.

To fulfill the increasing demand for power and mitigate the consequences of climate change, an electric system that can address these challenges in an economic, sustainable and reliable way is needed (Gungor et al., 2013). In this respect, smart grids can meet the rising electricity demand, enhance energy efficiency, increase quality and reliability of power supplies, and integrate low carbon energy sources into power networks as shown in Figure 1 (Liserre, Sauter, & Hung, 2010). Basically, a smart grid is an evolved power grid built on sophisticated infrastructure that manages electricity demand in an economic, reliable and sustainable manner.

Different from the traditional power grids, smart grids apply high standards to the control capability of all facilities. Because, although in the traditional power grids, power flows travelled from generators to customers, in smart grids, due to the increasing use of distributed power generation relying on renewable resources which fluctuate over time, there are additional sources of power flows which an electric utility must contend with (Lu, Kanchev, Colas, Lazarov, & Francois, 2011;

Figure 1. Smart Grid